5.0 DESCRIPTION OF THE ENVIRONMENT

5.1 Study Areas

Separate study areas were defined for the natural and human environment components, as the potential scope of effects for these two aspects is quite different in terms of areal extent. Natural environment effects will occur closer to the Rainy River Project (RRP) development area and in aquatic systems that drain from the RRP site; whereas human environment effects may occur more broadly.

5.1.1 Natural Environment Study Areas

The natural environment study area includes a smaller natural environment local study area (NLSA) nested within a larger natural environment regional study area (NRSA; Figure 5-1). For natural environment functions the NLSA, which includes the entire RRP site for all aspects, has been defined as:

- The Upper Pinewood River, which includes all lands and waters within the watershed upstream of, and including; McCallum Creek (also known as Jones Creek) and Tait Creek tributary subwatersheds; together with a 1 km buffer bordering the northern margin of the watershed to account for minor road allowance excursions which extend slightly beyond the watershed boundary at some locations; and

- A 4 km buffer (2 km on either side of the centreline) of the proposed 230 kV transmission line routing.

The NRSA (natural environment) includes the entire Pinewood River watershed (including the NLSA and RRP site) together with a corridor extension to the northeast to accommodate transmission line routing alternatives.

Watershed boundaries were mainly selected to define the NLSA and NRSA because:

- These boundaries capture all aspects of drainage associated with the RRP, including water takings, and effluent and runoff discharges; all of which will occur within the Pinewood River watershed; and

- All proposed RRP developments are located within the Upper Pinewood River watershed, except as described above for minor road allowance excursions which are captured by the 1 km buffer along the north side of the watershed. Any residual RRP adverse effects to terrestrial ecosystem components are also expected to occur within the NLSA, as defined above.

The NLSA measures 270 km^2 and includes the upper approximately 36% of the Pinewood River watershed, to a point just downstream of the Tait Creek and McCallum Creek subwatershed inflows. As such, the NLSA encompasses all of the proposed RRP development, and any associated environmental effects extending from those developments, including the final effluent discharge point for treated effluent to the Pinewood River (Figure 4-1). It is expected that final effluent discharges to the Pinewood River will be such that Provincial and Federal protection of aquatic life guidelines (or defensible equivalents) will be met in the Pinewood River within a short distance from the final effluent discharge point to the river. The northern boundary of the NLSA has been extended approximately 2 km north of the Pinewood River watershed boundary in the area of the tailings management area to provide a buffer between the tailings management area and the NLSA boundary, and to accommodate a new road allowance in the area to maintain local access to Marr Road.

All reasonably measureable RRP-related effects to the terrestrial environment are expected to occur within the NLSA. This includes those related to air quality and sound emissions, recognizing that wildlife populations are mobile and can move into and out off the NLSA with varying capacities, depending on the species and time of year. There are no known local wildlife migratory corridors that pass through the NLSA, other than those associated with aquatic systems and associated riparian habitats that are captured by watershed and sub-watershed boundaries. Similarly, it is expected that reasonably measurable effects to area aquatic systems would occur within the NLSA except as described below in connection with the NRSA.

The NRSA boundary includes the NLSA together with the remainder of the Pinewood River watershed, encompassing a total area of 690 km^2. The remainder of the Pinewood River watershed has been included in the NRSA, as Fisheries and Oceans Canada (DFO) and the Ministry of Natural Resources (MNR) have requested that the effect on aquatic habitats of the middle and lower reaches of the Pinewood River of the water taking for process plant needs be assessed. Environmental effects to the aquatic habitat downstream of the Pinewood River system are not expected to occur because: protection of aquatic life guidelines (or defensible equivalents) are expected to be met within the Pinewood River within a short distance of the final effluent discharge point; and the Rainy River, into which the Pinewood River flows is a very large system (watershed that is approximately 100 times greater than the Pinewood River). If protection of aquatic life guidelines are met in the Pinewood River, there is no potential for adverse effects from the RRP effluent quality to the larger downstream systems.

In preliminary discussions with the Federal and Provincial government agencies, concern was expressed for potential downstream effects to both the Rainy River and the Lake of the Woods aquatic environments resulting from possible malfunctions and accidents, including a possible failure of the tailings management area containment. The RRP designs include a number of safeguards to prevent such an occurrence from happening, and to minimize the consequences should a breach of the tailings management area containment occur. These measures include: designing the tailings dams to accepted rigorous engineered standards; providing for a downstream polishing pond (water discharge pond) and wetland system (constructed wetland),

which will provide for secondary containment of tailings solids in the event of a dam failure; and pre-treating the tailings slurry within the process plant to destroy cyanide and precipitate heavy metals before the excess water is discharged to the tailings management area for further treatment. For these reasons, the NRSA was not extended downstream beyond the Pinewood River watershed.

5.1.2 Human Environment Study Areas

The human environment local study area (HLSA) has been defined as the area immediately surrounding the RRP site, set back sufficiently to include any properties, persons and activities which could reasonably be expected to experience an environmental effect, such as those relating to land use disruption (such as to homesteads and agricultural activities), sound and air quality emissions, groundwater well function, recreational use and traditional land use (Figure 5-2). The only expected RRP-related effects to persons, properties or activities outside of the HLSA would be those involving potential effects to such aspects as:

- Traffic flow;
- Community and social services;
- Employment, training and business opportunities; and
- Potentially traditional land uses.

Project effects to persons, properties and activities outside of the HLSA are expected to occur over a larger area (the human environment regional study area; HRSA), recognizing that positive socio-economic effects relating to business and labour can extend far more broadly to other parts of Ontario, Canada and internationally. The HRSA was defined using the following criteria:

- Aboriginal or non-Aboriginal communities generally within a 100 km driving distance from the RRP and therefore expected to experience socio-economic effects from the RRP;

- Those First Nations communities for which there was a commitment to gather socio-economic information through the Fort Frances Chiefs Secretariat Participation Agreement with Rainy River Resources (RRR); and

- Statistics Canada census reporting units.

The HRSA is comprised of a number of communities that are likely to experience direct and indirect employment and economic benefits and associated economic and social effects. The HRSA also allows for the assessment of cumulative or regional effects resulting from other known or future planned projects. HRSA communities, as shown on Figure 5-2, include the:

- Township of Alberton;
- Township of Chapple;
- Township of Dawson;
- Township of Emo;
- Town of Fort Frances;
- Township of La Vallee;
- Township of Morley;
- Town of Rainy River; and
- Township of Sioux Narrows – Nestor Falls.

With the exception of Sioux Narrows – Nestor Falls, all of the NRSA communities are located in the Rainy River District. Sioux Narrows – Nestor Falls is located in the Kenora District.

A number of First Nations have reserves or reserve lands in the general vicinity of the RRP but located outside of the HRSA (Figure 5-3). It is recognized that a number of these First Nations have, or may have, traditional lands that overlap with the area that could be affected by the RRP development, and accordingly, they could potentially have an interest in the RRP. This includes reserves and reserve lands on Lake of the Woods. Environmental effects from planned RRP activities are not expected to extend to the Rainy River, or to waters downstream of the Rainy River, such as Lake of the Woods.

Aboriginal communities that may also experience employment and economic benefits and/or social effects either due to their proximity to the project, or through benefits received through agreements signed with RRR, include (in alphabetical order):

- Anishinaabeg of Naongashiing First Nation;
- Couchiching First Nation;
- Lac La Croix First Nation;
- Big Grassy River First Nation;
- Mitaanjigamiing First Nation;
- Naicatchewenin First Nation;
- Naotkamegwanning First Nation;
- Nigigoonsiminikaaning First Nation;
- Ojibways of Onigaming First Nation;
- Rainy River First Nations;
- Seine River First Nation; and
- Métis citizens living in the region that are represented by the Rainy River Lake of the Woods RCC Region #1.

5.2 Baseline Study Methodologies

5.2.1 Background

The objectives of the environmental baseline studies are to characterize the natural and human environment aspects of potentially affected areas, along with reference locations (such as upstream locations) where appropriate for comparison. The extent and focus of baseline studies for the different environmental aspects depends on the potential for that specific aspect to be affected by the RRP. For this reason, not all aspects of the natural environment are studied throughout the defined study areas at the same level of detail.

Baseline data to support the Environmental Assessment (EA) were obtained from published sources, government databases, site-specific studies focused on development of the RRP, and community and Aboriginal Traditional Knowledge. The environment site-specific studies have included the following general aspects (as well as other aspects) as well as documentation of applicable published material:

- Air quality;
- Meteorology and climate;
- Sound;
- Geotechnical;
- Geochemistry;
- Groundwater quality and paths (hydrogeology);
- Surface water quality and flows (hydrology);
- Aquatic resources and habitat;
- Wildlife and habitat;
- Species at Risk (SAR);
- Sediment quality;
- Socio-economics;
- Archaeology and cultural resources; and
- Traditional knowledge and traditional land use (TK / TLU).

Studies to date have been completed using standard field protocol and scientific methodology, to accurately document areal and temporal variability.

The list below contains the environmental baseline study reports prepared for the RRP, the majority of which are referenced and/or appended to this report (where appended, the appendix letter has been provided):

- Rainy River Gold Project, Climate, Air Quality and Sound Baseline Study. Prepared by AMEC Environment & Infrastructure (AMEC 2013d; Appendix F);

- Rainy River Gold Project, Interim Report, Metal Leaching and Acid Rock Drainage Characterization of Mine Rock and Tailings. Prepared by AMEC Environment & Infrastructure;

- Rainy River Gold Project, Metal Leaching and Acid Rock Drainage Characterization of Mine Rock and Tailings. Prepared by AMEC Environment & Infrastructure (AMEC 2013h; Appendix G);

- Rainy River Gold Project, Hydrogeology Baseline Report. Prepared by AMEC Environment & Infrastructure (AMEC 2013g; Appendix H);

- Rainy River Gold Project, Summary of 2012 Investigation of Private Wells and Monitoring Wells. Prepared by AMEC Environment & Infrastructure;

- Rainy River Gold Project, Low Flow Field Investigations, Field Observations Report. Prepared by AMEC Environment & Infrastructure;

- Rainy River Gold Project, March 2012 Hydrology Program, Field Observations Report. Prepared by AMEC Environment & Infrastructure;

- Rainy River Gold Project, Aquatic Resources 2011 Baseline Investigation. Prepared by AMEC Environment & Infrastructure (AMEC 2012b; Appendix I-2);

- Rainy River Gold Project, 2012 Aquatic Resources Baseline Report. Prepared by AMEC Environment & Infrastructure (AMEC 2013f; Appendix I-3);

- Rainy River Gold Project, 2013 Aquatic Resources Baseline Report. Prepared by AMEC Environment & Infrastructure (AMEC 2013l; Appendix I-4);

- Rainy River Gold Project, 2013 Fish and Fish Habitat Existing Conditions for Highway 600 Realignment. Prepared by AMEC Environment & Infrastructure (AMEC 2013o; Appendix I-5);

- Rainy River Gold Project, 2011 Wildlife Baseline Study. Prepared by AMEC Environment & Infrastructure (AMEC 2012c; Appendix J-2);

- Rainy River Gold Project, 2012 Terrestrial Baseline Study. Prepared by AMEC Environment & Infrastructure (AMEC 2012e; Appendix J-3);

- Rainy River Gold Project, 2012 Aerial Nest Survey. Prepared by AMEC Environment & Infrastructure (AMEC 2012e; Appendix J-4);

- Rainy River Gold Project, 2013 Winter Aerial Survey for Mammals. Prepared by AMEC Environment & Infrastructure (Appendix J-5);

- Rainy River Gold Project, Species at Risk Baseline Report 2008 to 2010. Prepared by Klohn Crippen Berger (KCB 2011c; Appendix K-1);

- Rainy River Gold Project, 2011 Species at Risk Report. Prepared by AMEC Environment & Infrastructure (AMEC 2012d; Appendix K-2);

- Rainy River Gold Project, 2012 Species at Risk Report. Prepared by AMEC Environment & Infrastructure (AMEC 2012f; Appendix K-3);

- Rainy River Gold Project, 2013 Species at Risk Report. Prepared by AMEC Environment & Infrastructure (AMEC 2013m; Appendix K-4);

- Rainy River Gold Project, 2013 Terrestrial Baseline Study: Bats. Prepared by AMEC Environment & Infrastructure (AMEC 2013n; Appendix K-5);

- Rainy River Gold Project, Socio-economic Baseline Report. Prepared by AMEC Environment & Infrastructure (AMEC 2013e; Appendix L);

- Stage 1 Archaeological Assessment, Rainy River Advanced Exploration Project, Richardson Township, District of Rainy River. Prepared by Ross Archaeological Research Associates;

- Stage 1 Archaeological and Cultural Heritage Resource Assessment of the Rainy River Resources Advanced Exploration Project, northwest of Fort Frances, Rainy River District, Ontario (Woodland Heritage Services 2012; Appendix M-1);

- Stage 2 Archaeological and Cultural Heritage Resource Assessment of the Rainy River Gold Project, northwest of Fort Frances, Rainy River District, Ontario (Woodland Heritage Services 2013; Appendix M-2);

- Cultural Heritage Assessment Report, Cultural Heritage Landscapes and Built Heritage Resources, Rainy River Gold Project, Township of Chapple, District of Rainy River, Ontario (Unterman McPhail Associates 2013; Appendix M-3); and

- Rainy River Gold Project, Baseline Report 2008 - 2010. Prepared by Klohn Crippen Berger (KCB 2011a; Appendix N).

Information from other field investigations / work not formally documented as of the issuance of this document may also have been used in the preparation of the EA Report.

The first comprehensive baseline study for the RRP was developed by Klohn Crippen Berger (KCB 2011a). The KCB baseline study was developed principally to support advanced exploration at the RRP, recognizing that if the RRP was to proceed to development, the studies would require expansion to support the project development phase and associated EA and permitting requirements. KCB (2011a) addressed:

- Physiography;
- Climate;
- Hydrology;
- Surface water quality;
- Hydrogeology;
- Groundwater quality;
- Geochemistry;
- Soils;
- Air quality;
- Sound;
- Aquatic systems;
- Wildlife;
- Vegetation;
- Socio-economics; and
- First Nation aspects.

Selected aspects of the KCB baseline study were set up as ongoing programs, such as the monthly baseline water quality sampling program and the operation of an onsite climate station.

In mid-2011, after consulting with RRR on the likely scope of the proposed RRP, AMEC conducted a gap analysis targeted at expanding the existing KCB environmental baseline database to support the development of the RRP. Additional environmental baseline investigations were conducted primarily during in 2011 and 2012.

On July 18, 2012 a meeting was held with the Federal and Provincial regulatory agencies as identified by the Canadian Environmental Assessment Agency (CEA Agency) and the Ministry of Northern Development and Mines (MNDM), to review highlights of the KCB baseline materials, and to discuss completed and ongoing baseline work being carried out by AMEC. In follow up to the July 2012 meeting, the baseline workscope for 2012 and extending into 2013, was modified to take into account comments received from the participating government agencies.

To support the existing data base, AMEC and RRR undertook, or supported the undertaking of, additional baseline studies in the following areas:

- Sound (supported by the MNR and Trent University);
- Geotechnical studies of ground conditions;
- Geochemistry of identified ore, mine rock and overburden;
- Surface water hydrology;
- Hydrogeology and groundwater modelling related to future open pit dewatering;
- Aquatic resources (fisheries and benthos);
- Water and sediment quality;
- Vegetation plot studies of representative site area habitats;
- Wildlife studies (breeding bird surveys; amphibian surveys; SAR studies);
- TK / TLU;
- Cultural heritage resources (Woodland Heritage Services);
- Built heritage resources and cultural heritage landscapes (Unterman McPhail Associates); and
- Socio-economics.

All TK / TLU collected thus far indicate very little current or recent use of the NRSA by Aboriginal peoples, since uptake of the area by settlers for agriculture and forestry in the late 1800s, and early 1900s (Section 5.12). As a consequence, the TK / TLU data that have been collected to date tend to be more broadly applicable at the regional level and less focused on the RRP site area, and in the main these data corroborate and further substantiate the more detailed western science-based data collections carried out specifically for the RRP. For example, TK / TLU information indicates that Moose were once more common in the area and that White-tailed Deer were less common; but that over the years Moose numbers have declined, whereas numbers of White-tailed Deer have increased. This observation supports baseline data presented in the KCB Baseline Report (Appendix N). Similarly, TK / TLU data indicated that Lake Sturgeon are known to inhabit the Rainy River, but it was unclear as to whether or not this species also moves into the lower reaches of the Pinewood River. Recent fisheries studies conducted on the Pinewood River by AMEC and MNR resulted in the three captures of Lake Sturgeon in the lower reaches of the Pinewood River, confirming the presence of this species. RRR has committed to the continued collection of TK / TLU data as the project moves forward, recognizing that any such additional information would be helpful to further identifying and minimizing project-related environmental effects.

5.2.2 Climate and Air Quality

Climate data are used in water balance and flood design calculations (precipitation and temperature data); for assessing general site design and operations conditions (temperature data); and for air quality and sound modelling (wind data).

Regional baseline climate data (climate normal data) were obtained from Environment Canada (EC) for Barwick, Ontario (EC ID 6020559) located approximately 23 km south of the RRP site (EC 2012a). Canadian climate normal data available for the Barwick Station are restricted to

temperature and precipitation. Temperature, precipitation and wind data are available from the Fort Frances Airport climate station (EC ID 6022476) located approximately 50 km southeast of the RRP site. Wind data are also available locally from the Canadian Wind Energy Atlas (EC 2011a). Rainfall Intensity Duration Frequency data are available for Rainy River. Rainfall plus snowmelt data are available for Fort Frances. The Ministry of Transportation (MTO) website also provides Intensity Duration Frequency rainfall data for any site in Ontario based on geographic coordinates (MTO 2010).

A local climate station was established on the RRP site in 2009 to supplement longer term published data. This station measures temperature, precipitation, relative humidity, wind speed and direction, barometric pressure and solar radiation. As a result of the short term nature of the record from this site, reliance is placed on climate data from the regional stations.

Regional background air quality data were obtained from the Experimental Lakes Area station, located approximately 95 km north of the RRP site, which provides background data on chloride, potassium, sodium, ammonium, nitrite, nitric acid, sulphate, sulphur dioxide, calcium and magnesium (EC 2011b). The Experimental Lakes Area station operates as part of the EC Canadian Air and Precipitation Monitoring Network (CAPMoN). Additional regional air quality data were obtained from the EC National Air and Pollution Surveillance (NAPS) Network stations in Winnipeg (Station 070119) and the Experimental Lakes Area (Station 64001; EC 2008); and from the Ministry of the Environment (MOE) Air Quality Index (AQI) station in Thunder Bay (Station 63203; MOE 2010). The NAPS station in Winnipeg provides data on nitrogen oxides, ozone, fine particulate matter ($PM_{2.5}$) and carbon monoxide. The NAPS station at the Experimental Lakes Area provides data on ozone. The AQI station in Thunder Bay provides data on nitrogen oxides, ozone and fine particulate matter ($PM_{2.5}$).

In addition, particulate data for the three standard size classes (PM_1, $PM_{2.5}$ and PM_{10}) were obtained from three representative site locations by KCB (2011a).

5.2.3 Sound

Background sound data are used as input to sound modelling, to ensure that MOE sound guideline values can be met at the nearest off property human receptor locations. Sound emissions also have the potential to adversely affect sensitive wildlife species.

Data have been collected from a number of locations on and near the RRP site which are representative of anthropogenic influenced sites (for example near RRR exploration work, roads and homesteads), as well as from more remote sites. Data were collected by KCB using Quest Model 2900 Advanced Integrating Sound Level Meters in July 2009, and September and October, 2010. Data were collected by the AMEC, RRR, MNR and Trent University consortium using Larson Davis model SoundTrack LxT Integrating Sound Level Meters equipped with long term measurement gear including wind screens and bird spikes, during the period of May 30 to July 18, 2011, and from August 17 to 27, 2012. Monitoring locations are shown in Figure 5-4.

5.2.4 Geotechnical Studies

Geotechnical studies were carried out to support engineering design functions and risks, and were combined with hydrogeological investigations to support groundwater modelling exercises. In addition to the preliminary investigation carried out by KCB in 2010, detailed geotechnical studies were carried out by AMEC during the 2011/2012 period to assess ground conditions associated with various planned structures such as the tailings management area, mineral waste stockpiles, foundations, pit wall stability and other aspects (AMEC 2012h; 2013i).

Feasibility level design was supported by a total of 105 geotechnical boreholes, 68 dynamic cone probes, 14 geomechanical holes, 103 test pits, and 26 cone penetration tests. This included 38 test pits and 68 dynamic cone tests to probe bedrock depth in plant site area. Based on the geotechnical investigations (including 34 boreholes, 38 test pits and 68 cone penetration tests), the process plant lay out was configured to optimize the design. This investigation also included nine hydrogeological boreholes that were drilled to assess potential hydrogeological interactions of open pit with Pinewood River (AMEC 2013g). Borehole locations are shown on Figure 5-5.

Drilling was carried out with track mounted Central Mine Equipment Company 850 drill rigs utilizing 200 mm hollow stem augers and NQ core barrel (for NQ size rock coring). The borehole drilling through overburden was generally advanced by auger drilling with 200 mm hollow stem augers or by the wash boring method. Where auger refusal or difficulty in advancement was encountered, the drilling operation was switched to rock coring to penetrate through the cobbles / boulders and bedrock. Test pits were advanced by a Caterpillar 320D excavator.

Soil sampling was typically carried out using standard penetration tests at 0.76 m intervals to a depth of 3 m from surface, followed by subsequent testing at 1.5 m intervals to bedrock. Samples were recovered using a split spoon sampler. Thin wall Shelby tube samples of soft cohesive soils were collected from select locations. Where soft to firm cohesive soil was encountered, vane shear testing (MTO vane, N size) was carried out in selected boreholes to identify peak and remoulded strength under undrained conditions.

Bedrock was cored using NQ size core barrel. Cores were placed in core boxes, logged and photographed. Dynamic cone penetration testing was carried out to probe bedrock depths in the Plant Site area. Dynamic cones were advanced by track mounted CME 850 drill rigs to refusal, or to a 12 m depth, whichever occurred first. Penetration resistance was recorded for selected dynamic probe locations.

Constant head packer testing was carried out on selected boreholes to investigate the in situ hydraulic conductivity of the bedrock. In addition, piezometer response tests and slug tests were conducted within different geologic units to assess hydrologic properties of the various

stratigraphic units. Standpipe piezometers were installed in selected boreholes to monitor groundwater levels.

All soil samples were sealed, labelled and sent to the AMEC geotechnical laboratory for index testing. Selected samples were subjected to natural moisture content, grain size distribution and Atterberg limits determination tests to assist in the description and classification of the soil samples and stratigraphy. Specialized testing for deformation and strength characteristics was also carried out depending on design requirements.

5.2.5 Geochemical Analyses

Geochemical analyses of the ore and mine rock are needed to assist with the development of tailings and mine rock management strategies, to ensure that any potential for acid rock drainage (ARD) development is thoroughly understood, and that water and material management systems are developed accordingly for the short and long term.

The approach and methodology for the collection and characterization of mine waste materials was based upon requirements described under the Ontario *Mining Act*; namely guidance found within the Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND 2009). The document represents best practice and industry standard approaches and methodologies for metal leaching (MI-2) and ARD sampling and characterization.

The proposed open pit will produce ore, overburden and three major mine rock types, together with a number of other lesser mine rock types. The types of mine rock and approximate proportions expected to be produced, based on the current mine plan are presented in Table 5-1. Spatially representative samples of the different mine rock types were collected from drill core for static and kinetic testing.

Characterization methods utilized for mine rock and tailings are summarized in the following sections. Further details are provided in AMEC (2013h). The geochemical program is ongoing such that additional sampling is occurring to further refine geochemical predictions and to assist in the development of a mine rock management strategy.

5.2.5.1 Mine Rock Characterization

Two stages of geochemical sampling have been conducted. An initial program by KCB included the collection and analysis of 444 rock core samples and 19 overburden samples (KCB 2011b). An additional 214 rock samples and three overburden samples were collected and analyzed under the direction of AMEC in 2011. The rock samples were specifically identified from regions of the proposed open pit that contained little or sparse previous sampling (AMEC 2013h). The three overburden samples were recovered during excavations to expose mineralization in 2011 and to supplement previous KCB overburden sampling.

In December 2012, the combined set of 659 geochemical rock samples was vetted against the feasibility pit limit and resource block model. From this operation, a set of 362 non-ore (outside ore blocks) mine rock samples spatially located within the Feasibility open pit was established. This sample set formed the basis of the current acid base accounting assessment for mine rock.

ML / ARD samples were shipped to SGS Laboratories in Burnaby, British Columbia for geochemical testing. Static tests were used to assess the current geochemical characterization of materials, while kinetic tests were used to evaluate the leaching characteristics of materials over time. For consistency, the analytical methods used for samples collected in 2011 under the direction of AMEC were comparable to those completed in the previous geochemical investigation (KCB 2011b). These analytical methods also represent industry best practice.

Table 5-2 summarizes the number of samples committed to the various testing procedures used in the ML / ARD characterization program for 2011 mine rock sample analysis.

Static acid base accounting testing is a method to assess the acid generation and neutralization potential of the geologic material. Acid base accounting test work was carried out using the techniques and calculations described below:

- Conducting paste pH tests to assess the currently available acidity / alkalinity of a sample, with testing conducted with 1 part of sample mixed with 1 part of de-ionized water;

- Determining the forms of sulphur (including total, leachable sulphate sulphur and sulphide sulphur). Total sulphur was measured by a Leco carbon / sulphur analyzer; sulphate sulphur was determined by dilute hydrochloric acid digestion and colorimetry; and sulphide sulphur was determined using the Sobek method (using 1 part nitric acid and 7 parts water) with gravimetric finish. Calculated sulphide sulphur was also determined as total sulphur less sulphate sulphur. The difference between the total sulphur, sulphate and sulphide analysis was considered as insoluble sulphur;

- Determining acid potentials (AP) calculated from the sulphide sulphur content of the samples. For the AP calculation the calculated sulphide sulphur value (determined by difference between total sulphur and sulphate analyses) was used instead of the measured sulphide value, as the calculated value is more conservative for ARD characterization;

- Determining the forms of neutralizing potential (NP) by two complimentary methods: capability for acid neutralization (Sobek method with siderite correction), and measurement of carbonate carbon based on the analysis of total inorganic carbon. Splits from a subset of samples were also analyzed for modified acid base accounting NP without siderite correction;

- Determining the neutralization potential ratio (NPR) to characterize the potential of geologic materials to produce net acidity. Values less than one indicate that the AP exceeds NP, and values greater than one indicate that a sample has excess NP. For this study, where the AP value was below detection (the sample has no measurable sulphide content) the detection limit value of 0.3 kg $CaCO_3$/t was substituted for the AP;

- Determining the net acid generation (NAG) potential as an assessment of the potential of a sample to generate acid (AMIRA 2000). NAG tests use hydrogen peroxide to rapidly oxidize sulphide minerals in a sample and determine if a sample has enough neutralization capacity to buffer the acidity generated during sulphide oxidation;

- Conducting elemental analysis to quantify the concentration of elements in rock samples; determined by aqua regia digestion followed by an Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) scan;

- Conducting leachable metal tests to assess the presence of potentially soluble elements and their release during initial stages of weathering, involving the use of shake flask extraction tests on the samples using a 3 parts de-ionized water to 1 part solid ratio, agitated for 24 hours. The resulting leachates were analyzed for pH, conductivity, hardness, sulphate and dissolved metals; and

- Conducting mineralogical analysis using x-ray diffraction (XRD) with Rietveld refinement (Rietveld-XRD). This technique provides a semi-quantitative to quantitative assessment of the mineral composition of a sample. Mineralogical analysis provides information on the major mineralogical phases in a sample, which can be used to determine the forms of potentially acid generating and acid neutralizing minerals.

The above acid base accounting static testing program for mine rock was augmented by development of a block model utilizing the extensive exploration geochemical data base comprising more than 91,000 rock samples from 127,000 m of drill core. Relationships were established between acid base accounting determined AP and NP, known as acid base accounting static data; and sulphur and calcium (elemental analysis by Inductively Coupled Plasma Mass Spectrometry; ICP-MS), respectively. These relationships were utilized to calculate surrogate AP and NP from elemental analyses available in the large exploration data base. The surrogate AP and NP from the exploration data base were then utilized by RRR to develop a 5 m x 5 m x 5 m ARD block model in conjunction with an updated resource block model in late 2012.

Kinetic test work for mine rock was carried out using laboratory humidity cells and field cells constructed onsite. Humidity cell testing provides a measure of accelerated weathering, using wetting and drying cycles, to estimate anticipated metal fluxes from mine wastes, rates of neutralization potential depletion and the time until acid generation occurs in the sample and the

potential duration of acidic drainage. Field cells provide similar data, but are operated using larger and coarser sample material operated at ambient site conditions.

Humidity cells were constructed and operated using industry standard methods (MEND 2009) and involve the use of crushed rock core that is flushed weekly and analysed for pH, sulphate and a range of other indicator and metal parameters. The cells are subjected to three days of circulating humid air followed by three days of dry air between sampling events. Drum type field cells were constructed on-site using rock core and subjected to ambient precipitation and climate conditions and were routinely sampled (at least monthly) between March and November (when in an unfrozen state). Drainage waters from the cells were analysed for comparable parameters to those in the humidity cells.

5.2.5.2 Tailings Characterization

Three simulated tailings materials were derived from metallurgical testing and subjected to similar static and kinetic testing procedures as those outlined above for mine rock. The three tailings materials include:

- Material representative of initial pit operations (Starter Pit sample);
- Rock from the main ore zone (ODM sample); and
- Rock representing the mine life remaining after the Starter Pit to end of mine (ROM sample).

All samples were analysed for static testing by SGS Lakefield using the same methods as those described above for mine rock. Kinetic testing included operation of humidity cells for each of the three tailings materials in duplicate using industry standard methods.

5.2.6 Hydrology

The Pinewood River watershed was extracted directly from the Land Information Ontario data warehouse of MNR and used as the base watershed for which to further delineate subwatersheds. The Ontario 20 m digital elevation model was then extracted from the Land Information Ontario data warehouse for the Pinewood River watershed. Standard flow direction and flow accumulation surface models were generated using the Ontario Digital Elevation Model applying the D8 (eight cardinal direction) surface flow model. Using raster-based hydrology modelling tools, the Pinewood River watershed was subdivided into a series of rational subwatersheds based on the positioning of outlet points (pour points) for Pinewood River tributaries and at specific locations along the Pinewood River. Outlet point upstream contributing area divide lines were generated using the surface models and these lines represented a set of subwatersheds within the Pinewood River watershed (Figure 5-6).

Hydrological data are required for water balance calculations, engineering design input and for determining receiving water assimilative capacity. Hydrological assessments are also essential for the assessment of water taking effects on fish and fish habitat.

Hydrological assessments were developed from published Water Survey of Canada data from the Pinewood and Rainy Rivers. Water Survey of Canada data from the Pinewood River are available for the Pinewood River near Pinewood (Station 05PC011) for the period of 1952 through 1998; and for the Pinewood River at Highway 617 (Station 05PC023) for the period 2007 to present. Station 05PC011 has a watershed area of 461 km^2, whereas Station 05PC023 has a watershed area of 233 km^2. The entire Pinewood River has a watershed of 575.5 km^2. Data from Station 05PC011 were collected seasonally (March to October). Data from 05PC023 are collected for all months.

Water Survey of Canada data are also available for two stations on the Rainy River: Rainy River at Fort Frances (Station 05PC019) and Rainy River at Manitou Rapids (Station 05PC018). The periods of record for these two stations extend back to 1905 and 1928, respectively. The two Rainy River stations drain large watersheds of 38,600 km^2 and 50,200 km^2, respectively. Data from the Rainy River were used primarily to help assess possible long term trends that may be related to climate change.

In addition, KCB set up a series of site-specific water level and flow monitoring stations on the Pinewood River, and on some of the smaller tributaries in the area. KCB and AMEC have also collected spot flow measurements from a number of creeks in the RRP site area. Unfortunately, the functioning of the water level and flow monitoring stations established by KCB has been compromised by beaver activity and drought conditions experienced in 2011 and 2012, such that the data are of limited value. Hydrological assessments presented herein are therefore based principally on flow data from the Water Survey of Canada Pinewood River stations, and from climate data.

5.2.7 Hydrogeology and Groundwater Modelling

An assessment of hydrogeological conditions is required to support water balance calculations, to determine minewater treatment and management strategies, and to assess the potential effects of groundwater taking on area wells, area creek systems and the Pinewood River.

A preliminary hydrogeological assessment of the RRP site was provided by KCB (2011a) during 2009 and 2010. KCB conducted the following work:

- 37 drill holes of which 33 were used for measuring water levels, 10 were used for performing slug tests and 2 were used for performing packer tests;
- 12 monitoring wells, several of which were used for measuring water levels and for performing slug tests;

- Water levels from 21 drill holes and monitoring wells have continued to be measured on a monthly to quarterly schedule since 2010;

- Collection or review of groundwater samples from 20 drill holes and monitoring wells collected between 2007 and 2009; and

- 4 test wells used to measure water levels and pump tests were completed in 3 of the wells.

A total of five pump tests were completed by KCB, three in TW 10-01 and one each in TW 10-02 and TW 10-04 KCB (2011a). The pump tests carried out in TW 10-01 varied from 4 to 15 hours at rates from 5.8 to 8 USgpm. The pump tests conducted in TW 10-02 and TW 10-04 varied from 3.6 to 10 hours and were conducted at a rate of 25 USgpm. Water levels and rates of water level recovery were measured in adjacent monitoring wells during the tests. All of the pump tests were performed in Labradorean Till sand and gravel lenses positioned between the overlying clay and clay till substrates and the underlying bedrock, which represent the most productive intervals encountered during drilling.

RRR have measured water levels and collected groundwater samples in select monitoring wells on a monthly to quarterly schedule since 2009, providing a record of groundwater conditions during this period.

AMEC expanded on this work in 2011 and 2012 by undertaking the following work:

- Drilling of 89 additional boreholes between December 2011 and October 2012. Piezometers were installed in 52 of these locations for water level monitoring;

- Slug tests were performed in 29 piezometers to further characterize hydraulic properties of the different overburden and shallow bedrock units;

- Drilling and packer testing in five deep, inclined boreholes drilled during a geomechanical investigation to characterize the hydraulic conductivity of the bedrock, included suspected fault zones;

- Supplemental groundwater sampling from six wells in areas not included in KCB and RRR sampling;

- A September 2011 survey of local creeks to collect stream flow measurements under low flow conditions; and

- A survey of private wells in the area on RRR property to collect information on local water use and groundwater level data.

Site-specific hydrogeological studies conducted by KCB and AMEC were used in conjunction with RRR site geological data and data from published sources (Bajc 2001; Caracle Creek International Consulting 2008; Nuinsco Resources 1997) to develop a more complete understanding of site hydrogeological conditions and to provide input into groundwater modelling. Such modelling was used to further characterize existing baseline conditions and to support the RRP design and the determination of potential environmental impacts.

A numerical, three-dimensional groundwater flow model was developed to represent current conditions and to estimate the expected seepage rate into the proposed open pit, as well as to assess the potential impact of pit dewatering on groundwater levels in local aquifers and on surface waters. The proposed underground workings, mineral stockpiles (including the tailings management area) and the various proposed ponds and West Creek re-routing were factored into the model results.

The model used to simulate groundwater flow in the RRP area was the Modular Finite-Difference Groundwater Flow Model (MODFLOW), originally developed by McDonald and Harbaugh (1988) for the United States Geological Survey. This model allows for the simulation of steady state and transient flow regimes in both two and three dimensions. A detailed description of MODFLOW is provided in the software package manual (McDonald and Harbaugh 1988).

The model was developed for the RRP for steady state groundwater conditions for pre-mining and post mining conditions, and yearly mined open pit and underground conditions. The model was calibrated to the groundwater levels recorded for the monitoring wells under an existing near average condition observed in 2010, and checked against low water (dry) conditions observed in 2011 and 2012. The model was run using calibrated parameters to predict: seepage into the proposed fully dewatered open pit; the extent of the drawdown cone; the potential reductions in base flow of the Pinewood River; and seepage from the tailings management area and mine rock stockpiles following closure. A fully integrated pre- and post-processor model (Visual MODFLOW Version 5.6) developed by Schlumberger Water Services (2011) was used to assemble input data for the model and to present the MODFLOW output results.

Principal hydrostratigraphic units comprising the model domain are defined in Table 5-3. Unit surface elevations for the groundwater model were derived from RRR data, water well records, geotechnical and geomechanical investigations (AMEC 2013j) and from data provided by Nuinsco Resources (1997).

The selected model domain for the updated RRP groundwater flow model is shown in Figure 5-7. The northern and eastern boundaries were generally set along the groundwater

divide in bedrock. The southern boundary was set along Tait Creek, located about 5.5 km south of Pinewood River. The top of the model domain was set as the ground surface interpreted from the Light Detection and Ranging (LiDAR) survey data. The bottom of the numerical model was established at an elevation of -500 masl or approximately 450 m below the bottom of the proposed open pit (Figure 5-8).

The total number of model layers was 19, including representation of near-surface deposits (Layer 1), till and shallow bedrock zones (Layers 2 to 5), shallow to intermediate depth bedrock (Layers 6 to 9), and deep bedrock (Layers 10 to 19). Horizontal grid spacing for the model varied from 10 m close to the proposed open pit area to about 100 m close to the model domain boundary. Vertical grid spacing (thickness of model layers) varied from about 1 m (Layers 1 and 2) to about 80 m (deep bedrock; Layer 19). The model domain also includes a more permeable brittle fault zone that transects the open pit in a north-south direction. Additional layers were added to simulate the underground workings for the predictive simulations.

All major simulated surface water features (creeks, lakes, ponds and wetlands) located within the model domain were represented by the MODFLOW river nodes (McDonald and Harbaugh 1988) with the specified stage elevations close to the ground surface. Input parameters (hydraulic conductivities and recharge rates) assigned to the various overburden and bedrock aquifer zones for the groundwater flow model are summarized in AMEC (2013j).

Calibration of the model was achieved by adjusting hydraulic conductivity and recharge values to obtain a reasonable match between computed and observed groundwater levels. The results were also compared to flow data measured in the Pinewood River, as estimated from Water Survey of Canada flow gauging records, for the Water Survey of Canada 05PCO23 station, for the late summer / early fall and winter periods.

Details of model constructs are described in AMEC (2012j).

5.2.8 Water and Sediment Quality

5.2.8.1 Water Quality

Water and sediment quality are important parameters for defining the health of aquatic ecosystems and also provide a basis for calculating allowable effluent discharge loadings to the local receiving waters. Knowledge of local water quality is also necessary for assisting with the design of potable water treatment systems.

RRR began collecting baseline water quality data in 2007 from a limited set of stations proximal to the RRP. The sampling program was expanded and by June 2010 a standardized monthly water sample collection program had been established which included 14 stations. These included 11 stations within the Pinewood River watershed, 1 site downstream of Muskrat Lake to the northeast of the Pinewood River watershed, and 2 sites on the Rainy River (upstream and

downstream of the Pinewood River inflow; Figure 5-9). Six of the 14 monthly stations are expected to be retained as long term permanent monitoring stations (Table 5-4). The remaining eight stations currently being used to characterize the RRP site are considered temporary stations as these stations will be displaced or extensively modified by proposed RRP development.

Water samples from the regular monthly stations are collected as grab samples from approximately 10 cm below the water surface and are preserved in bottles which are kept in a cool environment until analyzed at a Canadian Association for Laboratory Accreditation laboratory (Maxxam Analytics 2008 to 2011; ALS 2012 to present). Samples are analyzed for a broad set of parameters including: acidity, alkalinity, biological oxygen demand, chemical oxygen demand, chloride, colour, conductivity, dissolved and total organic carbon (TOC), dissolved oxygen, fluoride, hardness, nitrogen compounds, oil and grease, pH, phosphate, redox potential, total and free cyanide, total dissolved solids, total suspended solids, turbidity, sulphate and a wide spectrum of ICP-MS metals.

In addition to the regular monthly water quality samples, spot water quality samples were also collected during the aquatic (fish and benthos) sampling programs, to document water quality conditions at that time. This sampling included field measurements for dissolved oxygen, conductivity, pH and temperature.

Analytical results from water quality sampling programs were compared to Canadian Environmental Quality Guidelines (CEQG) and Provincial Water Quality Objectives (PWQO) for the protection of aquatic life. These guidelines and objectives are a set of criteria that are considered by the Federal and Provincial governments to protect all forms of aquatic life at all stages of their life cycles over an indefinite exposure period. Federal and Provincial drinking water quality guidelines are less stringent than CEQG and PWQO values for the protection of aquatic life.

5.2.8.2 Sediment Quality

A limited set of sediment samples (four samples) was collected by KCB during 2008 and 2009 from the Pinewood River, and from West Creek and Marr Creek. A much more extensive set of sediment samples was collected by AMEC in 2011 (26 samples) and 2012 (29 samples). Sample locations are shown in Figure 5-10, and are listed in Table 5-5. Sampling over the two years provided extensive coverage of all creeks within the potential development zone as well as along the Pinewood River, upstream and downstream of the proposed development.

Surficial sediment samples were collected from each location using a Petite Ponar grab sampler. At each sampling location, three replicate sediment grabs were collected and pooled to provide one composite sample per location to improve sample representation. Chemical analyses and grain size analysis were conducted at Maxxam Analytics or ALS Laboratory.

Results were compared to the Ontario Provincial Sediment Quality Guidelines (PSQG). The guidelines define three levels of effects that reflect potential chronic and long term effects of certain elements on benthic invertebrates as per the following:

- **No effect:** no toxic effects are observed on aquatic organisms (concentrations are less than the method detection limits);
- **Lowest effect level (LEL-2):** level of sediment contamination that can be tolerated by the majority of the sediment-dwelling benthic invertebrates, for which the sediment is considered to be clean to marginally affected; and
- **Severe effect level (SEL-2):** level of sediment contamination at which pronounced disturbance of the sediment-dwelling community can be expected, for which the sediment is considered heavily affected.

Sediment quality results were also compared to the CEQG for sediment.

5.2.9 Aquatic Resources

Fisheries and benthos data are used to characterize local aquatic ecosystems, determine potential environmental sensitivities to potential adverse effects and to provide a basis for developing fish habitat compensation measures where adverse effects to aquatic ecosystems are otherwise unavoidable.

Fish, fish habitat and benthos studies were conducted by the MNR in partnership with the Rainy River First Nations in 1997 (MNR 2012a); KCB in 2009 and 2010 (KCB 2011a); and by AMEC in 2011 (AMEC 2012b), 2012 (AMEC 2013f) and 2013 (AMEC 2013l, 2013o). Sampling locations are shown in Figures 5-10, 5-11 and 5-12.

5.2.9.1 Aquatic Habitats

KCB characterized aquatic habitats throughout the study area using habitat measures and descriptors recorded in DFO / MOE stream survey forms. Metrics assessed included:

- Stream channel width;
- Floodplain width;
- Stream wetted width;
- Pool and sill depths;
- Riffle depths;

- Bank height and composition;
- Flow types and percent (pool, glide / run, riffle, cascade / rapids, chutes / falls);
- Substrate types and percent (bedrock, boulder, cobble, gravel / pebble, sand, silt, clay, organics);
- Riparian cover and percent (and near-stream vegetation species);
- Spot flow volume / discharge; and
- Photographs and notes on habitat features and functions.

Aquatic studies conducted by AMEC were intended to add to the previous studies by providing multi-year efforts, as well as expanding the study area, particularly in the upstream Loslo Creek area within the footprint of the proposed tailings management area and in the downstream Pinewood River reaches to allow assessment of potential RRP effects on these areas. Field sampling in 2011 was conducted between July 18 to 25 and September 26 to October 3 (AMEC 2012b); and in 2012 from July 11 to 19, August 28 to September 7 and from September 18 to 27 (AMEC 2013f). Field sampling during 2013 was conducted from May 14 to 22, 2013 (AMEC 2013l, 2013o).

During field investigations topographic maps, orthophotographs, a handheld global positioning system, rangefinder and compass were used to reference locations, orientations and to measure distances.

The 2011 habitat inventories were completed at (Figure 5-12):

- 9 locations on the Pinewood River;
- 2 locations on Tait Creek;
- 1 location on Loslo Creek (including the Cowser Drain);
- 10 locations on Marr Creek;
- 9 locations on West Creek;
- 3 locations on Clark Creek (including the Teeple Drain); and
- 1 location on Blackhawk Creek.

Habitat sampling in 2012 included (Figure 5-12):

- 16 additional locations on the Pinewood River;
- 2 locations on McCallum Creek;
- 1 location on Unnamed Tributary 1;

- 1 location on Tait Creek;
- 1 location on Unnamed Tributary 2;
- 7 locations on Loslo Creek;
- 1 location on Unnamed Tributary 5;
- 2 locations on West Creek;
- 1 location on Clark Creek; and
- 1 location on Unnamed Tributary 8.

Habitat metrics recorded by AMEC were the same as those recorded by KCB, together with additional data on:

- General channel form (gradient, meander length, meander amplitude and entrenchment); and

- Surrounding land uses.

Habitat inventories were also carried out by AMEC for representative pond habitats within the NLSA area. Shoreline pond habitat was differentiated on the basis of substrate composition, shoreline gradients, depth, riparian and aquatic vegetation and cover opportunities. The MTO Fish and Fish Habitat sampling protocol was used at possible pipeline and road crossing locations (MTO 2009). The sampling protocol was also applied to upstream and downstream reaches from possible crossing points to encompass contingency areas for pipeline or road crossings.

Bathymetry was recorded at specific locations on the lower Pinewood River to identify morphological and substrate features in areas of higher water depths. Extensive photographs were taken 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: is the water feature linear and channelized (characterized by fluvial processes) or is it 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 MTO *Environmental Guide for Fish and Fish Habitat* (2009):

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

- Intermittent: river, creek or stream defined as one which flow 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 in sufficient duration to create a defined channel (such as field swale, gully or 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: as the percent occurrence within a reach or ponded area of representative particles size (silt / clay, sand, gravel, cobble, boulder and 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 (such as vegetation, woody debris, rock).

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

A supplemental aquatic baseline survey was conducted in the spring of 2013 to provide further information specific to spring freshet condition and species presence and use of fish habitat in the Pinewood River and its tributaries within the NLSA: Loslo Creek / Cowser Drain, Marr Creek, West Creek and Clark Creek / Teeple Drain (Appendix I-4). Specifically, surveys were undertaken to investigate the use of the Pinewood River and its associated tributaries within the vicinity of the RRP by Walleye and Northern Pike during the period of potential spawning or staging for spawning as requested by regulatory agencies.

Sampling locations were selected based on their proximity to the RRP site, landowner permissions, accessibility and logistical feasibility. Field sampling during 2013 was conducted

from May 14 to 22, 2013. Components of this study included *in situ* surface water quality, visual habitat assessment and fish community / spawning surveys. Conditions experienced during the 2013 spring survey were freshet or flood condition with the bankfull water level exceeded throughout the Pinewood River and its tributaries, and inundation of the flood plain.

For the purposes of this baseline investigation Pinewood River and four of its tributaries were surveyed. Using seven sampling techniques, short duration gillnetting (less than or equal to eight hours), minnow traps, larval tows, backpack electroshocking, dip netting, spotlighting and angling, 12 fish species were captured with an average of 1.58 CPUE.

Surveys conducted using fishing gear and visual observation for Walleye in the mainstem Pinewood River, focussed on lower section of the river at locations previously identified as having potential as spawning locations for Walleye. Temperatures during the 2013 spring field survey ranged from 7 to 14°C in the Pinewood River.

5.2.9.2 Fish

Studies were conducted in 1997 on the Pinewood River at a location mid-stream section and five locations along the downstream section. Sampling was conducted following the Ontario Stream Assessment Protocol and included collection of fish using backpack electrofishing, benthic invertebrate sampling, and habitat assessment (Tables 5-6, 5-7 and 5-8; Stanfield 2010).

Fisheries studies conducted by KCB included coverage of the Pinewood River in the general vicinity of the RRP site, four Pinewood River tributaries (Clark Creek, West Creek, Marr Creek and Loslo Creek), as well as McCallum Creek, Tait Creek and a number of smaller creek systems peripheral to the Pinewood River watershed (Table 5-6; Figure 5-11; KCB 2011a). The majority of the fisheries work conducted by KCB involved the use of minnow traps, with more limited use of electro-fishing (West Creek), and gill and seine netting (Pinewood River). Gill netting was used to target larger fish species (Northern Pike, White Sucker and Brown Bullhead). Fishing and fish habitat assessment efforts by KCB were undertaken in the summer of 2009 and in the late winter, spring, summer and fall of 2010. Fisheries data were presented as: species presence or absence, relative abundance and catch per unit effort.

Fish community sampling techniques employed by AMEC included the use of gillnetting, minnow traps, seine netting, boat and backpack electroshocking, dip netting and angling (Table 5-6; AMEC 2012b and AMEC 2013f). These techniques were deployed to provide a range of passive and active sampling methods for capturing small and large-bodied fish species in pond and fluvial habitats.

Gill nets were primarily used in the lower reaches of the Pinewood River, in areas with sufficient wetted widths and depths that would favour the capture of large bodied fish species. Nets were

typically set on the substrate between depths of 1 and 4 m. Data were recorded as gillnet catch per unit effort (CPUE).

Minnow traps were used for capturing small-bodied fish. Traps were set at the majority of locations using a maximum of six baited minnow traps for sets of from 1 to 24 hours. Traps were generally set along creek banks or within 3 m of pond and river banks in depths between 0.5 m and 1 m. This technique was used to target the forage fish community and coincided with dip netting effort. Minnow trap CPUE values were calculated as the number of fish captured per trap hour.

Seine netting efforts were conducted in areas of greater relative width and depth, with data also being expressed as CPUE.

Backpack electroshocking was conducted using a Smith-Root Model LR-24 backpack electroshocker. Electroshock sites were sampled using a sweeping motion concentrating on equal effort in different habitats. Boat electroshocking was conducted in September 2012 on lower sections of the Pinewood River using a 2.5 GGP Smith-Root Electrofisher, operated from a zodiac. Electroshocking results were also expressed as CPUE.

Angling was utilized in the fall of 2012 to capture adult fish in the Lower Pinewood River.

All fish captured during baseline studied by AMEC during 2011 and 2012 were identified to species by qualified fisheries biologists, were measured for length and weight, and were scrutinized for any obvious parasites or lesions. Forage fish were returned unharmed to the location of capture except for a small number of individuals retained for analysis of total mercury and metals. Species specific whole body composite samples for forage fish were collected from the Pinewood River and tributaries (AMEC 2013f). A subsample of adult Northern Pike and Walleye captured at the Pinewood River were sacrificed, identified for sex and sampled for dorsal muscle tissue, liver tissue and calcified aging structures (scales, spines, cleithra, otoliths and fin rays as applicable to species). Tissue samples were stored in individually labelled whorl packs and kept frozen for storage and during shipment for analysis of total mercury and metal body burdens by Maxxam Analytics.

Details regarding the methodology utilized during the focussed 2013 aquatics investigations are provided in Appendices I-4 and I-5.

5.2.9.3 Benthic Invertebrates

Benthic studies carried out by KCB were limited to the Pinewood River and West Creek (Table 5-7; KCB 2011a). Benthic samples from the Pinewood River were collected using both an Eckman dredge and a Petite Ponar sampler. Benthic samples from West Creek were collected using a cylindrical Hess sampler. Replicate samples were collected and preserved in accordance with standard industry methods. Benthic data were analyzed for total density,

taxonomic richness, taxonomic evenness and for the Bray Curtis Index of dissimilarity as per Metal Mining Environmental Effects Monitoring (MM EEM) Guidelines (EC 2012b).

Benthic invertebrate communities were sampled by AMEC between September 27 and October 2, 2011 at 7 locations on the Pinewood River, 1 location on Tait Creek, 3 locations on Loslo Creek, 6 locations on Marr Creek, 5 locations on West Creek, 3 locations on Clark Creek and 1 location on Blackhawk Creek (Table 5-7; Figure 5-10; AMEC 2012b and AMEC 2013f). All samples were collected using a Petite Ponar grab sampler. Three replicate sub-samples were taken and pooled (homogenized) at each replicate station to improve sample representativeness, by reducing intra-sample variation inherent to benthic communities. All samples were preserved in 10% formalin.

Additional benthic samples were collected between August 28 and September 6, 2012 as well as September 19 and September 25, 2012 from 14 locations on the Pinewood River, 2 locations on McCallum Creek, 1 location on Tait Creek, 1 location on Unnamed Tributary 2, 5 locations on Loslo Creek, 1 location on Unnamed Tributary 5, 2 locations on West Creek Tributary 1 and 1 location on Clark Creek (Figure 5-10). Sampling gear was the same as that used in 2011.

Benthic invertebrate communities at each sample location were characterized using a series of descriptor indices including: total invertebrate density, Simpson's index of diversity, evenness and taxon richness. These indices were calculated and summarized using Metal Mining Environmental Effects Monitoring Guidelines (EC 2012b). Percent Ephemeroptera, Plecoptera, Trichoptera (EPT; mayflies, stoneflies and caddisflies) and percent Chironomids were also used as descriptors of the benthic invertebrate communities sampled as they are recognized as useful indices for characterization and comparison of benthic invertebrate communities.

5.2.10 Vegetation

Vegetation surveys were conducted by KCB in 2009 and 2010 and by AMEC in 2012. Vegetation surveys undertaken by KCB were conducted on 24 dates between June 2009 and October 2010 for a total of approximately 95 hours. Surveys were focused on visiting the full range of vegetation types and communities in the NLSA as determined by a review of aerial photographs and Forest Resource Inventory maps. Vegetation community observations were recorded at over 300 field stations (Figure 5-13). Data collection included ecosites (Racey et al. 1996), forest vegetation type (V-type; Sims et al. 1997) and wetland vegetation type (W-type; Harris et al. 1996). Soil texture, depth and moisture regime were determined by auguring at selected stations and trees were aged using an increment borer. A plant species inventory was compiled for the NLSA.

The 2012 vegetation surveys were conducted on June 18 to 21 and July 3 to 7. Surveys were undertaken by two botanists and typically lasted 10 hours each day. Site investigations were targeted at several polygons within the NLSA (Figure 5-13). These vegetation survey polygons covered approximately 1,300 ha and overlapped with new locations for certain RRP

components. Existing Forest Resource Inventory mapping was acquired from the MNR prior to site investigations and was used to guide field transects during surveying. Each of the Forest Resource Inventory communities within each vegetation survey polygon was visited to confirm the community classification. A plant species list was compiled for the NLSA.

Provincially rare species are those identified as rare or historical in Ontario based on records kept by the Natural Heritage Information Centre. Provincially rare species include those who are assigned S-Rank codes of S1 (extremely rare), S2 (very rare), or S3 (rare to uncommon). A historical information review indicate that no rare vegetation communities are present in the NLSA but discovered that rare plants in the Fort Frances District are often associated with the following features: rock outcrops and/or rocky lake shorelines, conifer swamps, uncommon forest types (elm stands, silver maple stands, yellow birch stands, basswood stands, ironwood stands, white ash stands and Hill's oak stands) or uncommon ecosites, climatically modified areas (banks of Rainy River), southern / prairie influences (shoreline of Lake of the Woods), mesic prairie – Long Sault Rapids, oak stands – groves and savannahs, and ash stands (Van den Broeck 2006). Searches for the habitat of rare plant species and rare plants were conducted concurrently with the vegetation surveys as described above.

5.2.11 Mammals

5.2.11.1 Aerial Surveys

Mammal species and habitat types within the NLSA were recorded by KCB and AMEC between 2009 and 2013 through aerial surveys, encounter transects and incidental observations during all fieldwork.

Two aerial surveys were conducted across the NLSA. A spring aerial survey was undertaken on April 5, 2012, during which all mammal species or habitat features were recorded. This survey provided coverage across the proposed RRP site area, as well as the proposed transmission line routing alternatives. For the proposed mine site area, the survey involved flying 20 east-west transects that were 17 km long and spaced at 500 m intervals (Figure 5-14). For the transmission line alternatives, the survey involved 24, 13.5 km long transect lines, spaced at 500 m intervals (Figure 5-14). Aerial surveys were undertaken using a Eurocopter AS350 (A-Star) helicopter, travelling at approximately 100 km/hr at an elevation of approximately 100 m. Waypoints for survey line start and end points were provided in advance to the pilot for navigation. A second aerial survey was conducted in the winter on February 20, 2013. For the proposed mine site area, the survey involved flying 10 east - west transects, each 17 km long, and 4 east-west transects that were 5 to 10 km long, all spaced at 1 km intervals (Figure 5-14). For the proposed transmission line alternatives, the aerial survey followed 11 transect lines that were 13.5 km long and also spaced 1 km apart. In addition to this, five potential aggregate pit sites were flown over.

Observers sat on either side of the aircraft and recorded sightings of all observed mammals, beaver lodges, beaver dams, muskrat houses, or other larger den features (such as wolf or bear dens). The survey date was consistent with the annual period during which denning activity or recent emergence from dormancy would be observed for wolves and bears (Olli et al. 1997; MNR 2009a). Observing dens located in dense forest can be difficult during an aerial survey, but use of a helicopter, researchers have the ability to fly slowly, hover, and even land when certain features require a closer look. Observation conditions were excellent with no cloud cover, no precipitation, low wind levels, and warm temperatures.

During aerial line transect surveys and incidental ground observations, recorded signs of mammalian presence included, but were not limited to, visual observations, hearing vocalizations, road kills, tracks, droppings, burrows, and dens. Searches of wildlife habitats were also conducted concurrently with all fieldwork and included: seasonal concentration areas, specialized habitats for wildlife, habitats for species of conservation concern, and animal movement corridors. Criteria used to identify these wildlife habitats are outlined in the *Significant Wildlife Habitat Technical Guide* (MNR 2000).

5.2.11.2 Bats Surveys

To detect the presence, diversity, and activity levels of bat species in the NLSA, five Songmeter SM2Bat+ recording devices were deployed at five separate locations (Figure 5-15; Appendix K-5). Detectors were positioned at locations where higher levels of bat activity were likely to occur, such as along woodland and wetland edges. Detectors were configured to begin recording at dusk (8:30 pm) and end recording at daybreak of the following morning (7:00 am). Recordings were taken across four nights between June 18 and June 22, 2012 and across three nights between July 4 and July 7, 2012. Additional surveys were completed during 2013. Data were recorded in Wildlife Acoustics Compression (WAC) format and were saved on 16 MB memory cards. Recordings made in the field were converted to Waveform Audio File (WAV) format using the Wac2Wav utility converter (Wildlife Acoustics) for analysis and identification using SonoBat software. The ability to assign a species identity to call recordings are largely affected by the quality of the recordings which is affected by the strength and directionality of the call, frequency response of the detector and by the recording of obstructive sound often produced by weather conditions (Adams et al. 2012).

A small number of bat species have recently been recommended for inclusion as Endangered Wildlife in Canada, by COSEWIC, including the Little Brown Myotis. The Little Brown Myotis and the Northern Long-eared Myotis have also recently been listed as Endangered by the Province of Ontario. The concern for these species is the rapid spread of White Nose Syndrome; a fungus which disrupts hibernation and which has a high fatality rate. The background information review identified both of these species as potentially occurring within the NLSA and therefore, special attention was paid to these species. Little Brown Myotis feed over open bodies of water, the margins of waterbodies and forests, in clearings and along open forest roads (Anthony and Kunz 1977). Big Brown Myotis is a generalist in terms of foraging habitat

and show no preference for over water versus over land sites, edge versus non-edge sides, areas with versus without canopy enclosures, or urban versus rural environments (Kurta and Baker 1990). As a result, detectors were placed along woodland or wetland edges in an attempt to capture the presence of both bat species.

5.2.11.3 Mammalian Habitat

Habitat for mammalian species of conservation concern was recorded opportunistically during formal wildlife and vegetation surveys. Species of interest included American Badger, Franklin's Ground Squirrel, Grey Fox and Eastern Wolf. American Badger, Grey Fox and Eastern Wolf are wide ranging predatory species that require a wide landscape that includes a variety of landscape features. Franklin's Ground Squirrel, has a strong affinity for tall grass and mid-grass prairies and generally avoids short grass habitats (IUCN 2012). Nests are in underground burrows (IUCN 2012). Suitable habitat for this species was screened during vegetation community surveys, while incidental sightings recorded opportunistically during formal wildlife and vegetation surveys.

5.2.12 Birds

Various types of breeding bird surveys were conducted between 2009 and 2012 to determine the diversity and abundance of breeding bird species utilizing the RRP site area, as described below. The surveys accounted for the species guilds, variety of habitat types and temporal behaviours of local breeding species.

5.2.12.1 Breeding Bird Point Counts

The historical information review indicated 175 breeding bird species may utilize the NLSA. The Significant Wildlife Habitat Ecoregion 3E Criteria Schedules (MNR 2012c) identifies 12 Significant Wildlife Habitat types used by birds in boreal Ontario and the historical information review indicates 10 breeding bird Significant Wildlife Habitat types may occur in the NLSA including:

- Colonially-nesting breeding bird habitat (bank and cliff);
- Colonially-nesting breeding bird habitat (trees / shrubs);
- Waterfowl nesting areas;
- Bald Eagle and Osprey nesting, foraging and perching habitat;
- Woodland raptor nesting habitat;
- Woodland area-sensitive breeding bird habitat;
- Sharp-tailed Grouse leks;
- Marsh Breeding bird habitat;
- Shrub / early succession bird habitat; and
- Special Concern and Rare wildlife species.

Breeding bird surveys were conducted between 2010 and 2012 to determine the diversity and abundance of breeding bird species utilizing the RRP area. Survey methods were implemented to detect a representative inventory of the wide variety of species likely breeding within, or in proximity to, the NLSA and reflective of the variety of breeding bird guilds indicated in the historical information review. Breeding bird surveys accounted for a variety of habitat types and temporal behaviours of local breeding species.

Breeding bird point count surveys were conducted by KCB in 2009 and 2010 (KCB 2011a), and by AMEC in 2011 and 2012 (AMEC 2011; AMEC 2012c). These surveys targeted the majority of diurnal breeding bird species which represent the majority of bird species likely occur in the NLSA.

KCB conducted breeding bird surveys on June 22, 2010 at 55 stations situated at 800 m intervals along roads. Surveys points occurred adjacent to a variety of habitat types (Figure 5-16) and followed survey methodology used by the North American Breeding Bird Survey (BSC 2001). All birds seen or heard within a 3 minute period less than 400 m from the station were recorded.

Forest bird monitoring was conducted in 2009 and 2010 at 100 stations in and near the NLSA (Figure 5-16) following the Forest Bird Monitoring Program protocol (Konze and McLaren 1997). This method consists of 10-minute listening stations at least 250 m apart. Stations were selected using 1:20,000 scale satellite imagery. Surveys began at sunrise and were completed by 11:00 am. In 2009, stations were surveyed twice and in 2010 stations were surveyed once.
Breeding bird surveys conducted by AMEC in 2011 mirrored locations used by KCB in 2010 in order to provide inter-year information, with the addition of some new locations to fill in gaps in coverage. A total of 29 breeding bird stations were surveyed, covering much of the NLSA (Figure 5-16). Breeding bird surveys conducted by AMEC in 2012 were expanded to further to proposed areas of development away from roadsides and not previously surveyed for breeding birds. Point counts surveys conducted by AMEC in 2012 were conducted at 104 predetermined survey stations with interval spacing of at least 300 m (Figure 5-16).

Breeding bird point count surveys undertaken by AMEC in 2011 and 2012 were conducted in partial accordance with the protocols described for the Ontario Breeding Bird Atlas (OBBA) Guide for Participants (OBBA 2001). At each station, all birds seen or heard during a 10-minute period, rather than the suggested 5-minute listening period in OBBA (2001) were recorded on a datasheet. Bird observations were recorded at four distance regimes: within a 50 m radius; 50 to 100 m radius; outside a 100 m radius; and flyovers (birds seen flying overhead). Surveys were conducted in the morning, beginning 30 minutes prior to sunrise (dawn) and ending within 5 hours of the start of the survey. Additional species observed between point count stations were recorded as incidental observations.

5.2.12.2 Sharp-tailed Grouse Lek Surveys

Surveys for Sharp-tailed Grouse mating display grounds (leks) were conducted on May 3, 2010 and May 4, 2010 by KCB. Surveys were conducted by driving roads in early morning and scanning pastures, hayfields, and other open habitat for displaying grouse. All roads through open habitat in the NLSA were surveyed (totalling approximately 25 km). Early morning survey stations were set up approximately 200 m from identified lek locations and scopes were used to identify and count the grouse present at each lek. Locations and numbers of grouse were documented at each station.

5.2.12.3 Nocturnal Bird Surveys

Nocturnal bird species such as rails, bitterns, owls and nightjars are not often detected during morning breeding bird surveys. Evening surveys targeting to detect the presence and prevalence of nocturnal birds were conducted by KCB in 2010 and by AMEC in 2011 and 2012.

Owls

Owl surveys were conducted by KCB in April and May of 2010 using the Northern Ontario Protocol described by Konze and McLaren (1997). Most of these survey points were replicated by AMEC in May and June of 2011 and 2012, in order to provide inter-year information and some new locations were added to fill in gaps in coverage.

In 2010, 12 survey stations were completed in the NLSA at 1.6 km intervals along roadsides (Figure 5-14). At each station a tape playback of Boreal Owl and Great Gray Owl was played followed by a listening period. All owls heard were recorded. Surveys were conducted at night, beginning 30 minutes after sunset and were completed by midnight. In 2011 and 2012, surveys were conducted using the Northern Ontario Nocturnal Owl Protocol described by Takats et al. (2001) as a guideline. Calls of the six nocturnal owl species previously recorded in the NLSA (Northern Saw-whet Owl, Boreal Owl, Long-eared Owl, Barred Owl, Great Gray Owl and Great Horned Owl) were played using portable speakers. Calls of each species were played for 20 seconds, followed by a 1 minute listening period. The survey at each station began with a 2 minute listening period. Species calls were played in order of the size of the owl species beginning with the smallest species and ending with the largest species. All owl observations were recorded. Surveys began 30 minutes after sunset and concluded at midnight. Nineteen additional stations were surveyed in June of 2012 (Figure 5-14).

Separate Short-eared Owl surveys were conducted, because this species is active at dusk and occupies more open habitat compared with the other owl species. An extensive roadside Short-eared Owl survey was conducted in June 2011. A route was driven which passed through all suitable Short-eared Owl habitat (grassland, pasture and meadow-marsh) within the NLSA. Ten minute point count surveys were conducted in all suitable habitat areas where each area was scanned with binoculars by observers familiar with Short-eared Owl habitat and behaviour.

Fields were scanned for foraging owls and fence-posts and trees along the edges were scanned for perched owls. This survey began 60 minutes prior to sunset and ended 30 minutes after sunset. Survey methods used were similar to those adopted by the Kingston Field Naturalists (2012) because no standardized Short-eared Owl survey methodology exists for Ontario.

Nightjars

Common Nighthawk and Eastern Whip-poor-will are crepuscular bird species not readily detected during morning breeding bird point count surveys.

KCB conducted two targeted whip-poor-will surveys in June of 2010. Inventory methods followed the Proposed Survey Technique for Common Nighthawk and Whip-poor-will, Version 1.0 (Holroyd 2009). This survey technique was followed as no standardized survey methodology was available for Ontario. Surveys were conducted along roads at a total of 38 survey locations. Point count surveys were conducted every 1.6 km along a predetermined road route for a period of 6 minutes per station.

AMEC recorded Eastern Whip-poor-will during 2011 nocturnal owl surveys and initiated targeted whip-poor-will surveys in June 2012. Surveys were largely conducted in accordance with standardized protocol outlined in the Whip-poor-will Roadside Survey Participant's Guide (BSC 2012). A total of 54 survey stations (Figure 5-14) were surveyed along roadsides passing through habitat deemed as suitable to whip-poor-will throughout the NLSA. These surveys were conducted within the recommended timing window starting 30 minutes after sunset and continued until midnight. Surveys at each station lasted 6 minutes. The June surveys were conducted under overcast conditions but the July surveys were conducted with clear skies and during a full moon phase.

No standardized survey protocols have yet been established for surveying Common Nighthawks in Ontario. This species was recorded concurrently during all whip-poor-will or nocturnal owl surveys undertaken between 2010 and 2012.

5.2.12.4 Marsh Birds

Surveys conducted by KCB followed methodology outlined in the Marsh Monitoring Program Bird Surveys (Konze and McLaren 1997) and the Inventory Methods for Waterfowl and Allied Species (RIC 1999). A total of 19 stations were surveyed (Figure 5-14) in the NLSA. Point count stations were selected prior to field investigations using 1:20,000 scale satellite images. Survey stations were selected based on suitable habitat, NLSA coverage and accessibility. Point counts were conducted at dusk at 6:00 pm and completed before sunset. All waterfowl and marsh birds observed in and/or adjacent to a 100 m radius circle were recorded by an observer over a period of 10 minutes for each point count station. At each point count station a call playback tape was played. A recording of Virginia Rail, Sora, Least Bittern and Pied-billed Grebe call was played three times at each station and responses were recorded.

Although marsh bird monitoring was not a formal part of the studies conducted in 2011 and 2012, marsh birds were recorded opportunistically by AMEC during nocturnal owl and amphibian surveys, which took place at night, during the same time frame as standard marsh bird monitoring and many survey points were located near to habitats suitable for marsh birds. The call playback tapes method suggested in BSC (2009a) were not used, yet all marsh species seen or heard calling were recorded.

5.2.12.5 Aerial Raptor Nest Surveys

A spring aerial raptor nest survey was undertaken on April 5, 2012 in association with the aerial mammal survey. This survey provided coverage across the proposed mine site area, as well as the proposed transmission line alternatives.

Observers sat on either side of the aircraft and recorded sightings of all stick nests, including diurnal raptors, ravens, owls, waterfowl and heronries. Observed nests were identified as active or inactive depending on evidence presented during observation. Active nests were occupied by adults incubating eggs or by unattended eggs. All birds observed were recorded and indentified if possible. Observation conditions were excellent with no cloud cover, no precipitation, low wind levels, and warm temperatures.

5.2.12.6 Species at Risk, Species of Special Concern and Provincially Rare Species

Nineteen avian SAR and Provincially rare species were listed during the historical information review which may occur in the NLSA. With the exception of a few species the majority of avian SAR and Provincially rare species belong to habitat guilds described in MNR (2000) including marsh, open country, shrub / early successional, woodland breeding bird habitats. Others species such as Black-billed Magpie (Provincially Rare; S3?), Barn Swallow (Threatened) and Chimney Swift (Threatened) generally take advantage of artificial habitat features created by humans. The majority of SAR and Provincially rare species were surveyed through various point count surveys as earlier described.

5.2.12.7 Migration Monitoring Surveys

Three Significant Wildlife Habitat types used by migratory birds occur in boreal Ontario (MNR 2000), including:

- Waterfowl stopover and staging areas (terrestrial);
- Waterfowl stopover and staging areas (aquatic); and
- Shorebird migratory stopover areas.

The historical information review indicated that these Significant Wildlife Habitat types are likely absent from the NLSA, yet migratory bird surveys were completed nonetheless to complete a

general assessment of the potential of the site as a migratory route and/or stopover habitat based on known regional bird migration patterns (Harris et al. 2002a).

Migratory bird monitoring was conducted by KCB from October 5, 2010 to October 8, 2010. The survey was not intended to be a comprehensive assessment of bird migration, which is dependent on weather and other factors and is highly variable between years. The survey station was located in a field south of the Pinewood River near the middle of the NLSA (15U 425745, 5408591). This site offered an unimpeded view of several kilometres to the north, east, and west. The Hawk Migration Association of North America (2006) protocol was followed. Monitoring consisted of standing at a suitable vantage point and recording the number of migrating raptors, waterfowl, and other birds. The monitoring period covered up to 6 hours beginning 30 minutes before sunrise. Bird observations were summarized into height zones and flight direction. Wind direction, temperature, and other weather parameters were recorded.

5.2.13 Reptiles and Amphibians

Amphibian breeding surveys were conducted annually between 2009 and 2012, utilizing the Marsh Monitoring Program Amphibian Survey protocol (BSC 2009b). Eighteen stations were surveyed by KCB in 2009 and 2010, 20 stations were surveyed by AMEC in 2011 and 38 stations were surveyed by AMEC in 2012 (Figure 5-17). Two rounds of monitoring during each season ensured early and late-breeding frog species were detected. Calling species were recorded during a 3 minute period with a recording radius of unlimited distance. The calls of each amphibian species were assigned specific call level codes in accordance with the protocol (BSC 2009b). Studies were conducted at night beginning 30 minutes after sunset (twilight) and were concluded before midnight.

Reptile and amphibian observations (outside of the amphibian breeding surveys) were recorded opportunistically during all other fieldwork. Searches of Significant Wildlife Habitat were also conducted concurrently with all fieldwork and included: seasonal concentration areas, specialized habitat for wildlife, habitats for species of conservation concern and amphibian movement corridors (as outlined in MNR 2000).

Typical habitat including rocks, logs, leaf litter and other forms of cover were turned over and replaced. Vernal pools (frog and salamander eggs and larvae), basking logs (turtles) and soil banks (turtle nests) were also examined.

5.2.14 Invertebrates

Incidental observations of odonates (dragonflies and damselflies) were compiled during all years of fieldwork between 2009 and 2012. Observations included adults and exuviae (shed larval skins). Incidental observations of butterflies were recorded by AMEC during fieldwork conducted in 2011 and 2012.

Searches for habitat for species of conservation concern (Monarch Butterfly, Midland Clubtail Green-faced Clubtail and Variegated Meadowhawk) were conducted concurrently with all field surveys. Monarch Butterfly habitat exists primarily wherever milkweed and wildflowers such as goldenrods, asters and Purple Loosestrife exist, including abandoned farmland, along roadsides and other open spaces where these plants grow (COSEWIC 2010a).

Midland Clubtail is usually found along rivers with moderate to fast flow, but also lakes with plenty of wave action (Jones et al. 2008). Green-faced Clubtail occurs in clear rocky rivers and streams. It is known to occur on several sections of the Rainy River (Jones et al. 2008). Variegated Meadowhawk utilize a variety of wetlands but is most often found associated with relatively shallow water, often with a sandy bottom (Jones et al. 2008).

5.2.15 Species at Risk

Throughout all surveys, special attention was focused on the detection of SAR. SAR are plant or animal species whose individuals or populations are considered Extirpated, Endangered, Threatened, or Special Concern in Ontario and Canada as determined by the Provincial Committee on the Status of Species at Risk in Ontario (COSSARO) and the Federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC). SAR and any activities within their critical habitat are regulated by the Provincial *Endangered Species Act* and the Federal *Species at Risk Act*.

Under the Federal *Species at Risk Act*, species considered SAR have been listed under either Schedules 1, 2, or 3. Schedule 1 species are those that have had their status reports reviewed by an official panel and are currently accepted with COSEWIC designation, granting them full protection by *Species at Risk Act*. Schedule 2 species are species that must have their status reviewed within 30 days of being posted to the schedule and Schedule 3 species are species that must have their status reviewed within one year of being posted. Under the *Species at Risk Act*, if a species is listed as an Extirpated, Endangered or Threatened, Section 32 of the Act prohibits killing, harming, harassing, capturing, taking, possessing, collection, buying, selling, leasing, trading or offering to buy, sell, lease or trade a member of the species. On private land, these prohibitions apply only to listed aquatic species and migratory birds that are also listed in the *Migratory Birds Convention Act*.

Under the *Endangered Species Act*, if a species is listed as an Extirpated, Endangered or Threatened, Section 9 of the *Act* prohibits killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, leasing, trading or offering to buy, sell, lease or trade a member of the species. Some of these prohibitions also apply to body parts of a member of the species and to things derived from a member of the species. Similarly, if a species is listed on the *Endangered Species Act* as Endangered or Threatened, Section 10 of the *Act* prohibits damaging or destroying the habitat of the species. This prohibition also applies to an Extirpated species if the species is prescribed by the regulations. The regulations may specifically prescribe an area as the habitat of a species but, if no habitat regulation is in force with respect

to a species, habitat is defined to mean an area on which the species depends, directly or indirectly, to carry on its life processes.

There are a few SAR (Federal and Provincial), as well as Provincially rare species that are known to occur within the RRP site area; or that have a moderate to high probability of occurring on the RRP site area. The majority of the SAR species are avian. Further detail on the aquatic and terrestrial SAR is provided in Section 5.8.19 and 5.10.6.

5.2.16 Human Environment

The June 2011 KCB baseline report was used as a starting point for data collection. A gap analysis was completed to determine additional information needs to complete the socio-economic baseline. Where more recent data were available (most notably those arising from the 2011 Census) sections were updated. Additional socio-economic information was collected using secondary sources. A survey was developed and sent to towns and townships in the study area, community groups and First Nation groups. RRR has offered to gather socio-economic information specific to the Métis regional community, and will incorporate this information when available. Follow up telephone calls were made to clarify information provided or to encourage completion of the survey. Some information was also collected from individuals at open houses hosted by RRR in May and November 2012 and during key stakeholder interviews conducted in December 2012.

Data limitations pertinent to this report include limitations inherent in the 2011 and 2006 Census data available through Statistics Canada. Census data for 2011 are limited to data that have been released in 2012. To date, population, dwellings, age and sex data have been released. Additional data are being released in 2013. When reporting Census data that were based on a 20% sample of households, Statistics Canada rounds the data and may not report data for small populations to ensure the confidentiality of the information. The result of rounding is that, for small populations, the calculated total of responses may appear inconsistent with the reported total data set.

Historically, Ontario has had one of the highest census data under coverage rates in Canada. Under coverage refers to people who were not counted in the Census. Ontario's net under coverage rate for the 2001 and 2006 Censuses was 3.8% (Statistics Canada 2007a). The overall net under coverage for all the Provinces and territories for the 2006 Census was 2.8% (Statistics Canada 2012a). Estimates for under coverage in the 2011 Census are not yet available.

To address potential deficiencies, secondary sources obtained from the Internet were used when and if available. The accuracy of non-published sources was verified, where possible, through primary data collection including questionnaires sent to stakeholder organizations and Aboriginal community representatives.

5.2.17 Traditional Knowledge and Traditional Land Use

5.2.17.1 Data Sharing Protocols with First Nations and Métis

RRR has engaged Aboriginal community members about exploration and development plans since taking over the property in 2005. In September 2011, RRR opened discussions with the Fort Frances Chiefs Secretariat First Nations about any existing sources of TK / TLU information sources relevant to the RRP area and about conducting TK / TLU studies. As subsequent First Nations were identified by the Crown for consultation, these communities also have been approached to determine their interest in conducting or participating in TK / TLU studies related to current use of the RRP site.

Data Sharing Protocols (DSPs) were developed to initiate these studies. RRR has approached all of the First Nations on the consultation list with the DSPs and requested that they be signed, if they are in agreement. The goal of the DSPs is to ensure that there is a common understanding of their intent, to state how the information collected would be used in the environmental study process and to clarify the ownership of the information collected. The DSPs act as contract between RRR and the Aboriginal party concerned. All DSPs were drafted and negotiated based upon the Considerations and Templates for Ethical Research Practices published by the First Nations Center at the National Aboriginal Health Organization (2008), incorporating the First Nations Principles of ownership, control, access and possession enumerated therein. All agreements adopt the same approach and include common principles: namely that the Aboriginal party concerned owns, controls, determines access to and retains possession of the information gathered concerning TK / TLU by its members on its asserted traditional territory.

The Métis Nation of Ontario is in the process of completing a TK / TLU study. RRR anticipates that as part of the consultation process with the MNO an addendum outlining any follow-up programs or agreements may need to be submitted in parallel with the final EA Report review.

5.2.17.2 Review of Publicly Available Information

A background search for publicly available information on TK / TLU, as well as the culture and history of the Aboriginal groups in the area, was conducted. In addition, RRR requested any existing documented TK / TLU information that would be relevant to the RRP study area. Only the Rainy River First Nations indicated that they had existing videos of TK / TLU but while welcomed, these were unrelated to the RRP study area and were therefore not included. A number of resources from early ethnographers in the area provided some cultural context but little information on current practices. Local reference books also provided information on the early settlement of the Township of Chapple and the Rainy River District. Internet searches of Aboriginal group websites provided little information on current TK / TLU.

5.2.17.3 Identification of Study Participants

In an effort to identify all potential TK holders or traditional land users within the communities, the study team used a number of approaches. The study was discussed at open houses held within communities. In addition, community liaison persons met with Elders and conducted site tours to familiarize them with the area and encourage participation in TK / TLU studies.

Posters describing the study and contact information were delivered to each of the First Nation communities. Each participant was asked to identify other traditional knowledge holders or land users that could be interviewed. Additional efforts were made to identify potential knowledge holders and land users from younger segments of the communities through ongoing discussions and participation at community events.

5.2.17.4 Interview Guide

RRR prepared a standard interview guide designed to lead data collection on traditional activities which may have been carried out in the recent past in the vicinity of the RRP, as well as current activities that may be affected by the RRP. Questions were prepared and reviewed for language comprehension and suitability by local community members. Translation services have been, and will continue to be provided where needed. Interviews were tailored to meet the needs of the interviewees and their knowledge base. In most cases, interviews were conducted in small groups led by a locally-known First Nation interviewee as well as with RRR community liaisons. Interviews were only conducted with individuals after an informed consent form was signed to ensure that the participant had full comprehension of the study parameters.

Maps were prepared to show the location of the RRP and to assist community members to identify relevant land features. Interviewees were encouraged to mark locations discussed on the maps during the interviews. The interviews were conducted in a manner that best suited the participating community members. Interview settings were established as preferred by the community and included visits to the RRP area where requested, or to verify and record specific resources.

Where consent was granted, interviews were recorded on video or audio. Where consent for recording was not given, only notes were taken by the interviewers.

5.2.18 Archaeology

Stage 1 and 2 Archaeological and Cultural Heritage Resource Assessment baseline studies were conducted in 2010, 2011, 2012 and 2013 in accordance with the *Ontario Heritage Act* and the Ministry of Tourism, Culture and Sport (MTCS) 2011 technical guidelines. This work was completed by archaeologists working under licence from the Province.

The archaeological field work was part of the overall EA process, prior to the development of the RRP advanced mineral exploration project and associated proposed infrastructure. The archaeological field work was undertaken to MTCS standards in advance of any new ground-disturbing activities. The archaeological assessment was completed as part of the baseline data collections required under the terms of the EA for the proposed undertaking. The *Environmental Assessment Act* describes the environment as including Section 1(1) (d) any building, structure, machine or other device or thing made by humans. This would include artifacts and archaeological sites. Archaeological assessment constitutes archaeological fieldwork as defined in regulations to the *Ontario Heritage Act* (O. Reg. 170/04), and as such, the archaeological assessment and this report is required to comply the terms of the *Ontario Heritage Act*.

Archaeological Resource Assessment studies are classified as Stage 1 through Stage 4, as follows:

- Stage 1: Preliminary assessment to determine if there are any known significant archaeological resources in the immediate vicinity of or on the subject property and the potential of the site to have heritage resources;

- Stage 2: Completion of a property inspection by a licensed archaeologist if the Stage 1 assessment identified known resources or the presence of archaeological potential areas, if recommended; and

- Stages 3 and 4: Advanced site-specific archaeological mitigation through excavation, documentation or site avoidance, if recommended.

The property has specific areas of high archaeological potential due to present and past (ancient glacial lake) water sources. Local conditions of relatively flat lacustrine clay soils have however, created extensive areas of marsh or sparse forest with wet soils. These areas are not suited to habitation and would be considered low potential. Therefore, initial Stage 1 and 2 fieldwork included property inspection to refine these areas. For this work the entire property was inspected visually and documented with photographs, coordinates and field notes. The shorelines (modern and ancient) were examined for landing / access points and then in archaeological potential areas, transects were walked through the subject property from the nearshore areas.

As a result of the field inspection, the archaeological potential was refined by eliminating steep slopes and wet lands with organic soils generally unsuitable for habitation. Steep slopes are prohibitive to settlement, but it could be that very shallow slopes could have also impeded settlement as they may have been extensive marshes in the past.

Archaeological potential was identified in areas where early pioneer settlements or habitations were present. The recent age of the initial Euro-Canadian settlement means that these habitations are still standing or are, at the very least, intact as archaeological ruins.

Areas that exhibited archaeological potential were subject to a test pit program where all pits were dug to a minimum of 0.03 m diameter and to a sufficient depth to expose and investigate sterile mineral soils. All soil was screened through 6 mm hardware mesh. Test pit survey was carried out on a 5 m grid for 100% of ancient and modern shorelines which had confirmed archaeological potential, within the areas where infrastructural development is planned. As well, subsurface test pitting was undertaken in the vicinity of the pioneer homesteads that are now archaeological sites on a 5 m grid to within 1 m of the former structures.

Certain agricultural areas known to have been cultivated and are presently not overgrown were scheduled for cultivation and pedestrian survey. Due to environmental constraints related to SAR, scheduling the ploughing had to be coordinated with seasonal restrictions and avoidance of certain areas. This meant that the work was delayed until late in 2013.

Some areas of the property were not subject to Stage 2 test pit survey due to extensive and intensive disturbance in the area of the proposed development and where previous infrastructural developments had occurred. Other areas with permanently saturated soils or wetlands and areas of open bedrock or steep slopes were not tested.

Aboriginal engagement for archaeology has been ongoing and will continue for the duration of archaeological investigations at the RRP.

5.2.19 Cultural Heritage Landscapes and Built Heritage Resources

According to the 2005 Provincial Policy Statement (Ministry of Culture 2006):

- Built heritage resources are those involving one or more significant buildings, structures, monuments, installations or remains associated with architectural, cultural, social, political, economic or military history and which are identified as being important to a community.

- Cultural heritage landscapes are geographical areas of heritage significance modified by human activities and valued by a community. It involves a grouping(s) of individual heritage features such as structures, spaces, archaeological sites and natural elements, which together form a significant type of heritage form, distinctive from that of its constituent elements or parts.

Additional requirements for classification as ruins or buried historic sites such as basements from early pioneer homesteads are described in the MTCS Standards and Guidelines for consultant Archaeologists (2011).

RRR archaeological consultants (Woodland Heritage Services Limited) compiled an initial inventory of built heritage sites through remote sensing, field global positioning system and photographs. The built heritage sites identified were located largely on private properties that were acquired by RRR until late 2012 (and into winter conditions).

An infield, built heritage and cultural landscapes baseline investigation was conducted by Unterman McPhail Associates (Unterman McPhail) during the spring of 2013 (Unterman McPhail 2013). The principal objectives of the cultural heritage assessment were to:

- Prepare an historical summary of the development of the study area (RRP mine site and proposed Highway 600 re-alignment route) through the review of both primary and secondary sources as well as historical mapping;
- Conduct a survey of the cultural heritage landscapes and built heritage resources found within the study area;
- Identify cultural heritage landscapes and built heritage resources within the study area through the analysis of major historical themes and activities, historic mapping and site review activities to identify sensitivities for change; and
- Make general mitigation recommendations.

The Minister of MTCS has not designated any of the cultural heritage resources, such as those listed in Table 1 under Part IV of the *Ontario Heritage Act* within or adjacent to the study area. In addition, there are no road bridges listed in the Ontario Heritage Bridge Guideline and no Ontario Heritage Trust easement properties or Federally recognized properties within or adjacent to the study area (Unterman McPhail 2013).

Consultation with the Township of Chapple and the Township of Morley was also conducted to confirm whether properties identified within and adjacent to the RRP are included in a municipal heritage inventory or is listed in the municipal heritage register.

5.3 Climate, Air Quality and Sound

5.3.1 Climate

Within the context of this EA Report, climate data are used in water balance and flood design calculations (precipitation and temperature data); for assessing general site design and operations conditions (temperature data); and for air quality and sound modelling (wind data). Climate data also affect fish habitat in local creeks and rivers. As described in Section 5.2.2, a local climate station was established at the RRP site in 2009; however, because of the short term nature of climatic records from this station, climatic statistics presented herein are based on data available from the various regional stations, as described below. As the database for

the local climate station expands, the derived data will later become increasingly important to site water management functions.

The closest EC climate station to the RRP for which 30-year climate normal data are available is the Barwick Station (Station 6020559) located approximately 20 km south of the RRP site. Thirty year climate normal temperature data for the Barwick Station are provided in Table 5-9. The mean annual temperature for the Barwick Station is estimated as 3.2˚C. The mean summer high temperature is 18.8˚C for July, while the winter mean low temperature is -15.9˚C in January.

Precipitation data for the Barwick Station have been collected since December 1978 and the station remains active. Mean 30 year climate normal monthly precipitation data are provided in Table 5-10. The mean annual average precipitation is 695.7 mm, with approximately 80% of this precipitation occurring as rain and 20% as snowfall. Monthly precipitation distributions for the minimum and maximum (2005) precipitation years, for the period of record, are shown in Table 5-11. The annual averages for these two years vary from 475.8 mm in 2006 to 965.1 mm in 2005, showing a variability factor of two between the two extremes.

The MTO provides a tool which interpolates Intensity Duration Frequency data published by EC for any location in Ontario (MTO 2010). Intensity Duration Frequency return period event quantities are provided for the site at latitude 48.83, longitude -95.00 (NAD83 UTM Zone 15N; E426605, N5409041) in Table 5-12.

The maximum probable precipitation, 24-hour event is estimated at 586 mm for the Rainy River station (Station 6026852; EC 2013a).

Rainfall plus snowmelt runoff data for Fort Frances, the closest station for which reliable data are available, are shown in Table 5-13. The 24-hour storm event data provided in Table 5-12 are considerably more extreme than the 24-hour rain plus snowmelt data shown in Table 5-13. The 24-hour storm event data are approximately equivalent to the 5-day return period rain plus snowmelt event data.

The Hydrological Atlas of Canada (NRCan 1978) estimates that the RRP region experiences 600 to 700 mm of lake evaporation per year. The most applicable local evaporation data are available from the Atikokan Climate Station (Station: 6020379) located approximately 175 km east of the RRP. Lake evaporation data from the Atikokan station are summarized in Table 5-14. The annual lake evaporation value for this station is 538 mm.

The Hydrological Atlas of Canada (NRCan 1978) also estimates that the RRP region experiences 500 to 600 mm of evapotranspiration per year. The long term mean annual runoff for Pinewood River watershed is 195 mm (Section 5.5). Evapotranspiration can be estimated from the mean annual precipitation (695 mm) minus mean annual runoff (195 mm), assuming that there is no change in long term soil or wetland storage within the basin, and that infiltration

into and out of the Pinewood River watershed basin from neighbouring watersheds is so small, based on soil and hydrogeological conditions, as to be negligible. The resulting estimate of mean annual evapotranspiration is 500 mm and is similar to the lower end range value for the region provided by the Hydrological Atlas of Canada.

Monthly average estimates of evapotranspiration can be developed by partitioning the mean annual value of 500 mm, in accordance with the monthly distribution of lake evaporation data, as per Table 5-14.

The Canadian Wind Energy Atlas predicts an average annual wind speed at 30 m above the site of 15.0 km/h, with the highest average wind in winter and fall (15.7 and 15.6 km/h, respectively) and the lowest mean wind speed in summer (12.9 km/h; EC 2011a). Near ground wind speeds are likely lower than the 30 m above ground estimates. The Atlas predicts on average no dominant annual wind direction. In the winter, winds tend to be from the southeast; in the spring winds from the northwest; northerly to northeasterly in the summer; and from the northeast in the fall.

Further climatic data are presented in AMEC (2013d).

5.3.2 Ambient Light

Ambient light levels vary with time of day, season, degree of cloud cover, and forest canopy expression. A lumen is a measure of light visible to the human eye. Light is measured in lux, where 1 lux is equal to 1 lumen per m^2. Other species such as birds view light somewhat differently than humans, as their eye structure also allows them to perceive light in the ultraviolet range (Teikari 2007).

Under bright sunlight, in open terrain, natural light levels can reach 100,000 lux during mid-day in the late spring / early summer period. In shade under similar conditions, light levels of 20,000 lux are typical. Under overcast, mid-day open conditions, lux levels of 10,000 to 20,000 are typical; however, under very thick cloud cover, even mid-day light levels can be reduced to less than 500 lux. In contrast, under a full moon on clear nights, light levels are typically in the order of 0.25 lux in open terrain; and under cloud cover with no moon, light levels can drop to levels of approximately 0.0001 lux. Light levels are reduced further in heavy timber both during the day and at night, with direct sunlight reaching the forest floor being transient. Light regimes are enhanced by snow cover.

Site-specific light measurements were not taken in connection with the RRP; however, lighting regimes at the RRP are considered natural. There are currently minimal anthropogenic (human influenced) light sources in the local area beyond that of limited lighting around local residences, and lighting produced by vehicle headlights on roadways. The major current anthropogenic light effect in the local environment is that generated by forest clearing for logging and agriculture.

5.3.3 Air Quality

The RRP site is remote from major industrial emission centres with the closest such sources being Fort Frances, Ontario and International Falls, Minnesota, both located approximately 50 km to the southeast of the RRP site. Both of these communities are the sites of pulp and paper industries. Local anthropogenic sources of air emissions, in the more immediate RRP site area, generally include road traffic, agriculture activities and drilling associated with RRP exploration activities; as well as the oriented strandboard mill in Barwick.

Background air quality at the RRP area is expected to be good, given the absence of nearby large urban centres and industrial sources. Air quality in the RRP area will; however, be influenced by long range transport of air emissions from the south and also by natural sources, such as volatile organic emissions from vegetation and natural fires. The greatest potential local influence to air quality is increased particulate matter from traffic, agricultural operations and drilling.

Background air quality data were developed for the RRP site from regional monitoring stations that are able to provide multi-year data for a variety of parameters. Background particulate matter data were supplemented by KCB onsite monitoring.

The nearest regional background air quality and precipitation quality station is located approximately 95 km north of the site at the Experimental Lakes Area, Ontario (NAD 83 Zone 15N, 447973E, 5501507N). This station operates as part of the EC Atmospheric Environment Service Canadian Air and Precipitation Monitoring Network (CAPMoN) network, and provides air chemistry data for chloride, calcium, magnesium, sulphate, sodium, ammonium, potassium, sulphur dioxide, nitrate and nitric acid concentrations (EC 2011b). Air quality and precipitation quality data from the Experimental Lakes Area station are summarized in Tables 5-15 and 5-16. The Experimental Lakes Area is considered to be representative of baseline air and precipitation quality at the RRP site.

The EC National Air and Pollution Surveillance (NAPS) Network operates a number of monitoring stations across the country. The NAPS network reports background air chemistry data that is collected for various gases and particulate matter, as well as various volatile organic compounds (VOCs) and semi-volatile organic compounds. A NAPS station exists at the Experimental Lakes Area (Station 64001); however, this station only collects ozone data. Other NAPS Stations applicable to the RRP include Stations 60807 and 60809 in Thunder Bay, located approximately 350 km east of the project and Station 070119 in Winnipeg, located approximately 250 km northwest of the RRP site. In addition, the MOE operates Air Quality Index stations including one at Thunder Bay (Station 63203).

Air quality at the Thunder Bay and Winnipeg stations is more influenced by urban populations relative to the Experimental Lakes Area and RRP site; however, higher ozone concentrations were observed at the Experimental Lakes Area station. Air pollution data and National Ambient

Air Quality Objectives are summarized in Table 5-17. All parameters summarized in Table 5-17 were within the maximum desirable level for the National Ambient Air Quality Objectives.

Air quality monitoring was conducted by KCB in the RRP area during 2009 and 2010, with a focus on particulate matter (PM_1, $PM_{2.5}$ and PM_{10}) at three locations, following consultation with the MOE. Measured average particulate concentrations at the three stations ranged from 5 µg/m^3 to 15 µg/m^3 for $PM_{2.5}$, and from 9 µg/m^3 to 15 µg/m^3 for PM_{10}. These values are less than the Ontario Ambient Air Quality Criteria for airborne $PM_{2.5}$ and PM_{10} concentrations. The results are not directly comparable because reported baseline air quality data were averaged over 3 hours rather than the standard 24-hour averaging period.

5.3.4 Sound

The MOE Guidelines for identify three classes of acoustical environment with regard to the assessment of sound produced by industrial operations, and to classify ambient background sound environments (MOE 1995). The ambient background classifications are as follows:

Class 1 Area is used to describe an area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the urban hum;

Class 2 Area defines an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas, and in which a low ambient sound level, normally occurring only between 23:00 and 07:00 hours in Class 1 Areas, will typically be realized as early as 19:00 hours. Other characteristics which may indicate the presence of a Class 2 Area include:

- Absence of urban hum between 19:00 and 23:00 hours;
- Evening background sound level defined by natural environment and infrequent human activity; or
- No clearly audible sound from stationary sources other than from those under impact assessment.

Class 3 Area means a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as the following:

- A small community with less than 1,000 population;
- Agricultural area;
- A rural recreational area such as a cottage or a resort area; or
- A wilderness area.

For EA purposes, the RRP site area would be regarded as a Class 3 Area. Class 3 Area performance criteria are defined by the NPC-232 (MOE 1995), as per the following:

- 7:00 am to 7:00 pm (day): 45 L_{eq} dBA;
- 7:00 pm to 11:00 pm (evening): 40 L_{eq} dBA; and
- 11:00 pm to 7:00 am (night): 40 L_{eq} dBA.

The L_{eq} sound level is defined as the value of the constant sound level which would result in exposure to the same total A-weighted sound energy as would the specified time-varying sound, if the constant sound level persisted over an equal time interval. It is therefore a type of averaging procedure, and is measured in dBA. A-weighted sounds approximate the normal hearing range sensitivities of the human ear.

Baseline sound surveys were conducted for the RRP site area by KCB from July 1 to July 6, 2009, September 14 to September 17, 2010 and October 6 to October 8, 2010. Baseline sound data were collected for seven locations. The locations included both residential sites and identified locations of potential wildlife habitat sensitivity. KCB baseline monitoring was focused on the eastern portion of the RRP area, along Highway 600. To collect data around the entire site footprint and augment existing studies, further baseline studies were conducted by RRR in August 2012.

Additional monitoring was conducted during 2011 and 2012 by the MNR and Trent University to determine the impact of mineral exploration drilling on nearby receptors. Monitoring station locations for the baseline and exploration sound monitoring studies are provided in Figure 5-4.

KCB monitoring results showed that the hourly L_{eq} generally ranged from 36 to 49 dBA, while 90th percentile sound data (L_{90}) generally ranged from 26 to 40 dBA, and the upper limit of fluctuation sound (L_{10}) ranged from 38 to 53 dBA. The L_{90} sound level is the sound level which is exceeded 90% of the time, and is typically used to define the background lower sound level environment, corresponding to more quiet times of the day or night. The L_{10} sound level is the sound level which is exceeded 10% of the time, and corresponds to noisier periods, which in a rural environment might include periods of heavier road traffic, or intermittent agricultural machine operation.

RRR found in 2012 that baseline L_{eq} data for receptors at the edge of the RRP site ranged from 29 to 40 dBA during the daytime, 20 to 31 dBA during evenings and 17 to 20 dBA at night. All results were below MOE exclusionary performance limits for Class 3 Areas.

The MNR and Trent University work focused on investigating potential impacts to residents and wildlife, resulting from exploration drilling at the RRP site. The 2011 investigation conclusions were that sound levels near the RRP exploration site were not impacted by drilling, except at the RRP site itself. Roads did have a notable impact at adjacent monitoring sites.

Further detail regarding sound survey results are provided in KCB (2011a) and AMEC (2012g).

5.4 Geology, Physiography and Soils

5.4.1 Geology

The RRP is positioned within the Achaean age Rainy River Greenstone Belt that forms part of the 900 km long, east-west trending Wabigoon Subprovince of the Canadian Shield (Blackburn et al. 1991). In general, the Rainy River Greenstone Belt is bounded by the Sabaskong Batholith in the north and the Rainy Lake Batholithic Complex in the east. It extends south into Minnesota where the Long Point Intrusive Rocks, the Baudette Intrusive Rocks (both granitoid), and the Rainy Lake - Seine River Fault, the Vermillion Fault and the Four Towns Fault constrain the belt. A thin septum of supracrustal rocks separates the batholiths and connects the Rainy River Greenstone Belt with the Kakagi-Rowan Lakes Greenstone Belt to the north. To the west the greenstone terrain is overlain by unmetamorphosed Palaeozoic to Mesozoic sedimentary rocks of the Western Sedimentary Basin. Regional metamorphic grade in the Rainy River Greenstone Belt has been identified as generally greenschist to lower-middle amphibolite facies. Adjacent to later-stage intrusive batholiths, rocks may attain upper amphibolite facies, with possible local partial re-melting.

There is limited outcrop exposure in the area and much of the interpretation of the local geology is based on past and recent drilling investigations. Locally, the deposit is hosted within an assemblage of steeply southwest-dipping mafic volcanic, intermediate to felsic volcanic and sedimentary units. These units progress from the oldest in the north (lower mafic and intermediate volcanic) to a conformably, overlying clastic sedimentary unit (the Pinewood Sedimentary Succession) in the south. Minor later-stage mafic to ultramafic intrusive zones have been observed in drill core. The entire RRP area, including the ore deposit, is cross-cut by a northwest-striking, steeply dipping diabase dyke. The area is bounded to the east by the Black Hawk Stock, a large plutonic intrusive which forms a regional topographic high.

Intermediate rocks (dacites) host most of the gold mineralization (SRK 2012). Pillow lavas occur east as well as further to the west of the deposit. The deposit is associated with a series of vertical strike slip faults with an inferred tabular fault zone below, and directly adjacent to, the deposit. The larger, crustal-scale Quetico Fault crosses the area to the south, with splays extending into the RRP area. The seismic hazard associated both with these faults and with the region is considered to be low.

Gold mineralization is associated with early sulphide formation of pyrite, sphalerite, chalcopyrite, galena stringers, veins and disseminated pyrite, with later formed quartz-pyrite-chalcopyrite veins and veinlets.

5.4.2 Palaeontological and Palaeobotanical Sites

There are no known sites of sites of palaeontological or palaeobotanical significance with the NLSA or NRSA.

5.4.3 Seismicity

Major seismic activity generally occurs at the boundaries between tectonic plates. Nonetheless, there are regions in Canada that experience notable seismic activity in the absence of any plate boundaries. The nearest seismic zone to the RRP site is the eastern Ontario / western Quebec area located approximately 2,000 km to the southeast, which has experienced several earthquakes of magnitude 6.0 or greater (NRCan 2013).

The RRP is situated within the stable interior portion of the North American Plate in a low risk seismic zone (Adams and Halchuk 2008). In reporting on seismic activity for Northern Ontario, Hayek et al. (2010) indicate that there were a very small number of earthquakes detected in the area of the RRP between 1987 and 2009. None of these earthquakes exceeded magnitude 2.0, a level which is not large enough to be felt or to cause damage. Given the location of the RRP within the North American Plate, these small tremors are most likely small crustal adjustments induced by regional geological stress field.

5.4.4 Physiography

Terrain in the RRP site area transitions from upland, bedrock-controlled topography with a relatively high density of lakes to the northeast, to a lower-lying, poorly drained area with very little topographic relief to the southwest. The Pinewood River system, which drains most of the RRP site area, occupies a broad lacustrine plain. Lands in the immediate RRP site vicinity are typically gently rolling to flat, with wetlands occurring in low-lying areas and rounded bedrock outcrops and subcrops occurring in upland areas. Elevations range between 430 masl in highlands northeast of the RRP site and approximately 340 masl in lower reaches of the Pinewood River valley southwest of the RRP site. Maximum slopes in localized areas are typically in the order of 5 to 10%. Low-lying areas were inundated by glacial Lake Agassiz which left a variably thick veneer of lacustrine clay over much of the landscape.

Late Wisconsinan glaciation in the region was affected by ice originating from both the Labradorean and Keewatin sectors of the Laurentide Ice Sheet. An initial strong southwesterly flow of Labradorean ice was followed by a late-glacial advance of Keewatin ice flowing from the west. Glacial Lake Agassiz was also present in the region over long periods and is responsible for wide-spread deposition of glaciolacustrine deposits (Bajc and Gray 2001).

The weight of ice was such that the land surface was depressed proportional to the ice thickness. With the withdrawal of the Laurentide Ice Sheet, the entire region is experiencing

uplift (isostatic rebound). The total amount of rebound is estimated at about 100 m near the northwestern Lake Superior shoreline (Sado and Carswell 1987).

The lowland physiographic regions observed at the site are typically characterized by the presence of a deeper Labradorean Basal Till (Whiteshell formation) in contact with the bedrock and a younger Keewatin Till (Whitemouth Lake formation) above. The Whitemouth Lake formation may be in contact with the Whiteshell formation or the two tills can be separated by glaciolacustrine (or sometimes glaciofluvial) sediments. Extensive surface peat deposits occur in many low-lying areas. Alluvial deposits occur in the creek and river valleys.

The Whiteshell formation consists mainly of silty sands and gravels with little to no clay, and very low carbonate content of typically between 0 and 5%. Material is typically locally-derived. The coarser-grained nature of this basal till unit allows it to form localized aquifers, frequently kept under pressure by the overlying, lower permeability Whitemouth Lake formation. Sediment thicknesses are typically less than 5 m and discontinuous, although it may be locally up to 20 m thick. The Whiteshell formation thins on bedrock highs and is thicker in depressions with interlayered deposits of ice contact glaciofluvial sand and gravel as well as glaciolacustrine sand, silt and clay.

The Whitemouth Lake formation is clay-rich and clast-poor, consists of a high proportion of material of distal, western provenance, with a resultant high matrix carbonate content of approximately 28%. It is prevalent throughout the area except where it is disrupted by bedrock and subcrop zones. Average thickness at the RRP site is in the order of 20 to 25 m.

Lake Agassiz lacustrine sediments, comprising clays with minor silts and sands, typically occur above and below the Whitemouth Lake formation, but can also occur locally in more complex sequences (Nuinsco Resources 1997). Overall overburden thicknesses can range up to 100 m in some places, but are typically in the order of 20 to 30 m in areas closer to the RRP site, which are not disrupted by bedrock exposures. Peat deposits are typically <1.5 m in thickness but can be thicker and are widespread in low-lying areas.

5.4.5 Permafrost

There is no permafrost at or close to the RRP site. The RRP site is located approximately 500 km south of the approximate zone of discontinuous permafrost and 800 km south of the zone of continuous permafrost (Geological Survey of Canada 2000).

5.4.6 Soils

Soils in the RRP area are generally composed of gray luvisols, gleysols, humisols (organic soils) and rockland soils, with lesser expressions of podzolic and brunisolic soils (KCB 2011a). Gray luvisols are typically clay or clay / silt rich and imperfectly drained; gleysols are poorly drained / frequently saturated. In the RRP site area, gleysols generally consist of silt loams to

more coarsely-textured soils. Humisols are associated with wetland systems. From a textural perspective the majority of RRP area soils consist of clay and clay loam soils, with lesser quantities of sandy clay loam, sandy loam, loam, silt loam and silty clay. Site-specific investigations undertaken by KCB included 95 soil samples collected from 50 test pits across the area (KCB 2011a).

Soils in the RRP area are overwhelmingly calcareous, due largely to the high matrix carbonate content of the Whitemouth Lake formation, from which the soils are derived. The exception to this general trend, are humisols which have a very high organic content and are acidic. Cation exchange capacity tends to be relatively high because of the elevated organic and clay content of most soils present. Soil metal content were typical of expected background conditions for the soil types present, with mean metal concentrations generally below Ontario guideline values (KCB 2011a); upper range site values were frequently above the generally more stringent Canadian Environmental Soil Quality Guidelines (Table 5-18). Exceedance of guidelines in background soil conditions is not uncommon and does not imply contamination.

Soil suitability for agriculture is limited by moisture content and climate, with most of the agriculture present in the area devoted to forage crops and livestock (mainly beef and dairy cattle).

5.5 Geochemistry

5.5.1 Mineralogy and Lithology

The geology of the RRP site is complex, with mineralization divided into four separate styles among a number of different rock types with varying styles of alteration (BBA 2012). In general, gold mineralization is dominantly vein-hosted and primarily associated with sulphide minerals including pyrite, chalcopyrite, sphalerite and galena.

Mine rock represents the greatest quantity of material and highest risk for possible future acid drainage at the site. The complexity of the geology and the varying mineralization styles are key factors to consider as different units may contribute more or less to ML / ARD potential. Within the RRP area, felsic metavolcanics, mafic metavolcanics and clastic metasediments have been identified as the main lithological units associated with mine waste, with preliminary volume estimates from drill core of 60%, 17% and 11%, respectively (AMEC 2013h). Additional lithologies make up an estimated 12% of the volume of mine rock.

5.5.2 Static Test Results

5.5.2.1 Overburden

Previous geochemical baseline studies (KCB 2011b) included analysis of 28 overburden samples, with 19 samples (14 Whiteshell Till and 5 Whitemouth Lake Till / Lake Agassiz

sediment) submitted for acid base accounting testing and 28 samples submitted for total element and leachable metals (shake flask extraction) analyses. Subsequently, an additional three overburden samples were collected and submitted for acid base accounting testing, elemental content and leachable metals (AMEC 2013h). Two of the samples were collected from Whiteshell Till with the third consisting of Whitemouth Lake Till.

In the case of both the original 28 samples and the three additional samples, the Whiteshell Till samples exhibited sulphur values above the specified screening criteria, with values for sulphur ranging from <0.1 to 3%. In addition, anomalous levels of silver and arsenic were present in many of the samples. In an additional Whiteshell sample, cadmium and zinc were both above the 10 times crustal abundance screening threshold.

In general, the Whiteshell Till exhibits a lower neutralization potential than the Whitemouth Lake Till, with AMEC (2013h) reporting NPR values of <2 and 70.3, respectively. Previous results indicated that 4 of the 14 Whiteshell Till samples had a NPR of <2. Values <2 are considered to be potentially acid generating (PAG), which suggests that the Whiteshell Till may be PAG, or of uncertain acid generating character. The general trend of the results from both till units are reflective of their provenance, with the Whiteshell Till derived in part, from local mineralized bedrock.

Short term leach tests on samples from both till units suggested generally low potential for metal leaching. Shake flask extraction results for both the Whitemouth Lake and Whiteshell Till samples are all below Provincial effluent discharge criteria and below PWQO, with the exception of copper and aluminium concentrations from the Whitemouth Lake Till, which marginally exceeded PWQO.

5.5.2.2 Mine Rock

All mine rock samples (n = 362) had paste pH values between 4.7 and 9.9, with a median value of 9.0. Concentrations of total sulphur ranged from 0.02% to 9.0% with most samples in the range of 0.1 to 5%. Most samples in excess of 5% total sulphur were from relatively minor sub-lithologies of pyritic metasediments or chemical metasediments. The relationship of total sulphur and calculated sulphide sulphur confirms that sulphide is the main source of sulphur for the majority of the rock types.

The calculated NPR values ranged from 0.1 to 529 with mean and median values of 1.9 for both. Based on the total dataset, 28% of mine rock samples had a NPR <1 and 50% had a NPR >2. Based on guidelines in Mine Environmental Neutral Drainage (2009), approximately 50% of the samples would be classified as PAG (NPR <2).

In general, samples with NPR <1 had net acid generation pH (NAGpH) values near or less than 4.5. Samples with NPR >2 recorded NAGpH values greater than 4.5 indicating that those samples had little potential to produce net acidity in the future. The majority of samples with

NPR between 1 and 2 had NAGpH values above 4.5 and were classified as uncertain in terms of future acid generation. Close inspection of the data indicates that no samples with a NPR above 1.65 generated a NAGpH <4.5. This suggests that materials with a NPR >1.65 may potentially be considered non-potentially acid generating (NPAG). Additional data from the ongoing humidity cell testing would be required to further assess this possibility.

A total of 158 felsic metavolcanic samples were analyzed, with NPR values ranging from 0.10 to 44, with mean and median values of 1.3 and 1.5, respectively. Approximately 62% of the samples (98 of 159 samples) had NPR <2 and 33% of the samples (52 of 159 samples) had NPR <1.

A total of 56 mafic metavolcanic samples were analyzed. The NPR of these samples ranged from 0.44 to 169 with mean and median values of 3.0 and 4.7, respectively. Approximately 34% of the samples (19 of 56 samples) had NPR <2 and 13% of the samples (7 of 56 samples) had NPR <1.

A total of 20 intermediate metavolcanic samples were analyzed with resultant NPR values between 0.27 and 28 with mean and median values of 2. Ten of 20 of the intermediate metavolcanic samples had NPR <2 and 6 of these had NPR <1.

A total of 74 metasediment samples were analyzed from various sublithologies; 45 of these samples represented clastic metasediments, 15 were pyritic metasediments and 14 were chemical metasediments. The NPR of clastic metasediment samples ranged from 0.3 to 21 with mean and median values of 1.0. Approximately 75% of clastic metasediment samples (34 of 45 samples) had NPR <2 and 53% of samples (24 of 45 samples) had NPR <1.

The NPR of chemical metasediment samples ranged from 0.56 to 37. Five of 14 chemical metasediment samples had NPR <2 and three of these had NPR <1.

Pyritic metasediments NPR ranged from 0.3 to 7.1. Eight of 15 pyritic metasediment samples had NPR <2 and 6 of these samples had NPR <1.

A total of 47 intrusive samples (excluding diabase) were analyzed from various sublithologies and of these 6 were early mafic to ultramafic intrusive, 24 were early felsic to intermediate intrusive, 12 were later mafic to ultramafic intrusives and 5 were later felsic to intermediate intrusives. Almost all intrusive samples had a NPR >2. Six of 24 early felsic to intermediate intrusive samples had NPR <2 and 2 of these samples had NPR <1. Two of 12 late mafic to ultramafic intrusive samples had a NPR <2 (none with NPR <1).

A total of 4 late structural zone samples and 3 diabase samples were analyzed with results summarized below. The NPR values for the late structural samples ranged from 0.2 to 2.9, with a median NPR of 0.6. The NPR values for the diabase samples ranged from 4.8 to 7.9 with a

median NPR of 5.3. Three of 4 late structural samples had a NPR value <2 (all of which had a NPR <1). All of the diabase samples had a NPR >4.

5.5.2.3 Tailings

Three simulated tailings samples were produced during metallurgical testing of ore composite materials developed jointly by RRR and SGS Lakefield. The ore composites produced and resulting tailings represent three different types of ore. The tailings types tested include materials produced from early stage ore (Starter Pit sample), ore from late in mine life (ROM sample) and the main ore zone (ODM sample).

All of the tailings samples had consistent slightly alkaline paste pH values (8.2 to 8.8) with the ROM samples having higher paste pH values than the ODM and Starter Pit samples. Concentrations of total sulphur were also consistent throughout all of the samples with values ranging from 2.1 to 2.3% (Table 7-13 in Appendix G). The ODM samples had the highest overall sulphur content. The relationship between total sulphur and sulphide sulphur shows that sulphide and sulphate are both contributing to the total sulphur content (Figure 7-21 in Appendix G).

The siderite corrected Sobek NP values ranged from 107 to 186 kg $CaCO_3$/t, while the modified Sobek NP values ranged from 41 to 46 kg $CaCO_3$/t. Carbonate NP values ranged from 33 to 41 kg $CaCO_3$/t (Table 7-13 in Appendix G). Siderite corrected values seem high in comparison, but were verified by retest by the laboratory. Higher siderite corrected values are probably related to fine grain size of the tailings and in part due to higher fizz test classification than the waste rock. For tailings the modified Sobek NP is inferred to represent the most reasonable overall assessment of NP.

The calculated NPR values (based on the modified Sobek NP) ranged from 0.74 to 0.91 (Table 7-13 in Appendix G). Based on these values all of the tailings samples would be classified as PAG (NPR <2) based on the Mine Environmental Neutral Drainage guidelines (Figure 7-22 in Appendix G).

All of the tailings samples had NAGpH values less than 4.5.

5.5.3 Elemental Content

5.5.3.1 Overburden

For comparative purposes, elemental content of the AMEC (2013h) overburden samples were compared to 10 times average continental crust values (Price 1997). Overall, bismuth was detected in excess of 10 times the average crustal abundance for all samples. Sulphur was detected in excess of the 10 times screening criteria for both Whiteshell Till samples, but not the Whitemouth Lake Till sample. Arsenic and silver were above the 10 times screening criteria in

Whiteshell Till samples, and cadmium and zinc were above the 10 times screening criteria in the other one.

5.5.3.2 Mine Rock

For comparative purposes, elemental content of the mine rock samples were compared to 10 times average continental crust values (Price 1997). Overall, sulphur, bismuth and selenium stand out as anomalous with respect to 10 times average crustal abundance. The mean and median concentration for sulphur for the entire acid base accounting sample set was 1.4% and 1.0%, respectively in comparison to 0.35% for 10 times the average crustal abundance. The mean and median concentration for bismuth for all samples was 0.6 and 0.2 ppm, respectively in comparison to 0.085 ppm for the 10 times average crustal abundance. The mean and median concentration for selenium for all samples was 0.8 ppm and 0.5 ppm, respectively in comparison to 0.5 ppm for 10 times average crustal abundance. It should be noted that the detection limit for selenium in the current work is at the reported 10 times crustal abundance concentration of 0.5 ppm.

Several other elements including silver, arsenic, cadmium and zinc sometimes had concentrations in excess of 10 times the crustal abundance. Copper, chromium, mercury, molybdenum, antimony, lithium, lead, cesium, rhenium and tungsten had isolated occurrences where an elemental concentration was in excess of the 10 times crustal abundance screening criteria.

As previously identified, sulphur, bismuth and selenium were naturally elevated in all rock units sampled. The other elements that are sometimes or infrequently elevated tend to vary among the rock types. The variations in distribution of these elements among samples (by lithology) are identified in Appendix F (Table 7-7 in Appendix G).

5.5.3.3 Tailings

For comparative purposes, the elemental content of the tailings were compared to 10 times the average continental crust values (Price 1997). Overall, arsenic, bismuth, cadmium, selenium and silver stand out as anomalous with respect to 10 times average crustal abundance (Table 7-14 in Appendix G). The mean and median concentrations for arsenic of entire dataset were 70 ppm and 65 ppm, respectively, in comparison to 18 ppm for 10 times the crustal abundance. The mean and median concentrations for bismuth in the dataset were 1.2 ppm and 0.89 ppm, respectively, in comparison to 0.085 ppm for 10 times the crustal abundance. The mean and median concentrations for cadmium in the dataset were 4.3 ppm and 4.6 ppm, respectively, in comparison to 1.5 ppm for 10 times the crustal abundance. The mean and median concentrations for selenium were 0.7 ppm in comparison to 0.5 ppm for 10 times the crustal abundance. It should be noted that the detection limit for selenium in the tailings is reported to be higher than 10 times the crustal abundance at 0.7 ppm. The mean and median

concentrations for silver were 0.86 ppm and 0.87 ppm, respectively, in comparison to 0.75 ppm for 10 times the crustal abundance.

Antimony and zinc were also identified as elements that had concentrations in excess of 10 times the crustal abundance and were elevated in all but the ROM samples.

5.5.4 Leachable Metals

A total of 74 rock samples representing different lithologies and metal contents were analyzed by the shake flask extraction test to assess the presence of potentially leachable metals. These test methods are not intended to simulate site-specific leaching conditions, but to provide a screening assessment of the potential for metal leachability. The shake flask extraction testing results were compared to regulated mining effluent discharge values (O.Reg. 560/94) as well as the more stringent PWQO for reference purposes only. These guidelines are useful in identifying parameters of interest when evaluating final discharge to receiving waters.

All samples exhibited neutral to slightly alkaline pH in the range of pH 7.4 to a maximum of pH 8.3. Dissolved metal concentrations in the shake flask extraction tests were generally low with no results reported at concentrations above O.Reg 560/94. Aluminum concentrations were consistently elevated in comparison to PWQO. Six samples that included felsic metavolcanic, chemical metasediment, felsic intrusive and mafic to ultramafic rocks exhibited dissolved chromium at very low concentrations in the range of 0.001 to 0.002 mg/L. Six samples that included clastic metasediment, felsic metavolcanic rocks and mafic to ultramafic rocks, exhibited dissolved copper at low concentrations of 0.007 to 0.04 mg/L. One or two samples in a variety of lithologies had antimony, arsenic, cadmium, cobalt and phosphorus concentrations that were elevated in comparison to PWQO.

Based on short term leach tests there is little evidence of metal leaching from rock under neutral pH conditions. Aluminum was somewhat elevated in the short term leach tests completed (and often elevated in these test due to the presence of colloidal aluminium and are not considered an indicator of a readily soluble phase in the sample). It should be noted that short term leach results are not directly applicable to actual leaching conditions as these tests only measure a particular moment in time and do not account for longer term (kinetic) changes in the weathering, oxidation and/or metal solubility in the sample that would be expected under field conditions.

All of the tailings samples were analyzed by the shake flask extraction test to assess the presence of potentially leachable metals. The results are presented in Table 7-15 in Appendix G, along with comparison to regulated effluent discharge values (O.Reg. 560/94). The more stringent PWQO are also provided for reference purposes only. All of the tailings samples exhibited neutral to slightly alkaline pH in the range of pH 7.3 to 8.5. Dissolved metal concentrations in the shake flask extraction tests were generally low with no results reported at concentrations above O.Reg 560/94. Aluminum concentrations were consistently elevated in

comparison to PWQO. The ROM samples exhibited silver concentrations elevated in comparison to PWQO and the Starter Pit samples exhibited antimony concentrations elevated in comparison to PWQO.

5.5.5 Block Model

5.5.5.1 Surrogate Development

The approach to block modelling utilizes the large exploration database to interpolate the potential PAG and NPAG mine rock volume distributions within the future open pit. The large exploration database provides near continuous sampling data over 1 to 2 m sample intervals from borehole spacings within the pit at generally between 10 to 30 m. In order to utilize this large data set however, a relationship was required to estimate the NP and AP of rock samples on the basis of rock chemistry rather than traditional acid base accounting data. This approach essentially produces surrogate relationships for NP and AP from the existing ICP-MS exploration geochemistry data set. Three-dimensional modelling of the NP and AP within the pit based on the existing borehole sample data and analyses can then proceed; in this case supporting the development of a 5 x 5 x 5 m block model of NP and AP. When combined this data describes a three dimensional distribution of NPR on the basis of the 5 m x 5 m x 5 m blocks.

The following sections describe how the surrogate relationships for NP and AP were developed, and checked. The surrogate relationships and block model results presented are considered interim and additional checks and evolution of this approach is continuing.

The AP is determined by the following relation (MEND 2009):

$$\text{AP (kg } CaCO_3\text{/t)} = \text{Sulphide Sulphur (wt\%)} \times 31.25$$

AMEC has determined that the ICP-MS sulphur analysis used for the exploration samples is a reasonable fit to sulphide sulphur and thus AP. Therefore the relation below can be used to determine surrogate AP from the exploration database using ICP-MS sulphur (Figure 8-7 in Appendix G). This relationship applies across all lithologies:

$$\text{Surrogate AP (kg } CaCO_3\text{/t)} = \text{ICP-MS Sulphur (wt\%)} \times 31.25$$

The relationship between NP and the exploration ICP-MS data is less clear due to a more complex relationship between NP and mine rock mineralogy. Calcium carbonate (calcite) and calcium-magnesium carbonate (dolomite) have been confirmed to be the dominant neutralizing minerals in the RRP waste rock and there is a good correlation between ICP-MS calcium and acid base accounting NP for all waste lithologies with the exception of diabase (Figure 8-8 in Appendix G). The following best-fit relation can be used as a predictor of NP from ICP-MS calcium for all lithologies except diabase:

$$\text{Surrogate NP (kg } CaCO_3\text{/t)} = (37.14 \times \text{Calcium [\%]}) - 4.21$$

A conservative estimate of NP for diabase can be based on the minimum NP determined in the current acid base accounting data set (approximately 20 kg $CaCO_3$/t).

5.5.5.2 Evaluation of Error and Implications of Surrogate Calculations

The excellent relationship between ICP-MS sulphur and acid base accounting sulphur indicates that the surrogate AP determined in this manner will result in little error in AP prediction on this basis. Although the correlation between ICP-MS calcium and acid base accounting NP is very good, there is some scatter in the data that could result in incorrect coding of some waste rock samples as NPAG when acid base accounting NP would determine a PAG condition (Figure 8-9 in Appendix G). The alternate relationship is also possible (surrogate NP would determine a PAG condition when acid base accounting NP would determine a NPAG condition).

An option for minimizing the potential problem of mapping PAG as NPAG material on the basis of the surrogate relationship is to shift the best-fit line to a point where such miscoding no longer occurs in the acid base accounting database. Adjustment of the trend line in such a manner results in the following more conservative surrogate relationship (Figure 8-8 in Appendix G):

$$\text{NP (kg } CaCO_3\text{/t)} = (37.14 \times \text{Calcium [\%]}) - 19.0$$

By using this trend, in total 8% of the acid base accounting samples were misclassified, but none of these resulted in PAG rock being misclassified as NPAG rock (Figure 8-10 in Appendix G). All misclassifications resulted in NPAG rock being classified as PAG rock. From a waste management perspective, this could result in some NPAG rock being placed in the PAG waste rock pile, but the likelihood of the opposite condition occurring is considered minor.

5.5.5.3 Acid Rock Drainage Block Model Results

Results of the block model are presented in several plan views and sections cut through the proposed pit (Figures 8-11 through 8-17 in Appendix G). Individual blocks are identified as PAG (NPR <1), uncertain (NPR between 1 and 2) and NPAG (NPR >2). Ore blocks on the basis of gold equivalent cut-off grade (with allowance for silver) are also identified. These initial block model results are generally consistent with the low resolution spatial distribution indicated by plotting acid base accounting data (Figures 8-4 through 8-6 in Appendix G). NPAG materials predominate in the south and PAG materials predominate in the northern regions of the pit.

Materials quantities derived from the current mine plan and block model are provided in Table 8-2 in Appendix G. The estimate indicates that approximately 44% of the waste material within the future pit will be PAG. As the project moves forward additional block model runs are planned to optimize the management and handling of mine rock.

5.5.6 Kinetic Test work

5.5.6.1 Mine Rock

Twenty samples of mine rock were chosen to undergo testing in humidity cells. The first set of 10 selected from initial KCB sampling, was initiated by KCB in February, 2010. A second set was selected from the 2011 AMEC sample set was initiated by AMEC in May, 2012. As of September 24, 2013 the cells initiated in 2010 had been in operation 191 weeks and the cells initiated in 2012 had been in operation 74 weeks. These samples were selected to cover the range of NP and AP for PAG material with NPR <2 for major lithologies comprising mine rock from the proposed pit (Table 5-4 and Figure 5-1 in Appendix G). Several selected samples approaching median NPR for the major lithologies were also included as well as a few samples containing elevated zinc.

The pH of 18 of the 20 mine rock humidity cells has remained relatively constant over the duration of testing. The median pH value for these circumneutral cells was 7.4. Two of the humidity cells exhibited significant declines in pH over the course of testing becoming more acidic. Consistent with these results, low acidity loading rates were observed in all pH neutral cells (average 1.5 mg/kg/wk). In the two acidic cells, maximum acidity loading rates were recorded at 43 and 26 mg/kg/wk, respectively.

Sulphate loads for all neutral pH mine rock humidity cells have exhibited a generally steady state throughout the duration of testing with the exception of an initial drop within the first 20 weeks of operation. Median steady state loading rates ranged from 1.3 to 21.4 mg/kg/wk in all cells The highest sulphate loading rate for the non-acid cells was for a low NPR (0.7) mafic volcanic sample with 8.1% sulphide. The two acidic cells exhibited increasing sulphate release rates, beginning at approximately 20 weeks and 60 weeks, respectively. Both cells reached a maximum steady sulphate release rate of approximately 23 mg/kg/week after acid onset.

For circumneutral humidity cells, Ag, Be, Bi, Cr, Fe, Hg, P, Tl, Ti and Zr were found in concentrations in the leachate at or near detection limits. For six elements (Cd, Cu, Li, Ni, Se and Zn), two to four cells exhibited somewhat elevated leachate concentrations (maximum 50 times detection limit values), but were more typically at or near detection limit values. Eight elements (B, Ca, K, Mg, Na, S, Si and Sr) had loadings that consistently decreased throughout the duration of testing. The remaining 10 elements (Al, As, Ba, Co, Mn, Mo, Pb, Sn, V and U) all had loadings consistently above detection limit and generally remained steady throughout the testing period. For the acidic humidity cells, notable increases in loading rates were observed after the cells went acid for 14 elements (Al, Be, Cd, Co, Cr, Cu, Fe, Li, Ni, Pb, Si, Sr, U and Zn).

5.5.6.2 Tailings

Six tailings humidity cells are currently in operation representing three tailings types (each in duplicate). As of October 18, 2013 the ODM cells were in operation for 76 weeks, Starter Pit cells were in operation for 70 weeks and the ROM cells were in operation for 75 weeks. Detailed results for the tailings humidity cells can be found in Appendix G.

The pH of the tailings cells remained relatively constant with a slightly downward trend. Values for pH range between 6.6 and 8.1, with a median pH value of 7.1. The pH for all cells remained relatively constant around pH 7.0 after week 10. Acidity loading rates have remained constant around 2.0 mg/kg/wk throughout the entirety of the testing period. Alkalinity loading rates were initially high (up to 80 mg/kg/wk), but declined to around 5 to 6 mg/kg/wk as testing progressed. Sulphate loading rates follow a similar trend as alkalinity with high initial loadings (up to 280 mg/kg/wk), declining by week five to fairly steady rates between 10 and 20 mg/kg/wk.

Eighteen elements (Ag, As, Be, Bi, Ca, Cr, Cu, Hg, Li, Ni, P, Se, Tl, Th, Ti, V, W, Y and Zn) had loading rates near or at detection limit for the all cells. The following observations are provided for early stage (21 to 30 weeks of operation) metal loadings from the tailings humidity cells:

- Major elements (Al, Ca, Fe, K, Mg, Na and Si) all exhibited loading under 10 mg/kg/wk with the exception of Ca which had loading rates as high as 100 mg/kg/wk;

- Most trace elements exhibited loading rates below 0.01 mg/kg/ wk (As, Ba, Mo, Ni, Sb and Sn) and with some consistently lower than 0.001 mg/kg/wk (Cd, Co, Pb, Th, U and Y); and

- A few metals exhibited elevated loading rates in comparison to others (B, Mn, Sr and Zn).

5.5.7 Field Test Cells

Field cells are kinetic tests constructed to provide site-specific drainage quality information under field, rather than laboratory, conditions. The objective of a field cell is to expose selected drill core material to weathering conditions at the site and collect drainage water over time for laboratory analysis. Seven field cells were constructed on the RRP site in October 2011. A maximum of 14 sampling events were captured between October 2011 and November 2012 (Appendix G).

Core from various lithologies were preselected from the major lithologies expected from the future pit mine rock at the site. Sample selection was made from long sections of generally consistent lithology and further guided by calcium and sulphur contents from exploration data. Lithologies targeted for this work included felsic and intermediate volcanics, mafic volcanics, metasediments along with a single cell for pyritic metasediment.

The pH values of the field cell leachate ranged from 7.4 to 8 for all field cells exhibiting a generally declining trend for most of 2012. The field cell leachate pH values were generally above the average steady state pH range observed in the humidity cell leachate (7.0 to 7.6).

Acidity loading rates are similar for all field cells, and range from 0.08 to 1.6 mg/m^2/wk, and increased to some extent over the course of the experiments. The field cell loading rates were similar to the average steady state loading rates of the humidity cells (0.08 to 0.7 mg/m^2/wk), particularly during the initial 35 weeks of field cell operation. Alkalinity loadings varied over time and were similar for all field cells. Loading rates ranged from 1.4 to 2.2 mg/m^2/wk, and generally decreased over the course of sampling. Rates were generally elevated relative to the average steady state loading rates observed in the humidity cell leachate (0.06 to 3.4 mg/m^2/wk). Sulphate loading for all field cells were elevated for the initial sampling event and ranged from 5.5 to 10 mg/m^2/wk. Sulphate loading rates declined over time in all field cell leachates, and ranged from 0.2 to 6.0 mg/m^2/wk for the remainder of samples collected.

Metals analyses on leachates from the field cells had concentrations near or at the detection limit for Ba, Be, Bi, B, Cd, Cr, Co, Fe, Pb, Li, Mn, Hg, Ni, Se, Ag, Te, Tl, Si, Sn, Ti, W, U, V, Zn and Zr. All detectable field cell loading rates were elevated for the initial three weeks of flushing and increased again in the early spring (weeks 32 to 35). Generally the field cell loading rates were variable, although a general decreasing trend over time was observed for most constituents.

5.6 Hydrology and Water Quality

5.6.1 Watersheds

Watersheds in the vicinity of the RRP are shown in Figure 5-6. Subwatersheds shown in the figure are in relation to the Pinewood River, such that watershed areas at different key points along the river are shown, as opposed to the watersheds of individual tributaries. Subwatersheds were divided in this manner to allow for determinations of receiving water assimilative capacity at different points along the Pinewood River, as well as to allow for the calculation of water supply potentials from the Pinewood River.

The Pinewood River has a total watershed area of 575.5 km^2. Opposite the RRP site, where Loslo Creek (Cowser Drain) enters the Pinewood River, the watershed measures 106.2 km^2. The Pinewood River watershed area increases significantly at two points downstream where major inflows enter the river: downstream of the McCallum Creek and Tait Creek outlets, where the watershed expands to 207.1 km^2, and downstream of the Kishkakoesis River inflow, where the Pinewood River watershed expands to 460.2 km^2. The McCallum Creek outlet is of particular importance to the RRP because this is one of the proposed locations for final effluent discharge to the Pinewood River, as this is the closest point in the river where there is a major

increase in the watershed due to the inflow of the McCallum Creek and Tait Creek systems (Figure 5-6).

The RRP site on the north side of the Pinewood River is drained by four small creek systems, which from east to west are: Clark Creek (Teeple Drain), West Creek, Marr Creek and Loslo Creek (Cowser Drain). These creek basins range in size from 7.3 km^2 (Marr Creek) to 16.35 km^2 (West Creek). Major portions of the Clark Creek, Marr Creek and Loslo Creek basins will be overprinted by RRP developments, principally the tailings management area and stockpiles. West Creek currently flows through the proposed open pit and will have to be diverted around the pit in order for the RRP to proceed. It should be also noted that the lower approximately 3.3 km reach of Loslo Creek and 2.3 km of Clark Creek leading to the outflow into the Pinewood River have been previously designated as Municipal drains under the *Drainage Act* (respectively, the Cowser Drain constructed in 1980 and the Teeple Drain constructed in 1994).

The Rainy River has a watershed area in excess of 50,000 km^2 where the Pinewood River enters the Rainy River. At the Water Survey of Canada hydrological station at Manitou Rapids, located approximately 35 km upstream of the Pinewood River inflow, the Rainy River watershed measures 50,200 km^2. Hence, there is an approximate 100:1 mixing ratio provided by the Rainy River, relative to Pinewood River flows.

The Rainy River is an international waterway that separates Ontario (Canada) from Minnesota (United States). The Rainy River flows into the south end of Lake of the Woods, itself an international waterbody, which borders Ontario, Manitoba (Canada) and Minnesota (United States). Lake of the Woods drains by way of the Winnipeg River to Lake Winnipeg, which in turn drains to Hudson Bay by way of the Nelson River.

5.6.2 Surface Water Flows

Runoff data for the Pinewood River are available from Water Survey of Canada Stations 05PC011 and 05PC023. Water Survey of Canada Station 05PC011 (at Pinewood) has a watershed area of 461 km^2 and is located downstream on the system near the community of Pinewood at UTM NAD 83, Zone 15N, 409345E, 5400705N. This station was operated seasonally (March through November) from 1952 to 1998. Water Survey of Canada Station 05PC023 (at Highway 617) has a watershed area of 233 km^2 and is located where the Pinewood River crosses Highway 617 at UTM NAD 83, Zone 15N, 413011E, 5405672N. Station 05PC023 has been operated year-round since April 2007. Both stations exhibit natural flow and are not regulated, such as by damming.

Runoff data from the Rainy River are available for the Rainy River at Manitou Rapids (watershed area 50,200 km^2) and at Fort Frances (watershed area 38,600 km^2). The Fort Frances Station has operated since late 1905 and the Manitou Rapids Station has operated since mid-1928. The Rainy River is a regulated (impounded) system.

The Water Survey of Canada Station 05PC023 (at Highway 617) is located approximately 4 km downstream of the McCallum Creek outlet (Figure 5-18). Unfortunately, the period of record for this station is short (five years) and the data for 2011 are provisional. Monthly and average annual flow data for Water Survey of Canada Station 05PC023 are shown in Table 5-19. The 5-year average runoff value of 215 mm appears somewhat high based on longer term data available for Water Survey of Canada Station 05PC011 (at Pinewood; see below). Flow data for the open water period are available from Station 05PC023 in real time, so this station is well suited to provide operating data for RRP water taking and effluent discharge management described in Section 4.12.

Greater reliance is placed on data from Water Survey of Canada Station 05PC011 (at Pinewood) for deriving longer term annual average and return period flow data for the system, as these data are more extensive covering a period of 47 years (1952 to 1998; Table 5-20). This station however, was operated only seasonally such that there are no data for the months of January, February, November and December. Mean flows for these four months can however, be estimated from year round data available for the Water Survey of Canada Station 05PC023 (at Highway 617) by determining the proportional flows for these months in comparison to flows for the period of March through October. The derived monthly runoff proportions can then be applied to the longer term monthly averages available for Water Survey of Canada Station 05PC011 (at Pinewood) to derive flow estimates for the missing months of January, February, November and December. The derived average annual runoff for Station 05PC011 for the entire calendar year is calculated at 195 mm. For example, the mean monthly flow for January of 0.218 m^3/s shown in Table 5-20, for Station 05PC011, was calculated by multiplying the average annual flow for the months of March through October collectively for Station 05PC011 (i.e., a value of 3.940 m^3/s) by the 0.0553 proportional factor shown for January in the right-hand column of Table 5-19 for Station 05PC023. Mean monthly Table 5-20 values for February, November and December, for Station 05PC011, were calculated similarly.

Year to year trend hydrologic analysis for the Pinewood River shows no developing long term trends over the period of record (Figure 5-19). Results from this station can therefore be reasonably applied to the RRP site. As time progresses and more data become available for the Pinewood River Water Survey of Canada Station 05PC023 (at Highway 617) data from this station will eventually become more applicable.

In addition to average annual and average monthly flows, extreme low and high flow estimates of Pinewood River flows are also of interest from both a water management and water supply perspective, and from an environmental management perspective. Annualized 5th percentile and 95th percentile flow values were derived for the Water Survey of Canada Station 05PC011 (at Pinewood) to provide an indication of water supply and receiving water assimilative capacities in relation to RRP needs (Table 5-20). To estimate annualized 5th percentile low flow monthly values, the derived mean monthly flows shown in Table 5-21 for all months were multiplied by a factor of 1.357 / 4.034, where 1.357 is the 5th percentile m^3/s value for the March

to October annual data set and 4.034 is the average m^3/s value for the March to October annual data set. To derive annualized 95th percentile high flow monthly values, the derived mean monthly flows shown in Table 5-20 for all months were multiplied by a factor of 8.160 / 4.035. The resultant estimated annual runoff values for a 5th percentile low flow year and a 95th percentile high flow year are 66 mm and 394 mm, respectively. These values are used in annual site water balance calculations.

The long term mean annual runoff value generated from the Rainy River flows measured at the Manitou Rapids Water Survey of Canada Station 05PC018 is 230 mm, which is higher than the measured value of 215 mm for the Pinewood River Water Survey of Canada Station 05PC023 (at Highway 617) and the long term value of 195 mm calculated for the Pinewood River Water Survey of Canada Station 05PC011 (at Pinewood). The Rainy River watershed extends east as far as the Thunder Bay area. The Hydrological Atlas of Canada (NRCan 1978) shows typical annual runoff for this area transitioning from approximately 300 mm near to Thunder Bay to approximately 200 mm closer to Lake of the Woods; thus the Rainy River watershed is in a transitional runoff regime. The higher runoff value for the Rainy River stream flow station reflects this transitional effect. An annual runoff value of approximately 200 mm would therefore be expected for the RRP site area, given its position closer to Lake of the Woods. The derived annual runoff value of 195 mm for the Pinewood River Water Survey of Canada Station 05PC011 (at Highway 617) is therefore regarded as being representative of average annual site (Pinewood River watershed) conditions. Inspection of the Rainy River flow data shows a slight, but weakly expressed trend to increasing annual flows (Figure 5-20). If the data prior to 1940 are excluded, the trend is essentially flat similar to that shown for the Pinewood River in Figure 5-19. The 1930s represented an exceptionally dry period.

Return period low flow estimates, which are frequently used for determining receiving water assimilative capacities under extreme low flow conditions, can be derived from the Pinewood River at Highway 617 station, recognizing that the period of record is limited to five years. The resulting values are shown in Table 5-21 for the lowest average 7-day period, for annual return periods varying from 2 to 20 years. The results were derived from application of the log-normal distribution. The MOE typically interprets the 20-year return period 7-day average low flow (i.e., the 7Q20 value) as being indicative of extreme low flow conditions for determining receiving water assimilative capacity. The 7Q20 value for the Pinewood River is effectively zero, as are the 7Q5 and 7Q10 values. These low values support the assumption of very limited groundwater infiltration.

The lowest flow period appears to occur most frequently during the late summer, but may also occur during the late winter. The derived flow values are excessively low for a watershed of this size (233 km^2), in comparison to Provincial norms, and reflect two conditions: first that the Pinewood River is located near to the western border of Ontario and precipitation values decrease towards the west; and second that the Pinewood River watershed is characterized for the most part by Lake Agassiz clays which offer limited groundwater recharge potential and hence restricted stream baseflow potential.

The data presented in Table 5-20 show that the Pinewood River (near Pinewood) has had zero, or near zero, monthly average flows in 10 out of 40 recorded instances for March (25% occurrence), and 4 out of 46 recorded instances for September (8.7% occurrence). All of the March zero flow monthly averages occurred prior to 1983. No zero monthly average flows have as yet been recorded for the upper Pinewood River flow station (Water Survey of Canada Station 05PC023 at Highway 617). The September zero monthly average flows recorded for Water Survey of Canada Station 05PC011 (at Pinewood) may not be fully reflective of actual watershed flows at this time, as there is extensive Beaver activity in the area which would impound water in the system, especially during the late summer and fall months when dam building by Beaver is at its height, thereby accentuating the appearance of drought conditions.

Attempts were made by KCB, RRR and AMEC to measure flows in some of the local creeks that drain to the Pinewood River. Unfortunately, due to the complications of low gradient, small systems and frequent Beaver impoundment, no useful data could be obtained from this program. During summer and early fall periods spot flow measurements showed that these creeks can and frequently do go to a zero flow condition, as would be expected from the Pinewood River data. Therefore, for determining tributary creek flows in site area water balance calculations, runoff conditions have been prorated from data developed in Table 5-20 for the Pinewood River (near Pinewood).

Additional data and discussions regarding surface water flows are provided in Appendix W-1.

5.6.3 Water Quality

Surface water quality samples have been routinely collected from 14 RRP monitoring stations on a monthly basis since June 2010 (Section 5.2.8.1). This includes samples from all site area creeks (Clark, West, Marr, Loslo), the Pinewood River and Rainy River, and from an Unnamed Creek which drains to Muskrat Lake as a control site (Figure 5-9). A more limited set of water samples was collected from the RRP site area prior to June 2010, and additional water samples were collected in association with site-specific fisheries and aquatic investigations. Discussions presented below are focused on results of the routine monthly sampling collection program, as this data set is the most complete and uniform for the site.

Up until the end of November 2012, 416 samples had been collected and analyzed for the combined 14 stations, including duplicate samples. Station data summaries for the key parameters, including total metals, are presented in Table 5-22 for the following metrics: minimum, maximum, median, standard deviation, number of samples and 75th percentile values. Data for all parameters, including dissolved metals can be found in AMEC (2013f).

PWQO and CEQG are values set by the Provincial and Federal governments which are considered protective of all forms of aquatic life including the most sensitive species, for an indefinite period of exposure including allowance for factors of safety on top of published toxicity

values found in accepted (credible and rigorous) literature documents. It is not uncommon for a number of parameters to exceed PWQO and CEQG values in the background environmental baseline condition, even in areas which are completely undisturbed.

There are a number of circumstances where exceedance of the PWQO and CEQG values is common:

- Total metal values for samples showing elevated total suspended solids (TSS), especially for very common minerals such as aluminum and iron;
- Total aluminum concentrations in areas where clay / silt soils are common, as aluminum is a common clay mineral;
- Samples collected from under the ice in low volume water systems, because the process of ice formation tends to exclude ions from the ice crystal lattice, thereby concentrating the ejected ions in the underlying water column; and
- Samples collected during summer drought conditions in low volume water systems, because of ion concentration due to evaporative processes.

Results of RRP samples are reflective of all of the above conditions, particularly because area substrates are clay / silt rich, and because the clay / clay till overburden precludes significant Baseflow contributions to site area creeks and rivers, as described in Section 5.6.2. The lack of significant baseflow means that RRP water samples collected in both winter and summer are particularly prone to ion concentration effects resulting from both ice formation and evaporative processes.

The majority of parameters for surface waters met PWQO and CEQG for the protection of aquatic life, with the exception of:

- Common exceedances for aluminum (mainly CEQG), iron and phosphorus;
- Frequent exceedances for cadmium (CEQG), copper (mainly CEQG) and cobalt (PWQO); and
- Occasional, to rare, exceedances for arsenic, lead, nickel and zinc.

Further discussions on these particular parameters are provided below.

5.6.3.1 Aluminum

Ten out of 416 samples had dissolved (clay-free) aluminum concentration above the PWQO value of 0.075 mg/L. Five of the 10 samples with elevated dissolved aluminum concentrations

were from the upstream Marr Creek station; the reason for this distribution is not known. Four of the ten occurrences occurred in winter and three occurred in summer, potentially reflecting ice formation and summer evaporative process effects.

Unlike the PWQO for aluminum, which is based on clay-free samples, the CEQG standard of 0.1 mg/L, for waters with a pH value above 6.5, is for unfiltered (total) aluminum concentration. Approximately 63% of the 416 samples exceeded this threshold because of association with TSS. Aluminum, as discussed above, is a primary component of clay minerals, and suspended solids containing clay fractions are expected to contain elevated aluminum concentrations in the natural state; hence the Provincial caveat for clay-free samples.

5.6.3.2 Arsenic

Only 2 of 416 samples showed total arsenic concentrations above the more stringent CEQG value of 0.005 mg/L. The existing and interim PWQO values for arsenic are 0.1 mg/L and 0.005 mg/L, respectively. Both samples with elevated arsenic were associated with elevated TSS values. One sample with an arsenic concentration 0.0074 mg/L (slightly above the more stringent guideline value) was associated with a TSS value of 42.2 mg/L and the other elevated arsenic value of 0.013 mg/L was associated with a sample having an extremely high TSS value of 1,340 mg/L. The first sample was a summer (July) sample and the second sample a winter (February) sample. Both samples are considered non-representative of typical site baseline conditions.

5.6.3.3 Cadmium

All cadmium concentrations met the PWQO value of 0.0002 mg/L with the exception of the single sample exhibiting the very high TSS reading of 1,340 mg/L, where the cadmium value was 0.00074 mg/L; and 2 cadmium values out of a sample set of 416 met the Interim PWQO hardness-based cadmium values. The CEQG value for cadmium is more stringent than the PWQO value and is also hardness-based. Twenty-three of the 416 samples exceed the Federal hardness-based CEQG value and an additional 143 samples had detection limits that were higher than the calculated hardness-based CEQG value, and therefore could not be assessed. The CEQG hardness-based values for cadmium are extremely low, such that it is not uncommon for these values to be exceeded under baseline conditions in northern Ontario.

5.6.3.4 Copper

Copper concentrations were generally very low and consistent with applicable PWQO concentration thresholds, with less than 1% (4 out of 416) of the samples showing total copper concentrations in excess of the existing and interim PWQO value for copper of 0.005 mg/L. All associated hardness values were >20 mg/L. Approximately 8%, or 34 of 416 samples, showed total copper values in excess of the more stringent Federal CEQG value of 0.002 mg/L for copper. In cases where total copper concentrations exceeded the CEQG value, excluding the

sample with an extreme TTS value of 1,340 mg/L, there was effectively no correlation between total copper and TSS. The r^2 value in this case was 0.029, indicating that only 2.9% of the variation in total copper concentration could be explained by the relationship with TSS. Thirteen of the 34 samples exceeding the CEQG threshold were winter (December through March) samples and 11 were summer (July through September) samples, suggesting influence by freezing and evaporative processes for these samples. The nine non-winter / non-summer values (one value was excluded as being anomalous) showed an average copper concentration of 0.0031 mg/L, which is only slightly greater than the CEQG threshold.

5.6.3.5 Cobalt

Approximately 12% (50) of 416 samples, for cobalt exceeded the PWQO value of 0.0009 mg/L in the background condition. This is a relatively high percentage exceedance for this metal. There is no CEQG for cobalt. Slightly elevated cobalt concentrations are a characteristic of Lake Agassiz soils in southern Manitoba (Haluschak et al. 1998) and presumably also of Lake Agassiz soils in the RRP area. An analysis of cobalt values which were above the median detection limit (271 samples) showed no effective correlation of cobalt concentration with total suspended solids (TSS), with an r^2 value of only 0.017, indicating that 0.7% of the variation in cobalt concentration for these samples can be explained by association with TSS.

However, a review of data seasonality showed that 29 of the cobalt exceedances occurred during the winter months (December through March) and 16 of the exceedances occurred during the summer months (July through September). Of the remaining five values that exceeded the PWQO threshold, one was considered anomalous (extremely high TSS, 1,340 mg/l-2) and four non-winter / non-summer values were only marginally above the PWQO value of 0.0009 mg/L, averaging 0.0012 mg/L for the four samples. The fact that the vast majority of the samples which exceeded the PWQO value of 0.0009 mg/L were winter or summer samples suggests influence by freezing and evaporative processes for these samples.

5.6.3.6 Iron

Approximately 76% of the baseline sample iron values exceeded the PWQO and CEQG value of 0.3 mg/L. Iron commonly exceeds PWQO and CEQG values in the background condition, as iron is a common crustal mineral, and hence there is frequently a strong association between total iron concentrations and the concentration of TSS. In the case of the Rainy River data; however, there was only a modest correlation between iron and TSS, with an r^2 value of 0.28, indicating that 28% of the variation in iron concentrations can be explained by association with TSS. The modest correlation with TSS is improved if the June through August data are excluded, indicating that algae may comprise a portion of the TSS fraction during the summer months. Exclusion of the summer data resulted in an r^2 value of 0.37. The other factor affecting iron concentrations is the seasonal concentration of dissolved metals due to ice formation in winter and evaporation in summer, as discussed above. A review of the 2012 dissolved iron data revealed that there were 15 instances where dissolved iron exceeded the PWQO and

CEQG value of 0.3 mg/L. Ten of the 15 instances occurred in winter and 5 instances occurred in summer (July through September).

5.6.3.7 Lead

Only 2 of 416 samples exceeded either PWQO or CEQG thresholds for the protection of aquatic life. CEQG standards for lead are based on hardness. PWQO standards are based on alkalinity (existing standards) or hardness (interim standards). One sample with a lead concentration of 0.023 mg/L and a very high TSS value of 1,340 mg/L exceeded both the CEQG and Interim PWQO standards. The second sample with a lead concentration of 0.0026 mg/L exceeded the applicable CEQG threshold, but not the applicable PWQO threshold. This sample also had a very high TSS value of 159 mg/L. The first sample was a winter sample and the second a summer sample. Both samples are regarded as being non-representative.

5.6.3.8 Nickel

Similar to lead, only 2 of 416 values for nickel exceeded the PWQO threshold of 0.025 mg/L, and only a single value exceeded the hardness-based Federal CEQG value. One of the elevated nickel samples was the non-representative winter sample with a 1,340 mg/L TSS concentration. The other sample was a low TSS summer sample.

5.6.3.9 Phosphorus

The average total phosphorus concentration for the regular monthly collective 14 RRP water quality monitoring stations was 0.069 mg/L, which is slightly more than double the Interim PWQO value of 0.03 mg/L for this parameter. A total of 67% of the samples exceeded the PWQO threshold value. There is no CEQG value for phosphorus. The most likely source of excess phosphorus in the system is agricultural activity, particularly cattle excrement. Two water quality stations that showed very little phosphorus enrichment were Stations SW4 (Unnamed Creek draining to Muskrat Lake) and SW14 (upper West Creek). These were the only two stations which do not drain areas of agricultural land.

5.6.3.10 Zinc

Only 7 of 416 samples showed total zinc values which exceeded both the PWQO and CEQG threshold value of 0.03 mg/L, and 9 samples exceeded the Interim PWQO value 0.02 mg/L. One of the samples was the sample with a very high TSS reading of 1,340 mg/L, which is not representative. Excluding this value, there was a weak r^2 correlation value of 0.16 for zinc and TSS. Six of the nine values which exceeded the Interim PWQO value were either winter (four) or summer (two) values. The average concentration of the three non-winter / non-summer values of 0.032 mg/L was only slightly above the CEQG and PWQO threshold value of 0.03 mg/L. The highest recorded zinc value, excluding the very high TSS sample was 0.051 mg/L for a winter sample.

5.7 Hydrogeology and Groundwater Quality

General details of the physiography and geological setting are described in Section 5.4 and are elaborated in greater detail herein and in Appendix H.

5.7.1 Stratigraphy

The overburden consists mainly of Late Wisconsinan (Pleistocene) deposits that were a result of two main ice advances, Labradorean and Keewatin, with succeeding glaciolacustrine sedimentation associated with Lake Agassiz following glacier retreat. The overburden is of variable thickness reaching 30 to 40 m thickness within the NRSA, but thinning to 0 m on higher ground where bedrock highs occur, particularly to the north and east of the proposed open pit (Figure 2-1 in Appendix H). The glaciolacustrine sediments occur mainly in the western part of the NLSA as their location is limited by the extent of previous eastward transgressions of Lake Agassiz and higher elevation ground to the east. The main overburden formations that are encountered in the project area are as follows from stratigraphically lowest to highest:

- **Whiteshell Till**: is of Labradorean origin and was deposited beneath ice advancing into the area from the northeast across the Canadian Shield. Where found, it appears to subcrop throughout the project area below younger units. The Whiteshell Till is predominantly a silty sand, with some gravel and cobbles, and trace clay, with some boulders. Some isolated glaciofluvial deposits are associated with the Whiteshell Till.

- **Wylie Formation**: is a glaciolacustrine clay, silt and fine sand, associated with Glacial Lake Agassiz, which occupied a widespread area, primarily to the northwest of the site. The unit occurs between, and is gradational with, the Whiteshell and Whitemouth Lake Tills. The Wylie Formation likely contains material derived from both Labradorean and Keewatin sources, with the upper portions being more clay rich and Keewatin in origin. The Wylie Formation at the site is generally less than 2.5 m thick, is not as extensive as the near-surface glaciolacustrine deposits of the Brenna Formation and is more common at lower elevations.

- **Whitemouth Lake Till**: is of Keewatin origin, and was deposited beneath ice advancing into the area from the northwest across glacial Lake Agassiz deposits and sedimentary rocks. This till appears to be one of the most widespread and thickest Quaternary units in the project area, being thickest in low-lying areas. The Whitemouth Lake Till is silty clay with trace to some sand and trace gravel. It is suspected that the Whitemouth Lake Till contains swelling clays such as smectite, given the Keewatin origin of the clay. Some isolated glaciofluvial deposits are associated with the Whitemouth Till.

- **Brenna Formation**: is a glaciolacustrine clay of Keewatin origin. It has a widespread occurrence above the Whitemouth Lake Till throughout low-lying areas. It is varved in places and contains sand lenses and gravel at some locations.

Recent Holocene sediments have been deposited since Lake Agassiz retreated from the area, approximately 9,000 years before present. Deposits of peat, which are fairly common within the project area, occur in bogs, swamps and along some drainages, with more limited peat deposits occurring in some small areas in the upper reaches of local creeks. The most extensive area of peat is located in the southwest corner of the project area. Recent alluvial deposits are expected to occur along the Pinewood River and its tributaries. The alluvium likely consists of silt, clay, sand and some organics.

The project area lies within the Rainy River Greenstone Belt. The bedrock geology comprises predominantly mafic to intermediate metavolcanics and intermediate to felsic metavolcanics of greenschist to lower amphibolites facies. Exploration drilling to date in and around the proposed open pit has not identified any major tectonic structures (faults or ductile shear zones of large displacement) in the project area (Appendix H). Drilling has revealed a brittle fault (the Eastern Fault) that can be correlated across the proposed open pit (Figure 2-3 in Appendix H). This is a north - south striking structure that dips at approximately 50° and is a 50 to 100 m thick zone consisting of a relatively thin central zone of fault gouge with brittle deformation either side. This fault can be traced 2.3 km to the north of centre of the proposed open pit and 1.8 km to the south. It does not have a large displacement as the mineralized gold-bearing zones are not notably offset.

5.7.2 Hydrogeological Investigations

The hydrogeological environmental baseline condition for the RRP has been determined through a number of investigations including, most recently, those completed by AMEC in 2011 to 2012. Data collected prior to 2011 (KCB 2011a) are summarized in Appendix H as relevant. Data collected by AMEC are summarized in this section with detailed data and/or analyses catalogued in Appendix H.

Shallow (overburden and the shallow bedrock) and deep bedrock investigations have been conducted by AMEC within the project area (AMEC 2013g,i). These AMEC investigations are described separately as they consider largely different hydrostratigraphic units (different parts of the groundwater flow system) and also different methods of testing (mainly slug testing in shallow piezometers for the overburden and Shallow Bedrock as opposed to packer testing in boreholes for the bedrock).

5.7.2.1 Overburden and Shallow Bedrock

As part of the geotechnical and hydrogeological site investigations for the RRP, 89 boreholes were drilled between December 2011 and October 2012 (AMEC 2013i). Piezometers were

installed at 52 of these locations for groundwater level monitoring, including multi-level installations. Piezometers were typically installed in one of three geological units which included the Shallow Bedrock, the Whiteshell Till and the Whitelake Mouth Till. The locations of the boreholes with piezometers are shown in Figure 2-2 of Appendix H.

Slug testing of the AMEC piezometers was conducted in June 2012 to supplement existing hydraulic data on the overburden and the Shallow Bedrock. A summary of these data are provided in Table 3-2 in Appendix H. The Whiteshell Till was identified as the most permeable unit, but with modest hydraulic conductivities of the order of 5.0E-05 m/s. The Shallow Bedrock was assessed to have hydraulic conductivities of approximately 1.0E-06 m/s, but the Whitemouth Lake Till was considered an aquitard with hydraulic conductivities of approximately 1E-08 m/s.

5.7.2.2 Bedrock

The physical characteristics of the intermediate and deeper groundwater flow system have been assessed as part of the AMEC (2013i) geomechanical field program completed between January and April 2012. This program comprised 10 inclined NQ-sized holes between 300 and 750 m long.

The data collected by the geomechanical program provide information on the local geological structure around the proposed pit and underground mine that is of relevance to the hydrogeological assessment of the bedrock. The cores of all of these boreholes were oriented and geomechanically logged (AMEC 2013i).

The hydraulic conductivity was assessed with 61 packer tests performed in 6 of the 2012 inclined and NQ-sized geomechanical holes. Packer testing was undertaken at the bottom of the boreholes during its advance. The intervals usually ranged from 18 to 21 m to depths of 300 m below ground surface with longer intervals at greater depths. The results of the packer testing are summarized in Appendix H (Table 3-4 and Figure 3-2 in Appendix H). These show the hydraulic conductivity rapidly decreasing with depth; mean hydraulic conductivities approach 1.0E-08 m/s at depths greater than 50 m below the bedrock surface.

The packer testing undertaken by AMEC on the bedrock has found no consistent relationship between hydraulic conductivity and the degree of brittle deformation as determined from geomechanical logging. The only major fault structure (Eastern Fault) that can be correlated across the proposed open pit does not have estimated hydraulic conductivities that are above average based on measurements to date.

5.7.2.3 Groundwater Flow

There has been ongoing groundwater monitoring within the project area since August 2009 from a total of 26 locations; 21 of these locations continue to be monitored. Groundwater levels are

also being measured at the 30 piezometer sites installed by AMEC and at an additional 16 existing private wells on RRR land (Figure 2-2 in Appendix H).

Groundwater flow approximately follows topography with a groundwater divide to the northwest, approximately coincident with the watershed boundary of the Pinewood River. Groundwater flow is generally towards the west in the Pinewood River watershed, but locally is towards the Pinewood River corridor. Horizontal gradients are relatively steep on higher ground approaching 0.01, but become more subdued in the lower lying areas where they decrease to approximately 0.003 (Figure 3-3 in Appendix H). This change in horizontal gradient is a strong indication that, as the groundwater flows from the higher ground to lower elevations, there is flow from the relatively tight Shallow Bedrock to the more permeable Whiteshell Till and other granular material immediately above the bedrock, the Pleistocene lower granular deposits (PLGD).

Groundwater in the Shallow Bedrock and PLGD becomes confined as it moves westwards and towards the Pinewood River (Figures 3-4 and 3-5 in Appendix H) beneath the lower permeability silty clays of the Whitemouth Lake Till and the glaciolacustrine deposits that largely sandwich this till (the Pleistocene Aquitard). Artesian conditions within the Shallow Bedrock and PLGD are common along the stream corridors with upwards gradients on the order of 0.03 to 0.1, while downwards gradients occur in the higher areas between the streams.

5.7.3 Conceptual Model

Five hydrostratigraphic units have been identified (Table 5-3) that are key in explaining the groundwater - surface water interaction in the Pinewood River watershed and the artesian conditions that occur as well as in predicting the groundwater level drawdown and surface water flow depletion associated with the proposed open pit. They are as follows:

- **Near-surface Flow System**: comprises all the Holocene sediments (alluvium, peat) and hydrologically is the unit that produces the short to medium-term interflow response in the river (Section 3.4 in Appendix H). Locally, this may also include more granular and weathered units of the younger Pleistocene deposits where they lie immediately beneath the Holocene deposits, likely to be mainly from the Brenna Formation;

- **Pleistocene Aquitard**: is comprised mainly of the Whitemouth Lake Till, but also includes the upper and lower glaciolacustrine deposits that sandwich the Whitemouth Lake Till (the Wylie Formation beneath and the Brenna Formation above). Vertical flow is likely to dominate. Overall, the Pleistocene Aquitard is of low enough hydraulic conductivity to give rise to artesian conditions found in the low lying areas in the west of the project area, along the Pinewood River and its tributaries;

- **PLGD**: is comprised predominantly of the Whiteshell Till with possible additions of glaciofluvial deposits of Labradorean origin beneath the Pleistocene Aquitard. This is not referred to as an aquifer because of its overall modest hydraulic conductivity;

- **Shallow Bedrock**: includes bedrock within 10 to 20 m of the upper bedrock surface and is often weathered and fractured. It is expected to have a moderate overall hydraulic conductivity, at least one order of magnitude lower than the PLGD. Hydraulically, this has a reasonable connection with the PLGD; and

- **Intermediate and Deep Bedrock**: overall there is a decreasing hydraulic conductivity can be observed with depth. The distinction between intermediate and deep is made to approximately replicate the observed data and is taken at approximately 200 to 300 m below ground surface.

The pattern of groundwater flow at the site is illustrated schematically in a conceptual cross section shown in Figure 3-12 in Appendix H. Most of the effective precipitation is either runoff or infiltrates in shallow soils (mainly weathered silts and clays), peat and alluvium. The latter is expected to discharge relatively quickly over the short to medium term as interflow and is interpreted as part of a near-surface flow system (including beaver dams and other obstructions).

Limited groundwater recharge to the deeper groundwater system (Shallow Bedrock and PLGD) is expected to occur, primarily where the bedrock is at surface or has limited cover of overburden. Some very limited recharge to the deeper groundwater system is possible through the Whitemouth Lake Till on higher ground where downward groundwater gradients likely occur. Where glaciolacustrine clays and peat are close to surface within the project area, recharge to the deeper groundwater system is minimal (effectively zero), particularly where artesian conditions prevail. Averaged over the entire project area, recharge to the deeper groundwater system is considered to be less than 5% (<10 mm) of the total effective precipitation.

Groundwater discharge from the deeper groundwater system to the Pinewood River and its tributaries does occur but is very distributed and the overall flows are very low. Given this conceptual model, the majority of watercourses and wetlands are considered weak discharge areas for the deep groundwater system.

Groundwater withdrawal from the proposed open pit is expected to increase the overall recharge rates in the proximity of the pit due to alteration of the direction of vertical gradients from the upward to the downward ones and due to an increase in the moisture penetration ability / capacity of soil(s) through the lowering of the water table caused by dewatering operations.

5.7.4 Predictive Numerical Modelling

A numerical three-dimensional steady state groundwater flow model (MODFLOW; McDonald and Harbaugh 1988) has been developed and used to estimate:

- Seepage rate into the proposed open pit and the underground workings;
- Drawdown in PLGD / Shallow Bedrock, caused by the mine dewatering;
- Potential reduction in groundwater discharge to the surface water features; and
- Inflow from tailings management area and east mine rock stockpile as well as their potential groundwater pathways.

General details of the predictive numerical modelling are described herein and are provided in greater detail in Appendix S.

5.7.4.1 Model Domain and Numerical Grid

The selected model domain for the updated RRP groundwater flow model is shown in Figure 2-1 in Appendix S. The northern and eastern boundaries were generally set along the groundwater divide in bedrock, as described in the baseline report produced by KCB (2011a). The southern boundary was set along Tait Creek, located about 4.5 km south of Pinewood River. The top of the model domain was set as the ground surface as interpreted from the LiDAR survey data. The bottom of the numerical model was established at an elevation of 500 m below sea level which is 450 m below the bottom of the proposed open pit (Figure 2-2 in Appendix S). Areas located beyond the selected model domain (both vertically and horizontally) are expected to have a negligible impact on the groundwater water flow within the project area.

The hydrostratigraphy described above has been applied to the numerical groundwater flow model. Nineteen model layers were used. Model layer 1 represents the Near-surface System. Model layer 2 represents the upper part of Pleistocene Aquitard (predominantly Brenna Formation) and Pinewood River alluvium (along the river). Model layer 3 represents the middle portion of Pleistocene Aquitard (Whitemouth Lake Till). Model layer 4 represents the lower portion of Pleistocene Aquitard (predominantly Wylie Formation). Model layer 5 represents PLGD (predominantly the Whiteshell Till). Layers 1 through 5 also represent Shallow Bedrock within the localized bedrock outcrop areas. Model layer 6 represents Shallow Bedrock. Intermediate Bedrock is represented by model layers 7, 8 and 9. Deep Bedrock is represented by model layers 10 through 19. Note that in order to simulate seepage into the proposed underground mine workings the model bottom elevation was lowered from -500 to 1,500 m and a corresponding increase in a number of model layers from 19 to 55.

Figure 2-2 in Appendix S shows a representative model east-west cross section drawn through the area of the proposed open pit. It also shows the Eastern Fault striking north-south and dipping to the east at about 50° angle. In the model, this fault was represented conservatively with hydraulic conductivity values greater than those for the surrounding rock mass in the Intermediate and Deep Bedrock. It should be noted that the Eastern Fault was the only permeable structure in the bedrock directly simulated by the developed numerical model.

Horizontal grid spacing varied from 10 m close to the proposed open pit area to about 100 m close to the model domain boundary. Vertical grid spacing (thickness of model layers) varied from about 1 m (layers 1 and 2) to about 80 m (Deep Bedrock in model layer 19).

5.7.4.2 Boundary Conditions and Input Parameters

The no-flow condition was specified along the majority of the northern, eastern and western boundaries of the model domain since these boundaries are expected to coincide with (or to be close to) the inferred groundwater flow directions.

All major simulated surface water features (creeks, ponds and wetlands) located within the model domain were represented by the so-called MODFLOW river nodes with the specified stage elevations being close to the ground surface. Input parameters (hydraulic conductivities and recharge rates) assigned to the various overburden and bedrock aquifer zones for the groundwater flow model, are summarized in Table 3-6 in Appendix S. Some of these parameters were varied within the framework of the predictive sensitivity analysis.

5.7.4.3 Model Calibration

The model was calibrated to water levels observed in September 2010 from 20 monitoring wells which were predominantly located relatively close to the proposed open pit. The model was also compared to observed water levels from June and October / November 2012 which are more representative of the whole project area. In the opinion of AMEC, this data set, which is comprised of 89 wells with known and reliable water levels, does not represent the typical (average recharge) hydrogeological condition of the study area due to the abnormally dry weather experienced in 2011 and 2012 leading up to the 2012 field measurements. The models which simulated groundwater discharges to surface water were also assessed against measured low flows in the Pinewood River.

5.7.4.4 Mine Dewatering – Predictive Simulations and Sensitivity Analysis

The groundwater flow model described above was used to estimate:

- Seepage flow rate into the proposed fully dewatered open pit;
- The open pit zone of influence within the PLGD and Shallow Bedrock units; and
- Impacts of pit dewatering on the base flow contribution to Pinewood River and its tributaries.

The fully dewatered open pit was simulated using the open pit and underground workings design provided by RRR in late 2012. Groundwater seepage into the underground workings and

dewatered open pit were simulated by using MODFLOW drain nodes (Figures 3-1 and 3-2 in Appendix S).

Figure 3-4 in Appendix S shows model predicted drawdown in the Shallow Bedrock caused by the open pit dewatering (Base Case). Under the Base Case scenario, the stabilized seepage rates (neglecting storage component) into the proposed fully developed open pit was estimated to be about 3,000 m^3/d to 3,500 m^3/d over the life of the mine (Appendix S, Figure 3-3). The relatively small change in predicted seepage between years 1 and 12 is attributed to the fact that most of the groundwater flow occurs in the basal unit (PLGD) and Shallow Bedrock, and the drawdown cone stabilizes shortly after the excavation of the open pit removes the PLGD in the first year of mining.

The groundwater flow model was also run with other sets of input data as part of the predictive sensitivity analysis. The main purpose of this analysis was to evaluate the influence of uncertainty in the input parameters on the model predictions. The conducted sensitivity analysis demonstrates that the model-predicted steady state seepage rate into the proposed fully dewatered open pit is expected to vary within a range of about 2,900 to 3,900 m^3/d (Table 3-1 in Appendix S).

Based on the results presented above, annual average groundwater discharge into the surface water features can be potentially reduced by 3,000 to 4,000 m^3/d, primarily through the interception of groundwater by the open pit and underground workings that would otherwise flow to the Pinewood River or the wetlands in the Pinewood River valley downstream of the proposed mine.

Figure 3-5 in Appendix S shows the model predicted zone of influence for all the simulated scenarios, defined as a 1 m drawdown in the Shallow Bedrock. According to the results presented in this figure, the zone of influence is predicted to extend approximately 4 to 5 km from the open pit. The zone of influence appears to be slightly elongated in the north - south direction due to the presence of the Eastern Fault striking in this direction, and to the east due to the dewatering effect of an underground ramp to the east of the open pit.

5.7.4.5 Predictive Groundwater Flow Paths

The groundwater model was used to estimate potential contribution of water to local surface water features emanating from the tailings management area and east mine rock stockpile after closure. A number of conservative assumptions were used for this analysis, including:

- For the base case scenario, surficial clay layer (Brenna Formation) was assumed to be absent (replaced by Whitemouth Lake Till) within a significant area underlying the tailings management area;

- A relatively high vertical hydraulic conductivity of clay (1E-8 m/s) was utilized in all simulated variants; and

- PLGD, the most transmissive hydrostratigraphic unit, was assumed to be continuous everywhere underneath the tailings management area, except for the bedrock outcrops. This assumption results in significant vertical gradients and downward flow component from the tailings management area into the PLGD unit.

Additional details on the groundwater flow path modelling are provided in Section 4.0 of Appendix S.

It should be noted that the water within the tailings management area will be pre-treated and subject to enhanced natural degradation through retention time management and the east mine rock stockpile will be encapsulated. As such only limited migration from these features is expected.

For the tailings management area, according to the conducted flow budget analysis 1,690 m^3/d is predicted to be coming out of tailings management area upon closure with the water cover maintained at an elevation of 378 masl. The majority of the flow (about 76%) coming of the tailings is predicted to be captured by the seepage collection ditches, simulated to be 1.5 m deep; while the remaining 24%, or 411 $m^{3/}$d, is predicted to bypass the ditches, migrating underneath them. A relatively small component of this flow (31 m^3/d) is predicted to discharge into the partially flooded open pit. The remaining flow component of 380 m^3/d is expected discharge into Loslo Creek and wetlands, located along Pinewood River (Figure 4-1 in Appendix S).

For the east mine rock stockpile, the model predicted flow component, bypassing the seepage collection ditches and the open pit, is conservatively predicted to be up to about 120 m^3/d. A significant portion of this water (40 to 50%) ends up in the pit lake, with the remainder discharging to the Pinewood River (Figure 4-2 in Appendix S). Approximately half of the water reaching the pit lake does so via the ramp in the underground workings to the east of the open pit. For the base case scenario, only 25 m^3/d reaches the Pinewood River under steady state conditions.

5.7.5 Groundwater Quality

Groundwater sampling was completed during 2007 and 2009 to 2012. The baseline study completed by KCB (2011a) reported extensively on the groundwater quality of the overburden and the bedrock with data up to 2010. In general, it was found that the groundwater comprised of typical calcium-magnesium-bicarbonate type water with the majority of sampling points having total dissolved solids exceeding 500 mg/L. The following dissolved metal concentrations were noted to exceed or meet the PWQO at 1 or more of the 20 monitoring wells that were sampled: aluminum (1 site), cadmium (1 site), cobalt (6 sites), copper (1 site), iron (14 sites),

mercury (1 site), molybdenum (1 site), uranium (4 sites) and zinc (1 site). It should be noted that groundwater cannot be directly compared to the PWQO but the objectives can nevertheless be used for description purposes. Exceedances of the PWQO were also observed in surface waterbody samples for aluminum, cobalt, copper and iron.

KCB (2011a) also reviewed a municipal groundwater study for the Township of Chapple and noted that the raw water quality of samples collected from four municipal water supply wells completed in bedrock at the community of Barwick, located approximately 23 km south of the site, frequently exceeded the Ontario Drinking Water Standards for aluminum, iron and manganese. They also indicated the frequent occurrence of higher iron concentrations in the project area.

Subsequent groundwater sampling by RRR of 19 monitoring wells in 2011 to 2012 is summarized in Appendix H. This sampling has found dissolved metal exceedances of the PWQO for some of the metals reported by the KCB at one or more wells. The groundwater was found to contain metal contents which exceeded the PWQO on one or more sampling occasion and include: arsenic (6 sites), cobalt (4 sites), iron (4 sites), molybdenum (2 sites), tungsten (4 sites) and uranium (2 sites). Groundwater was also found to exceed the CEQG for the protection of aquatic fresh water life for similar metals including: arsenic (6 sites), cadmium (1 site), iron (4 sites), mercury (1 site) and uranium (1 site).

There is no strongly discernable difference between groundwater quality in individual hydrostratigraphic units with regards to metals for which there are PWQO / CEQG with the exception of uranium. As been noted by KCB (2011a), exceedances in uranium concentrations are only observed in wells screened in the Pleistocene Aquitard, a trend that was also observed in subsequent sampling efforts.

5.7.6 Water Wells

An assessment has been made of the occurrence of private water wells within a 10 km radius of the proposed open pit using the geographic location data from the MOE water well information system and cross-referenced against more detailed water well records requested and obtained from the MOE. Well locations were recorded by the MOE using global positioning system after 2003 and are considered accurate. For wells recorded prior to 2003, only schematics of the well location are available. AMEC conducted a private well survey in 2012 which located 68 private wells within approximately 10 km of the proposed open pit.

The majority of the private wells were drilled to the base of a coarse granular material which is presumed to be the PLGD located above the bedrock surface. These wells are usually in the range of 10 to 30 m below ground surface. Where the PLGD is absent, the wells are much deeper and can approach 100 m depth. This indicates that the specific capacity of bedrock wells is much lower than those sourcing water predominantly from the PLGD.

Figure 2-4 in Appendix H shows the locations of the wells, with an indication of accuracy on a scale of 1 to 3, with 1 being accurate (global positioning system / well survey), 2 being moderately accurate (reasonable well location diagram in water well records) and 3 being inaccurate (poor well location diagram in water well records). It is likely that these are an underestimate of the total number of wells as buildings within the 10 km buffer number approximately 130. It may be assumed that the majority of these buildings have a well for water supply. Well locations and buildings correspond are found primarily along the main roads, particularly Highway 71, which is located 6 km from the open pit. To the south and north of the proposed pit there are few roads and correspondingly few wells / buildings. The majority of wells / buildings in close proximity to the open pit are located along Highway 600. Within a radius of approximately 2 km of the margins of the proposed open pit there are a possible 21 wells of which 18 have been identified through associated wells records. The other possible wells are associated with three buildings with no located well record nearby; the majority of these are on RRR lands.

5.8 Aquatic Resources

5.8.1 Habitat Types and Fish Passage Considerations

As indicated in Section 5.2.9.1, several habitat-based criteria were used to classify reaches, sections and ponded areas of water features within and beyond the NLSA into discrete categories or habitat types. Table 5-23 provides a summary of both qualitative and quantitative criteria used to delineate habitat types. Compiled species lists are provided in Appendix I-1.

These habitat types are useful from a broad scale perspective to represent aquatic resources habitat availabilities. 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 Figure 5-21. A more detailed representation of the availability of habitat types is provided in Figure 3-1 in Appendix I-3. Illustrations of habitat type cross sections and photographs provided in Appendix A of Appendix I-3.

Overall, nine habitat types were classified and their presence delineated throughout and beyond the NLSA. Based on the classification criteria, habitat types were often specifically associated with sections of the Pinewood River (upstream, midstream or downstream) or its tributaries.

Habitat Types 1 and 2 were most often associated with the Pinewood River. These two types primarily consisted of a relatively deep and wide channel mostly comprised of flat morphology with some pools. Generally these habitat types were characterized by relatively narrow floodplain widths with variable composition of riparian vegetation. Although both Habitat Types 1 and 2 showed some similarity with regard to channel dimension, substrate and cover availability, Habitat Type 1 had narrower floodplains with moderate entrenchment and forested

riparian vegetation extending close to the channel edge. Habitat Type 1 aquatic vegetation was dominated by Red-head Pondweed and Hornwort Coontail.

Habitat Type 2 had a slightly wider floodplain (maximum 50 m) dominated by sedge species, Speckled Alder and willow species. Mixed forest was available within the valley at a greater distance from the channel margins. Aquatic vegetation in Habitat Type 2 was dominated by Yellow Cowlily, Broadleaf Arrowhead, Tape Grass and Hornwort 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 and boulder). Mixed forest species associated with both Habitat Types 1 and 2 included: Black Spruce, Larch, Balsam Poplar, White Elm and White Birch.

Habitat Types 3, 4 and 5 were generally present in the smaller tributaries to the Pinewood River including McCallum Creek, Unnamed Tributary 1, Tait Creek, Unnamed Tributary 2, Loslo Creek (including Cowser Drain), Unnamed Tributary 5, Marr Creek, Unnamed Drainage A, West Creek, Unnamed Tributary 6, Clark Creek (including Teeple Drain), Blackhawk Creek and Unnamed Tributary 8A. Habitat Type 3 was characterized by areas of braided diffuse channels with wide, densely vegetated grass and 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.

Habitat Type 4 was comprised of relatively shallow and narrow single channel reaches and was typically observed in the headwater areas of creeks. Habitat Type 4 also included intermittent reaches of tributaries which transitioned to more defined creek channel morphology further downstream. This habitat type was dominated by flat morphology and did not have riffle and run complexes. 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 NLSA and associated with wide floodplains dominated by grass and sedge species. Beaver activity further moderates the flow throughout the NLSA watercourses and specifically in the tributaries of the Pinewood River. As such, Habitat Type 5 beaver ponds were often directly associated with Habitat Type 3. Habitat Type 3 was often present within the shallow and narrow braided and diffuse channels that were linked to the upstream and downstream reaches adjacent to the Habitat Type 5 beaver ponds.

Substrate throughout Habitat Types 3, 4 and 5 was relatively consistent and was comprised of silt / muck, sand, clay and detritus mixed, with a higher degree of organics found in the Habitat Type 5 beaver ponds. Aquatic vegetation within these habitat types consisted primarily of Broadleaf Arrowhead, Yellow Cowlily, Hornwort Coontail, Red-head Pondweed and Lesser Duckweed. All of these habitat types were associated with large floodplains, dominated by grasses and sedges, with Speckled 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 midstream and downstream sections of the Pinewood River to its confluence with the Rainy River. As the Pinewood River approaches the Rainy River, the channel widths and depths are considerably increased in comparison to the upper reaches of the river. Habitat Type 6 and 7 were present in the majority of the downstream Pinewood River sections and consisted of larger bankfull widths and depths and greater floodplain widths. These habitat types also had a considerable difference with regard to available substrate types in comparison to upstream Pinewood River habitat types and specifically an increase in the availability of cobble, gravel and boulders.

The difference between Habitat Types 6 and 7 was an increase in bankfull width and depth within Habitat Type 7 in comparison to Habitat 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 therefore may provide the greatest potential for overwintering opportunities in the downstream sections. Upper riparian zones of both habitat types were comprised of mixed forest containing Black Spruce, Larch, Balsam Poplar, White Birch and White Elm.

Habitat Types 8 and 9 specifically represented specialized habitat areas found in the downstream Pinewood River. Habitat Type 8 included localized natural semi-offline back-bays connected at various locations to the lower Pinewood River. These back-bays were shallow (0.15 to 0.85 m) and wide (up to 150 m) flooded depressions that exhibited signs of frequent inundations and varying water level fluctuations. These areas were dominated by grass and sedge riparian vegetation. They were typically connected to the Pinewood River by defined channels with narrow widths and shallow depths. These channels provided 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 species, Tape Grass, Common Water Milfoil, Broadleaf Arrowhead, Yellow Cowlily, Red-head Pondweed and Lesser Duckweed. This habitat type was considered important from the context of spawning and nursery habitat for a number of species, but specifically for Northern Pike.

Habitat Type 9 was 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 area of increased flow velocities such as Walleye. Habitat Type 9 was situated in downstream sections of the Pinewood River and included gravel and cobble bars and boulder and bedrock outcroppings. These substrates were also associated with riffle and run complex morphology.

5.8.1.1 Fish Passage Considerations

Natural obstacles within the Pinewood River watershed are most frequently in the form of beaver dams. Beaver dams are present at numerous locations within the mainstem Pinewood River from its upper to lower reaches, but not in downstream reaches where bankfull widths of greater than 20 m were encountered during field surveys. The low flow and gradient of the

Pinewood River makes the construction of dams by beavers less difficult and during years of optimal conditions this species may create structures throughout the watershed.

Beaver dams are not permanent and in many cases are not impermeable to small bodied species and young of the year of larger bodied fish species. These structures may be routinely blown out during higher flows in the spring or fall; or removed where conditions warrant. As such they are not considered permanent obstacles to fish movement, yet may facilitate some degree of population fragmentation.

Beaver dams were also present within the smaller tributaries of the Pinewood River including Loslo Creek, Marr Creek and West Creek. These structures were typically found at locations directly below well established wetland complexes indicating some longevity in their location and maintenance. Impounded water features within these small creeks likely provide important spawning, nursery and overwintering habitat to small-bodied fish species as well as habitat for other flora and fauna, including amphibians and water fowl.

A small waterfall with a vertical height of 1.5 m is present at the eastern edge of the Community Pasture within Marr Creek. This may prevent fish movement in an upstream direction toward the beaver-controlled wetland at the headwaters of Marr Creek, thereby creating some fragmentation of the fish population in the creek (KCB 2011a).

In regards to manmade obstacles, fish passage at water crossings of smaller tributaries of the Pinewood River were typically afforded by corrugated steel pipe culverts. These crossings were shown to provide ample conveyance of flow during wet periods with suitable gradients allow for upstream fish movement. Crossing locations having slightly greater water depths than upstream or downstream channel reaches provided refuge for small bodied fish species during drought conditions as observed during recent field surveys (AMEC 2013f). Crossings of the mainstem Pinewood River provide suitable conveyance of flow and do not restrict movement of fish species upstream or downstream.

5.8.2 Pinewood River System

The Pinewood River watershed is approximately 576 km^2, originating at the outlet of Pinewood Lake and flowing westward for approximately 75 km before draining into the Rainy River. The Pinewood River receives drainage from numerous creeks within the NLSA including Westra Creek, Gallinger Creek, Blackhawk Creek, Clark Creek, West Creek, Marr Creek, Loslo Creek, Tait Creek, McCallum Creek and numerous unnamed tributaries. The Kishkakoesis River system and numerous other smaller waterbodies drain to the Pinewood River outside of the NLSA. The Pinewood River watershed lies in an area of gently rolling glaciofluvial and lacustrine sedimentary deposits with intermittent areas of bedrock outcrop. Surrounding land use within the Pinewood River watershed is primarily agricultural and therefore historic deforestation and clearing has reduced the occurrence of forested riparian vegetation; however, some reaches of the river have mixed forest within the flood plain and, in some cases, up to the river banks.

Several habitat types were identified in the mainstem of Pinewood River (Habitat Types 1, 2, 6, 7, 8 and 9; Figure 5-21; Figure 3-1 and Appendix A in Appendix I-3). Habitat Type 1 was present in abundance at upstream and downstream sections of the Pinewood River, providing a relatively deep and wide channel with bankfull widths ranging from 5 to 10 m and bankfull depths ranging from 0.25 to 0.75 m. This habitat type included forested riparian zones, silt dominated substrates and a moderate amount of in-stream cover. Habitat Type 2 generally had larger bankfull widths and depths and floodplains dominated by grass and sedge and containing hummocks throughout its margins. This habitat type was found in the greatest proportion in midstream and the more upstream portions of the downstream section of the Pinewood River.

Habitat Type 6 was found through a large portion of the downstream Pinewood River and this habitat type was discernible from Habitat Types 1 and 2 by a relative increase in bankfull width and depth and a significant shift in substrate composition. Habitat Type 6 substrates were primarily clay-based with an abundance of gravel, cobble and boulder interspersed throughout.

Habitat Type 7 largely typified the lower sections of the downstream Pinewood River to approximately 300 m upstream from its confluence with the Rainy River. Bankfull widths ranged from 20 to 60 m and bankfull depths ranged from 1.0 to 4.5 m. Substrates in this habitat type included an abundance of gravel and cobble as well as isolated bedrock outcroppings.

Habitat Type 8 represented the semi-online floodplain depressions that are adjacent to the lower sections of the downstream Pinewood River. These depressions were connected by a defined yet narrow channel to the mainstem Pinewood River. These low-lying back-bays were subject to frequent inundation and water level fluctuations based on water levels in the Pinewood River. Bankfull depths ranged from 0.15 to 0.85 m, bankfull widths ranged from 30 to 150 m and substrate in the back-bays was comprised of silt / muck and clay. The riparian and floodplain vegetation was dominated by grasses and sedges. Submergent and emergent aquatic vegetation was available in moderate density. During periods of inundation, these backbay areas likely provide ideal spawning and nursery habitat for Northern Pike and other species which have an affinity to aquatic vegetation for spawning and cover.

Habitat Type 9 included isolated areas along the Pinewood River that provide specific and important habitat for fish spawning and nursery areas. These areas included identified gravel and cobble shoals which may provide spawning habitat for a number of species, including Walleye, specifically during periods of higher flow velocities. This habitat type category also included significant natural features such as a large bedrock outcrop (Appendix A; Photo 25 of Appendix B in Appendix I-3).

Pinewood Lake is sufficiently large (greater than 5 ha) and deep (greater than 10 m) to be designated as a lake, although it is partially controlled by beaver activity. Pinewood Lake habitat was observed by KCB from the shore, by boat and through a snorkel survey. KCB noted that the foreshore area is heavily vegetated with thick shrub communities and with mixed forest on

the well-drained uplands. Human-related disturbance to the shoreline or riparian area was not observed. Emergent and submergent macrophytes such as sedges, horsetail species and cattail species were present along the shoreline and pondweed species, milfoil species and lily species were present around the perimeter of the lake (Section 11.3.4.1 of Appendix N).

Although sediment particle size was variable amongst the Pinewood River sample locations, generally, sample locations in the NLSA were dominated by fine grained particles such as sand (fine and coarse), silt and clay, with the percentage of sand decreasing in a downstream direction. Sampling locations further downstream and outside of the NLSA tended to contain at least some gravel (at least 10%) and some also contained pebble and/or cobble.

Sediment samples from the Pinewood River were analyzed from 2 locations each in 2009 and 2010 (KCB 2011a), 6 locations in 2011 (AMEC 2012b) and 14 locations in 2012 (AMEC 2013f; Figure 5-10 in Appendix I-3). In general, inorganic and metal parameters in sediment samples from the Pinewood River met both Provincial PSQG and Federal CEQG guideline values, with some exceptions. Total Kjeldahl nitrogen (TKN) and TOC were typically found at values between the PSQG lowest effect level (LEL) and PSQG severe effect level (SEL) for these parameters. Several metals parameters, including arsenic, chromium, copper, iron, manganese and nickel were found to be above the PSQG LEL at various locations along the Pinewood River in 2011 and 2012. Manganese was found to be above the PSQG SEL at one location located in the midstream section of the Pinewood River (Table 3-3 in Appendix I-2; Table 3-4 in Appendix I-3).

The fish community in the Pinewood River system has been sampled using a number of methods including gill netting, minnow trapping, electrofishing, seine netting, dip netting and angling (Appendices I-2, I-3 and N). Fish species captured in the Pinewood River during historical and recent surveys included: Black Crappie, Blackchin Shiner, Blacknose Dace, Blackside Darter, Brassy Minnow, Brook Stickleback, Brown Bullhead, Central Mudminnow, Common Shiner, Creek Chub, Emerald Shiner, Finescale Dace, Golden Shiner, Johnny Darter, Lake Chub, Lake Sturgeon, Mimic Shiner, Northern Pearl Dace, Northern Pike, Northern Redbelly Dace, Pumpkinseed, Rock Bass, Sauger, Shorthead Redhorse, Smallmouth Bass, Spottail Shiner, Trout-perch, Walleye, White Sucker and Yellow Perch (Table 5-24).

Fish community sampling conducted by KCB and AMEC between 2008 and 2012 supplemented information collected by the MNR and the Rainy River First Nations in the midstream and downstream Pinewood River in 1997. In addition to the above-noted species, the MNR and Rainy River First Nations also identified Hornyhead Chub at one location just downstream of the confluence with the Kishkakoesis River and Log Perch at a number of downstream Pinewood River locations.

Large-bodied fish were captured in greater abundance in the lower reaches of the Pinewood River, from the confluence of Kishkakoesis River downstream, where wetted widths and depths were significantly larger in comparison to the upper reaches. Species such as Black Crappie,

Largemouth Bass, Pumpkinseed, Rock Bass, Sauger, Shorthead Redhorse, Smallmouth Bass, Trout-Perch, Walleye and Yellow Perch were only observed in the deeper and wider reaches of the Pinewood River, downstream of the confluence of Kishkakoesis River. However, Northern Pike were captured along the entire extent of the mainstem Pinewood River.

Forage fish as sampled by minnow traps, seine nets and electroshocking showed some differences in distribution from upstream to downstream sampling locations within the Pinewood River. Common Shiner, Brook Stickleback and Finescale Dace were the species of greatest abundance at sample locations within the upstream reaches of Pinewood River. Common Shiner, Emerald Shiner, and Golden Shiner were captured in the greatest abundance in the midstream and downstream reaches of the Pinewood River in 2012.

The long term dataset provides high scale resolution and completeness to the Pinewood River species list. Species presence was directly attributable to habitat types as described herein and areas of potential spawning for keystone species (Northern Pike and Walleye) were identified in the mainstem Pinewood River.

A supplemental aquatic baseline survey was conducted in 2013 to provide further information specific to spring freshet condition and species presence and use of fish habitat in the Pinewood River and its tributaries within the NLSA: Loslo Creek / Cowser Drain, Marr Creek, West Creek and Clark Creek / Teeple Drain (Appendix I-4). Surveys were undertaken to investigate the use of the Pinewood River and its tributaries near the RRP site by Walleye and Northern Pike during the period of potential spawning or staging for spawning as requested by regulatory agencies. Conditions experienced during the 2013 spring survey were freshet or flood condition with the bankfull water level exceeded throughout the Pinewood River and its tributaries, and inundation of the flood plain.

All fish species captured in 2013 were captured during previous baseline surveys other than Lake Sturgeon. Although Lake Sturgeon was not directly targeted during fisheries surveys in the spring of 2013, a single fish was captured in the lower Pinewood River. As such, surveys of the mainstem Pinewood River and its tributaries during spring of 2013 did not indicate any major seasonal shift in species presence / absence.

Surveys conducted using fishing gear and visual observation for Walleye in the mainstem Pinewood River, focussed on lower section of the river at locations previously identified (Appendix I-3) as having potential as spawning locations for Walleye. Temperatures during the 2013 spring field survey ranged from 7 to 14°C in the Pinewood River. This is within the range of general spawning activity for this species of 5 to 11°C (Kerr et al. 2004; Scott and Crossman 1998), yet the peak spawning activity window is considered to occur between 7 and 8°C (McMahon et al. 1984; Roseman et al. 1996).

Ripe and running White Sucker were captured which typically indicates the termination of the Walleye spawning period. The lack of captured of Walleye even in downstream locations of the

Pinewood River in spring of 2013, may indicate that departure from this tributary to the Rainy River occurred quickly after spawning; or that the number of spawning individuals was relatively low given the available habitat, which may also be limiting.

Sampling in the vicinity of the RRP site area between 2008 and 2012 did not provide evidence of any aquatic species at risk either under Federal (*Species at Risk Act*) or Provincial (*Endangered Species Act*) legislation. Lake Sturgeon, classified Provincially as Threatened in the area, were not present within the RRP site area and environs during the spring 2013 survey, but were identified within the lower reaches of the Pinewood River (approximately 28 km downstream of the RRP) through sampling efforts by AMEC in May 2013. Further focussed efforts to capture this species in the Pinewood River were undertaken by the MNR during May 2013 and yielded another two individuals, captured approximately 1 km upstream of the AMEC capture location and 27 km downstream of the proposed RRP open pit. Specific information with regard to the effort expended by the MNR has not been made available; however, despite a numerous set of gill nets within the Pinewood River during the AMEC spring 2013 field survey, only one individual was captured providing a low CPUE and potentially indicating a lack of suitable habitat and/or a small spawning population specific to the lower Pinewood River.

The benthic invertebrate community in the Pinewood River was sampled at 6 locations by the MNR and Rainy River First Nations in 1997, 2 locations each in 2009 and 2010 (Appendix N), 6 locations in 2011 (Appendix I-2) and 14 locations in 2012 (Figure 5-10; Table 3-7 in Appendix I-2; Table 3-6 in Appendix I-3). The benthic invertebrate community within the Pinewood River was generally indicative of a low gradient system with variability in descriptive benthic invertebrate community metrics being a result of differences in habitat availability (i.e., substrates) as opposed to sediment or water quality impairments. Total invertebrate density was variable between sampling locations (ranging from 72 to 18,609 individuals/m^2) for all sampling years. Total invertebrate density, family richness, diversity and evenness generally increased from upstream to downstream within the Pinewood River and were greater in depositional areas (pools and flats). An increase in density and diversity is expected moving downstream in a watershed with an increase in tributary inputs (i.e., stream order).

The family Chironomidae dominated with respect to proportion of the benthic invertebrate community in the Pinewood River and EPT taxa, which are often associated with relatively high water and sediment quality and larger substrate particle sizes (gravel, cobble and boulder), were typically present in low proportions or absent. Other taxa represented with relatively high proportions in the Pinewood River included biting midges, phantom midges, worms, amphipods, mud snails, ramshorn snails and bivalve molluscs. As such the benthic invertebrate community is represented by a number of disturbance tolerant species which is not necessarily reflective of low water or sediment quality, but indicative of a low gradient depositional system influenced by beaver activity.

5.8.3 McCallum Creek System

McCallum Creek originates on the north side of the Pinewood River, west of the Loslo Creek subwatershed, and drains southerly to the Pinewood River at the west side of the NLSA. The McCallum Creek subwatershed covers an area of approximately 25 km^2. McCallum Creek receives drainage from several small tributaries at its headwaters.

McCallum Creek contains Habitat Types 3, 4 and 5 (Figure 5-21). The creek is characterized by a low gradient and extensive beaver activity. Habitat Type 4 represented the majority of McCallum Creek with reaches of a single narrow and shallow channel with dense grass and sedge riparian vegetation and limited in-stream aquatic vegetation. Habitat Type 5 was also identified through digital imagery analysis at McCallum Creek, specifically in upstream reaches. Braided and diffuse channels consistent with Habitat Type 3 occurred in isolated areas of McCallum Creek and specifically in reaches adjacent to beaver ponds.

The substrate throughout McCallum Creek was relatively uniform, comprised primarily of sand and silt / clay with organic / detritus. Inorganic and metal parameters in sediment samples from McCallum Creek generally met both Provincial PSQG and Federal CEQG guideline values; however, TOC and TKN were typically at concentrations between the PSQG LEL and PSQG SEL. Several metals parameters, including chromium, copper, iron and nickel as well as non-metal phosphorus were found to be above the PSQG LEL at one or both of the locations sampled in 2012 (Table 3-3 in Appendix I-2; Table 3-4 in Appendix I-3).

Four fish species were captured in McCallum Creek in 2012 including Brook Stickleback, Central Mudminnow, Finescale Dace and Pearl Dace, with nearly half the captures being Central Mudminnow. Brook Stickleback, Dace species and Central Mudminnow were captured in McCallum Creek during studies conducted by KCB and AMEC between 2008 and 2012 (Table 5-24).

The benthic invertebrate community was sampled at two locations in McCallum Creek in 2012 (Figure 5-10). In general the more downstream location showed a more robust benthic invertebrate community than upstream, with higher total invertebrate density and family richness (1,319 individuals/m^2 and 9 families downstream versus 159 individuals/m^2 and 4 families upstream). Families present at both locations were indicative of low gradient depositional habitat and included Chironomidae, Naididae, Hyalellidae and Sphaeriidae. EPT taxa were not identified in samples from McCallum Creek.

5.8.4 Unnamed Tributary 1 System

Unnamed Tributary 1 is a small tributary east of McCallum Creek which drains a small northern area into the Pinewood River. The majority of its length is typified by alternating sections of beaver pond habitat (Habitat Type 5) and braided and diffuse channels (Habitat Type 3; Figure 5-21). The entire tributary is associated with a large floodplain (>150 m) and is

dominated by grass and sedge species with Speckled Alder and willow species. As the tributary drains into the Pinewood River it becomes more channelized, briefly transitioning to Habitat Type 4. Unnamed Tributary 1 was dry during the period of field survey in 2012; however, the sediment quality, benthic invertebrate community and fish community of this small tributary are expected to be similar to other similar tributaries to the Pinewood River (Unnamed Tributaries 2 and 5; Sections 5.8.6 and 5.8.8). The fish community is expected to consist of forage and baitfish fish species.

5.8.5 Tait Creek

Tait Creek is a tributary of the Pinewood River located in the southwest region of the NLSA. The Dearlock – Tait Creek subwatershed drains an approximate area of 76 km^2.

Tait Creek was characterized by a single well-defined channel, with a relatively wide floodplain (approximately 300 m) densely dominated by grass and sedge species with some Speckled Alder and willow species. The majority of reaches of Tait Creek were classified as Habitat Type 2 (Figure 5-21). Beaver activity near the confluence of Tait Creek with the Pinewood River has caused impoundment (Habitat Type 5) in lower reaches of the creek. Habitat Type 4 dominated the upper reaches of Tait Creek, as well as some of its smaller tributaries. The substrate throughout Tait Creek was relatively uniform, comprised primarily of silt / clay and detritus with localized pockets of coarse and fine sand.

The habitat in ponded areas (Habitat Type 5) within this subwatershed (Tait Creek Tributary 2; Figure 5-21) had a relatively uniform shoreline and a depth averaging 2 m. Although localized areas varied to some extent, substrate compositions throughout were predominantly silt / muck with clay and detritus mixed. Emergent littoral vegetation was dominated by Common Cattail in the shallow shoreline areas, while floating vegetation such as Yellow Cowlily provided cover in open water areas. Other aquatic macrophytes included Hornwort Coontail, Floating-leaf Pondweed and Broadleaf Arrowhead. Speckled Alder and willow species thickets extended to the water's edge in the riparian zone. The forest surrounding ponds was dominated by Black Spruce with interspersed Larch and Balsam Poplar.

Inorganic and metal parameters were found to meet both the PSQG and CEQG guideline values in Tait Creek sediment samples with the exception of TOC and TKN exceeding the PSQG LEL in a sample collected from the pond habitat. Grain size was consistent with a sand / silt composition.

The fish community in Tait Creek was sampled at two locations in 2010 (Tait Creek Tributaries 3 and 4; Appendix N), one location in 2011 (Tait Creek Tributary 2; Appendix I-2) and one location in 2012 (mainstem Tait Creek; Figure 5-11). Brassy Minnow, Brook Stickleback, Creek Chub, Central Mudminnow, Pearl Dace and Northern Redbelly Dace were captured in Tait Creek and its tributaries in order of greatest abundance (Table 5-24).

The benthic invertebrate community in Tait Creek showed moderate to high densities with a low to moderate family richness (6 to 15 families). Diversity was relatively low as well and the community was typically dominated by chironomids with some representation by EPT taxa in localized samples. Samples with increased proportional representation of EPT taxa were indicative of increased substrate particle size and a reduced influenced by adjacent beaver pond morphology.

5.8.6 Unnamed Tributary 2 System

Unnamed Tributary 2 is a small tributary located at the west side of the NLSA draining to the Pinewood River from the north. The majority of its length is typified by alternating Habitat Type 5 beaver pond habitat and Habitat Type 3 braided and diffuse channel morphology (Figure 5-21). The entire tributary is associated with a large floodplain (greater than 150 m in width) and was dominated by grass and sedge species with Speckled Alder and willow species. As the tributary approaches the Pinewood River it becomes more channelized with characteristics of Habitat Type 4.

Inorganic and metal parameters in sediment from this tributary were found to meet both the PSQG and CEQG guideline values with the exceptions of TOC, TKN, chromium and nickel, all of which exceeded the PSQG LEL but met the PSQG SEL (Table 3-3 in Appendix I-2; Table 3-4 in Appendix I-3). Substrates were dominated by silt with some fine sand and clay and trace coarse sand and gravel.

No fish species were captured in the Unnamed Tributary 2 system despite dip netting and minnow trap efforts during 2012. The fish community of this small tributary is expected to be similar to other similar tributaries of the Pinewood River (e.g., Unnamed Tributary 5; Section 5.8.8) and consist of small-bodied forage fish.

Invertebrate sampling at Unnamed Tributary 2 yielded a low density of benthic invertebrates with only two families represented (Planorbidae, 75% and Sphaeriidae, 25%). No individuals belonging to the EPT or chironomid families were collected from this site.

5.8.7 Loslo Creek System and Cowser Drain

Originating in a large wetland complex extensively influenced by beaver activity, Loslo Creek lies west of Marr Creek and flows south towards Pinewood River through forested areas and agricultural fields. 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 Loslo Creek watershed is 16.2 km^2 in area. The lower approximately 3.3 km reach of Loslo Creek is designated as a Municipal drain under the *Drainage Act*, as it flows almost exclusively through agricultural pasture lands through this section.

The wetland at the upper end of Loslo Creek is 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. Flowing south from the convergence of the upper Loslo Creek tributaries, the creek became channelized and well defined.

Habitat Type 5 (ponds) was present throughout the majority of upper Loslo Creek (Figure 5-21) 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 defined channel morphology. Some reaches of these intermittent channels existed in dense Speckled Alder and willow species thickets with localized areas of terrestrial vegetation growing within the channel. Loslo Creek is more channelized and defined prior to draining into the Pinewood River, flowing through agricultural fields as a maintained Municipal drain. 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.

In general, inorganic and metal parameters in sediment samples from Loslo Creek and Cowser Drain met both Provincial PSQG and Federal CEQG guideline values. However, TOC and TKN were typically found at values between the PSQG LEL and PSQG SEL and exceeded the SEL at the majority of sample locations in the upper tributaries of Loslo Creek. Furthermore, phosphorus as well as several metals parameters including chromium, copper, iron, manganese and nickel were found to be above the PSQG LEL at one or more of the upper tributary locations sampled in 2011 and 2012 (Table 3-3 in Appendix I-2; Table 3-4 in Appendix I-3).

Sediment particle size distribution was variable amongst Loslo Creek sampling locations but generally consisted of a mixture of coarse and fine sand material with clay / silt and small percentages of gravel observed at some locations. Depositional pond areas had a higher percentage of clay and silt and organics than those on the channelized reaches of the creek.

The fish community in Loslo Creek was sampled using minnow traps in 2010 and using seine nets, minnow traps and dip nets in 2011 and 2012, with gill nets also used in 2011. A summary of fish species captured during the 2008 through 2012 field studies is provided in Table 5-24. The fish community in Loslo Creek and Cowser Drain was dominated by baitfish and forage fish species including Blackchin Shiner, Brassy Minnow, Brook Stickleback, Central Mudminnow, Creek Chub, Emerald Shiner, Finescale Dace, Lake Chub, Northern Redbelly Dace, Spottail Shiner and White Sucker.

Benthic invertebrate community samples were collected by AMEC in 2011 and 2012 field programs. The benthic invertebrate community in the Loslo Creek subwatershed was relatively robust with variable diversity, yet was indicative of low gradient, poorly channelized, beaver influenced aquatic habitat. Simpson's diversity values ranged between 0.23 and 0.75. Evenness remained relatively consistent in 2011 samples, ranging from 0.22 to 0.30; however, evenness ranged from 0.37 to 1.00 in 2012 samples. Total invertebrate density at Loslo Creek sampling locations was variable ranging from 72 individuals/m^2 to 9,507 individuals/m^2. EPT taxa were typically absent or present in only a trace proportion (1%). The proportion of chironomids was generally high (29 to 88%) with other benthic invertebrate taxa present in significant proportions including Naididae, Hyalellidae and Planorbidae.

5.8.8 Unnamed Tributary 5

Unnamed Tributary 5 is a small intermittent creek that originates within pastureland to the south of Pinewood River and drains into the river approximately 200 m downstream of Marr Creek. Beaver activity within Unnamed Tributary 5 had created some ponding (Habitat Type 5) along its length. Reaches of Habitat Type 3 (braided and diffuse channels) conveyed water into and from these pond features (Figure 5-21). Near its confluence with the Pinewood River the tributary becomes more channelized and reflects a Habitat Type 4 classification.

Inorganic and metal parameters were found to meet PSQG and CEQG in Unnamed Tributary 5 sediment samples with the exception of TOC, TKN, chromium and nickel, all of which exceeded the PSQG LEL. Substrate composition was variable and ranged from an even distribution of sand, silt and clay, to areas primarily consisting of gravel and coarse sand with some pebble / cobble, fine sand and silt and traces of clay.

Fish community sampling in Unnamed Tributary 5 was conducted in 2010, 2011 and 2012 (Figure 5-11; Table 5-24) and identified the presence of Brassy Minnow, Brook Stickleback, and Central Mudminnow.

Benthic invertebrate community samples had a relatively moderate density ranging from 1,551 to 2,724 individuals/m^2, with a family richness ranging from 5 to 10. Simpson's diversity was also moderate (0.42 to 0.54), yet the percentage of EPT taxa was less than 3% in this subwatershed with chironomids generally dominating the community as in other smaller tributaries of the Pinewood River.

5.8.9 Marr Creek System

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 subwatershed 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 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 (grass and sedge) 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.

Marr Creek flows through forested lands in the Pinewood River valley just prior to draining to the Pinewood River. The substrate through the downstream reaches was generally comprised of silt / muck and clay.

Inorganic and metal parameters analyzed from fluvial and pond habitats were generally found to meet PSQG and CEQG objective values at Marr Creek. TOC and TKN exceeded the PSQG LEL at all sample locations and exceeded the PSQG SEL at one mid-stream location which was dominated by agricultural pastureland and no riparian buffer. Copper and manganese showed some exceedance of PSQG but these results were localized. Sediment particle size was variable between Marr Creek sampling locations. A slightly higher percentage of clay was observed at upstream reaches of Marr Creek, yet in general sample locations showed an even mixture of sand, silt and clay.

A summary of presence / absence of fish species captured during the 2008 through 2012 field studies is provided in Table 5-24. A total of 12 fish species were captured in the Marr Creek system including Brassy Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Emerald Shiner, Fathead Minnow, Finescale Dace, Lake Chub, Northern Pearl Dace, 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 providing reduced fish habitat quality.

Benthic invertebrate family richness ranged from 2 to 15 which increased in a downstream direction. EPT taxa were absent from Marr Creek sampling locations with the exception of two downstream locations which had proportions of only 0.85 and 1.32%. Chironomids were present at each sampling location and generally accounted for a large portion of the relative abundance of taxa. The following families were also represented in significant proportions in Marr Creek samples: Chaoboridae, Hydrobiidae and Valvatidae (valve snails). The Marr Creek benthic

invertebrate community is indicative of a tributary influenced by agricultural practises and, as a result, has a relatively low diversity of disturbance tolerant taxa.

5.8.10 Unnamed Drainage A

A tributary of Marr Creek, Unnamed Drainage A is a small intermittent and ephemeral drainage feature originating in groundwater seepages roughly 350 m north of Roen Road. The creek channel showed signs of seasonal flow through forested areas with braiding observed in several locations (Section 11.3.3.5 in Appendix N). The upstream reaches were undefined. The substrate was primarily clay with localized gravel and cobble deposits. Surrounding forested areas near Roen Road consisted of White Birch, Trembling Aspen and Black Ash.

The fish community in Unnamed Drainage A was sampled in 2010 during seasonal flow. Brook Stickleback was the only fish captured (Table 5-24). Discernable fish habitat in Unnamed Drainage A extends from approximately 150 m downstream of its origin to approx 150 m downstream of Roen Road (approximately 500 m). Beyond this, the channel became braided and diffuse to the point of surface sheet flow.

5.8.11 West Creek System

West Creek drains an area of approximately 16 km^2 and has four sub-tributaries north of Roen Road which converge into a single main channel that eventually drains into the Pinewood River. As with other nearby creeks, a number of beaver dams impede flow causing flooding of riparian areas and creating a morphology consisting primarily of pools and flats. Beaver activity in the upper sections of West Creek tributaries provided some Habitat Type 5 and Habitat Type 3 conveying flow through the transition zones between beaver ponds and the more channelized sections downstream (Figure 5-21).

Overall, the majority of West Creek tributaries were defined by Habitat Type 4. This habitat was comprised of a single relatively shallow channel which was intermittent in localized sections during field investigations in 2012. Bankfull widths ranged between 0.57 to 2.30 m and bankfull depths ranged from 0.14 to 0.45 m. A number of locations on the mainstem of West Creek were well-defined with moderate entrenchment. The creek channel became braided near the mouth of West Creek before draining into the Pinewood River. During periods of high flows in West Creek and the Pinewood River, the flood prone area at the confluence of these watercourses is likely thoroughly inundated and would provide spawning and nursery habitat for Northern Pike and other spring spawning species that have an affinity for vegetation. Substrates were variable and sediment particle size increased in a downstream direction from a silt-dominated matrix to one of sand and silt mixed. The presence of silts with a higher degree of organics was typical of Habitat Type 5 ponds.

West Creek Tributary 1 is a small ephemeral stream north of Roen Road. Fish have been observed in West Creek Tributary 1 during past investigations. Low flow conditions have

however, created intermittent fragmentation from the main channel of West Creek thereby restricting movement and possibly preventing overwintering survival (Section 11.3.3.1.2 in Appendix N).

West Creek Tributary 2 crosses Roen Road approximately 500 m north of West Creek Tributary 1. Beaver activity has restricted flows creating a small pond approximately 1.3 km upstream of the road crossing. The pond was densely vegetated around its perimeter with Speckled Alder and willow species thickets which extended to the water's edge. Emergent aquatic vegetation (sedge species) occupied shallow littoral areas while Floating-leaf Pondweed and Slender Pondweed dominated the open water areas. As seen in other pond habitats within the study area, substrates consisted mainly of silt or muck with clay and detritus. The remainder of West Creek Tributary 2 consisted of alternating Habitat Types 3 (braided and diffuse channels with wide floodplains dominated by grasses and sedges) and Habitat Type 4 (relatively narrow and shallow single channel reaches, respectively).

West Creek Tributary 3 crosses Roen Road approximately 500 m north of the West Creek Tributary 2 crossing. West Creek Tributary 3 is intermittent, draining through semi-forested valley lands with a relatively higher gradient than the other West Creek tributaries. A large beaver pond / wetland complex exists at the headwater of West Creek Tributary 3. Substrate in the channelized reaches was comprised of silt / muck and clay, but also contained some isolated deposits of gravel. Undercut banks and woody debris provided some fish cover through forested reaches.

West Creek Tributary four drains a large wetland at its headwaters and flows south to its confluence with the main channel of West Creek (Figure 5-21). A number of beaver dams along the length of West Creek Tributary 4 impeded flow and may restrict fish movement. The channel became braided at the mouth where it met the mainstem channel. Willow species and Speckled Alder thickets occupied the riparian zones of channelized reaches and beaver ponds. Substrate within the channelized reach contained clay with some boulder and cobble.

The mainstem of West Creek becomes divided into multiple braids near its confluence with the Pinewood River. The average bankfull width of these braids was 3.0 m within a relatively large flood plain of 120 m wide. The floodplain vegetation here consists of grass and sedge species and with a topography dominated by hummocks. During periods of higher flow and high precipitation, the grass and sedge hummock areas between the channelized braids are inundated and may provide spawning opportunities for such species as Northern Pike. Substrate in this area changes from a silt / muck in upper reaches to a clay dominated sediment type in the lower reaches. A high percentage of organics and detritus are also present in the lower reaches of this creek as a result of inputs from the greater floodplain to the channelized sections.

Sediment sampling conducted throughout the West Creek subwatershed demonstrated that inorganic and metal parameters met PSQG and CEQG values with the exception of TOC and

TKN which, for the majority of samples, did not meet the PSGQ LEL. TKN was above the SEL at one location in West Creek near its confluence with the Rainy River. TOC also exceeded the PSGQ LEL in all analyzed samples except those situated in upper sections of the subwatershed. In general, sediment quality was not found to be a limiting factor with regard to aquatic ecosystem health in West Creek.

Sediment particle size was variable between West Creek sample locations. Upper sections of the creek (tributaries) provided some larger particle sized substrates which consisted of gravel, sand and/or pebble and cobble. Generally, the percentage of sand decreased from the upstream sample locations to the downstream locations. Downstream sample locations were characterized by a sand and silt composition.

The fish community was sampled using a combination of electrofishing, seine netting, dip netting and minnow trapping between 2009 and 2012. As shown in Table 5-24, fifteen species have been captured in the West Creek system including Blackchin Shiner, Blackside Darter, Brassy Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Emerald Shiner, Finescale Dace, Iowa Darter, Lake Chub, Northern Redbelly Dace, Pearl Dace, Spottail Shiner and White Sucker. In general, species captured in West Creek were small-bodied forage fish. No large-bodied sportfish species were captured in West Creek during sampling periods; however, it is expected that Northern Pike may use the lower section of West Creek for spawning and nursery habitat during periods of floodplain inundation.

Benthic invertebrate community sampling was conducted throughout the West Creek subwatershed in 2009 to 2012 (Figure 5-10). Density and family richness was relatively moderate within West Creek. Total invertebrate density ranged from 1,261 to 15,841 individuals/m^2 with family richness ranging from 7 to 24. Diversity values ranged from 0.17 to 0.78 with EPT being absent from sampled communities or present at less than 10%. One exception was a location in the upper portion of the subwatershed (West Creek Tributary 4) which had a percent EPT of 37% which is indicative of the larger particle size substrates available in this location (Table 3-7 of Appendix I-2).The percentage of chironomids within West Creek was variable and ranged from less than 1 to 91% (Table 3-7 of Appendix I-2 and Table 3-6 of Appendix I-3). Other taxa which were represented in significant proportions at West Creek included Naididae, Ceratopogonidae and Sphaeriidae.

5.8.12 Unnamed Tributary 6 System

Unnamed Tributary 6 is a watercourse situated to the south of the Pinewood River and approximately 720 m downstream of the confluence of Clark Creek with the Pinewood River. Unnamed Tributary 6 is classified as Habitat Type 4, an intermittent watercourse with a defined single channel flow path which leads to a permanent channel. The substrate consisted primarily of fine-grained materials (sand, silt and clay).

At its upper reaches the tributary was classified as being intermittent with a single channel. In its lower reaches the tributary was more defined and permanent with substrates consisting primarily of sand, silt and clay. This tributary was sampled by KCB using minnow traps in 2010. Fish species captured in Unnamed Tributary 6 included Brassy Minnow and Brook Stickleback, as well as minnow species.

5.8.13 Clark Creek System and Teeple Drain

Clark Creek originates east of Clark Road, flowing southwest through wetland and pasture lands and passing a Municipal landfill before draining into the Pinewood River approximately 500 m west of Highway 600. Approximately 2.3 km of the lower section of Clark Creek has been designated as a Municipal drain (Teeple Drain) under the *Drainage Act* and is maintained as such. Beaver activity throughout the majority of Clark Creek has created a number of large ponds which have reduced flow in the creek. Habitats alternate between Habitat Type 5 and Habitat Type 3 along the majority of Clark Creek. Beaver pond bankfull widths ranged from 20 to 50 m and bankfull depths ranged from 0.5 to 1.8 m. The riparian zone and floodplain of Clark Creek was dominated by grass and sedge species with Speckled Alder and willow species. The floodplain was greater than 150 m in these sections. Lower reaches of Clark Creek were more channelized with greater bankfull widths and a slight increase in gradient than upstream as indicative of its maintenance as a Municipal drain. Substrates within the creek were variable with finer particle substrates dominating in upstream low gradient pond areas compared to a higher percentage of gravel and sand available in lower sections of the creek.

Inorganic and metal parameters analyzed in sediment samples were found to meet both the PSQG and CEQG guideline values with the exception of TOC, TKN and nickel. TOC was above the PSQG LEL at three of the four sample locations while TKN was above the PSQG LEL at all four locations. Nickel was marginally above the PSQG LEL at one of the four sample locations.

A summary of presence / absence of fish species captured during in Clark Creek and Teeple Drain from 2008 to 2012 is provided in Table 5-24. Fish species captured in Clark Creek included Blacknose Dace, Blackside Darter, Brassy Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Emerald Shiner, Fathead Minnow, Finescale Dace, Golden Shiner, Lake Chub, Northern Redbelly Dace, Pearl Dace, Spottail Shiner and White Sucker. No adult or juvenile sportfish species were captured in this watercourse during sampling periods over the five years.

The benthic invertebrate community in Clark Creek and Teeple Drain was sampled at three locations in 2011 and one location in 2012 (Figure 5-10). Density was relatively low within Clark Creek, ranging from 174 organisms/m^2 to 2,956 organisms/m^2 and family richness ranged from low to moderate (3 to 14). Density and family richness both generally decreased in a downstream direction, with the exception of the most upstream sample, which was collected in a beaver pond habitat (Habitat Type 5) and had the lowest density and family richness. EPT taxa were present at three of four Clark Creek sample locations; however only in relatively low

proportions ranging from 3 to 13%. The sample with the highest EPT occurred in the sediment with the highest sand and lowest clay content. The percentage of chironomids generally decreased in a downstream direction, ranging from 14 to 75% with the exception of the beaver pond habitat sample which contained 33% chironomids. Other taxa which were represented in significant proportions in the benthic invertebrate community of Clark Creek included Hyalellidae, Elmidae and Sphaeriidae.

5.8.14 Blackhawk Creek System

Blackhawk Creek is a tributary of the upper Pinewood River which flows in a northerly direction, draining pasturelands and wooded areas prior to and after crossing Highway 600. Habitat types in Blackhawk Creek alternated between Types 3, 4 and 5 in upper reaches transitioning to a more uniform Type 4 through its mainstem which was relatively entrenched vegetated banks with substrates consisting of silt / muck with boulders, cobble and gravel. The lower reach of the creek became braided prior to flowing into the Pinewood River. Cover for fish was limited to some undercutting of creek banks and emergent vegetation which included sedge and rush species and Broadleaf Arrowhead. Other aquatic macrophytes observed at the Blackhawk Creek sample location included Floating Arrowhead, Marsh Marigold, Marsh Spike-rush and Slender Pondweed. The mean bankfull width of the main channel was 4.5 m and the mean bankfull depth was 2.1 m with an average floodplain width of 60 m. As at the majority of other creek sampling locations, sediment quality met PSQG and CEQG for the majority of parameters; however, TOC and TKN were above Provincial standards at the LEL.

Central Mudminnow, Brook Stickleback, Brassy Minnow, Common Shiner, Northern Redbelly Dace, Fathead Minnow, Finescale Dace, Pearl Dace, Creek Chub and White Sucker were caught during surveys from 2008 to 2012 with Common Shiner and White Sucker captured in the highest abundance in 2012 (Table 5-24).

The single benthic invertebrate community sampling location on Blackhawk Creek yielded a low density of benthic invertebrates (72.46 organisms/m^2). Three families were represented in the sample and included Chironimidae (60%), Tubificadae (20%) and Sphaeriidae (20%). No individuals belonging to the EPT families were collected from this site.

5.8.15 Unnamed Tributary 8A System

Unnamed Tributary 8A is a small intermittent channel that provides conveyance to the Pinewood River during periods of increased precipitation and runoff. This tributary flows in a southerly direction through forested areas and agricultural fields. The creek was completely dry during the 2012 field investigation with terrestrial grasses growing within the channel. Past beaver activity in the headwaters of the tributary combined with low water volumes affected the connectivity of the creek to the Pinewood River during 2012. The creek bed was well defined with some entrenchment and a clay substrate.

During the 2012 field survey ephemeral pools near the tributaries confluence with the Pinewood River were sampled to assess the fish community and resulted in five species of fish captured, including Brook Stickleback, Central Mudminnow, Finescale Dace, Creek Chub and Pearl Dace (Table 5-24).

5.8.16 Muskrat Lake

Muskrat Lake is located north of the upper reaches of the Pinewood River and receives drainage from a number of small tributaries to the northwest. Muskrat Lake is drained by Unnamed Creek A (Figure 5-21) which flows in a northeast direction toward Boundary Lake and Off Lake.

Muskrat Lake was noted to have abundant aquatic vegetation during field investigations conducted by KCB in 2009 (Section 11.3.4.2 in Appendix N) and a fish community composition including Fathead Minnow, Central Mudminnow, Brassy Minnow and Brook Stickleback (Table 5-24). Dace species, Central Mudminnow and Iowa Darter were also noted in the Unnamed Creek draining of Muskrat Lake by KCB (Figure 11.3 and Section 11.3.4.2 in Appendix N).

The Muskrat Lake benthic invertebrate community was also sampled by KCB in 2009 at five randomly selected littoral zone locations. The samples only contained chironomids and bivalve mollusks. However, it was expected that other taxa, such as oligochaete worms, gastropods and crustaceans are likely also present. It is likely that the benthic invertebrate community within Muskrat Lake and the Unnamed Creek which drains the lake similar to those found in other low gradient subwatersheds (Marr Creek) within the NLSA.

5.8.17 Other Local and Regional Study Area Waterbodies

A number of other watercourses and waterbodies are located within the boundary of the NLSA and are shown on Figure 5-18 and listed in Table 5-24. The majority of these waterbodies are located within the 4 km buffer (2 km on either side of the centreline) of the proposed 230 kV transmission line routing preferred alternative. Impacts to aquatic resources within these waterbodies are not expected as waterbody avoidance and standard mitigation practices will be employed during construction of the overhead transmission line, negating in water or near water development. Other waterbodies which are not in the vicinity of proposed RRP developments but are within the NLSA, include small tributaries of the upper Pinewood River (Gallinger Creek and Westra Creek). Available aquatic habitat and fish community information is provided for these waterbodies and watercourses in Figure 5-21, and Tables 5-23 and 5-24. Data presented regarding confirmed fish species presence or known spawning habitat locations was provided by the Fort Frances MNR (2013a).

The Kishkakoesis River and Spruce Island subwatersheds are located to the east of all proposed RRP developments and drain areas of 92 and 96 km^2, respectively. The Spruce

Island subwatershed drains the area within and surrounding Spruce Island Provincial Park and flows to the Kishkakoesis River. The Kishkakoesis River then flows into the Pinewood River approximately 7.5 km downstream of the Highway 617 crossing with the Pinewood River.

The LeBlanc - Richardson Drain as designated under the *Drainage Act* was constructed in 1983. The drain commences approximately 600 m east of Highway 600 and flows in a southwesterly direction to the highway right of way where it then follows a southerly course (outside of the right of way) for approximately 800 m. The drain was constructed as an open type trapezoidal channel with capacity suitable for capture of surface flows and lateral tile drainage installations (Wegman-Graham 1983).

Gallinger Creek and Westra Creek are small tributaries of the upper Pinewood River which are located approximately 4 and 3 km (respectively) downstream of Pinewood Lake. These tributaries have subwatershed areas of 8.2 and 5.6 km^2, respectively. Fish species composition was not confirmed through site reconnaissance; however, it is expected that the fish community in these tributaries would be similar to the other upper Pinewood River tributaries and may consist of Central Mudminnow, Finescale Dace, Pearl Dace, Creek Chub, White Sucker, Common Shiner, Brook Stickleback and Brassy Minnow.

Mud Lake, Little Pine Lake and Yoker Lake are located in the northeast portion of the NLSA (Figure 5-21). These lakes along with the small tributaries that feed them form the upper reaches of the Log Creek system which drains to the north and out of the NLSA. Mud Lake is drained by a tributary of Log Creek as is Little Pine Lake which also receives flow from Yoker Lake via a connecting tributary approximately 2 km in length. Little Pine Lake is the largest of these three (110.7 ha) with Mud Lake and Yoker lake being similar in shape and size (13 ha).

Muskrat Lake and Boundary Lake (110 ha) are drained by tributaries of Unnamed Creek A which flows in an easterly direction and receives two other tributaries (Unnamed Creek C and Unnamed Creek E) prior to discharging to the southwestern section of Off Lake. Boundary Lake is described as having a cool water thermal regime which supports Northern Pike.

Beadle Lake is located at the northeastern corner of the NLSA. It provides habitat which supports Northern Pike and Walleye, and is 181 ha in area. It is assumed that to support these piscivore species that small-bodied forage fish species are present in abundance, including Mottled Sculpin which have been confirmed in this waterbody. Beadle Lake is drained by Bremner Creek at it most southeast lobe. Bremner Creek receives flow from Unnamed Waterbody 1 prior to discharging to Preachers Lake. This area of confluence has been confirmed as Walleye spawning habitat. Preachers Lake is drained by Unnamed Creek E which also provides known Walleye spawning habitat. Preachers Lake also provides habitat for Smallmouth Bass, Northern Pike, Walleye and Yellow Perch indicative of a cool water thermal regime and fish community.

Unnamed Creek E flows in a southwesterly direction into Pony Lake which has an area of approximately 30 ha. Pony Lake is known to provide habitat for White Sucker, Northern Pike, Walleye and Yellow Perch. Pony Lake is drained by the continuance of Unnamed Creek E to a point of confluence with Unnamed Creek A, directly upstream of where this tributary discharges to Off Lake within the NRSA. Unnamed Creek A has been identified as providing spawning habitat for both Walleye and Northern Pike in sections directly upstream of Off Lake.

Spring Lake has a surface area of 38 ha and while located in the NRSA drains in a northerly direction out of the NRSA and ultimately to Cedar Lake. Spring Lake supports a known Black Crappie population.

Off Lake is the largest waterbody located within the NRSA (surface area of 448 ha) and receives drainage from those waterbodies and tributaries as described above, as well as Unnamed Creek B and Unnamed Creek C which flow from south to north draining the area to the southwest of Off Lake. Unnamed Creek B flows to its confluence with Unnamed Creek A which then discharges to Off Lake. Unnamed Creek C flows directly into the southern lobe of Off Lake. Off Lake has a mean depth of 4.9 m and has a morphoedaphic index of 14.8. The morphoedaphic index is an indicator of the potential fish yield for a lake and is calculated by dividing either total dissolved solids or conductivity of a lake by its mean depth. A morphoedaphic index value of 14.8 as calculated for a summer sampling period may be considered moderate to high in comparison to values for lakes in close proximity (Panorama Lake and Burditt Lake for comparison, have morphoedaphic index values equal to 3.3 and 7.2, respectively). Off Lake provides habitat for Black Crappie, Pumpkinseed, Smallmouth Bass, Northern Pike, Walleye and Yellow Perch (Table 5-24). Off Lake is drained at its most southeastern embayment by Unnamed Creek D which continues outside the NRSA and ultimately to the Manomin River system. Unnamed Creek D has been identified as Northern Pike, Walleye and White Sucker spawning habitat.

5.8.18 Metal Body Burdens in Fish

In 2012, a total of 70 Northern Pike and 15 Walleye from the Pinewood River were sampled for dorsal muscle tissue metal concentrations. In addition, 42 of these Northern Pike specimens and 13 of these Walleye specimens were also sampled for liver tissue metal concentrations. Thirty-one species-specific, whole small-body composite fish samples were collected from the Pinewood River and its tributaries and analyzed for metal content. The small-bodied fish species included Brassy Minnow, Common Shiner, Emerald Shiner, Pearl Dace, Northern Redbelly Dace, Central Mudminnow, Creek Chub and Yellow Perch. Capture, effort and metal body burden data from these samples are provided in Appendix H of Appendix I-3.

Small-bodied composite samples involved a minimum of 3 individuals and a maximum of 48 individuals which were composited to create wet batch weights ranging from 35.7 to 337.5 g. Mercury concentrations in composite samples for all small bodied species was generally low,

being less than or equal to 0.20 µg/g. Pearl Dace and Creek Chub captured in the upstream Pinewood River exhibited the highest observed concentrations of mercury.

Cadmium was found to be present in whole fish composite samples at a maximum of 0.06 µg/g within Brassy Minnows collected at Clark Creek. Nine of the sample locations analyzed had mean cadmium whole body tissue concentrations equal to or less than 0.02 µg/g and 3 samples had concentrations below the 0.01 µg/g detection limit for this parameter (Figure 3-3 in Appendix I-3).

Copper concentrations ranged from less than detectable (<0.05 µg/g) to 2.2 µg/g (Northern Redbelly Dace from West Creek) for composite small-bodied fish samples. The mean copper concentration for all tributaries and species sampled was 0.9 µg/g (Appendix H in Appendix I-3). Manganese concentrations ranged from below detection limits to a maximum of 0.06 µg/g. Five of the samples had concentrations of 0.01 µg/g, only slightly above detection limit, and samples from Loslo Creek (Finescale Dace) and Blackhawk Creek (Common Shiner) exhibited non-detectable concentrations for this parameter.

Mean selenium concentrations in whole body composite samples ranged from 0.20 to 0.50 µg/g with Loslo Creek showing non-detectable concentrations for Finescale Dace (Figure 3-5 in Appendix I-3).

Mean zinc concentrations in whole body fish composite samples ranged from 18 (Yellow Perch from the Pinewood River) to 108 µg/g (Central Mudminnow from Unnamed Tributary 5). Nine of the mean values reported by species for those watercourses sampled were less than or equal to 40 µg/g.

Northern Pike were captured and sampled from the Pinewood River in 2012 from several locations from approximately 500 m upstream of the inflow of Clark Creek to the downstream terminus of the Pinewood River at the Rainy River (Figure 2-4 and Appendix H in Appendix I-3). Northern Pike sampled from the Pinewood River ranged in size from 185 to 570 mm (total length) with a mean of 378 mm. These sizes were well distributed between the two end points. The minimum age of individuals sampled was <1 year, indicating individuals having emerged during the spring of 2012 young of year. The maximum age of Northern Pike sampled was 5 years. The majority of fish sampled were one year (30%), two years (27%) and three years (18%). Larger and older Northern Pike were not captured in the Pinewood River despite the selectivity of fishing gears used being adequate for the capture of larger longer lived individuals. Total mercury body burdens in Northern Pike dorsal muscle tissue ranged from 0.11 to 0.67 µg/g with a mean of 0.34 µg/g (Table 3-15 in Appendix I-3). The relationship between total mercury concentration in muscle tissue and total length of Northern Pike was statistically significant, showing an increasing trend in mercury body burden with increasing size (Figure 3-6 in Appendix I-3).

Other parameters of interest including arsenic, cadmium, chromium, copper, lead and nickel were generally not present in concentrations above reportable detection limits in Northern Pike muscle tissue.

Mercury was present in Northern Pike liver tissue with a mean concentration of 0.15 µg/g (ranging from 0.06 to 0.30 µg/g). Cadmium was found at levels slightly above detection limits (0.01 µg/g) with a mean of 0.05 µg/g. Generally, copper, selenium and zinc were present in Northern Pike liver tissue at higher concentrations than shown for the same parameter in muscle tissue (Appendix H of Appendix I-3).

Walleye were sampled from the downstream Pinewood River (as this species was not captured in midstream or upstream sections) ranged in size from 223 to 688 mm (total length) with a mean of 383 mm. The minimum age of individuals sampled was 1 year and the maximum age was 15 years. The majority of fish sampled were one year (40%) and three years (25%). Total mercury body burdens in Walleye dorsal muscle tissue ranged from 0.08 to 1.8 µg/g with a mean of 0.40 µg/g (Table 3-15 of Appendix I-3). The relationship between total mercury concentration in muscle tissue and total length was statistically significant showing an increasing trend in mercury body burden with increasing size (Figure 3-6 in Appendix I-3). Cadmium was not found above detection limits (0.1 µg/g) in Walleye muscle tissue but was present in liver tissue for this species ranging from 0.03 µg/g to 0.20 µg/g. Mean mercury concentrations in Walleye liver tissue was slightly lower than for Walleye muscle tissue (0.33 µg/g vs. 0.40 µg/g, respectively).

5.8.19 Aquatic Species at Risk

Lake Sturgeon are known to inhabit the Rainy River system, yet records specific to this species inhabiting the Pinewood River near the RRP site are not available through TK or Provincial species distribution records. Lake Sturgeon were also not found within the NLSA during any of the field investigations related to the RRP.

Lake Sturgeon are known to use the Rainy River within the vicinity of its confluence with the Pinewood River as a migratory route. This section of the Rainy River is also suspected as important nursery habitat due to the availability of fine sediment deposition. Ontario tributaries of the Rainy River within relatively close proximity (for example, Sturgeon Creek) are known to be important spawning and nursery habitat for Lake Sturgeon.

It was therefore, deemed possible that this species uses the lower sections of the Pinewood River with variable frequency depending on suitable flow conditions (MNR 2013a). A targeted survey was conducted in the Spring of 2013 in an attempt to confirm whether or not, Lake Sturgeon are present in the lower Pinewood River. During the survey, a single Lake Sturgeon was captured by AMEC in a back eddy directly below the rock structure previously enhanced through a MNR / DFO / Rainy River First Nations partnership. The rock structure is located approximately 5 km upstream of the confluence of the Pinewood River with the Rainy River.

The Lake Sturgeon was captured by gill net (127 mm stretch mesh size and 15 m long) at a water temperature of 13.4°C. This individual had a total length of 1.78 m. It was released live and in good health at the point of capture. Despite further efforts with similar gear within the Pinewood River during the remainder of the 2013 Spring survey, there were no additional capture of this species (or any other aquatic Species at Risk). Subsequently, RRR was informed that the MNR also captured two Lake Sturgeon in the lower reaches of the Pinewood River, in the same general vicinity as the AMEC capture, and approximately 27 km downstream of the RRP open pit, but within the NRSA.

COSEWIC has proposed six population Designatable Units (DU) for Lake Sturgeon within the Province of Ontario based on genetic and biogeographical distinction (COSEWIC 2006) including the Lake of the Woods – Rainy River populations (DU6). This DU currently has no schedule of status under *Species at Risk Act* (Appendix I). At the Provincial level, COSSARO has assigned population status in three regions of Ontario including the northwestern Ontario population (which encompasses COSEWIC DU4-6). The northwestern Ontario population is included in the Species at Risk Ontario list as Threatened and afforded protection under the *Endangered Species Act* (2007; Appendix J-1). Assessment of Lake Sturgeon status has been conducted on a number of waters in the Lake of the Woods – Rainy River system and evidence suggests that this sub-population is improving (Golder 2011; MNR 2012).

A recovery strategy for Lake Sturgeon in Ontario has been developed in accordance with the requirements of the *Endangered Species Act* (Golder 2011). A final government response statement summarizing the Government of Ontario's intended actions and priorities in response to the recovery strategy is currently not available.

It should be noted that since 1993, Rainy River First Nations has operated a Lake Sturgeon culture facility in northwestern Ontario at Manitou Rapids. Brood stock are collected from the Rainy River and an average of 40,000 Lake Sturgeon fry have been released back into the Rainy River at Manitou Rapids to supplement and improve local Lake Sturgeon stocks (MNR 2009c). Fry from this hatchery have also been stocked elsewhere in Canada and the northern United States.

There are no other Federally or Provincially listed aquatic Species at Risk captured during baseline studies within the NLSA or NRSA.

5.9 Vegetation

5.9.1 Published Information

A search and review of background information was conducted for the terrestrial environment of the NLSA to summarize all available information of relevant species, densities, diversity and communities. Where possible, records documenting the presence of valued habitat at regional

and local scales are presented, including frequency and duration of use by ecological components.

5.9.1.1 Plant Species and Habitat Types

A list of plant species and habitat types potentially occurring in the NLSA was compiled from a variety of sources including:

- MNR District Office, Fort Frances;
- Life science inventory reports for Provincial parks in the area (Harris et al. 2002b; Harris and Foster 2004a,b);
- A query of the Natural Heritage Information Centre (MNR 2012b) was conducted in February 2011 for SAR occurrences in the 10 km by 10 km blocks the overlap the NRSA (i.e., blocks 15VQ10, 15VQ11, 15VQ20, 15VQ21, 15VQ30, 15VQ31, 15VQ32); and
- Review and Inventory Strategy for Rare Plants Crossroute Forest 2007 – 2017 (Van den Broeck 2006).

The NLSA occurs within Ecoregion 5S, but there are no published Significant Wildlife Habitat Ecoregion Criteria Schedules for this ecoregion. Results of historical information review not only provided ecological context to natural features observed within the NLSA, but also guided field investigations to fill information gaps of the natural history of the NLSA where required.

The RRP NLSA is a low density rural area within which some agricultural (cattle and fodder cropping) and logging activities occur. Lands in the immediate RRP site vicinity are typically gently rolling to flat, forested wetlands in low-lying areas, rounded bedrock outcrops and subcrops in upland areas and areas that have been cleared for agriculture. Local drainage systems are characterized by small creeks draining to the Pinewood River which drains most of the RRP site area. Area creeks are also small and frequently intermittent in nature. Portions of the natural drainage systems have already been altered near the site through the development of agricultural drains, road development and ongoing beaver activities.

Ecosite data (1997 to 1999) for much of the NLSA was provided by the Fort Frances District MNR while Forest Resource Inventory mapping (1994 to 1998) was acquired for the entire NLSA. Where ecosite data was not provided, Forest Resource Inventory data was converted to Northwestern Ontario Ecosite community codes using the MNR conversion tool. Ecosite data for the entire NLSA was further converted to Ecological Land Classification (ELC) codes for northern Ontario using the MNR conversion tool. The MNR Land Information Ontario Soil Survey Complex (MNR 2009b) was used to guide some decision-making.

Ecosite data indicates the presence of 40 ELC community types within the NLSA (Figures 5-22a,b,c; Table 5-25). A total of 179 woodland features are present and cover 66% of the NLSA (Table 5-26). The area and number of woodland features overlapping the NLSA were determined by amalgamating polygons having ELC codes assigned to woodland Significant Wildlife Habitat types (deer yarding areas, furbearer denning areas, woodland raptor nesting habitat and woodland amphibian breeding habitat). In this way, woodland designation infers a classification of function, thereby translating vegetative characteristics of the area to its suitability in providing habitat for wildlife.

Aspen – Birch Hardwood Forest is the most extensive forest type within the NLSA and covers 46.6% the total land area. Other hardwood forest types accounted for just 1.5% of the NLSA. The remainder of woodland features are comprised of coniferous forest types which cover 9.8% of the NLSA and are dominated by Black Spruce and pine species. The majority of woodland features are less than 1 ha in size and 59 woodland features are greater than 10 ha.

Coniferous swamp covers a combined 18.1% of the NLSA, while other wetland features account for 11.3%. Open country features such as agricultural lands and cultural meadow account for approximately 11.8% of the NLSA and largely occur along roadways. Ecosite data will be further elaborated along with vegetation field study results.

Van den Broeck (2006) lists 67 known rare plant species in the Crossroute Forest area of which the vast majority are located in close proximity to Rainy River, Rainy Lake or Lake of the Woods. In the Fort Frances District rare plants are often associated with the following features: rock outcrops and rocky lake shorelines, conifer swamps, uncommon forest types (elm stands, silver maple stands, yellow birch stands, basswood stands, ironwood stands, white ash stands and Hill's oak stands) or uncommon ecosites, climatically modified areas (banks of the Rainy River), southern / prairie influences (shoreline of the Lake of the Woods), mesic prairie – Long Sault Rapids, oak stands – groves, and savannahs and ash stands. Where these habitats exist within the NLSA they will guide rare plant field surveys for the RRP.

In the absence of MNR published Significant Wildlife Habitat Ecoregion Criteria Schedules for Ecoregion 5S the Rainy River District MNR provided a list of infrequently occurring plant communities to be considered within this EA Report (MNR 2012d). These rare vegetation communities included:

- Hill's Oak / Burr Oak Forest or Savannah;
- Any forest where a significant portion of the tree canopy is supported by: Green Ash, Elm, Basswood, Oak species, Yellow Birch; and
- Forests that support and/or provide suitable habitat for rare plants (for example shallow soils over bedrock).

The ecosite data provided by MNR suggests that no rare vegetation communities exist within the NLSA.

5.9.1.2 Species at Risk and Provincially Rare Vegetation

A list of rare plant species and vegetation communities which may occur within the NLSA was attained prior to the start of field investigations by AMEC. A query was conducted of the Natural Heritage Information Centre (MNR 2012b) using the 10 km by 10 km blocks (15VQ10, 15VQ11, 15VQ20, 15VQ21, 15VQ30, 15VQ31, 15VQ32). No records of rare vegetation communities were reported in the Natural Heritage Information Centre. Two Provincially rare plant species, Muskroot and Eastern Swamp Saxifrage, may occur within the NLSA. Both these species are Provincially ranked as S1 (Critically Imperilled) but have not been recorded in the area since 1946 and 1961, respectively. Muskroot grows in moist, rich hardwood forests. It flowers in the spring season (April to May) although its distinctive foliage may persist until late summer (MNR 2012b). The Eastern Swamp Saxifrage grows in swamp and marsh habitats and blooms in May and June (MNR 2012b).

A review of the *Rare Vascular Plants of Ontario* (Oldham and Brinker 2009) listed a number of Provincially rare plant species which are known to occur in the Rainy River District. Many of these species are associated with prairie or savannah habitats, or with the watercourse / waterbodies of Rainy River, Rainy Lake or Lake of the Woods.

The Crossroute Forest Management Plan also provides a summary list of rare fauna for the area (MNR 2006) and includes two plant SAR: the Small-flowered Lipocarpha which is Provincially Threatened and Federally Endangered and is confined to moist sandy beaches which have some protection from waves (COSEWIC 2002); and the Western Silvery Aster which is Provincially Endangered and Federally Threatened and grows in open bur oak savannahs on shallow soils over bedrock (MNR 2008). Since these habitats do not exist within the NLSA, it is unlikely that these species will occur.

5.9.2 Vegetation Communities

The RRP site is located in a low density rural area within which some agricultural (focused on cattle and fodder cropping) and logging activities occur. Adjacent areas show mainly second growth poplar-dominated forests and wetlands. Lands in the immediate RRP site vicinity are typically gently rolling to flat, with forested wetlands occurring in low-lying areas and rounded bedrock outcrops and subcrops occurring in upland areas and some of the area has been cleared for agricultural development. Local drainage systems are characterized by numerous small creeks draining into the Pinewood River. Portions of the natural drainage systems have been altered near the RRP site through the development of agricultural drains, road development and ongoing beaver activities. Area creeks are also small and frequently intermittent in nature. There are no lakes within the immediate RRP site area except along the

NLSA transmission line corridor. ELC vegetation communities present in the NLSA are listed in Table 5-25.

The detailed results and figures field investigations are presented in Appendix N.

5.9.2.1 Hardwood Forest

Hardwood Forest represents the most extensive forest type in the NLSA and covers 47.6% (12,699 ha) of the total NLSA area. This forest type is largely dominated by Trembling Aspen although smaller components of White Birch and Black Ash are present.

The Aspen – Birch Hardwood Forest type represents 96.9% of the hardwood forest within the NLSA. Aspen – Birch Hardwood Forest occurs across four soil types (Dry to Fresh Course, Fresh Silty to Fine Loamy, Fresh Clayey and Moist Fine) and is represented by four ELC codes (B055, B088, B104, and B119). Fresh Clayey Aspen - Birch Hardwood Forest is the most extensive ELC community (B088) within the NLSA. Aspen communities are herb and shrub rich and commonly include an understory of Mountain Maple, raspberry species, other deciduous shrubs, grasses and sedges. The ground layer is most commonly dominated by typical hardwood forest species such as Wild Sarsaparilla and White Snakeroot. Much of the hardwood forest in proximity to the RRP site is young and in various stages of regeneration. Younger, regenerating hardwood forest often included pockets of exposed bedrock, which limited the frequency and size of trees.

Black Ash and White Elm occur occasionally within some polygons although very rarely occur in such proportions as to be individually mapped as its own specific community. Black Ash Hardwood Forest (B089, B105 and B130) covers just 401.5 ha of the NLSA and represents 1.5% of the total area.

5.9.2.2 Coniferous Swamp

Coniferous Swamp (B127, B128, and B129) covered 18.3% (4874.6 ha) of the NLSA and is the second largest vegetation community type therein. The most common species in the canopy and subcanopy were Black Spruce, White Spruce, Tamarack and Eastern White Cedar. The understory is dominated by Labrador Tea, Low Bush Blue Berry, Velvet Leaf Blueberry, Leatherleaf, Bunchberry and Speckled Alder surrounding the edges. Sphagnum and Feathermoss cover most of the ground layer with occasional emergence of sedges such as Bladder Sedge, Fringed Sedge, Fox Sedge and Hop Sedge where moss covers less of the ground.

Most swamps within the NLSA occur in close proximity to each other (about 1 km apart) and are hydrologically connected to permanent or intermittent watercourses. Such features may make them significant for wildlife movement and distribution of plant species.

5.9.2.3 Coniferous Forest

Coniferous Forest (B011, B012, B034, B035, B040, B048, B049, B051, B052, B054, B065, B066, B082, B083, B098, B101, B114, B115, B116) represents 9.9% (2637.2 ha) of the vegetation cover in the NLSA. Coniferous forest cover is varied and consists of 15 ELC communities occurring across a variety of soil types. Rocky outcrops are occasionally encountered within coniferous communities throughout the northern portion of the NLSA. These communities are typically dominated by pine and/or spruce species. The herbaceous layer of these communities includes Large-leaved Aster, Pale Corydalis, blueberry species and Fringed Black Bindweed.

In some cases where Eastern White Cedar dominated upland forest communities are present (B051, B066 and B115) understory diversity is poor and the ground layer is dominated by needle litter. Conifer forests growing on shallow soils (B011 and B012) also tend to be deficient in herbaceous ground cover and are often associated with exposed bedrock.

5.9.2.4 Meadow and Shallow Marsh

Meadow and Shallow Marsh (B142, B144 and B149) comprised 4.6% (1239.8 ha) of the NLSA. Marshes occupied flood plains of permanent and intermittent watercourses throughout the NLSA such as the Pinewood River and its tributaries (Clark Creek, Loslo Creek, Marr Creek and West Creek). These marshes occur where seasonal flooding prevents colonization of Sphagnum and other peatland plants, and slows the rate of peat accumulation.

Marshes were typically graminoid, dominated by various sedge and grass species (narrow emergent species) with rare occasions of broad leaved emergent species (broad emergent species). The most dominant grass species include Canada Blue Joint, Common Cattail, Fowl Blue Grass and Fowl Manna Grass. Water Sedge, Lake Sedge, Bladder Sedge, Slender Sedge and Bebb's Sedge were also common. Broad emergent species such as Wild Calla, Broadleaf Arrowhead and Marsh Marigold were common in open water areas of marshes along with floating and submergent species such as Floating-leaf Pondweed, Coontail and Great Duckweed. Herbaceous species such as Northern Bugleweed and shrub species such as Speckled Alder and Narrow-leaved Meadow-sweet were common along marsh edges.

5.9.2.5 Thicket Swamp

Speckled Alder and Willow species were often found as thickets along the peripheries of open wetlands. Mineral and Organic Thicket Swamp (B134 and B135) types cover 3.2% (865.2 ha) of the NLSA.

5.9.2.6 Fen

Sparse Treed Fen (B136) and Poor Fen (B129) cover 3.6% (954.8 ha) of the NLSA. Vegetation consists of widely-spaced Tamarack and Black Spruce (2 to 10 m tall) over a Sphagnum carpet with sedges and ericaceous shrubs. Other dominant species include Bog Birch and Shrubby Cinquefoil along with a diversity of sedges and herbs.

5.9.2.7 Bog

Open Bog (B138) covers much less than 0.01% (2.2 ha) of the NLSA. Vegetation consists of extremely sparse and stunted Black Spruce and is dominated by ericaceous shrubs, sedges and sphagnum mosses. Common shrubs include leatherleaf, bog laurel, bog rosemary and Labrador-tea. Herbaceous plants include pitcher plant, round-leaved sundew, dense cottongrass and few-seeded sedge. The system is hydrologically isolated.

5.9.2.8 Rock and Mineral Barren

Barren habitat consisting of Rock Barren (B164) and Active Mineral Barren (B007) covers less than 1% (77 ha) of the NLSA and is found largely in the northern part of the NLSA amongst tracts of coniferous forest of very shallow soils. One area of Active Mineral Barren (B007) is present in the form of a gravel pit occurring along Roen Road.

5.9.2.9 Agricultural Land

Agricultural lands cover 7.7% (2,044 ha) of the NLSA. Agriculture is largely limited to hayfields and cattle pastures containing Timothy, Smooth Brome, Reed Canary Grass, Alfalfa, clovers, Blue-joint Grass and other graminoids. Agricultural lands largely occur along roads in well-drained clay areas of the NLSA. The majority of agricultural lands within the NLSA have been active in the last five years.

5.9.2.10 Cultural Meadow

Cultural Meadow covers 2.1% (569.5 ha) of the NLSA. Fallow agricultural fields are common, although generally of small size. These fields tended to be dominated be non-native grasses and herbs such as Timothy, Smooth Brome and clovers (including Red Clover).

5.9.2.11 Open Water

Open Water covers the remaining 2.7% (714 ha) of the NLSA.

5.9.2.12 Rare Vegetation Communities

No rare vegetation communities were found in the NLSA.

5.9.3 Plant Species

A total of 380 vascular plant species were observed in the NLSA between 2009 and 2012 (Appendix J-1, J-2, J-3 and N). The species are mostly boreal and Great Lake St. Lawrence in affiliation. Boreal species are particularly well represented in peatland habitats. In contrast with the Lake of the Woods area west of the NRSA, very few prairie and savannah indicators (Bakowsky and Oldham 1998) were observed in the NLSA, perhaps related to the absence of mafic bedrock preferred by these species, microclimatic factors, or lack of rocky shorelines. Neither Bur Oak nor Northern Pin Oak were observed. The majority (88%) of these species are Provincially ranked as S4 or S5 (Secure) and globally ranked as G4 or G5 (Common to Very Common). Approximately 16% of the recorded species are exotic weeds typically associated with pastureland, roadsides and other disturbed habitats.

Surveys were conducted for Provincially (COSSARO, *Endangered Species Act*) and Federally (COSEWIC, *Species at Risk Act*) listed plant SAR species. No plant SAR were recorded in the NLSA during any of the baseline surveys. A review of the Natural Heritage Information Centre (MNR 2012c) revealed that two plant SAR were known to occur in the greater Rainy River area. Small-flowered Lipocarpha, listed Provincially as a Threatened Species and Federally as an Endangered Species, is confined to moist sandy beaches which have some protection from waves (COSEWIC 2002). This habitat does not exist within the NLSA. Western Silvery Aster, listed Provincially as Endangered and Federally as Threatened, grows in open bur oak savannahs on shallow soils over bedrock (MNR 2008). This habitat does not exist within the NLSA either.

KCB observed two Provincially rare plant species within the NLSA during the 2009 to 2010 vegetation surveys. New England Violet which is Provincially ranked as S3 (Vulnerable), was observed at three locations in the NLSA; two of the locations may be directly affected by RRP activities. Field Sedge, also ranked as S3 (Vulnerable), was observed at two locations although a single location is expected to be directly impacted by RRP activities (Figure 13.7 in Appendix N). These two species are not considered Threatened or Endangered by the COSSARO, and therefore are not afforded protection under the *Endangered Species Act*. New England Violet occurs in rock outcrops, meadows and grassy lake terraces and may be distinguished from other violets on the basis of leaf shape and dentation (Coffin and Pfannmuller 1988). Field Sedge is known to occur in moist meadows and prairies or on sandy or gravelly beaches near the normal water line of lakes and ponds. This species flowers four to six weeks after the recession of spring water levels, typically in late June (MNR 2012b).

AMEC was unable to verify the KCB locations of these Provincially rare species during the AMEC investigations. No rare plant species were observed within the NLSA by AMEC during the 2012 vegetation surveys.

5.10 Wildlife

5.10.1 Published Information

A review of background information was conducted for the biophysical environment of the NLSA to summarize all available information of relevant species, densities, diversity and communities. Where possible, records documenting the presence of valued habitat at regional and local scales are presented, including frequency and duration of use by ecological components.

A list of species and habitat types potentially occurring in the NLSA was compiled from a variety of sources including:

- MNR District Office, Fort Frances;
- Life science inventory reports for Provincial parks in the area (Harris et al. 2002b; Harris and Foster 2004a,b);
- A query of the Natural Heritage Information Centre (MNR 2012b) was conducted in February 2011 for SAR occurrences in the 10 km by 10 km blocks overlapping the NRSA (blocks 15VQ10, 15VQ11, 15VQ20, 15VQ21, 15VQ30, 15VQ31, 15VQ32);
- The Forest Management Plan for the Crossroute Forest (MNR 2006) and informal interviews with local residents;
- North American Breeding Bird Survey route 68066 (Stratton, Ontario) occurring approximately 15 km west of the western edge of the NLSA (USGS Patuxent Wildlife Research Center 2012);
- OBBA database (seven atlas squares overlapping the NLSA; Cadman et al. 2007);
- Important Bird Areas database (BSC 2012);
- Christmas Bird Count (National Audubon Society 2012);
- Atlas of the Mammals of Ontario;
- Ontario Herpetological Atlas;
- Ontario Butterfly Atlas;
- Ontario Odonata Atlas; and

- eBird.org.

The NLSA occurs within Ecoregion 5S but there are no published Significant Wildlife Habitat Ecoregion Criteria Schedules for Ecoregion 5S,. Results of historical information review not only provided ecological context to natural features observed within the NLSA, but also guided field investigations to fill information gaps of the natural history of the NLSA where required.

5.10.1.1 Mammals

A review of historical information of wildlife occurrences in the NRSA yielded records of 22 mammalian species. Species of cultural significance protected under the *Fish and Wildlife Conservation Act* including game animals (Black Bear, Snowshoe Hare, Moose, Elk and White-tailed Deer), furbearers (Red Squirrel, Beaver, Muskrat, weasels, American Mink, American Marten, Fisher, River Otter, Bobcat, Lynx, wolf and Red Fox*)* and specially protected mammalian guilds (bats, shrews and chipmunks) have been recorded in the NLSA. Cougar were also historically reported in northwestern Ontario (Natural Heritage Information Centre and Ontario Puma Foundation), including some sitings within the past ten years bordering the east side of Lake of the Woods. TK / TLU data collected from the Big Grassy River First Nation also mentioned that Cougar did occur in the region, along with the species noted above.

RRR received a comment regarding restocking programs for Lynx in Ontario. MNR have indicated that they were unaware of any such programs.

The background information review found that 11 significant wildlife Habitat types may occur in the NLSA:

- Moose late winter cover;
- Deer yards (location information provided by the MNR);
- Seeps and springs;
- Mineral licks;
- Cervid (ungulate) movement corridors;
- Denning sites for American Mink, otter, American Marten, Fisher, Gray Wolf, Eastern Wolf and Black Bear;
- Wolf rendezvous sites;
- Furbearer movement corridors;

- Bat hibernacula;
- Bat maternity colonies; and
- Special Concern and Rare wildlife species.

Cervids (Ungulates)

Three of the four native ungulate species in Ontario occur in the Rainy River District including White-tailed Deer, Moose and Elk. White-tailed Deer is the most common of these species and is common in many habitats including agricultural areas and other habitats under anthropogenic influence. Moose occur in boreal habitats such as coniferous forest, bogs, swamp as well as silviculture lands. Moose also occur in Great-Lakes St. Lawrence forests (deciduous, mixed-wood habitats).

In 1998, the MNR created The Plan for the Restoration of Elk in Ontario (Bellhouse and Broadfoot 1998) and 443 Elk were released between 1998 and 2001 at four sites across Ontario including 104 animals released at Cameron Lake near Lake of the Woods (Ellis 2012). The Lake of the Woods region was part of the range of the historic Ontario Elk population and was considered by MNR to continue to provide suitable Elk habitat. The Rainy River Elk population has been continually monitored by the MNR since release and the population has remained constant at 25 to 45 individual animals between 2004 and 2012. MNR monitoring has recorded Elk as far east as Barwick (Ellis 2012), which is south of the NLSA.

The MNR conducted an aerial survey for elk in the area in 2012 (described in the 2013 Ontario Elk Research and Monitoring Update; MNR 2013b) but did not record any elk within the NLSA. However, this report stated that elk have been observed in a farmer's field near North Branch, just west of the NLSA, that elk have been observed near North Branch in the past, and that this group is likely made up of 10 or less animals. Local farmers have also told AMEC staff that elk have been spotted near North Branch but they have not been observed east of North Branch. Baseline studies for the RRP (2009-2012) indicated that the NLSA is largely unsuitable as habitat for moose, elk and caribou and no elk were seen in the NLSA nor was any evidence of this species (i.e. droppings) recorded between 2009-2012.

The background information review identified four critical Significant Wildlife Habitat types for Moose and deer which include Moose late winter cover, ungulate movement corridor, mineral licks and seeps and springs. Additional Significant Wildlife Habitat that may occur in the RRP includes winter deer yarding areas.

Moose late winter cover and deer yarding areas both consist of a core area of mainly coniferous trees (pines, cedar and spruce) with a canopy cover of more than 60% which provides shelter from snow and wind (MNR 2012c). Moose late winter cover areas are generally greater than 50 ha and are dominated by tall (greater than 6 m) trees in moderately rugged to gentle terrain

with deep soils. Areas must rate 3 or 4 in Selected Wildlife and Habitat Features: Inventory Manual (Ranta 1998). Core deer yards are usually surrounded by mixed or deciduous forest with understory shrubs and small trees, especially white cedar, providing winter food (MNR 2000). The MNR determines deer yarding areas following methods outlined in Ranta (1998).

Moose aquatic feeding habitat occurs in wetlands and isolated embayments in rivers and lakes which provide an abundance of submerged aquatic vegetation (MNR 2012c). Moose aquatic feeding habitat is usually mapped by the MNR, however, this habitat type has not been mapped for wildlife Management Unit 10. Forest Resource Inventory and ecosite data provided by the MNR was converted to ELC and indicated that 37 features covering 214 ha may provide Moose aquatic feeding habitat.

Mineral licks are upwellings of sodium-rich groundwater that are visited by wildlife to replenish sodium levels which had been depleted from the consumption of plants that are much higher in potassium than sodium in the spring (MNR 2000). Mineral licks are most commonly sought after by Moose, deer and Porcupine. These sites are rare, occurring most frequently in areas of sedimentary and volcanic bedrock and rarely in areas of granitic bedrock except where the site is overlain by calcareous glacial till (MNR 2000). No records of mineral licks were found for lands occurring within the NLSA.

Ruffed Grouse, Moose, White-tailed Deer, Black Bear and Northern Two-lined Salamander typically use seeps and springs. Seeps and springs are areas where groundwater has come to the surface, often within forested headwater areas of coldwater streams (MNR 2000). These groundwater seepages may support numerous species, potentially providing habitat for plants, animals (fish) and/or feeding and drinking areas. Those that occur within forested areas where the canopy maintains cool, shaded conditions are most important (MNR 2000). No records of seeps and springs were found for lands occurring within the NLSA.

Ungulate movement corridors consist of forested ecosites following riparian areas, woodlots, ravines or ridges that connect deer wintering yards or moose aquatic feeding areas with mineral licks. Mapping of deer yards (MNR 2006) in the NLSA indicate that winter deer yarding habitat covers most of the forested habitat present. Ungulate corridors generally follow riparian areas, woodlots, or areas of physical geography (ravines or ridges; MNR 2012c). The Pinewood River and its tributaries appear to provide a suitable corridor for ungulates moving between large Woodlands 2 and 31 as well as several smaller woodlands. Highway 600 and Barwick Road present barriers to ungulate movement and have likely jeopardized the suitability of many natural corridors which join yarding areas throughout the NLSA.

Furbearers

Trapline records (Table 12.6 in Appendix N) and Dobbyn (1994) indicate that 18 furbearing mammals may exist in the NLSA. Furbearers include Beaver, Muskrat, weasels, American Mink, American Marten, Fisher, River Otter, Bobcat, Lynx, wolf, Red Fox and a variety of other small

mammal species that are trapped for commercial use of their pelts. Fur harvest records from MNR trapline data (1993 to 2008) of three traplines occurring partially within the NLSA indicated the potential presence of 15 furbearing mammal species. The Forestry Management Plan for the Crossroute Forest indicated that the NLSA occurs outside of the Marten Core Area as well as the Marten / Pileated Habitat Planning Area (MNR 2006).

The background information review identified four Significant Wildlife Habitat types used by furbearing mammals including denning sites for American Mink, River Otter, American Marten, Fisher, Gray Wolf, Eastern Wolf and Black Bear, wolf rendezvous sites, furbearer movement corridors and mast-producing areas.

Furbearer dens generally occur in large, undisturbed, unfragmented, treed ecosites, although otters prefer shorelines. Suitable landscapes for furbearer dens will include a high availability of cavity trees or downed woody debris as hollowed trees, downed hollow logs and old beaver lodges or muskrat homes, serve as den sites for many species (MNR 2012c). Wolves, in particular, locate den sites in a variety of site-specific habitats such as rock caves, hollow logs and stumps, beaver lodges, or ground excavations on well-drained sandy knolls or hillsides often near water. Forest characteristics of ecosites used as wolf den sites range from aspen and hardwood dominated, mixed wood and conifer rich. Frequent re-use of den sites is common. Dens may include an extensive number of tunnel entrances and large entrance diameters and den locations may be identified by the presence of scat and old prey bones. No records of denning sites were found for lands occurring within the NLSA.

Wolf dens may occur within or near to wolf rendezvous sites, which are generally found in proximity to water and occur in a variety of open habitats such as bogs, burns, clear cuts, beaver meadows and open forest. These features may be identified by abundant matted vegetation. Rendezvous sites are used year-to-year and act as pack gathering places or nurseries for wolf pups until they are able to join the pack to hunt. Multiple rendezvous sites may be used by the pack. No records of wolf rendezvous sites were found for lands occurring within the NLSA.

Furbearer movement corridors are typically found within a riparian area of a lake, river, stream, or wetland. Movement corridors are generally associated with dens and other highly utilized habitat features. River Otter and American Mink are known to occur in substantial numbers in proximity to the NLSA based on trapline data. No records of furbearer movement corridors were found for lands occurring within the NLSA. The Pinewood River and its tributaries appear to provide a suitable corridor for animals moving between woodlands 2 and 31 (Figure 5-23). Highway 600 and Barwick Road present barriers to animal movement and have likely jeopardized the suitability of many natural corridors which join yarding areas throughout the NLSA.

Mast-producing tree species are an important source of food for mammals and birds who consume the fruits and nuts, particularly Black Bears (MNR 2000). Areas containing numerous

mast-producing trees are important foraging areas, especially when the animals require energy rich food to help build fat reserves for the winter. Natural sites with abundant mast-producing shrubs including blueberry, raspberry, choke cherry, oak and Beaked Hazel are examples of foraging areas with abundant mast (MNR 2000). Mast areas may also utilized by White-tailed Deer and Ruffed Grouse. No records of mast-producing areas were found for lands occurring within the NLSA.

No records of furbearer Significant Wildlife Habitat including denning sites, wolf rendezvous sites, movement corridors and mast-producing areas were found. Ecosite data indicates that 109 forested features consisting of 17,751 ha of vegetation communities which may provide habitat for furbearers are present within the NLSA. Surveys for furbearer habitat features were included in field investigations.

Bats

The Atlas of the Mammals of Ontario (Dobbin 1994) indicates the presence of 5 bat species in the Rainy River District: Eastern Red Bat, Northern Myotis, Hoary Bat, Big Brown Bat and Little Brown Myotis. The *Significant Wildlife Habitat Technical Guide* (MNR 2000) identifies three Significant Wildlife Habitat for Ontario bat species including: bat hibernacula, bat maternity roosts and bat migration stopovers.

Based on historical information review, both recorded bat species in the NRSA are known to hibernate in Ontario. In Ontario, the locations and site characteristics of bat hibernacula are relatively poorly known (MNR 2012c). Of the information available, bat hibernacula generally consist of caves, abandoned mine shafts and underground foundations. Ecosite data indicates that 29 land features which may possibly provide suitable conditions for bat hibernacula are present in the NLSA.

Historical records indicate that both recorded bat species in the NRSA utilize maternity colonies. For these species, tree cavities and crevices under loose bark or buildings can provide maternity roost habitat (Fenton 1970).

No records of known bat hibernacula or maternity roosts were found for lands occurring within the NLSA. Ecosite data indicates that 161 unique forested habitat features covering 12,846 ha, which may contain suitable maternity roost trees, are present within the NLSA. Site investigations were undertaken to identify the presence of any unrecorded critical bat habitat features such as hibernacula and maternal roosting sites (large diameter trees, snags and crevices). Acoustic surveys were conducted to inventory bat species found within the NLSA and add to the body of knowledge of bat occurrence in the Rainy River District.

Little is known regarding bat migratory stopover habitat in Ontario. The *Significant Wildlife Habitat Technical Guide* (MNR 2000) does not provide descriptions or criteria for identifying

critical bat migratory stopover habitat. As a result, this habitat will not be subject to identification during field investigation.

Special Concern and Rare Wildlife Species

The historical information review indicated that three mammalian species of special concern, Franklins Ground Squirrel, American Badger and Grey Fox, may occur in the NLSA.

5.10.1.2 Birds

The *Significant Wildlife Habitat Technical Guide* (MNR 2000) identifies 15 Significant Wildlife Habitat types used by birds in boreal Ontario:

- Waterfowl stopover and staging areas (terrestrial);
- Waterfowl stopover and staging areas (aquatic);
- Shorebird migratory stopover areas;
- Colonially-nesting breeding bird habitat (bank and cliff);
- Colonially-nesting breeding bird habitat (trees / shrubs);
- Colonially-nesting breeding bird habitat (ground);
- Waterfowl nesting areas;
- Bald Eagle and Osprey nesting, foraging and perching habitat;
- Woodland raptor nesting habitat;
- Sharp-tailed grouse leks;
- Marsh breeding bird habitat;
- Open country breeding bird habitat;
- Shrub / early succession bird habitat; and
- Special concern and rare wildlife species; and
- Woodland area-sensitive breeding bird habitat.

Historical records targeting the NLSA tallied 175 bird species. This list of species, which includes 44 area-sensitive species, indicates the possible presence of bird Significant Wildlife Habitat within or surrounding the NLSA through the presence of waterfowl, marsh bird, colonially-nesting bird, shorebird, raptor, open country bird and early succession bird species.

The historical information review indicates 10 Significant Wildlife Habitat types may occur in the NLSA:

- Colonially-nesting breeding bird habitat (bank and cliff);
- Colonially-nesting breeding bird habitat (trees / shrubs);
- Waterfowl nesting areas;
- Bald Eagle and Osprey nesting, foraging and perching habitat;
- Woodland raptor nesting habitat;

- Woodland area-sensitive breeding bird habitat;
- Sharp-tailed grouse leks;
- Marsh breeding bird habitat;
- Shrub / early succession bird habitat; and
- Special Concern and Rare wildlife species.

All avian Significant Wildlife Habitat identified as potentially occurring within the NLSA are habitats used for breeding. The field investigations targeting birds in the NLSA were largely focused on identifying breeding species and breeding bird Significant Wildlife Habitat in the likely absence of shorebird and waterfowl migratory stopover habitat types.

Migratory Breeding Birds - Woodland Birds

The historical information review indicated that 21 area sensitive woodland breeding bird species and 11 woodland bird species of interest may occur in the NLSA. Table G-3 of MNR (2000) lists 36 area-sensitive bird species that utilize old-growth forest habitat.

Large, mature (>60 years old) forest stands having greater than 30 ha of interior forest habitat (habitat at least 200 m from forest edge habitat) are considered candidate Significant Wildlife Habitat (MNR 2000). Ecosite data indicates that 13 large woodlands with greater than 30 ha of interior forest habitat occur within the NLSA (Table 5-26). The presence of significant woodland area-sensitive breeding bird habitat will be confirmed during field investigations.

Migratory Breeding Birds - Wetland Birds

A wide variety of wetland breeding birds are listed in historical records for the area. Table G-3 of MNR (2000) lists 54 area-sensitive bird species that utilize wetland habitat. Wetland bird breeding Significant Wildlife Habitat includes waterfowl nesting areas, marsh breeding bird habitat, colonially-nesting breeding bird habitat (trees / shrubs), while wetland bird migration habitat includes terrestrial and aquatic waterfowl stopover and staging areas (MNR 2000).

Migratory Breeding Birds - Waterfowl Birds

Historical records indicate six waterfowl species may occur in the NLSA during the breeding season. Waterfowl nesting sites are generally large undisturbed areas with an abundance of ponds and wetlands. Vegetation is an important component of waterfowl nesting sites as most species nest in grassy cover, shrubby fields adjacent to wetlands, or in tree cavities along shorelines or swamps (MNR 2000). Table 1.2.2 of MNR (2012c) describes candidate waterfowl nesting areas as extending 120 m from a wetland (>0.5 ha) or a wetland (>0.5 ha) and any small wetlands (0.5 ha) within 120 m or a cluster of three or more small (<0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur (MNR 2012c).

No significant waterfowl nesting sites are known to occur in the NLSA although ecosite data indicates that 235 wetlands covering 3,462 ha of suitable waterfowl nesting habitat are present. For that reason, the presence or absence of candidate significant waterfowl nesting sites within the NLSA was confirmed through field investigations.

As described in MNR (2000), many waterfowl congregate in large flocks and set up a pattern of pre-migration staging prior to migration, whereby the birds move in groups between feeding ponds and a large waterbody for roosting. During migration, waterfowl require stopover areas that supply food to replenish energy reserves, resting areas and cover. There are two types of waterfowl stopover and staging areas: terrestrial and aquatic. Terrestrial areas can be fields which temporarily flood during spring and provide important habitat for migrating waterfowl. Aquatic areas include ponds, marshes, lakes and other more permanently wet areas which provide important habitat for both local and migrating waterfowl (MNR 2012c).

No candidate waterfowl stopover and staging areas are known to occur in, or in proximity to, the NLSA, although ecosite data indicates presence of 201 wetland features covering 2,343 ha that could provide suitable wetland staging habitat. As the NLSA is situated away from any large waterbodies, it does not provide aquatic stopover habitat for significant numbers of waterfowl. Thousands of waterfowl congregate annually between the barrier islands and the Rainy River mouth, within the Lake of the Woods Sand Spit Archipelago Important Bird Area which occurs approximately 45 km to the west of the NLSA. Concentration of waterfowl in this area is particularly notable in early spring (IBAC 2012). It is anticipated that migrating waterfowl passing through the Rainy River District will be drawn to these higher quality aquatic features, instead of low quality wetlands that occur within the NLSA. The NLSA consists largely of agricultural fields which are not considered Significant Wildlife Habitat. Christmas Bird Count circles near the NLSA have recorded six waterfowl species between 1992 and 2011, although these records likely only pertain to large bodies of water that are not completely frozen during the winter such as Lake of the Woods and Rainy Lake. No terrestrial waterfowl stopover and staging areas are anticipated to occur within the NLSA.

Migratory Breeding Birds - Marsh Breeding Birds

Wetlands are the preferred habitat for many birds in Ontario. As outlined in MNR (2012c), all wetland habitat is to be considered candidate significant marsh breeding bird habitat as long as there is shallow water with emergent aquatic vegetation present (MNR 2012c). Ecosite data indicates that 229 wetland features providing 2583 ha of suitable marsh bird breeding habitat are found within the NLSA.

Based on a review of background information, five marsh bird species (Pied-billed Grebe, Sandhill Crane, Sora, Marsh Wren and Sedge Wren) are known to occur in proximity to the NLSA. No records of significant marsh breeding bird habitats are known within the NLSA. Nonetheless, the presence of marsh birds in proximity to the NLSA and the presence of wetlands potentially supporting marsh breeding habitat in proximity to the NLSA, suggests the

potential presence of candidate significant marsh breeding habitat. As such, the presence of candidate significant marsh breeding habitat within the NLSA was to be confirmed during field investigations.

Migratory Breeding Birds - Colonially-nesting Birds

The *Significant Wildlife Habitat Technical Guide* (MNR 2000) lists three types of significant colonially-nesting bird habitat types in the boreal forests of Ontario including: bank and cliff, tree / shrub and ground (MNR 2012c). Historical records indicated that Great Blue Heron (a tree-nesting species) and Cliff Swallow (a bank and cliff-nesting species) may occur in the NLSA. Ecosite data indicates that 101 habitat features covering 16,325 ha of forested habitat are present in the NLSA which may provide suitable tree / shrub colonially-nesting bird breeding habitat. Habitat preferences for these species are species-specific and it is acknowledged that smaller patches of preferred habitat could be found within these 101 forested habitat features. The Forestry Management Plan for the Crossroute Forest indicated that a heronry is present approximately 3 km west of Muskrat Lake (MNR 2006). No records of Bank or Cliff Swallow colonies are known for the NLSA. The presence of bank and cliff, and tree / shrub colonially-nesting sites within the NLSA was investigated during field studies.

Records indicate five ground colonially-nesting bird species (Double-crested Cormorants, American White Pelican, Herring Gull, Ring-billed Gull and Brewer's Blackbird) exist in proximity to the NLSA. Ground nesting colonial species largely nest on small bare islands located in large bodies of water, although Brewer's Blackbirds nest in a variety of wet terrestrial habitats. No large waterbodies are situated within the NLSA, therefore no ground colonially-nesting breeding bird habitat is expected to occur therein.

The Lake of the Woods Sand Spit Archipelago Important Bird Area and the Three Sisters Islands Important Bird Areas (approximately 45 km and 55 km west of the NLSA, respectively), both occur in Lake of the Woods and provide ground nesting habitat for colonially-nesting bird species. The Lake of the Woods Sand Spit Archipelago Important Bird Areas hosts colonies of nesting Ring-billed Gull, Herring Gull, American White Pelican and Common Tern; while the Three Sisters Islands Important Bird Area is colonized by American White Pelican, Double-crested Cormorant and Herring Gull. Lake of the Woods colonies of American White Pelican totalled 7,432 pairs in 2004 (Ratcliff 2005). Adults of all of these species may travel vast distances from their nesting sites to forage. As a result, foraging Ring-billed Gull, Herring Gull, Common Tern, American White Pelican and Double-crested Cormorant may occur within the NLSA despite a lack of suitable nesting habitat.

Ecosite data indicates that 176 habitat features covering 1,401 ha of suitable Brewer's Blackbird nesting habitat may occur in the NLSA. MNR (2012c) indicates that a significant Brewer's Blackbird habitat feature hosts five breeding pairs of this species. The presence of this species in the NLSA was assessed during field investigations.

Migratory Breeding Birds - Shorebirds

A total of five shorebird species have been recorded in proximity to the NLSA, all of which are regularly breeding species south of the Hudson's Bay Lowlands. Shorebird migratory stopover areas are identified as Significant Wildlife. Of the 23 shorebird species listed in the schedules as utilizing shorebird migratory stopover areas (MNR 2012c), thee (Upland Sandpiper, Wilson's Phalarope and Wilson's Snipe) were documented through a review of the background information.

The *Significant Wildlife Habitat Technical Guide* (MNR 2000) identifies shorelines lakes, rivers and wetlands including beach areas, bars and seasonally flooded, muddy and barren (non-vegetated) shoreline habitats as key habitat characteristics of shorebird migratory stopover areas, whereas intensive agricultural fields are not included within this habitat criteria (MNR 2012c). Migrating shorebirds often follow the shorelines of the Great Lakes because they provide some of the best shorebird migratory stopover habitat; due to their location along migration routes and because wave action maintains large and productive beaches (MNR 2000). During inclement weather, large numbers of shorebirds may accumulate in shoreline stopover areas that produce abundant food and provide safe places to rest. The Lake of the Woods Sand Spit Archipelago Important Bird Area occurs approximately 45 km west of the study area and provides quality stopover habitat for shorebirds in both the spring and fall (IBAC 2012). The Significant Wildlife Habitat outlines that only suitable habitats for shorebird stopover areas occurring within 5 km of shoreline can be considered significant habitat (MNR 2012c). It was deemed unlikely that the NLSA supports significant numbers of migratory bird species as it is located far from any large lakes or shoreline habitats.

Migratory Breeding Birds - Open Country Birds

Table G-3 of MNR (2000) lists 14 area-sensitive bird species that utilize grassland habitat. Historical records indicated that 14 open country bird species may occur in the NLSA. Large fields with abundant vegetation and scattered trees and shrubs are important open country habitat for birds. Ecosite data indicates that 74 meadow / grassland habitat features covering 570 ha are present in the NLSA. A number of area-sensitive birds require areas of relatively large open grasslands as they are more likely to be buffered from disturbance, more likely to increase the distance of nesting habitat to woody edges (thereby reducing nest predation and parasitism) and provide more opportunities for nesting (MNR 2000). For these species, grasslands areas provide essential food, cover and nesting habitat. Appendix Q in MNR (2000) identifies large grasslands greater than 30 ha are likely most significant and support and sustain a high diversity of these species, whereas open country habitats used for intense farming activity are not considered candidate significant habitats for open country breeding birds (MNR 2000). Table 1.3 of MNR (2012c) indicates that agricultural lands actively used (such as for row cropping, intensive hay and livestock pasturing) in the last five years are not candidate significant open country breeding bird habitat. Air photograph interpretation concludes that much of the open country habitat present in the NLSA has been used actively for agriculture in

the past five years. Field investigations will confirm whether any natural occurring open country habitat qualifying as significant open country breeding bird habitat is present in the NLSA.

The Prairie subspecies of the Sharp-tailed Grouse is known to occur throughout the Rainy River District and historical Breeding Bird Survey and Christmas Bird Count data have recorded this species in proximity to the NLSA. This subspecies exists as two distinct populations in Ontario: a Rainy River population and a population along the North Shore of Lake Huron. The *T. p. campestris* subspecies originated in the prairies and only occupies open plain and farmland habitats and occupies different ecological and geographical niches than the northern subspecies, *T. p. phasianellus* (Cadman et al. 2007). Sharp-tailed Grouse lekking sites consist of undisturbed, bare, grassy areas where a knoll or slightly elevated rise in topography occurs. Ecosite data indicates that six distinct habitat features covering 89 ha of suitable lekking habitat may occur in the NLSA. Field investigations were undertaken to confirm the presence of Sharp-tailed Grouse and their lekking sites in open country habitats in the NLSA.

Migratory Breeding Birds - Shrub / Early Successional Birds

The general decline of avian species associated with shrubland and early successional habitats has been identified as a conservation concern in southern Ontario (Cadman et al. 2007; Ontario Partners in Flight 2008). Table G-3 of MNR (2000) lists 14 area sensitive bird species that utilize thickets or second growth habitats. Three species (Eastern Kingbird, Ruffed Grouse and Tennessee Warbler) were identified in the records review as occurring in shrubland and early successional habitats in the NLSA. Ecosite data indicates that 145 habitat features covering a total of 865 ha of suitable shrub / early successional habitat may occur in the NLSA.

The Breeding Bird Survey data showed historical records of Golden-winged Warbler in proximity to the NLSA. The Golden-winged Warbler is listed Provincially as a species of Special Concern and is listed Federally as a Threatened species and breeds in successional / shrub, or old field habitats, surrounded by forests. This species is not listed in MNR (2012c); although a small population occurs in the Rainy River District (Cadman et al. 2007). Golden-winged Warbler habitat was considered in conjunction with general shrub / successional breeding bird habitat. Field investigations will confirm the presence of Golden-winged Warbler in shrubland and early successional habitats in the NLSA.

The NLSA is primarily associated with agricultural lands and woodlands, although shrubland / early successional habitat does occur. As such, the presence of significant habitat for shrubland / early successional bird species within the NLSA will be confirmed during field investigations.

Raptors - Woodland Raptors

Historical records show that eight diurnal raptor and six owl species may occur in the NLSA. Recorded species include woodland nesting species that construct stick nests such as Broad-

winged Hawk, Red-tailed Hawk, Sharp-shinned Hawk, Cooper's Hawk, Great Horned Owl and Great Gray Owl are, as well as cavity-nesting species such as American Kestrel, Northern Hawk Owl, Boreal Owl and Northern Saw-whet Owl. RRR received a comment regarding restocking programs for owls in Ontario. MNR indicated that they were unaware of any such programs.

Woodland nesting raptors typically nest in intermediate-aged to mature woodlands that provide large sturdy trees for nesting and perching and open understory flight and hunting prey (MNR 2000). Important factors in woodland nesting habitat selection for several species of raptors are species composition, size and age of forest stand (MNR 2000). MNR (2012c) indicates that all forested ecosites may provide woodland raptor nesting habitat. As a result, ecosite data indicates that 109 forest habitat features covering 17,751 ha are present in the NLSA.

No records of woodland raptor nesting habitats are available, although the presence of breeding raptor species and forest habitat features within the NLSA suggests the presence of candidate significant woodland raptor nesting habitat. As such, the presence of woodland raptor nests within the NLSA will be confirmed during field investigations.

Raptors - Bald Eagle and Osprey Nesting, Foraging and Perching Habitat

Bald Eagle was identified by the Natural Heritage Information Centre (MNR 2012b) as having occurred in the NLSA. Bald Eagles and Ospreys use shoreline habitat associated with lakes and large rivers (rarely small lakes and rivers) for nesting and foraging (MNR 2000). As both species are predominantly fish-eating birds, productive areas of open water or deep water marshes supporting large quantities of fish are required to feed growing young. Nests are usually built in large trees near shore or over water and are often re-used, becoming extremely large as new nest material is added each year (MNR 2000). The Bald Eagle shows a distinct preference for islands. Both Bald Eagle and Ospreys have no particular preference for mixed, coniferous or deciduous forest. Bald Eagle do show a preference for live trees and conifers in Ontario for nesting purposes, in open old growth forest / mature stands with 30 to 50% canopy cover (MNR 2000). Large trees (with a diameter at breast height greater than 60 cm) with crotches large enough to support the large nest are essential. They typically require an area of 255 ha for nesting, shelter, feeding and roosting, and build nests within 50 to 200 m from the shoreline (Cadman et al. 2007; MNR 2000). Nests are typically near the top of the nest tree, which must provide an unobstructed view and flight path in all directions.

Bald Eagles winter along shorelines of large waterbodies that provide areas of open water, with abundant and accessible fish (MNR 2000). This species has been recorded regularly during the Christmas Bird Count in the Rainy River District between 1992 and 2011, with counts numbering between 5 and 53 individuals. Bald Eagles roost in large trees growing in shoreline forest stands or on cliffs. The location of winter roosting sites changes within and among winters depending upon ice conditions and fish distribution; but the same general areas are used traditionally and often the same trees will be used year after year. An abundant supply of undisturbed mature trees or snags distributed evenly along a shoreline is important to ensure

that eagles can alter their winter distribution patterns depending upon ice conditions and fish distribution. Snags are preferred for perches and roosts, as are tall trees with large horizontal branches and should provide an unobstructed view (MNR 2000).

Based on a review of background information, Ospreys and Bald Eagles are reported to occur in the vicinity of the NLSA. The Forestry Management Plan for the Crossroute Forest indicated that an Osprey nest is present approximately 3 km west of Muskrat Lake, although no Bald Eagle nests were reported (MNR 2006). Cadman et al. (2007) shows a strong presence of breeding Bald Eagles and Osprey throughout the Rainy River District. Air photograph interpretation suggests that small lakes and coniferous forest along the transmission line may provide nesting, perching and foraging habitat for Bald Eagle and Osprey, to be confirmed during field investigations.

5.10.1.3 Reptiles

The historical information review indicated that four reptile species including two snake species (Eastern Gartersnake and Red-bellied Snake) and two turtles (Western Painted Turtle and Snapping Turtle) occur in the NLSA. A subspecies of the Eastern Gartersnake, the Red-sided Gartersnake, is also known to occur in the NLSA. The *Significant Wildlife Habitat Technical Guide* lists three types of reptile Significant Wildlife Habitat which include reptile hibernacula, turtle wintering areas and turtle nesting areas (MNR 2000) which may apply to the NLSA given the possible presence of both snakes and turtles.

Reptile (snake) hibernacula are often in animal burrows, rock crevices and other natural areas that enable the animals to hibernate below the frost line, often found in association with water to prevent desiccation (MNR 2000). Frequently, snake hibernacula are found among broken rocks at the base of cliffs or in karst areas and in rock piles, rubble and old foundations because these landforms often provide suitable subterranean crevices ideal for hibernation. Ecosite data indicates that 303 habitat features covering a total of 5,146 ha may provide suitable hibernacula for snakes. Consultation with the MNR revealed there are no records available for known reptile hibernacula in the NLSA. Nonetheless, the presence of reptile hibernacula features such as buried concrete or rock (such as building foundations), rock crevices or animal burrows will be recorded during field investigations.

Turtle overwintering sites are permanent waterbodies, large wetlands and bogs or fens with adequate dissolved oxygen (MNR 2012c). These areas may support congregations of turtles if overwintering habitats are limited (MNR 2012c). Three types of hibernacula used by adult Snapping Turtles in Algonquin Park have been identified by Brown and Brooks (1994):

- Stream sites where turtles are buried beneath logs, sticks, or overhanging banks in small streams that flow continuously throughout the winter;

- Lakeshore sites where turtles are wedged beneath or beside submerged logs and stumps, sometimes covered in silt, within 5 m of the shoreline; and

- Muddy sites where turtles are buried in deep anoxic mud in marshy areas or beneath floating mats of vegetation.

Ecosite data indicates that 185 habitat features covering 4,091 ha may provide suitable turtle overwintering habitat. Consultation with the MNR revealed there are no records available for known turtle wintering sites in the NLSA.

Turtle nesting areas must provide sand and/or gravel that the turtles can dig their nests in and are often south to south-west facing to maximize exposure to sunlight for egg incubation (MNR 2000). Female Painted Turtles lay their eggs up to 150 m, or more away from the water's edge. They select an exposed patch of soil or sand either in a field, beach or roadside, where digging is possible. Gentle slopes (<45°; Orchard 1986) with southern exposure and good drainage are often chosen. Females Snapping Turtles generally nest on sand and gravel banks along waterways, including artificial dam and railway embankments; but muskrat houses, abandoned beaver lodges, road shoulders, fissures in rocky shorelines, sawdust heaps, freshly dug soil, gardens, lawns and forest clearings have all been selected as nest sites with unknown success (COSEWIC 2008). If the turtle travels from the aquatic environment in search of a suitable nesting area, optimally, safe movement corridors will be present between the nesting and aquatic habitat (MNR 2000).

Ecosite data indicates one habitat feature, a gravel pit covering 6 ha that may provide suitable turtle nesting habitat. Based on a review of available resources, no records of turtle nesting habitats are available within the NLSA. Nonetheless, based on air photograph interpretation, the presence of woodlands and wetlands potential supporting turtle nesting habitat within, or in proximity to, the NLSA suggested the potential presence of candidate significant turtle nesting habitat. As such, the presence of turtle nesting habitat will be confirmed during field investigations.

5.10.1.4 Amphibians

The Rainy River District is home to 10 amphibian species including 2 salamander species and 8 frog species. Critical amphibian habitat indentified in the *Significant Wildlife Habitat Technical Guide* (MNR 2000) includes amphibian breeding habitat (woodland and wetland) and amphibian movement corridors.

Amphibian woodland breeding habitats consist of pools, wetlands or lakes within or adjacent (120 m) to woodlands (MNR 2000). Such waterbodies may be small and ephemeral (vernal), but nevertheless are important to local amphibian populations within a landscape, especially if they provide the only suitable habitat in the area (MNR 2000). The best breeding ponds contain a variety of vegetation structures in and around the edge of the pond that are used by frogs for

egg laying and for cover when calling. Damp closed-canopy habitats with dense undergrowth and moist fallen logs are particularly useful in providing cover from predation when amphibians move out of the water for various activities such as calling or resting (MNR 2000).Sites with several ponds and/or ponds close to creeks are especially valuable (MNR 2000).

The *Significant Wildlife Habitat Technical Guide* (MNR 2000) describes wetland amphibian breeding habitat as permanent or ephemeral wetlands or pools greater than 0.05 ha (about 25 m in diameter). The presence of shrubs and logs increase the significance of a pond for some species because of available perches for calling, foraging, escape and concealment from predators.

Movement corridors for amphibians migrating from their terrestrial habitat to breeding habitat can be extremely important for local populations as they can provide safe movement between the two seasonal habitats (MNR 2012c). MNR (2000) states that hedgerows should not be considered significant natural features, unless they provide the only animal movement corridors in the planning area.

Aerial interpretation of the NLSA indicates that woodland and wetland habitat that could potentially support amphibian breeding populations are abundant throughout, or within proximity to, the NLSA and suggest the presence of amphibian movement corridors. Ecosite data indicates that 109 habitat features covering 17,751 ha of forested land may provide suitable woodland amphibian breeding habitat while a further 239 habitat features covering 2,044 ha may provide suitable wetland amphibian breeding habitat. The presence of significant amphibian habitat within the NLSA will be confirmed during the field investigations.

5.10.1.5 Species at Risk and Provincially Rare Species

Species at Risk are plant or animal species whose individuals or populations are considered Extirpated, Endangered, Threatened or Special Concern in Ontario and Canada, as determined by COSSARO and COSEWIC. SAR and any activities within their critical habitat are regulated by the Province by the *Endangered Species Act* and Federally under *Species at Risk Act*.

Under the Provincial *Endangered Species Act*, if a species is listed as an Extirpated, Endangered or Threatened, Section 9 of the *Act* prohibits killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, leasing, trading or offering to buy, sell, lease or trade a member of the species. Some of these prohibitions also apply to body parts of a member of the species and to things derived from a member of the species. Similarly, if a species is listed on the *Endangered Species Act* as Endangered or Threatened, Section 10 of the *Act* prohibits damaging or destroying the habitat of the species. This prohibition also applies to an Extirpated species if the species is prescribed by the regulations. The regulations may specifically prescribe an area as the habitat of a species but, if no habitat regulation is in force with respect to a species, habitat is defined to mean an area on which the species depends, directly or indirectly, to carry on its life processes (MNR 2012b).

Under the Federal *Species at Risk Act*, wildlife considered SAR are listed under either Schedules 1, 2 or 3. Schedule 1 species are those that have had their status reports reviewed by an official panel and are currently accepted with COSEWIC designation, granting them full protection by *Species at Risk Act*. Schedule 2 species are species that must have their status reviewed within 30 days of being posted to the schedule and Schedule 3 species are species that must have their status reviewed within one year of being posted. Under the *Species at Risk Act*, if a species is listed as an Extirpated, Endangered or Threatened, Section 32 of the *Act* prohibits killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, leasing, trading, or offering to buy, sell, lease or trade a member of the species. On private land, these prohibitions apply only to listed aquatic species and migratory birds that are also listed in the *Migratory Birds Convention Act*.

Provincially rare species are those identified as rare or historical in Ontario based on records kept by the Natural Heritage Information Centre in Peterborough, Ontario. Provincially rare species include those who are assigned S-Rank codes of S1 (extremely rare), S2 (very rare), or S3 (rare to uncommon).

The *Significant Wildlife Habitat Technical Guide* (MNR 2000) identifies habitats of species of conservation concern and Provincially rare wildlife species. This Significant Wildlife Habitat type identifies habitat of species of conservation concern not listed as Threatened, Endangered, Extirpated, or Extinct by COSSARO and thus not protected under the *Endangered Species Act*. This Significant Wildlife Habitat type also applies to the habitat of species identified as Federally Endangered or Threatened under *Species at Risk Act* which are also not protected under the *Endangered Species Act*.

The historical information review indicates that 25 SAR or Provincially rare species may occur in the NLSA. The MNR district office in Fort Frances, Ontario have indicated that six additional SAR may occur in the NLSA including: American Badger, Least Bittern, Black Tern, Yellow Rail, Eastern Meadowlark and Monarch Butterfly.

An assessment of the probability of encountering those SAR and Provincially rare species identified during the historical information review within the NLSA is presented in Table 5-27.

Studies targeting the presence of SAR and Provincially rare species were conducted during site investigations. When possible, searches for these species were also included in standardized surveys that surveyed a broad guild of similar species.

5.10.1.6 Related Regulatory Instruments

All migratory birds listed under the *Migratory Birds Convention Act* are protected. The *Migratory Birds Convention Act* prohibits harming and/or killing these birds and/or destroying or collecting their eggs or nests, but does not protect their habitat. The *Fish and Wildlife Conservation Act*

protects several species of birds, in particular raptors and other species such as blackbirds not listed in the *Migratory Birds Convention Act*. The *Fish and Wildlife Conservation Act* protects Ontario fish and wildlife species, including game mammals, furbearing mammals, certain reptiles and amphibians, game birds and select non-migratory bird species, from hunting, trapping, illegal possession, or the collection of their eggs. The *Fish and Wildlife Conservation Act* prohibits the destruction of bear dens and/or the dens of fur bearing animals such as American Marten, Fisher, Lynx, River Otter, American Mink and Least Weasel, as well as the destruction of Beaver dams, unless a trappers license is obtained.

5.10.2 Mammals

Detailed site investigation results and figures are presented in Appendices J-2, J-3 and N. Section 5.9.2 serves to summarize those reports with respect to the main ecological components being considered in the Effects Assessment and Mitigation Plans (Section 7).

A total of 20 mammal species were observed in the NLSA between 2009 and 2012, or indirectly detected through tracks, browsing or scat evidence (Appendix J-1). Mammals recorded included game mammals (ungulates, Black Bear and Snowshoe Hare), furbearers (wolves, foxes, mustelids, Beaver and Muskrat) and bats. A number of other small mammal species are also likely to be present in the NLSA such as Coyote, Grey Fox, Raccoon and Bobcat.

5.10.2.1 Cervids (Ungulates)

Two ungulate species, White-tailed Deer and Moose were recorded in the NLSA during field investigations. No Elk were observed during RRP environmental studies. White-tailed Deer were commonly observed throughout the NLSA east of Highway 71, as were their tracks and droppings, indicating a high level of local habitat use by this species. The aerial surveys conducted in 2012 (April 5, 2012) recorded 25 deer which were scattered across a variety of habitat types. During the 2013 aerial survey (February 20, 2013), 163 deer and abundant deer tracks were recorded throughout the NLSA (Figure 3 in Appendix J-5). Aerial and incidental observations of White-tailed Deer were most frequently made in agricultural lands at the edges of hardwood forest. Deer Significant Wildlife Habitat are shown to occur across 17,751 ha in the NLSA from existing MNR mapping (MNR 2006). The results of field investigations do not confirm the presence of mammalian Significant Wildlife Habitat within the NLSA. MNR data indicates that deer wintering areas and yarding habitat is widespread between Fort Frances and Lake of the Woods and Stratum 1, rank 3 and 4 deer wintering concentration areas are found in and adjacent to the NLSA.

During the 2013 aerial survey (February 20, 2013), two Moose were sighted along the southeast boundary of the NLSA, east of the proposed mine site and south of the proposed transmission line (Figure 3 in Appendix J-5). Moose tracks were observed at a few locations in the NLSA; however, the species appears to be uncommon. Local residents also feel that Moose are uncommon but are occasionally seen in the large conifer swamps south of Dearlock on the

south side of the Pinewood River (outside of the NLSA; Appendix N). Moose have been declining in the Lake of the Woods area in Ontario and Minnesota for several decades (Murray et al. 2009). Potential late winter habitat for moose (dense, mature conifer forest; MNR 2012c) in the area consists mainly of black spruce swamp (ELC codes B127 and B128). This habitat is uncommon in the NLSA (about 0.8% of the landscape) and use of these stands by moose for winter habitats is not confirmed and as such, moose late winter cover is not considered to occur in the NLSA.

Seeps and springs may occur within forested areas at the headwaters of a stream or river system. Similarly, mineral licks occur around seepage areas. No such habitat was identified within the NLSA. Potential Moose aquatic feeding areas (wetlands with abundant aquatic vegetation) occur in beaver ponds and small lakes throughout the NLSA but no evidence of use by Moose was observed. Ungulate movement corridors connect deer wintering yards or moose aquatic feeding areas with mineral licks. Given the physical geography of the NLSA, the Pinewood River likely provides the most usable corridor for ungulate movement between wooded features.

5.10.2.2 Furbearers

Field observations and data of fur returns between 1993 and 2008 for traplines partially overlapping with the NLSA recorded 15 species of furbearing mammals (and 22 species of mammals) and these are listed in Appendix J-1.

Evidence of Beaver activity such as dams, lodges and chewed stumps were recorded throughout the NLSA. A 2012 aerial survey recorded 163 Beaver lodges at 146 wetland locations throughout, or adjacent to, the NLSA.

During the 2013 aerial surveys (February 20, 2013), one Eastern Wolf was sighted and tracks were observed in low abundance throughout the NLSA (Figure 3 in Appendix J-5). There does not appear to be any particular pattern in their distribution within the study area which may be reflective of the fact that prey (deer and hare) are abundant throughout the area and are not limiting.

Denning sites for American Mink, River Otter, Gray Wolf, Eastern Wolf, Canada Lynx, American Marten, Fisher and Black Bear occur around shorelines and within forested areas; however, none were identified within the NLSA. Similarly, wolf rendezvous sites occur in a variety of habitats such as open bog, meadow and open forest but were not identified through fieldwork within the NLSA. Four wolves were observed adjacent to Woodland 31 (Figure 5-23) in July, 2012. It is uncertain if these wolves were Grey Wolves or Eastern Wolves.

Fruit-producing shrubs including Mountain-ash, blueberries, raspberries, Beaked Hazel and Choke Cherry were identified within the NLSA. One area was identified as a candidate significant mast producing area. This site consisted of open, recently logged land which was

heavily recolonized by raspberry. At the time of recording (June 2012) raspberry bushes were full of fruit but no mammals were observed utilizing the habitat (although Black Bears were observed within 2 km of the site). Blueberry bushes bearing abundant fruit were also noted in rocky or hilly lands along the proposed transmission line; however, they did not reach densities of 50% cover and as such, were not identified as candidate mast producing areas.

American Mink tracks were noted along the banks of Marr Creek and may indicate the use of this tributary of the Pinewood River or the Pinewood River itself as a movement corridor. White-tailed Deer were regularly observed in agricultural lands in proximity to the Pinewood River from Highway 600. Although little empirical evidence was collected, it is likely that the Pinewood River represents the most important passage for animal movement in proximity to the planned mine site. No evidence of other animal corridor features was collected.

5.10.2.3 Bats

In 2012 bat detectors recorded 739 bat passes over 290 total recording hours. Analysis of resulting spectrograms revealed the confirmed presence of five bat species including Red Bat, Hoary Bat, Silver-haired Bat, Little Brown Myotis and Northern Myotis. Big Brown Bat may also be present. Silver-haired Bat was recorded most frequently (142 passes) followed by Little Brown Myotis (137 passes). Northern Myotis was the least recorded species (2 passes) and was identified at only a single station. Bat detector 3 was positioned in Woodland 80 and recorded the highest volume of calls (4.82 passes per recorded hour). No bat hibernacula or bat maternity colonies were found during field investigations. No cliffs or karst features in which caves may be present, are known within or in proximity to the NLSA.

Little Brown Myotis and Northern Myotis are listed Provincially as Endangered under the *Endangered Species Act*. Little Brown Myotis has historically been the most common Ontario bat species (Gerson 1984). This species was identified at all five detector locations within the NLSA. Critical habitats for this species include winter hibernacula and summer maternity roosts (MNR 2012c). During the summer, reproductive females require forest habitat that supports a healthy density of large-diameter cavity trees to use as maternity roosting sites. Females will use multiple roosts and a single roost may support tens to hundreds of individuals. Maternity roosts are generally large cavities that provide a warm, humid microclimate which optimizes gestation and postnatal growth of offspring (Kunz and Anthony 1982). No maternity roosts were observed in the study area, although forested areas comprised of large diameter Trembling Aspen may provide suitable maternity roost habitat by way of woodpecker holes in old trees suffering from heart-rot (Parsons et al. 2003; Psyllakis and Brigham 2006).

Northern Myotis was recorded at two locations within the NLSA. In Ontario, this species requires similar critical habitat features as the Little Brown Myotis. Densely forested habitats with a higher degree of canopy cover are preferred for roosting sites (Owen et al. 2002). Forest habitat with a high density of snags appears to be preferred and roosts are more often found in tress of

mid-decay stages (Owen et al. 2002; Broders and Forbes 2004). Females rarely select conifer tree species as roost sites (Broders and Forbes 2004).

In August and September, both Little Brown Myotis and Northern Myotis congregate at the entrance of caves which are used as hibernacula during the winter. Suitable hibernacula maintain winter temperatures between above freezing, have little air circulation, and remain humid (Humphrey and Cope 1976). No cliffs or karst features in which caves may be present, are known within or in proximity to the NLSA. Searches of land features potentially providing hibernaculum habitat for bats confirmed that none of these sites are suitable hibernacula (Appendix K-5). Therefore, the RRP footprint and adjacent areas do not contain bat hibernacula.

A total of 16 candidate maternity roost trees were identified within the 7 forest stands that overlapped the RRP footprint (Appendix K-5). Most of those trees identifiable to species (14 / 15) were Trembling Aspen. The density of candidate roost trees calculated for each stand ranged from 0 trees per hectare to 6.7 trees per hectare with an average ± SD of 3.6 ± 2.6 trees per hectare. MNR (2011c) specifies 10 trees per hectare as the minimum density of candidate roost trees required for identifying candidate bat maternity roosting habitat. As the sampled areas within the project had densities below 10 cavity trees per hectare, the RRP footprint and adjacent areas do not contain significant maternity roosting habitat for bats, particularly for species of the genus Myotis and Perimyotis.

5.10.2.4 Species at Risk or Provincially Rare Mammals

Two mammalian SAR (Little Brown Myotis and Northern Myotis) were observed during the 2012 field investigations. Critical habitat features for these species were not observed. No Provincially rare mammalian species were recorded during the 2010 to 2012 baseline surveys but 1993 to 2008 trapping data for traplines partially overlapping with the NLSA cited two records of Grey Fox. No evidence of American Badger or Franklin's Ground Squirrel were recorded in the NLSA.

5.10.3 Birds

Between 2009 and 2012, 167 bird species were observed during RRP environmental studies. The RRP NLSA encompasses a wide variety of habitats including coniferous forest, mixed forest, deciduous forest, thicket, swamp, bog and marsh and open country which provides suitable breeding and foraging habitat for many species as well as a variety of stopover habitats for migrating species.

During the Aboriginal review of the draft EA Report (Version 1) and through TK / TLU studies, comments were received regarding the relationship of the RRP area to the Mississippi Flyway for migratory birds. Lake of the Woods and Rainy Lake are areas that provide migratory stop-over habitat sites. The Mississippi Flyway passes over the NRSA, but results from the KCB migration surveys (2010) indicated that the RRP site area is not considered an important migratory stopover location as very low numbers of migrating waterfowl, raptors, shorebirds and

songbirds were recorded. KCB and AMEC ground surveys did not locate significant migratory stopover habitat for waterfowl, raptors, shorebirds and songbirds within the RRP footprint. It should also be noted that there are no tall stacks proposed for the RRP.

The majority of bird species observed in the NLSA have an Ontario S Rank (Table 5-27) of S5B or S4B which signifies the species' population status in the Province is either secure or apparently secure, respectively. Nine species recorded with S Ranks of S2B or S3B were observed during migration and were not thought to have used the NLSA for breeding. Details of these species are elaborated where applicable in the following sections.

The results of field investigations indicated that seven avian Significant Wildlife Habitat types occurred within the NLSA including:

- Bald Eagle nesting, foraging and perching habitat;
- Woodland raptor nesting habitat;
- Marsh bird nesting habitat;
- Woodland area-sensitive breeding bird habitat;
- Sharp-tailed grouse leks;
- Shrub / early succession bird habitat; and
- Habitat for species of Special Concern.

5.10.3.1 Breeding Birds

The RRP is found in a region of high breeding bird diversity which was reflected in the results of breeding bird surveys between 2009 and 2012. A total of 167 bird species were recorded in the NLSA and 152 of these species are thought to breed in the NLSA based on cumulative data from RRP-related studies.

Migratory Breeding Birds

Breeding bird studies have shown that 81% of breeding birds observed are migratory species protected under the *Migratory Birds Convention Act*. Across all breeding bird points count surveys conducted between 2009 and 2012, migratory birds are the most common species in the NLSA. White-throated Sparrow, Veery, Ovenbird, Red-eyed Vireo, American Robin, Nashville Warbler and Common Yellowthroat were the most commonly observed breeding species when averaged across all point count surveys. With the exception of Nashville Warbler, these species are consistent with the highest probability of observation in the Southern Shield region as reported in the OBBA (2001).

Area Sensitive Woodland Birds

Breeding bird surveys recorded 36 woodland area sensitive woodland breeding bird species across the NLSA. Woodland area-sensitive bird species were recorded in a total of 34 woodland

features. Veery was the most abundant woodland area-sensitive bird species, occurring in 26 woodland features while Ovenbird and Hermit Thrush occurred in 23 and 22 woodland features, respectively. The MNR (2000) provides a minimum area requirement for area sensitive species. Although this minimum area is not strict, it provides guidance to the degree of sensitivity exhibited by these species. Barred Owl, Black-and-white Warbler, Blue-headed Vireo, Broad-winged Hawk, Black-throated Blue Warbler, Eastern Whip-poor-will, Hermit Thrush, Northern Parula, Red-shouldered Hawk are the most sensitive species recorded in woodland features of the NLSA. While Hermit Thrust and Black-and-white Warbler were widespread throughout the NLSA, the other listed species were each observed in five or less woodland features. Woodlands 33, 121, 173, 156, and 31 were occupied by the greatest diversity of area sensitive species. These woodlands were also among the largest occurring in the NLSA.

Waterfowl and Wetland Birds

Marsh land is widespread throughout the RRP NLSA although few marshes are found within the RRP footprint. A total of 426 wetland features are found in the NLSA. RRP studies recorded 11 waterfowl species and aerial surveys confirmed four Trumpeter Swan nesting locations (Figures 3a and 3b in Appendix J-4). OBBA (2001) indicates that a small Trumpeter Swan breeding population exists in the Rainy River area and it is one of only four breeding populations in Ontario for this species.

Other marsh birds observed during marsh monitoring program surveys, breeding bird points and nocturnal surveys included American Bittern, Green Heron, Pied-billed Grebe, Sandhill Crane, Virginia Rail, Sora, Marsh Wren and Sedge Wren. American Bittern and Sandhill Crane were observed widely throughout the NLSA. Despite a strong diversity of marshland species across the NLSA, no marsh habitat was inhabited by five or more listed species. No significant marsh breeding bird habitat was recorded in the NLSA. Least Bittern surveys conducted in 2013 (Appendix K-4) did not record this species in the NLSA.

Four colonial ground-nesting waterbird species were recorded in the NLSA, although no suitable breeding habitat was present for any of those species. These species require small, bare, rocky islands, sometimes with sturdy dead trees, in large waterbodies. American White Pelicans were commonly observed soaring in small flocks up to 20 birds high above the NLSA. This species was rarely seen utilizing the NLSA, likely due to the lack of sizeable bodies of water therein. Small flocks of pelicans were recorded feeding on Pinewood River and in a small marshy pond north of Teeple Road. Double crested Cormorant, Herring Gull, Ring-billed Gull were observed sporadically across the NLSA. These species are wide-ranging in their search of food and will use the area for foraging. Colonies of these species are known to occur on Lake of the Woods, Rainy Lake, Kakagi Lake and other large lakes in the Rainy River District (outside the NLSA).

One Forster's Tern was observed in 2009. This species breeds in the marshy borders of lakes, islands, or streams and more often utilizes open, deeper portions of larger (>20 ha) wetlands

with considerable open water and large stands of island-like vegetation and/or large mats of floating vegetation (McNicholl et al. 2001). This species is unlikely to breed in the NLSA.

Brewer's Blackbird was not commonly observed in the NLSA. This species was recorded in one polygon potentially providing suitable breeding habitat, although it was not confirmed that five or more pairs were nesting in the feature. As such, no significant ground colonially-nesting breeding bird habitat was identified in the NLSA.

Great Blue Heron was recorded at nine point counts although no breeding colonies were found in the NLSA during breeding bird survey or during 2012 aerial stick nest surveys. A colony consisting of 13 nests was located approximately 20 km south of the NLSA at the southern origin of Highway 71. Prior to leaf-out, adult herons could be seen incubating eggs from the roadside. A heronry occurring approximately 3 km west of Muskrat Lake was not observed during aerial stick nest surveys.

Open Country Birds

The Rainy River District occurs at the eastern fringe of the prairie ecodistrict and thus is inhabited by bird species occurring only in select regions of Ontario. Open country habitat covers 9.7% of the NLSA and consists largely (78%) of agricultural habitat. Four meadow habitat features greater than 30 ha occurred in the NLSA.

Area-sensitive species grassland bird species were widely observed during field investigations and included Bobolink, Savannah Sparrow, LeConte's Sparrow, Northern Harrier and Short-eared Owl. Bobolink and Savannah Sparrow were most commonly observed within the NLSA, although these species were largely observed in hay fields or pastures. Bobolink is further discussed in Section 4.8.5. One Short-eared Owl was observed once in proximity to, but not within, the NLSA. Neither targeted Short-eared Owl surveys conducted in 2011, nor crepuscular bird or nocturnal owl surveys recorded this species in the NLSA. No open country breeding bird habitat could be designated significant.

Black-billed Magpies were commonly observed in agricultural lands close to anthropogenic features across the NLSA. Juvenile or post-breeding flocks upwards of 20 magpies were commonly observed west of the intersection of Highway 600 and Tait Road.

Prairie or western bird species encountered during environmental inventories included the Prairie Sharp-tailed Grouse, Le Conte's Sparrow, Brewer's Blackbird and Black-billed Magpie. Field surveys identified three Sharp-tailed Grouse leks, all of which were located within agricultural habitat (Figure 12.6 in Appendix N). A total of 44 Sharp-tailed Grouse were observed using lek sites within the NLSA and the number of displaying adults ranged from 9 to 22 birds. These leks are probably traditional locations used by grouse occupying the surrounding landscape (Sandilands 2005). Grouse hens with up to 13 chicks have been observed in the NLSA.

Shrub / Early Succession Birds

Shrub or early succession habitats covered 3.2% of the NLSA and occurred predominantly in proximity to the RRP site. Despite the presence of 74 habitat features, only 2 features were greater than 30 ha in size. Neither of these features met the criteria for significance as less than two shrub / successional species were recorded. Three significant shrub / early successional breeding bird habitat features were identified in the NLSA. Two such features were associated with Woodland 121, while the third feature hosting Golden-winged Warblers occurred adjacent to Woodland 65 (Figure 5-23). Golden-winged Warbler was widely observed during 2011 and 2012 across the NLSA. Brown Thrasher, an uncommon species in northwestern Ontario, was observed in 18 locations. Clay-coloured Sparrow was a relatively common species throughout the NLSA wherever open country with overgrown fencerows or young regenerating fields were found.

Aerial Insectivores

Breeding bird point surveys recorded the presence of 10 aerial insectivores including swallows, flycatchers and nightjars.

Five swallow species (Barn Swallow, Northern Rough-winged Swallow, Bank Swallow, Cliff Swallow and Tree Swallow) were recorded, although no Significant Wildlife Habitat in the form of Bank or Cliff Swallow colonies were recorded. Barn Swallow is a SAR and is addressed further in Section 5.10.6.2.

Flycatcher species recorded including Alder Flycatcher, Least Flycatcher, Olive-sided Flycatcher and Eastern Wood-pewee. Olive-sided Flycatcher is a SAR and is addressed further in Section 5.10.6.2. The Eastern Wood-Pewee has been assessed by COSEWIC as Special Concern and it is currently under consideration for listing under *SARA*, and is addressed further in Section 5.10.6.3.

Targeted whip-poor-will surveys recorded the presence of Common Nighthawk and Eastern Whip-poor-will. Both of these nightjar species are SAR and are addressed further in Section 5.9.5.

5.10.3.2 Raptors

Wildlife studies from 2009 to 2012 have recorded nine diurnal raptor species in the NLSA, eight of which are known or suspected to breed in therein.

An American Kestrel cavity nest was observed along Korpi Road in 2011 and seven Bald Eagle nests were observed during aerial surveys.

The proposed transmission lines will cross an undulating landscape of bedrock outcrops, mixed or coniferous forest, marshes and near small lakes. Aerial surveys recorded six Bald Eagle nests in this area, two of which were active with an adult sitting on the nest (Figures 3a and 3b in Appendix J-4). Incidental observations confirmed active nesting at a third site along the existing Highway 600 east of Blackhawk (Figure 10 in Appendix J-3). Monitoring of the Highway 600 nest recorded adults tending to the nest and the presence of at least one fledgling exercising its wings. Bald Eagles were observed at a total of 23 recorded locations between 2009 and 2013.

No Osprey were observed in the NLSA during breeding bird surveys, nor were any Osprey nests observed within or in proximity to the NLSA.

A total of seven owl species were recorded in the NLSA. Owl species recorded during standardized owl surveys included Northern Saw-whet Owl, Great Horned Owl, Great Gray Owl and Barred Owl. Incidental owl species observed included Long-eared Owl, Short-eared Owl and Northern Hawk Owl. One active Great Horned Owl nest was observed during 2012 aerial surveys (Figure 3a in Appendix J-4).

Common Raven was commonly observed throughout the NLSA during RRP wildlife surveys. Although not a raptor, this species is included as a listed species with regards to Woodland Raptor nesting habitat. Three active Common Raven nests were observed during 2012 aerial surveys (Figures 3a and 3b in Appendix J-4).

5.10.3.3 Species at Risk and Provincially Rare Birds

Thirteen avian SAR and five Provincially rare bird species were observed in the NLSA. Of these 18 species, 9 avian SAR (Eastern Whip-poor-will, Bobolink, Barn Swallow, Canada Warbler, Red-headed Woodpecker, Common Nighthawk, Olive-sided Flycatcher, Golden-winged Warbler and Bald Eagle) and two Provincially rare bird species (Black-billed Magpie and Redhead) are expected to breed in the NLSA. These species are discussed further in Section 5.10.6.

5.10.3.4 Migratory Bird Passage

The NLSA lacks landforms likely to concentrate migrants such as north-south trending ridges, river valleys, shorelines of large lakes, or isolated patches of forest in a non-forested landscape. No definitive summary of bird migration in the NLSA can be made with the existing data.

Field and open habitats cover 9.7% of the NLSA, although all open areas are cultural in origin and have been used for agriculture in the past five years. Significant terrestrial waterfowl stopover and staging areas require habitat use of natural staging habitat by 100 or more individuals of listed species (MNR 2012c). Canada Goose, Mallard, Wood Duck and Trumpeter Swan were the only confirmed waterfowl species observed during migration studies. Listed species Mallard and Wood Duck accounted for single sighted individuals during the course of

these studies. Flocks of up to 200 Canada Geese were observed landing in agricultural fields within the NLSA.

The NLSA is located inland from major waterbodies such as the Great Lakes and James Bay. Ponds, marshes and small lakes are present, although few aquatic habitat features capable of supporting >700 waterfowl use days are present in the NLSA. None occur within the proposed footprint of the RRP. Elsewhere in the Rainy River District, large numbers of staging waterfowl concentrate at the mouth of the Rainy River at Lake of the Woods and in the channel east of the Sable Islands. Shorebirds stage at sewage lagoons and on Sable Island shorelines (Harris et al. 2002b). This was also noted through personal communications in the KCB Baseline report (Appendix N). In a regional or Provincial context, the NLSA is probably no more significant than other parts of the ecoregion as a staging area for landbirds, shorebirds, or waterfowl (MNR 2000).

Six shorebird species including Killdeer, American Golden Plover, Whimbrel, Greater Yellowlegs, Wilson's Snipe and American Woodcock were observed in the NLSA.

5.10.4 Reptiles and Amphibians

A total of eight frog species were observed in the NLSA between 2009 and 2012 (Appendix J-1). These species include early breeders such as Spring Peeper, Wood Frog, Northern Leopard Frog and Boreal Chorus Frog. Lake spring breeders include American Toad and Tetraploid Gray Treefrog. Summer breeders include Mink Frog and Green Frog.

Ecosite data indicated that suitable amphibian woodland and wetland breeding habitat was largely associated with large woodlands within the NLSA. Woodlands 2, 31, 33, 155 and 158 were expected to provide large tracts of amphibian breeding habitat although call count data near these woodlands did not support this prediction. Call count data indicated that wetland habitat within Woodland 156, associated with Little Pine Lake, may provide high quality amphibian breeding habitat. Two other wetland areas, one along Marr Road and one south of Highway 600 east of Dearlock, may provide higher quality wetlands breeding habitat. These wetland features contained areas of open water or permanently submerged marshland. Call count data indicated that Muskrat Lake and associated Woodland 156 may provide a moderate quality wetland breeding habitat despite the large area of this feature. No amphibian movement corridors were established.

Three reptile species were observed in the NLSA between 2009 and 2012 (Appendix J-1) including the Western Painted Turtle, Snapping Turtle and Eastern Gartersnake. Few snake observations were recorded during field studies and no hibernacula features were found in the NLSA.

Observations of Western Painted Turtles near Muskrat Lake and Little Pine Lake indicate that these small lakes provide locally important habitat for this species. The observation of two

painted turtles along a logging road north of the Little Pine Lake during June may indicate that turtles using this lake as overwintering habitat migrate north to suitable breeding habitat. One turtle observed north of Little Pine Lake was greater than 400 m from any wetland features.

Two adult Snapping Turtles (listed Provincially as Special Concern) were observed within the NLSA in 2010, one in the Pinewood River just north of Tait Road, near Black Hawk Road and the second was found crossing Roan Road near the West Creek crossing. No evidence of nesting was observed. Snapping turtles are discussed further in Section 5.10.6.3.

5.10.5 Invertebrates

A total of 21 species of dragonfly and damselfly were observed in the NLSA between 2009 and 2012 (Appendix J-1). The list is dominated by species preferring wetlands, ponds and slow moving streams; whereas species requiring fast rocky streams and those associated with large lakes and rivers are lacking. Three Provincially rare dragonfly species were observed in the NLSA including Horned Clubtail (ranked S3), Arrowhead Spiketail (ranked S1) and Lilypad Clubtail (ranked S3). Two other dragonfly species were identified during the background information review as potentially occurring within or near to the NLSA including Green-faced Clubtail (ranked S1) and Midland Clubtail (ranked S3).

A total of 26 butterfly species were observed in the NLSA by AMEC in 2011 and 2012 (Appendix J-1). In June, butterflies are abundant across the NLSA, particularly Great Spangled and Meadow Fritillaries, Mourning Cloaks and Eyed Browns. During the summer of 2012, Red Admirals were particularly abundant which mirrored the banner year for this species across Canada. Neither Monarch Butterfly nor the host plant for Monarch larvae (Milkweed) were recorded in the NLSA.

Midland Clubtail is usually found along rivers with moderate to fast flow, but also lakes with plenty of wave action (Jones et al. 2008). Green-faced Clubtail occurs in clear rocky rivers and streams. It is known to occur on several sections of the Rainy River (Jones et al. 2008). These species were not recorded during field surveys conducted between 2009 and 2012. This habitat is not present within the NLSA.

Variegated Meadowhawk is found in a variety of wetlands but is most often found associated with relatively shallow water, often with a sandy bottom (Jones et al. 2008). This species was not recorded during field surveys conducted between 2009 and 2012. While wetlands are prevalent in the NLSA, sandy soils are uncommon. No significant habitat for Variegated Meadowhawk was identified within the NLSA.

5.10.6 Species at Risk and Provincially Rare Species

Field investigations completed between 2009 and 2012 yielded observations of 18 SAR and 9 Provincially rare species (KCB 2011c, Appendix K-1; AMEC 2012d, Appendix K-2; and AMEC

2012f, Appendix K-3). The *Significant Wildlife Habitat Technical Guide* (MNR 2000) identifies habitat for species of conservation concern and rare wildlife species as a Significant Wildlife Habitat feature in northern Ontario (MNR 2012c).

5.10.6.1 Endangered Species

Little Brown Myotis (Bat)

The Little Brown Myotis has experienced recent steep population declines in Ontario and across northeastern North America due to White Nose Syndrome caused by the fungus *Geomyces destructans*. It was designated as Endangered in February 2012 by COSEWIC and was subsequently listed as Endangered in October 2012 by COSSARO. This species is now protected as a SAR under the *Endangered Species Act* and is also protected under the *Fish and Wildlife Conservation Act*.

Little Brown Myotis was identified as being recorded a total of 137 times and was recorded at all five detector locations. It was the second to the Silver-haired Bat as the most abundant bat species recorded. No maternity roosts were observed in the NLSA, although forested areas comprised of large diameter Trembling Aspen may provide suitable maternity roost habitat by way of woodpecker holes in old trees suffering from heart-rot (Parsons et al. 2003; Psyllakis and Brigham 2006). No hibernacula features were observed within the NLSA.

Northern Myotis (Bat)

Northern Myotis was also listed as Endangered in February 2012 by COSEWIC. This species was listed as Endangered in October 2012 by COSSARO and is now protected as a SAR under the *Endangered Species Act*.

Northern Myotis passes were identified twice at bat detector station 5 (Figure 5-15). Recordings of Northern Myotis may have been made at all five detectors, although many calls could not be distinguished from Little Brown Myotis. As such, the abundance of this species within the NLSA is unclear. No critical habitat of this species, such as hibernacula or maternity roost features, was observed within the NLSA.

5.10.6.2 Threatened Species

Field investigations recorded five species listed as Threatened under the Provincial *Endangered Species Act*. These species included Grey Fox, Bobolink, Eastern Whip-poor-will, Barn Swallow and American White Pelican.

Grey Fox

Grey Fox is Provincially and Federally listed as a Threatened species. This species is secretive and occurs at very low densities within Ontario and little is known about the history of occurrence of this species in Ontario. Observations of this species in northwestern Ontario or southeastern Manitoba usually occur close to access points from the United States and are thought to be dispersing individuals from American populations (Naughton 2012).

Trapline fur harvest data provided by the MNR (Table 12.7 in Appendix N) indicated that two Grey Foxes had been caught near the RRP between 1993 and 2008 (one near the proposed mine rock stockpile and one along the proposed transmission line corridor). No Grey Foxes were observed during field studies in the NLSA between 2009 and 2012.

Bobolink

In Ontario, the Bobolink nests primarily in forage crops (hayfields and pastures) and old field habitat. This species does not generally occupy fields of row crops such as corn, soybean and wheat or pastures with high shrub density. The Bobolink can adapt to low or moderate livestock grazing, but not intensive grazing. The preferred habitat characteristics are often found in old (≥8 years) forage crops (COSEWIC 2010b). This type of habitat is associated with ELC codes CUM (Cultural Meadow) and agricultural lands; however, agricultural lands are considered sub-optimal habitat given that the first removal of hay occurs during the breeding season (mid-late June). Bobolink nesting success is positively correlated to larger habitat size (typically >30 ha) although this species will utilize smaller areas (10 to 30 ha).

Bobolinks were frequently observed in most hayfields scattered throughout the NLSA and were observed in 41.2% of the breeding bird point counts in 2011 (eleventh most numerous bird species observed during that year).

Eastern Whip-poor-will

This species avoids both wide-open spaces and dense forest. Common habitat choices include rock or sand barrens with scattered trees, savannahs, old burns or other disturbed sites in a state of early to mid-forest succession, or open conifer plantations. Accordingly, pine (barrens and plantations), oak (barrens and savannahs) and aspen and birch (early to mid-succession) are common tree species associations (COSEWIC 2009a).

The northern and northeastern portions of the NLSA, including the proposed transmission line corridor include large areas of suitable Eastern Whip-poor-will nesting habitat which consists of aspen and birch (early to mid-succession) and open forests with exposed bedrock adjacent to open lands such as thicket swamps, meadow marshes, regenerating cutovers, pastures and hayfields. Whip-poor-wills prefer open woodlands with little understory as they nest on the ground and hunt flying insects from unobstructed perches (Wilson 1985; COSEWIC 2009a).

Whip-poor-will surveys conducted by KCB and AMEC between 2010 and 2012 have recorded a total of 51 observations. Whip-poor-will surveys conducted in 2013 targeted potential compensatory lands surrounding the Project footprint and to the west near Lake of the Woods (Appendix K-4). Within the NLSA, 58 whip-poor-wills were recorded during the May survey period, while 45 were recorded during the June survey period.

Barn Swallow

Before European colonization, Barn Swallows nested mostly in caves, holes, crevices and ledges in cliff faces. Following European settlement, they shifted largely to nesting in and on artificial structures, including barns and other outbuildings, garages, houses, bridges and road culverts. Barn Swallows prefer various types of open habitat for foraging, including grassy fields, pastures, various kinds of agricultural crops, lake and river shorelines, cleared right of ways (ROWs), cottage areas and farmyards, islands, wetlands and subarctic tundra (COSEWIC 2011a).

Although Barn Swallow foraging areas such as wetlands, open water, riparian habitats and grasslands were abundant in the NLSA, appropriate nesting sites appear to represent the critical component of significant barn swallow habitat. Suitable Barn Swallow nesting structures such as barns, rural homes and sheds are present in the NLSA. In 2013, 35 to 40 active Barn Swallow nests were observed in 15 buildings on 9 properties within the NLSA (Appendix K-4).

American White Pelican

The status of the American White Pelican was reassessed by COSSARO in 2009. The Provincial designation was downgraded from Endangered to Threatened although it is still protected under the *Endangered Species Act*. This species does not have a Federal designation.

Although small flocks of American White Pelicans were occasionally observed flying across the study area, few were observed using waterbodies within the NLSA during 2011. Flocks of 4 to 20 pelicans have been observed on the Pinewood River, West Creek, Pinewood Lake, and a small marsh near the local landfill.

The closest known pelican colony to the NLSA exists on The Lake of the Woods Sand Spit Archipelago Important Bird Area and the Three Sisters Islands Important Bird Area (approximately 45 km and 55 km west of the NLSA, respectively). In 2004, this colony totalled 7,432 breeding pairs (IBAC 2012). Pelicans observed flying over the NLSA are expected to be flying to and from this colony (adult pelicans are known to travel up to 100 km from their nest site to forage; Cadman et al. 2007).

5.10.6.3 Special Concern Species

Field investigations recorded 10 species of Special Concern in Ontario. When possible, species specific habitat polygons were delineated for each species observed with the help of ecosites data provided by the MNR. The area of the habitat to the finest ecosites scale that protects the habitat form and function for species of Special Concern is considered Significant Wildlife Habitat (MNR 2012c).

Bald Eagle

The Bald Eagle is listed as a Species of Special Concern in northern Ontario but does not have a Federal designation. Eagles are commonly seen in the NLSA and were reported at 23 locations. During the 2012 aerial stick nests surveys, Bald Eagles accounted for 78% (14 of 18) of all raptor observations.

Aerial surveys conducted in 2012 recorded nine Bald Eagle nests in proximity to the NLSA, one of which occurred within the NLSA. During the 2012 aerial survey, three active nests were observed, while one of these nests was determined also recorded during the breeding bird point count surveys. This latter nest was located in a large Trembling Aspen at the corner of a woodlot north of Hwy 600, east of Blackhawk (Figure 10 in Appendix J-3). This nest was active in 2010, although no activity was observed in 2011. The nest was monitored periodically between June 18 and 22 and July 4 and 7, 2012. The Bald Eagle nest monitoring occurred from the roadside as not to disturb the nest and was conducted with the aid of binoculars and/or a spotting scope. Monitoring revealed that the nest was indeed occupied by a breeding pair of Bald Eagles and that at least one offspring was present. It is not known whether the juvenile(s) fledged successfully.

Bald Eagles are known to show strong fidelity to nesting sites and will re-use nest sites year after year. This species is also wide-ranging and on a daily basis will travel great distances from their nests to hunt. Bald Eagles feed primarily on fish and thus usually require large open waterbodies to hunt. A few open waterbodies occur within the NLSA, although none are large. Muskrat Lake may represent the best fishing location for Bald Eagles. Eagles will also take advantage of carrion and are often attracted to landfills, one of which occurs within the NLSA.

An active Bald Eagle nest and surrounding lands within a 400 to 800 m radius around the nest are considered significant Bald Eagle nesting, foraging and perching habitat (MNR 2012c).

Golden-winged Warbler

The Golden-winged Warbler is listed as a species of Special Concern in Ontario and is Federally listed as a Threatened species. The majority of Ontario Golden-winged Warblers occur in southern Ontario or along the Canadian Shield, although a small geographically separated population exists in the Rainy River District (Cadman et al. 2007).

A total of 25 Golden-winged Warblers were observed between 2011 and 2013 although no Golden-winged Warblers were observed during 2010 studies. This species was most often observed in disturbed areas such as regenerating forest or thicketed areas, and edge habitat along deciduous or mixed forests and rocky, open woodlands. Golden-winged Warblers were observed in Woodlands 31, 33, 48, 65, 83 and 121 (Figure 5-23) as well as thicket habitat associated with Woodland 65. It is apparent that this species prefers large tracts of regenerating forest or forest habitat that contains shrubby openings or shrub borders.

Common Nighthawk

Common Nighthawk is Federally listed under SARA as Threatened and Provincially listed under the *Endangered Species Act* as a species of Special Concern. Common Nighthawks were observed displaying over five woodland features (33, 121, 143, 156 and 152; Figure 5-23) as well as an open country feature. This species was most commonly observed north of Highway 600 and along the proposed RRP transmission line where forest is interspersed with open woodland or barren features which likely provide copious nesting habitat for this ground nesting species.

Olive-sided Flycatcher

The Olive-sided Flycatcher is listed as a Species of Special Concern in Ontario and is listed Federally as a Threatened species. It is a widespread species in northern Ontario and prefers areas of regeneration where it uses snags or taller vegetation as perches to hunt from.

Between 2009 and 2012, Olive-sided Flycatchers were observed at seven locations within the NLSA. Sightings of this species were well spaced across the NLSA and they were observed in a variety of habitats including a regenerating clear cut and riparian habitat bordering agricultural land.

Canada Warbler

The Canada Warbler is Federally listed as Threatened and listed of Special Concern in Ontario. As such, this species is not protected under the *Endangered Species Act*. A total of three Canada Warblers were observed at three locations across the NLSA.

A variety of forest types is used by this species including wet mixed deciduous-coniferous forest with a well-developed shrub layer, shrub marshes, ravines and steep brushy slopes and in upland forests with canopy gaps that promote a well-developed shrub layer (Conway 1999; Lambert and Faccio 2005). Moist mixed forests and slopes representing suitable Canada Warbler habitat are rare in the NLSA and likely inhibit this species from occurring in greater numbers.

Red-headed Woodpecker

The Red-headed Woodpecker is listed both Provincially and Federally as a species of Special Concern. A small, restricted population of Red-headed Woodpeckers is known to occur within the western portion of the Rainy River District. In 2011, a single Red-headed Woodpecker was observed flying north across Blackhawk Road, east of Heatwole. There was no indication that this individual was a resident to the area but given the prevalence of mixed-hardwood forest within the NLSA and surrounding areas, it is possible.

Peregrine Falcon

The Peregrine Falcon is listed both Provincially and Federally as a species of Special Concern. A single adult Peregrine Falcon was observed on May 4, 2010 in the NLSA and another single adult was observed during migration monitoring on October 2, 2010. Peregrine Falcons nest on cliff sites and tall manmade structures such as bridges. Based on the lack of suitable nesting sites in or near the NLSA and the timing of these observations, it is assumed that these were migrating birds moving to and from arctic breeding grounds, rather than locally nesting birds.

Short-eared Owl

This species was observed once within the NLSA flying over Teeple Field south of the Pinewood River. Subsequent Short-eared owl surveys in 2010 and 2011 failed to detect this species. No native grassland or old field habitat five years removed from agricultural activities occurred in the NLSA and as a result, no open country breeding bird habitat could be designated significant.

Rusty Blackbird

Rusty Blackbird is federally listed as Special Concern under SARA. A total of three Rusty Blackbirds were observed during migration surveys in October of 2010. Given the lack of observations of this species during breeding bird surveys across four years, this species is not expected to breed in the NLSA.

Eastern Wood-Pewee

In November 2012 the Eastern Wood-pewee was designated as Special Concern by COSEWIC and is currently under consideration for listing under SARA. This species and its nests are currently afforded protection under the *Migratory Birds Convention Act*. Fourteen Eastern Wood-pewees have been recorded at 14 point count locations within the NLSA.

In Ontario, Eastern Wood-pewee largely inhabits deciduous or mixed forests. This species is not area sensitive and will inhabit both small woodlots and large undisturbed forests. Nests are positioned near forest edges, clearings or water. This species is not known to be sensitive to

fragmentation, though no studies have compared reproductive success to habitat size (Blake and Karr 1987; Robbins et al. 1989; Freemark and Collins 1992).

The OBBA (Cadman et al. 2007) indicates that the Eastern Wood-pewee abundance is low across the Boreal Hardwood Transition Zone, yet small pockets of increased abundance are present in the Rainy River District and near Dryden. In Ontario, this species is most common south of the Canadian Shield. Results of baseline breeding bird surveys indicate that this species is regularly occurring, yet uncommon in deciduous forests in the NLSA.

Vegetation clearing for RRP activities will remove approximately 1,140 ha of deciduous habitat that may provide suitable habitat for Eastern Wood-pewee. Woodlands 33 and 121 both account for 35.7% of Eastern Wood-pewee observations while observations have also been made in Woodlands 31, 38 and 80. Based on baseline study results, partial or complete removal of Woodlands 31, 33, 38 80 and 121 will likely displace at least five pairs.

Collisions of birds with vehicles and human-built structures represent one of the largest sources of human caused mortality of songbirds. Increased vehicular traffic within the NLSA may cause an increase in collisions with songbirds.

Snapping Turtle

Snapping Turtles are listed as species of Special Concern both Provincially and Federally. Two adult Snapping Turtles were observed within the NLSA in 2010, one in the Pinewood River just north of Tait Road near Black Hawk Road and the second was found crossing Roan Road near the West Creek crossing. No evidence of nesting was observed within the NLSA though it is assumed that this species does nest in the NLSA due to the two observations in 2010.

5.10.6.4 Provincially Rare Species

A total of nine Provincially rare species were observed in the NLSA. Only three of these species (Black-billed Magpie, Lilypad Clubtail and Horned Clubtail) are expected to breed regularly in the NLSA.

Black-billed Magpie

Black-billed Magpies (S3?; Figure 5-27) are a common nesting species in the NLSA and are generally observed in proximity to farmhouses. An unused nest was observed in the front yard of a property on Roen Road. Juvenile or post-breeding flocks as large as 20 birds were observed regularly on particular properties within the NLSA. The Ontario breeding range of Black-billed Magpie is restricted to the Rainy River and Kenora Districts. The OBBA (2001) indicates that the breeding population of Ontario magpies is increasing and is now estimated to be between 200 to 250 pairs.

Redhead

Redhead (S2B) was observed during marsh bird surveys in 2010. Breeding of this species on site was not confirmed. A rare breeder in northern Ontario, Redhead has bred in the Rainy River District (Cadman et al. 2007).

Forster's Tern

A single adult Forster's Tern (S2B) was observed in the NLSA in June 2009. Although this species was observed in marsh habitat, although no further nesting evidence was observed. This species breeds marshy borders of lakes, islands, or streams and more often utilizes open, deeper portions of larger (>20 ha) wetlands with considerable open water and large stands of island-like vegetation and/or large mats of floating vegetation (McNicholl et al. 2001). Forster's Tern was not identified in the historical information review and is not reported to breed in proximity to the NLSA (Cadman et al. 2007). This species is unlikely to breed in the NLSA.

American Golden Plover

One American Golden Plover (S2B, S3N) was observed in June 2011 in a cow pasture north of Korpi Road. This shorebird species nests on relic marine beach ridges vegetated with lichens, mosses and heath near the Hudson's Bay coast (Cadman et al. 2007). The individual observed is expected to be a late migrant as no suitable breeding habitat occurs in the NLSA.

Whimbrel

One Whimbrel (S3B, S4N) was observed by KCB during migration. This species nests in a variety of wetland habitats in proximity to the Hudson's Bay coast and is not expected to breed in the NLSA.

Lapland Longspur

Lapland Longspur (S3B) was observed during migratory bird monitoring in October of 2010. In Ontario, longspurs breed on marine beaches and well-vegetated meadows of the Hudson's Bay coast. While this species can be expected during migration, it is not expected to breed in the NLSA.

Lilypad Clubtail

Two individuals of Lilypad Clubtail (S3) were observed in 2012, north of Boundary Lake within rocky mixed forest along the proposed transmission line corridor. This species is associated with marshy ponds, lakes and sluggish streams with mucky bottoms and lots of floating vegetation (Jones et al. 2008). Based on aerial photographic interpretation, there appears to be

a mat of floating vegetation along the south western short of Boundary Lake which may provide suitable habitat.

Horned Clubtail

Horned Clubtail (S3) was observed in 2010 and considered to be fairly common on the Pinewood River in the NLSA and generally on streams and lakes in the Rainy River and Lake of the Woods areas. This species is associated with ponds, small marshy lakes and sluggish streams with mucky bottoms and often floating plants such as water lilies (Jones et al. 2008).

Arrowhead Spiketail

A single Arrowhead Spiketail (S1) was collected in 2010 on the Pinewood River in the NLSA. As noted through personal communications conducted by KCB with odonate experts, this species is known from only one other record in the Rainy River area (Appendix N). This species is typically found along small and shallow, seepage-fed forest streams that are at least partially shaded (Jones et al. 2008).

5.11 Aboriginal Group Profiles

This section provides contextual and historical information on Aboriginal groups that were identified as potentially affected and interested Aboriginal groups (Table 2-2). Aboriginal groups identified in the RRP region include both First Nation and Métis. This analysis relied on desk-based research from a variety of primary and secondary sources to provide information on Aboriginal and treaty rights as well as Aboriginal land and resource uses that may be within the RRP region. The results of the research found limited information specific to the RRP area. The primary sources used in preparation include:

- Discussions with Elders, First Nation leaders and other community members;
- Websites of the individual Aboriginal groups;
- Aboriginal and Northern Development Canada (AANDC) First Nations profiles; and
- Ethnographic accounts of Aboriginal people at the time of contact and through to the historic period.

All of the First Nations identified in Table 2-2 are Ojibway (Anishinabe, Anishinaabe, Ojibwa, Ojibwe, Chippewa) people who are related culturally and linguistically to one another. Historically, the Ojibway nation inhabited a large territorial range across the sub-arctic region of southern Canada and the northern United States. Resources were variable across this large region and subsistence patterns were adjusted locally by each band to take advantage of those most abundant and reliable resources. The individual Ojibway bands were autonomous within

their resource base but connected by a clan network and familial relationships to one another. All of the First Nations recommended for consultation or notification by the Provincial or Federal government are signatories to Treaty No. 3.

The Métis Nation of Ontario (MNO) represents the collective aspirations, rights and interests of Métis people and communities throughout Ontario, including the RRP area. The MNO is locally represented by the Region 1 Consultation Committee who work in collaboration with MNO staff. The Region 1 Consultation Committee is representative of the Treaty No. 3 / Lake of the Woods / Lac Seul / Rainy River / Rainy Lake traditional territories and is comprised of members of the Sunset Country, Atikokan, Northwest and Kenora Métis Councils.

The sources used in this analysis are frequently historical and are not considered exhaustive. Some of the sources used provide information from an external perspective by non-Aboriginal people and may reflect a bias. Ethnographic materials reflect conditions at a particular point in time and have limited range with respect to past or future cultural practices.

Aboriginal signatories to treaties hold rights within the defined treaty area collectively and may exercise these rights throughout thus reducing the need to define and maintain traditional territories. Communities may retain knowledge about their traditional territories and have agreements about resource use within these areas but they are not made available to the public.

5.11.1 Pre-European Contact Historical Context

5.11.1.1 Overview

Early contact between the Ojibway and non-Aboriginals is generally considered to have occurred in the late 1600s in the Rainy Lake region (Nute 1969). More extensive exploration by Europeans dates to the 1730s, when Pierre Gautier Sieur de la Verendrye began exploring in search of the Northwest Passage and established fur trading posts between Rainy Lake and Lake of the Woods.

The mixed forest and abundant lakes and streams in the Rainy River area provided excellent fishing opportunities, as well as abundant plant gathering for the Ojibway. As with more recent times, subsistence was largely dependent on the vast navigable river and lake systems which not only provided food resources, but supported an organized method of travel and communication. The bands that inhabited this area were seasonally mobile but showed sedentism, agricultural specialization, and some long distance trade. During the Woodland period (600 BC to 1600 AD), burial ceremonies became more elaborate and burial mounds were constructed. These mounds demonstrate evidence of external cultural influences (Hopewell culture from the Ohio River Valley), trade relations and increasing complexity in village life (Wright 1994). Archaeological evidence from sites of the latter part of the Woodland period demonstrate evidence that pre-contact people were hunting a range of animals including

moose, deer, bear and beaver, as well as fishing with nets and harpoons (McMillan and Yellowhorn 2004).

5.11.1.2 Seasonal Camps

The Ojibway relied largely on seasonal staples such as wild rice and maple sugar. Fishing, hunting, trapping and gardening complemented wild plant gathering, where the climate allowed. The Ojibway moved regularly to seasonal camps near the resources they were harvesting. While the Ojibway did rely on seasonal food sources, they also harvested and stored animal and plant resources. They developed refined methods for food preservation and stored a portion of seasonal harvests including fish, game, crops, and other plants (Landes 1971, 1937). This strategy helped them survive through the winter months and times of scarcity.

In the spring, bands travelled to the sugar camps (Landes 1938, 1968). Men also fished with lines and hooks, and the fish were smoke dried. Once the food supplies were replenished, the bands moved to the summer garden camps located on the lakeshores or other water sources. Lodges were refurbished and gardens were worked. Waterfowl were also taken during the spring.

In the summer, families returned from the seasonal camps to rejoin others at their major fishing sites. During the summer pickerel, pike and suckers were available, while whitefish, trout and sturgeon came into shores in the late summer. The Ojibway netted or speared large quantities of fish and the abundant fisheries were the focus of community life. In later summer, plants became the focus of harvesting activities. Bands would head to rice camps, and other plants such as fruits and medicines were gathered (Landes 1938). At the end of summer, bands harvested the gardens planted earlier. The plants were prepared for storage and ceremonies celebrating the harvest took place. Men usually left for duck hunting while women prepared for fall fishing (Landes 1968).

Once the preparations of food and other supplies were complete in the fall, the Ojibway groups travelled to their winter camp located in the woods, where a winter wigwam would be constructed. Through the winter, men continued hunting with a focus on large game and set up traps in the band's territory. Women set up meat drying stations and engaged themselves with tanning hides, weaving and embroidery, and making and repairing fishing nets (Landes 1971).

5.11.1.3 Plant and Animal Resources in the Rainy River, Rainy Lake and Lake of the Woods Region

The Ojibway had expanded their territory and occupied the Rainy River, Rainy Lake and Lake of the Woods region at the time of European contact. Fishing was a significant part of their way of life and made the area important to Ojibway.

Elders from Seine River First Nation and Lac La Croix First Nation interviewed as part of an American study on Rainy Lake resources indicated that a number of plants are integral to the cultural tradition (Zedeño et. al. 2001). These plants included:

- Bulrush stems and muskrat roots (cattail rhizomes) for food;
- Cedar for purifying, to make seating for Mide lodges and for construction material;
- Cranberry bush, lily pads, sumac, white pine bark, balsam, pine, blueberry roots and wintergreen for medicinal purposes;
- Black oak for tools;
- Rabbit bush mixed with tobacco for pipe smoking; and
- White pine bark for firewood.

The Rainy Lake area was considered of particular importance for the collection of medicinal plants.

The informants in the study also identified animals and parts of animals that were important species in the Rainy Lake area:

- Turtle, beaver and fat from deer, skunk and bear for medicinal purposes;
- Turtle oil as mosquito repellent;
- Rabbit, deer and moose for hides;
- Deer and moose for food;
- Eagle and hawk feathers as protectors and helpers;
- Loon feathers used in ceremonies and as ornaments; and
- Hawk for ceremonies.

An Elder also reported that porcupine, skunk, fox, marten, mink, weasel, rabbit, moose, deer, bear, beaver, and muskrat were used for food, although deer and beaver were the major items.

The Elders indicated that fish were particularly important as a staple for people living in this area. Sturgeon was highly regarded and the Ojibway conducted ceremonies in the spring spawning season. Ceremonies existed for all fish species and were conducted annually.

The Ojibway Elders indicated that they travelled extensively and over great distances for resources. Travel routes crossed the Canada-United States border and would to extend into North Dakota, Michigan, and Wisconsin, Grand Portage and Thunder Bay. Other routes connected the Rainy Lake region to Lake Superior, and yet others would go to the Lake of the

Woods as well as to the Mississippi and St. Croix area (Zedeño et. al. 2001). Travel was primarily by waterways connected with portages and trails.

5.11.1.4 Spiritual Beliefs

Ojibway people have a unique relationship with the land. As such, beliefs and religious practices are based on the offerings provided by nature, including, but not limited to plants, animals, water, and events. The Ojibway have a rich oral mythology about supernatural humans and animals. The Ojibway mythology infiltrated into every part of their lives, providing instructions and teachings for both daily and ceremonial events.

The Ojibway were well known and respected for having individuals with shamanic abilities. Shamans cured illness, had visionary abilities or abilities to reveal hidden truths, and could provide medicines to improve the hunt or an individual's success in love (Hoffman 2006).

Most importantly, ceremonies were times for social gathering. Families operated independently in the pursuit of seasonal resources. Ceremonial and religious gatherings were opportunities for social interaction where people could feast, dance, play lacrosse and gamble. This was also an opportunity for young people to meet prospective mates.

5.11.2 Contact

5.11.2.1 Change in Culture

Contact with Europeans caused a dramatic shift in Ojibway culture. In the Rainy River region, the influential contact period was initiated in the 1730s when La Verendrye founded fur trade posts at Rainy Lake and at Lake of the Woods. When explorers and traders arrived, the Ojibways found themselves drawn into a new pattern of social and economic relations. The European fur trade was the primary catalyst for change (Taylor 1994; McMillan and Yellowhorn 2004). Animals that had been hunted for food were now hunted and trapped primarily for use in the fur trade. Dependence on European trade goods increased and implements of stone, bone and wood were replaced by purchased objects manufactured from metals. European firearms were efficient but encouraged reliance on fur trade posts for ammunition.

Traditional patterns and activities diminished and territorial boundaries evolved around exclusive hunting and trapping areas. In the past, since food was shared, access to hunting lands was originally open to all. Land tenure systems changed with the fur trade and defined family hunting areas began to dominate as furs were taken for profit. Aboriginal men who bargained with fur trade posts were given food and tobacco as a form of debt to ensure they returned the following year. The Ojibway shifted their diet to European food, such as flour and salt pork, from the trading posts and took up more permanent residences, hence reducing seasonal subsistence activities.

In the late 1800s many Ojibway in the Kenora District started to supplement fishing, hunting, and trapping with farming and seasonal wage labour (Taylor 1994). Near Lake of the Woods they planted several crops that were then stored underground for the winter. They harvested hay to feed cows that were kept for both meat and milk, and kept horses as well. Dam construction in the 1880s resulted in increased water levels that reduced wild rice yields and fish and muskrat harvests.

5.11.2.2 Treaty No. 3 and the *Indian Act*

Canada entered into Treaty No. 3 with the Ojibway in 1873. All of the First Nations identified as potentially affected by the RRP are signatories to the document. The Métis of Rainy Lake and Rainy River (or half-breeds as they were known at the time) also signed the Treaty by adhesion in 1875. The intent of the Treaty was to cede land for development in the Dominion of Canada. Under the Treaty, the signatories were to receive reserve lands for farming and the benefit of the Ojibway people.

Of significance in the Treaty is the clause that states the signatories:

> *"shall have right to pursue their avocations of hunting and fishing throughout the tract surrendered…subject to such regulations as may from time to time be made by her Government of Her Dominion of Canada, and saving and excepting such tracts as may, from time to time, be required or taken up for settlement, mining, lumbering or other purposes" (Queen's Printer 1966).*

The Treaty also provided for annual payments for each person living on reserve, provisions of monies for purchasing ammunition and twine for nets and where farming took place, provisions for farming implements, tools and seed stock.

The Treaty marks another significant shift in Ojibway culture and tradition as people adapted to life on reserve. The introduction of legislation in the 19th century aimed at assimilating First Nations people further restricted Ojibway people in the practice of their traditional culture and encouraged them to relinquish their land, language, and rights. In 1876, a few years after Confederation, Canada introduced the *Indian Act* as an attempt to consolidate the previous legislation that had been introduced piecemeal to govern the behaviour of First Nations people. The *Indian Act* has been modified and expanded over the years to further influence the lives of First Nations people.

5.11.2.3 The Métis

The Métis are descendants of the mixed race children of Aboriginal women and French and British men who were arrived in Canada with the fur trade. Distinct Métis settlements emerged along the fur trade network and the Métis became the middlemen that helped bridge cultural gaps with their understanding of both Aboriginal and European culture.

Fur trade posts at Rainy Lake were the centre of trade with the Ojibway in the region west of Lake Superior. Every major fur trade company had a post in the Rainy Lake vicinity. The presence of multiple posts at Rainy Lake over a lengthy period resulted in many unions between the Aboriginal women and European traders, which produced a large Métis population (Reimer and Chartrand 1999; McMillan and Yellowhorn 2004). A number of Métis families resided year-round near the Rainy Lake posts from at least the late 1700s (Reimer and Chartrand 1999).

A Métis interpreter, Nicholas Chatelaine, was hired as an interpreter during the Treaty No. 3 negotiations. The Ojibway proposed that "the Half-breeds that are actually living amongst us" be included in the Treaty. In 1875, Nicholas Chatelaine who represented the group of Métis residing in the area signed the Adhesion by Half-breeds of Rainy River and Lake. The Métis requested that they wished to form their own band with their own Chief (Moss 1979). They were offered their own reserve in the original negotiations; but eventually in compliance with the government wishes, they joined the Couchiching Band and resided on that reserve. The 1901 census indicates that there were Métis living at the Rainy Lake reserve and at McIrvine, a town near Fort Frances that was later annexed. Records from the fur trade posts corroborate these records. Many of these Métis identify their Aboriginal heritage as Cree and may have moved east from areas which were then considered part of Manitoba.

The Sunset Country Métis Council of the MNO represents the Métis in the Rainy River District today. The Sunset Country Métis Council is within the Rainy Lake / Rainy River traditional harvesting territory, which is a region established by the MNO for the MNO / MNR Interim Agreement on Harvesting. Harvesting activities include hunting fishing, berry picking and guiding which a local Captain of the Hunt oversees.

5.11.3 Community Profiles and Current Resource Use

The electoral governance system was introduced through the *Indian Act* and this is the current system in use today. Each of the following subsections present information provided primarily within the AANDC First Nations profiles (AANDC 2013) on: governance (where available), populations and reserves. Where relevant or available, additional community information is provided. In general, there is little publicly available information on current traditional resource use. Traditional resource use and knowledge is usually considered proprietary and is not disclosed by communities without consent.

5.11.3.1 Anishinaabeg of Naongashiing First Nation

The Anishinaabeg of Naongashiing First Nation has 12 reserves. The members have been relocated a number of times in their history but presently reside on Saug-a-gaw-sing No. 1 reserve, located on the southeast shore of Lake of the Woods. Table 5-28 provides a list of the reserves located near Kenora and Lake of the Woods (AANDC 2013). The Agency 30 reserve is shared with 12 other First Nations.

The Anishinaabeg of Naongashiing First Nation has a total registered population of 409 people. Currently, 161 band members reside on reserve while the majority (248) live off reserve. The registered population available from AANDC is provided in Table 5-29. Approximately 30% of the population has some knowledge of their language.

The Anishinaabeg of Naongashiing First Nation is governed by a custom electoral system with a four-year term. The current term for the administration expires in December 2013. The community council consists of a chief and two councillors.

The Anishinaabeg of Naongashiing First Nation describe their principal occupations as trapping, fishing and forestry (Anishinaabeg of Naongashiing 2013). They currently hold a large commercial fishing license. Their industries include wild rice harvesting, fish processing and retail adjacent to the reserve.

5.11.3.2 Mishkosiminiziibing (Big Grassy River) First Nation

Mishkosiminiziibing (Big Grassy River) First Nation has six reserves with the majority of its members residing at Big Grassy River 35G near the community of Morson, Ontario. Table 5-30 provides a list of the reserves and their location (AANDC 2013).

There are currently 754 registered band members in the Mishkosiminiziibing First Nation. Currently, 239 members live on reserve while the majority (515) life off reserve. The registered population available from AANDC is provided in Table 5-31. Approximately 32% of their population have knowledge of the Ojibway language.

The community is governed under the *Indian Act* electoral system with a two-year term. The current term for the administration expires in January 2015. The community council consists of a chief and five councillors.

There is no publicly available information on current traditional practices. Mishkosiminiziibing First Nation is participating in a TK / TLU study with RRR but this information remains confidential. The information has been used to inform the EA Report.

Mishkosiminiziibing First Nation operates the Assabaska Ojibway Heritage Park, which has a serviced campground. The park offers some aspects of Ojibway culture by providing the opportunity to rent tee pees and experience the culture through traditional songs, stories, crafts, food clothing and customized interactive programs. The management of the Assabaska Park demonstrates a strong interest in sharing and maintaining traditional aspects of Ojibway culture.

Mishkosiminiziibing First Nation has filed a claim for reserve lands. Ontario accepted the claim for negotiation in May 2013.

5.11.3.3 Naicatchewenin First Nation

Naicatchewenin First Nation has three reserves with the majority of members residing on Rainy Lake 17A and a few residing at Rainy Lake 17B. The Rainy Lake 17A reserve, where the community facilities are, is located near Devlin, Ontario. Table 5-32 provides the list of reserves, their size and location.

Naicatchewenin First Nation has 439 registered members with 286 living on reserve while 153 live off reserve. Approximately 42% of their members have some knowledge of the Ojibway language. The registered population available from AANDC is provided in Table 5-33.

The community is governed under the *Indian Act* electoral system with a two-year term. The current term for the administration expires in May 2014. The community council consists of a chief and three councillors.

Naicatchewenin First Nation is participating in a TK / TLU study with RRR but this information remains confidential. The information has been used to inform the EA Report.

5.11.3.4 Naotkamegwanning First Nation

Naotkamegwanning First Nation was formerly known as the Whitefish Bay First Nation. The Naotkamegwanning First Nation has four reserves. Table 5-34 provides a list of the reserves including their location and size (AANDC 2013). Whitefish Bay 32A serves as the main reserve and is the most populated. The reserve is located near Sioux Narrows. They continue to fish, hunt and harvest wild rice (Lakehead University 2013).

Naotkamegwanning First Nation has an on reserve population of 725 people with an off reserve population of 495. The registered population available from AANDC is provided in Table 5-35. Close to 50% of the community continue to speak Ojibway.

The community is governed under the *Indian Act* electoral system with a two-year term. The current term for the administration expires in November 2013. The community council consists of a chief and four councillors.

5.11.3.5 Ojibways of Onigaming First Nation

The Ojibways of Onigaming and the Mishkosiminiziibiing (Big Grassy River First Nation) were formerly part of the Assabaska Band. They have five reserves although Agency 30 is shared with 12 First Nations. The Ojibways of Onigaming reside primarily at Sabaskong Bay 35D located near Nestor Falls. Table 5-36 provides a list of the reserves and their location and size (AANDC 2013).

There are 764 members with 452 registered band members living on reserve while 312 live off reserve (Table 5-37). Many community members continue to speak Ojibway with approximately one third identifying Ojibway as their first language.

The community is governed under the *Indian Act* electoral system with a two-year term. The current term for the administration expires in August 2015. The community council consists of a chief and five councillors.

Very little published information on the Ojibways of Onigaming is available and there is no indication of their current use or interest in traditional practices and resources.

5.11.3.6 Rainy River First Nations

Rainy River First Nations is an amalgamation of seven Ojibway bands including the Manitou Rapids, Hungry Hall, Little Forks, and Long Sault Indian Reserves. Through a Provincial decision, six bands surrendered their reserves in 1914 and 1915, and began amalgamation into a single band at the Manitou Rapids. The total surrendered property was approximately 18,724 hectares (Ministry of Aboriginal Affairs Ontario 2005). The Rainy River First Nations filed a claim for the surrendered lands in the 1982 and subsequently, after extensive negotiations, reached a settlement that included financial and land compensation (Ministry of Aboriginal Affairs Ontario 2005).

AANDC does not provide information on Rainy River First Nations and there is little publicly available information.

Rainy River First Nations is situated 39 km west of Fort Frances, Ontario and present occupy 2,464 hectares of reserve land. Approximately 760 members are registered to Rainy River First Nations, with close to 240 members residing on reserve land. The First Nations is affiliated with the Pwi-Di-Goo-Zing-Ne-Yaa-Zhing Advisory Services Tribal Council and the Grand Council of Treaty No. 3 (First Nation Canada 2013). The Rainy River First Nations is participating in a TK / TLU study with RRR but this information remains confidential. The information has been used to inform the EA Report.

Rainy River First Nations is a steward of one of Canada's National Historic Sites, the Manitou Mounds, or Kay-Nah-Chi-Wah-Nung. Kay-Nah-Chi-Wah-Nung, which means "the Place of the Long Rapids". The site is best known for its burial mounds complex that date back 2,000 years. These sacred mounds, which are situated on the river terraces of the Rainy River at the Long Sault Rapids, were declared a National Historic Site in 1970. The entire complex contains 15 burial mounds and the archaeological remains of 30 village sites (Historic Places Canada 2013). The Kay-Nah-Chi-Wah-Nung Historical Centre is a world-class interpretive cultural centre built at Kay-Nah-Chi-Wah-Nung by the Rainy River First Nations. It contains five galleries with over 10,000 artifacts, a conservation lab, a gift shop and restaurant serving traditional Ojibway

cuisine. Manitou Mounds attracts thousands of annual visitors, eager to observe displays and interpretations of ancient Ojibway culture (First Nation Canada 2013).

The Rainy River First Nations economy is sustained through a combination of forestry-related activities, tourism through the Kay-Nah-Chi-Wah-Nung Historical Centre, a local convenience store, band related activities and land leasing. The Rainy River First Nations operate the Manitou Fish Hatchery Ltd., a progressive sturgeon hatchery that provides fingerlings to both state and tribal governments in Wisconsin, Missouri and Minnesota, where sturgeon populations were dangerously depleted.

5.11.3.7 Buffalo Point First Nation

Buffalo Point First Nation has six reserves although Agency 30 is shared with 12 First Nations. It is a relatively small reserve with a small population. Table 5-38 provides a list of the reserves and their location. Reserve 36 serves at the main reserve and residency for the First Nation. There are 122 members with 79 registered band members living off reserve (Table 5-39).

Buffalo Point First Nation is governed by a custom electoral system. The Band Council consists of a Chief, three councillors and a hereditary leader. The Chief remains in power for their lifetime or may choose to retire and select a new chief. The Chief of the Buffalo Point First Nation selects their Council members and together they constitute the Band Council, which are the authorized government and the legal authority on the reserve (Buffalo Point First Nation 2013).

Buffalo Point First Nation has been active in developing the reserve as a tourist destination in keeping with the community master plan. Band members have leased band land and started a number of successful businesses including a 350 dock slip marina, 18-hole golf course, recreational vehicle campground, luxury rental cabins, restaurant and trails for hiking, biking, cross-country skiing and snowmobiling (Buffalo Point First Nation 2013).

5.11.3.8 Métis

There is no distinct Métis settlement with reserve lands located in the vicinity of the RRP. The RRP is located within the MNO, Region 1. The Sunset Country Métis is the regional council representing Métis citizens that reside near the RRP. The MNR recognizes the MNO harvest card system and under this system, Métis citizens may harvest plants, fish, wildlife and firewood taken for heating, food, medicinal, social or ceremonial purposes. The harvest is organized by Region 1 and a Captain of the Hunt administers the cards regionally.

The MNO state in their recent Special Impact Report that there are some key groups of species that are likely to be important in many, if not all Métis communities in Ontario (MNO 2012). The wildlife and plant species include:

- Large mammals: moose, deer, caribou;
- Upland birds: ruffed grouse;
- Migratory birds: various duck species, geese;
- Mushrooms: chanterelle, birch mushrooms;
- Various fish: trout, pike, walleye, whitefish, sturgeon; and
- Plants: ferns, fruiting plants (such as blueberries and raspberries), herbs and trees.

It is important to note that plants have multiple uses including food, medicinal, ceremonial, as well as construction (Métis Nation Ontario 2012).

5.12 Aboriginal Traditional Land Use

TK / TLU studies with Aboriginal community Elders and other knowledge holders have been, and will continue to be completed, for the RRP to better understand traditional practices and environmental knowledge. TK studies include requests for information about wildlife, climate, plants, hydrology and many other topics. TLU include requests for information about how recent and current traditional practices are carried out on the land in the vicinity of the RRP. Studies have not determined significant historic or current use.

Opportunities for TK / TLU consultations were offered to area First Nations; and the following First Nations between July 2012 and February 2013 agreed to participate:

- Anishinaabeg of Naongashiing First Nation (Big Island);
- Buffalo Point First Nation;
- Mishkosiminiziibiing (Big Grassy River) First Nation;
- Naicatchewenin First Nation;
- Naotkamegwanning First Nation;
- Ojibways of Onigaming First Nation; and
- Rainy River First Nations.

The following First Nations subsequently worked closely with Rainy River Resources to collect TK / TLU information:

- Big Grassy River First Nation;
- Naicatchewenin First Nation; and
- Rainy River First Nations.

TK / TLU sessions held with several of the notification Aboriginal groups including: Couchiching First Nation, Mitaanjigamiing (Stanjikoming) First Nation, and Seine River First Nation. The TK / TLU studies were led by Ms. Stacey Jack, RRR Community Coordinator. Ms. Jack is a licensed Archaeologist, who, as a resident of the District and member of the Couchiching First Nation, has extensive knowledge of regional history. Stacey has worked extensively with area First

Nations over the past 20 years, including a leadership role in the development of the Manitou Mounds National Historic Site which is located approximately 35 km south of the RRP site.

In support of the TK / TLU studies, data sharing agreements were signed with these First Nations to ensure that sensitive information is protected and held strictly between the First Nations and RRR.

Through these consultations, no traditional activities were identified within the RRP area.

The Métis Nation of Ontario is in the process of completing a TK / TLU study. RRR anticipates that as part of the consultation process with the MNO an addendum outlining any follow-up programs or agreements may need to be submitted in parallel with the final EA Report review.

The following baseline information is based on TK / TLU provided by the Ontario government, publicly available information and information shared for public viewing by the Naicatchewenin First Nation, Big Grassy River First Nation and Rainy River First Nations.

5.12.1 Current Knowledge Base and Study Status

The Province of Ontario provided information to RRR on Treaty and Aboriginal rights, as well as information on possible land uses that potentially could be affected by the RRP, for each of the identified Aboriginal groups (MNDM 2012). The information provided is general in nature and sources for the information provided by the Province were not identified in the documentation. RRR has been working to verify current traditional uses and interests in the study area through direct discussions and ongoing studies with Aboriginal communities. These discussions will continue to verify the extent to which the RRP study area is being currently used by Aboriginal groups.

The land on which the RRP is situated has been in private ownership for homesteads and farms for several generations, dating back to the early 1800s. As the land has been held in private ownership and has been subjected to timber harvest and agriculture for many years, it is believed that traditional practices in the area have been curtailed.

The Anishinaabeg of Naongashiing First Nation report publicly that trapping, fishing and forestry are principal occupations of the members and seasonal work is available in resorts around the reserve. The Anishinaabeg of Naongashiing First Nation currently own the largest commercial fishing licence quota in Treaty 3. The Anishinaabeg of Naongashiing First Nation has not indicated that they currently use the RRP area for traditional purposes.

Interviews with Naicatchewenin First Nation members have identified one individual who hunts approximately 30 km north of the RRP area. The members specifically stated that they do not trap and that the land in the area has been used for agriculture for many years which has precluded their use. Interviewees expressed an interest in identifying medicinal plants in the

area and transplanting them elsewhere, although they are not currently collecting plants in the RRP area.

Big Grassy River First Nation Elders indicated that the RRP area was previously used seasonally for hunting, picking blueberries and pin cherries, collecting unspecified medicinal plants and as a travel route. The area has not been used since Big Grassy River First Nation community members were introduced to reserves in the late 1800s and the land was taken up for farming.

Rainy River First Nations members, through the course of the TK / TLU study to date, stated that they have harvested poplar trees in the RRP area in the summer. They also historically picked berries in the area and they collected bark for medicinal use as well as other unspecified medicinals. Rainy River First Nations members also identified that there were Moose and Caribou in the RRP area but no deer. The identification of animal resources and activities are from memory and do not represent current use by the individuals interviewed.

5.13 Non-Traditional Land and Resource Use

This section summarizes the land and resource uses within the HLSA (Figure 2 in Appendix L) focusing on land use planning, industrial and commercial land uses, parks and environmentally sensitive areas and outdoor recreation.

The principal local features of existing or past land uses in the HLSA are those related to agricultural and forestry practices. Areas of abandoned farmland are evident throughout the area, where farmlands are returning to scrub and successional forest communities, including in some cases small, desegregated wetlands. The HLSA shows a preponderance of mixed poplar forests, which occupy approximately 50% of the landscape. Poplar forests, principally Trembling Aspen, are indicative of disturbed lands recovering from past forestry and farming activities, or regrowth following past fires.

5.13.1 Land Use Planning

5.13.1.1 Township of Chapple

The HLSA is within the Township of Chapple. The Township Official Plan is a policy document, adopted by Township Council under the provisions of the *Planning Act*. It reflects matters of Provincial interest and applies to all non-Crown Land within the Township.

The Township is responsible for planning within its boundary. The Township Official Plan applies to all land except Provincial Crown Land within the Township. The document formally lays out the planning goals and objectives over a 20 year time horizon. A new Official Plan was adopted by Township Council on March 12, 2013 following a comprehensive review process

that was initiated in 2011 (Township of Chapple 2013). Approval by the Ministry of Municipal Affairs and Housing was received on September 13, 2013.

In regards to the Official Plan and the RRP:

- Section 3 establishes policies for specific land uses designations. Schedules A and A-1 are the corresponding Land Use Schedules. These policies identify where different types of land use should locate in the Township and the development standards that will be applied when development occurs. Specific to the RRP. Section 3.11 establishes the Mine Site designation, acknowledging that mine sites are regulated under the *Mining Act* and that other Federal and Provincial legislation applies. The Mine Site designation is an overlay on underlying land use, and as such, the underlying policies apply until such time as the mine receives approval to operate. This Section also states that the Zoning By-law shall be amended to show the boundaries of the mine, on EA approval.

- Section 6 defines the transportation policies and Section 6.2(12) specifically acknowledges a conceptual preferred re-alignment of Highway 600.

A zoning amendment may be required to develop portions of the RRP. RRR has initiated discussions with the Township of Chapple related to the anticipated zoning amendments required for project development.

5.13.1.2 Crown Land

Crown land use planning is carried out under authority of the *Public Lands Act* with MNR acting as the lead Ministry. The Guide for Crown Land Use (MNR 2011a) provides many of the policies and guidelines for land use planning. Direction provided by the Guide is derived from various sources including Ontario's Living Legacy Land Use Strategy (MNR 1999), A Land Use Planning System for Ontario's Natural Resources (MNR 2011b) and the Crown Land Use Atlas (MNR 2011c).

The majority of Crown Lands currently fall into the General Use designation (Section 7.18.1). A full range of resource and recreational uses can be allowed; however, the designation does not mean that all uses and activities must be permitted.

There are no Provincially significant features such as wetlands or protected areas in the HLSA.

5.13.2 Industrial and Commercial Land Uses

5.13.2.1 Mining

Mining is a key economic activity in northwestern Ontario. Mineral exploration and mining activities are controlled by the MNDM under the *Mining Act*. Figure 3 of Appendix L shows land in the HLSA currently under active mining claims or leases.

There are no operating mines in the Rainy River District. The closest operating gold mines are in the Red Lake District (Red Lake Gold Mine, Goldcorp Inc. approximately 245 km to the northwest). The next closest mine is the Lac des Iles Mine owned by North American Palladium Ltd. which produces platinum group metals and is located 320 km east-northeast of the RRP site (Ontario Prospectors Association 2012).

There are currently approximately 70 major exploration projects where mineral exploration and/or development is occurring in northwestern Ontario (MNDM 2011). The Hammond Reef Gold Project (Osisko Hammond Reef Gold Limited), located 160 km to the east of the RRP is the closest known gold mining development project to the RRP site. The Josephine Cone Mine has also initiated an EA for the development of an iron ore mine (Bending Lake Iron Group, located 145 km northeast of the RRP site). There are also three mine development projects at various stages in the Balmertown area (Rubicon Minerals, Phoenix Gold Project; Goldcorp Inc., Cochenour Project; and Claude Resources Inc., Madsen Project; Ontario Prospectors Association 2012).

A number of companies are actively exploring for gold in Minnesota, but Minnesota is best known for being the largest producer of iron ore / taconite in North America with a number of mines located approximately 200 km southeast of the RRP site near Hibbing (Minnesota Department of Natural Resources 2012). Several of these operations are located within the Rainy River watershed.

The RRP is comprised of a total of 238 land parcels, which consist of patented whole, surface rights only, minerals rights only, leasehold interest only and unpatented mining claims. RRR, through direct ownership or option agreement, has a 100% interest in the lands forming the RRP (Figure 1-2). The gold mineralization as currently understood, is situated in the southern half of the former Richardson Township. The former Richardson Township is one of several townships that comprise Chapple Township, the Municipal organization in the area.

5.13.2.2 Forestry

The majority of forests in Ontario are on Crown (public) land and management is the responsibility of MNR. The MNR forest management planning process divides the forests into Forest Management Units which are managed by individual forest companies under a Sustainable Forest License (MNR 2012g).

The HLSA is within the Crossroute Forest Management Unit (KCB 2011a; Figure 4 in Appendix I-2). The Sustainable Forest Licence for the Crossroute is held by Resolute Forest Products (Resolute). The current Forest Management Plan (2007 to 2017) show no planned harvesting in the area overlapping the HLSA (KCB 2011a).

5.13.2.3 Agriculture

In the Rainy River District, agriculture is an important component of the regional economy with 420 farm operators on 312 farms with total gross farm receipts (excluding forest products sold) for the main commodities at over $13 million in 2006 with a total market value of over $178 million (Statistics Canada 2007b). Livestock production was the most important commodity (beef cattle and dairy) both of which are common in the HLSA (KCB 2011a).

The RRP site and surrounding lands are predominantly privately held, with RRR holding a very large private land package.

5.13.2.4 Outdoor Recreation

Hunting and Trapping

The HLSA is within Wildlife Management Unit 10 (Figure 5 in Appendix I-2). Six commercial traplines overlap with the HLSA (Figure 6 in Appendix I-2), four of which are resident traplines and two are registered (MNR 2012d).

Fur returns for traplines for the period of 1993 through 2008 indicated that Beaver, marten and weasels are the most frequently trapped animals in the HLSA. Other animals trapped but with less frequency include: Red Fox, otter, fishers and mink (Angus 2012).

In the HLSA, partridge, Spruce Grouse, Sharp-tailed Grouse and waterfowl are hunted on private and Crown land. Bears and deer are also commonly hunted in the HLSA. Bear management areas FF-10-007, FF-10-008, FF-10-010 and FF-10-005 overlap the HLSA (Figure 7 in Appendix I-2). These areas are designated to manage tourist licences for bear hunting (MNR 2012d).

Fishing and Sport Water Use

The HLSA lies within the Fisheries Management Zone 5. MNR sets out regulations specific to the management zone including season dates, rules and regulations for international fisherman (MNR 2012g).

The Pine / Pinewood River and Little Pine Lake are two water systems in the HLSA that are considered fish-bearing (Township of Chapple 2012a).

From an environmental perspective, the RRP site is unique in that there are no lakes located within, or adjacent to, the RRP footprint. There are small lakes near the proposed transmission line routing.

Based on multiple years of aquatics baseline investigations, while limited baitfishing does occur within certain RRP area streams, the area does not support a significant commercial or recreational fishery. The area around the proposed mine site experiences limited bait fishing, mainly in West Creek and Clark Creek (KCB 2011a). The only sport fish available locally are Northern Pike and Brown Bullhead in the Pinewood River. Fishing for these species is limited near the RRP site. There is no known presence of Lake Sturgeon or Walleye in the RRP site area (MNR 2012d) and no specific habitat was identified for these species in the Upper Pinewood River. Three Lake Sturgeon were captured in the lower Pinewood River in 2013 (AMEC 2013l).

More extensive recreational fishing opportunities are available within the lakes located approximately 15 km or more to the northeast and upstream of the RRP site; most notably Off Lake, Beadle Lake, Boundary Lake, Little Pine Lake and Burditt Lake.

Extensive fishing opportunities are also available downstream of the Pinewood River, in the Rainy River and including the Pinewood River inflow area.

Other Recreation Uses

Other recreation uses in the region generally include cottaging, camping, snowmobiling and hiking. Borderland Snowmobile maintains 536 km of trails (Borderland Snowmobile Club 2012). A snowmobile trail (L601) intersects with the HLSA along Highway 71 in the south before turning east towards Pine Lake.

There are no cottages or outfitter camps in the HLSA (Figure 9 in Appendix I-2). East of the HLSA, there are cottages and outfitter camps on Burditt Lake, Off Lake, West Jackfish Lake and Lake Despair.

5.13.3 Environmentally Sensitive Areas

There are no Areas of Natural and Scientific Interest or Provincially Significant Wetlands or Federal / Provincial Parks within or proximal to the RRP site.

There are two Provincial Nature Reserve Parks (Cranberry Lake and Spruce Islands) and one Conservation Area (Sifton Township) located west and northwest of the RRP site, respectively (Figures 5-1 and 5-2).

5.14 Socio-Economics

5.14.1 Regional Communities

The largest community in the HRSA is Fort Frances, located on the border with the United States, with a population of 7,952 as of the 2011 Census. It serves as the service hub for the area offering medical, business, recreational and legal services. The area has eight townships (Alberton, Chapple, Dawson, Emo, La Vallee, Morley, Rainy River and Sioux Narrows - Nestor Falls; Figure 1 in Appendix I-2) with an average of 817 residents each, the largest of which is Emo with a population of 1,252. The proposed RRP would be located in the Township of Chapple.

The HRSA contains 11 First Nations communities identified for consultation: Anishinaabeg of Naongashiing First Nation, Couchiching First Nation, Lac La Croix First Nation, Big Grass River First Nation, Mitaanjigamiing First Nation, Naicatchewenin First Nation, Naotkamegwanning First Nation, Nigigoonsiminikaaning First Nation, Ojibways of Onigaming First Nation, Rainy River First Nations and Seine River First Nation. The HRSA First Nations have an average of 320 residents, with Couchiching First Nation the largest with a population of 796 and Mitaanjigamiing First Nation the smallest with an on-reserve population of 98. Métis citizens living in the region are represented by the Rainy River Lake of the Woods Regional Consultation Committee Region #1. According to the 2006 Census, there are between 500 and 999 Métis living in Fort Frances. A map of reserves from these First Nations is presented in Appendix L (Figure 1 in Appendix I-2).

The economies of these rural townships have depended on agriculture (principally cattle-raising), tourism (particularly sport tourists from the United States) and forestry. The forestry sector is in decline. Progressive layoffs over the last five years culminated in November 2012 when the mill in Fort Frances (the community's largest industrial employer) temporarily shut down and laid off an additional 230 workers. The future of the mill is still being decided. Increasingly the area is looking to mining as a new driver for the regional economy.

All of the communities in the HRSA (with the exception of Sioux Narrows - Nestor Falls) have had falling populations since the 2006 Census, averaging 6% across the HRSA. Communities in the HRSA have less people in the working age population (residents ages 20 to 64 make up 57% of the population against the Ontario average of 62%). This is largely the result of the high proportion of seniors in the population: the median age across the HRSA is 44 against an Ontario average of 40 and the share of residents 65 and over is 18% against an Ontario average of 15% (Statistics Canada 2012a).

5.14.2 Population and Demographics

5.14.2.1 Population

The total population in the HRSA non-First Nation communities was 14,396 in 2011, representing approximately 0.1% of the total population in the Province of Ontario. Just over 55% of the population in the HRSA resides in Fort Frances (Statistics Canada 2012a). Emo is the second largest community in the HRSA with a population of 1,252 in 2011 (Table 4-1 in Appendix I-2).

Most communities within the HRSA have experienced, and are expected to continue experiencing, population losses (Ministry of Finance 2012). This trend of decline differs greatly from the overall population gain of 5.7% across the Province of Ontario (Statistics Canada 2012a). From 2006 to 2011 the HRSA experienced a population decline of 3.9% or 586 residents.

Tables 4-1 and 4-2 in Appendix L shows the First Nations population in the HRSA from the 2011 census. The total population of these communities was 2,942, an increase of 9.94% from 2006. The memberships of these First Nations were significantly larger at 6,239 and the reported average living on Reserve was only 40.1%. At 796, Couchiching First Nation has the largest on reserve population within the HRSA. Population figures provided through AANDC may vary from those provided from Statistics Canada as the timing of data collection varies between the two organizations and AANDC published data is provided by the communities themselves. Aboriginal Community Profiles (produced by AANDC) provide more detailed population counts with respect to residency status.

5.14.2.2 Age-Sex Breakdown and Household Size

The demographics of the HRSA are skewed older (Tables 4-4 and 4-5 in Appendix I-2), with 4.5% less working age residents than the Ontario average of 61.7% and a median age of 43.2, 2.8 years above the Ontario average. Factors that are likely contributors to this trend are the out migration of young people and lower housing prices attracting retirees to the area. For First Nation communities, populations are typically much younger. The share of the population below the age of 15 averages 34% and the median age is 24.3, more than 16 years below the Ontario average.

The average household (occupied private dwelling) size in the study area is 2.6, roughly the same as the Ontario average (Statistics Canada 2012a).

5.14.2.3 Migration

In general, the population of the HRSA (using data from 2006, since information from the 2011 Census was not available) is significantly less mobile than the Ontario average. The share of the population who lived at the same address five years ago is 73% while the Ontario average is 59% and the communities experienced much lower levels of in migration from other Provinces, territories and other countries. At the same time, the out migration of young people from northwestern Ontario contributes to current and future population losses (Ministry of Finance 2012). For First Nation communities, mobility rates are similar to non-First Nation communities in the region.

5.14.2.4 Ethno-linguistic Characteristics

The 2006 Census documented that 21% of the population in the Rainy River District identify themselves as Aboriginal (Table 4-8 in Appendix L; 68% of these as North American Indians, 29% as Métis), higher than the Ontario average of 2%. Fort Frances has the largest proportion of Aboriginal population (16%) of any urban centre in Ontario. Outside of the Reserves, the share of the Aboriginal population in smaller communities range from 17% in Rainy River to 4% in Emo. Data from the 2011 Census have not yet been released, but the national and regional trend from 2001 is a sustained increase across communities (Statistics Canada 2012a). This is due to the expectation of a continuation of rapid growth of the Aboriginal population, arising from demographics and an increasing willingness to self-identify as Aboriginal, paired with the decline of the overall population in the District.

The Rainy River District is significantly more unilingual (98% English) compared to the Ontario average (80%; Tables 4-10 and 4-11 in Appendix I-2). There are no significant numbers of bilingual French and English speakers and a French-speaking population of 2% is found only in Dawson and Sioux Narrows – Nestor Falls. For Aboriginal communities, the primary linguistic difference is in the share of the community who speak non-official languages (the census does not make an attempt to identify these languages). Of the communities for which data is available, Naotkamegwanning First Nation had the highest share of residents for whom English was not the mother tongue (39%) and who spoke a language other than English at home (20%). By contrast, in Couchiching First Nation 99% of households were reported to speak English at home (Statistics Canada 2012a).

5.14.3 Regional Economy, Labour and Business

5.14.3.1 Forestry

Much of the study area has traditionally been reliant upon economic activities related to forestry, agriculture, recreation and tourism.

The local economy is still struggling with the decline in forestry activity. In Fort Frances the pulp and paper mill owned by Resolute was the primary employer until an indefinite shutdown in November 2012 and layoffs of 230 employees (CBC 2012). This was the culmination of a multi-year set of progressive layoffs at a mill that had 780 employees as late as 2010 (KCB 2011a). The company has not announced if the mill will re-open in the future, although one option the company is considering is investing in a more value added product that would sustain operations at the site (RRFDC 2012).

5.14.3.2 Agriculture

Agriculture remains an important component of the regional economy with 380 farm operators and 91 employees with total gross farm receipts (excluding forest products sold) for the main commodities at over $15.9 million in 2011 (Statistics Canada 2012b). Livestock production was the most important commodity (beef cattle and dairy) both of which are common in the study area. The Township of Emo has a new community-owned abattoir which opened in 2010 (Revell 2010).

5.14.3.3 Recreation and Tourism

Recreation and tourism in the HRSA is mainly related to outdoor pursuits such as hunting, fishing, camping, snowmobiling and hiking in the nine Provincial Parks and nine Conservation Reserves in the HRSA.

In 2009, the Rainy River District received 210,000 overnight visits (similar to the 2006 count of 205,000). Of these, 143,000 listed pleasure as the main purpose of the trip and more than half of the visitors were from the United States. The overwhelming attraction cited by tourists was fishing; it was listed as an activity for 120,000 of those visits. Total visitor spending (Table 5-8 in Appendix I-2) amounted to $82.5 million with 83% of that spending arising from overnight visitors. Visitor spending focused on accommodation (26%) and food and beverages (20%). Ministry of Tourism, Culture and Sport estimates the economic impact of these expenditures to have directly supported the fulltime equivalent of 858 jobs, indirectly supported 121 jobs and induced another 96 jobs in the area. This produced $34.7 million in total labour income and provided the Federal, Provincial and Municipal governments with an estimated $27.7 million in tax revenue (MTCS 2012a).

Caliper Lake Provincial Park is the closest recreation area, located approximately 30 km north of the RRP site and outside the HRSA. In 2010, Caliper Provincial Park received 9,298 visitors. The park has walking trails, swimming, canoeing and fishing (MNR 2012b). Birding is very popular at the mouth of the Rainy River on Sable Island northwest of the Town of Rainy River. Sable Island is home to permanent breeding population of the Piping Plover (Town of Rainy River 2012a). Caliper Lake Provincial Park was closed by the Province in May 2013.

5.14.3.4 Businesses and Services

Service businesses in the Rainy River District that support the current primary industries of tourism, forestry and agriculture include: financial services and insurance, media and communication, health, retail, agricultural supplies, accommodation and tourism. There are some companies serving the mining sector can be found in the HRSA: Acklands-Grainger, Rainy Lake Tribal Contracting and Salteaux Consulting & Engineering. Peterbilt Fort Frances is the largest heavy truck dealership in the region (RRFDC 2012). Both Emo and Fort Frances have welding firms focusing on automotive work, although John Gavel Custom Manufacturing in Emo also undertakes fabrication and industrial maintenance (Gavel 2012). There are multiple catering services, as well as office and shop supply companies available in Fort Frances. Transportation services are available in Emo and Fort Frances (RRFDC 2012). Many local companies have experience providing services to industrial clients through their work for Resolute and consequently have already achieved specific qualifications necessary for fulfilling contracts for them, for example in safety training (RRFDC 2012).

5.14.3.5 Mining

In a region that has been experiencing the economic effects of a declining forest industry through layoffs and closures, the mining sector represents an economic opportunity that will bring long term, skilled employment opportunities to the region, adding to the sustainability of the local economy. Mining is a highly skilled and technical industry offering good salaries. The average weekly wage paid in Ontario's mining industry in 2011 was almost 60% more than the Ontario average industrial wage, while wages paid in the mining support sector were almost 95% higher (Dungan and Murphy 2012). In recent years, there has been an increase in mine services employment with mining companies outsourcing specialized mining jobs to contract miners, drilling companies and consultants. The industrial benefits from mine construction and operation are appreciable. Results from a 2011 survey by the Ontario Mining Association found that over 70% of the value of mining supplies and services were provided within Ontario, 31% locally and more than 43% from the rest of Ontario (Dungan 2012).

There are no operating mines within the Rainy River District, but exploration by mining companies have discovered deposits of gold, platinum and nickel. The advancement of the RRP has encouraged exploration in gold deposits in particular and there are multiple companies exploring gold claims in the Rainy River District. These include Bayfield Ventures Corporation (Bayfield Ventures 2012) who hold claims adjoining those of RRR, Coventry Resources Ltd. (Coventry Resources 2012) and Rheingold Exploration Corporation (Rheingold Exploration 2012). None of these exploration programs are proposed for development at this time.

Osisko is proposing to develop the Hammond Reef Gold Project located approximately 30 km north of the Town of Atikokan. A Feasibility Study is underway and an EA is currently in preparation (Osisko 2011).

5.14.3.6 Employment by Industry and Occupational Grouping

The 2006 Census provides industrial and occupational characteristics of the labour force (Table 5-1 in Appendix I-2). In it, agriculture and other resource-based industries accounted for a larger share of the workforce in the region than the Province as a whole. This was most pronounced in the Townships of Chapple and Morley, where 26.2% and 22.4% of the workforce, respectively, was in this category compared to the Ontario average of 2.9%. Health care and social services workers accounted for a larger share of the workforce (10.1% in Rainy River and 15.5% in Fort Frances) than the Ontario average (9.5%), as did other services which employed 25.3% of those in the HRSA and 25.8% of those in Fort Frances against an Ontario average of 18.7% (Statistics Canada 2007a).

Data from the Labour Force Survey undertaken by Statistics Canada suggest that structural changes in the economy of northwestern Ontario since 2006 may have disproportionately negatively impacted the Rainy River District (Table 5-2 in Appendix I-2). Three of the five occupation categories that the region specializes in: transport, primary industry and manufacturing, saw workforce count declines of 17%, 29% and 43%, respectively. The two other specializations, government and management grew at 22% and 5%, respectively. Applying these changes uniformly across the region would imply a 6% reduction in the overall labour force (Statistics Canada 2012a).

In First Nation communities, leading employers varied considerably between communities (Table 5-3 in Appendix I-2). Two thirds (66.7%) of the Mitaanjigamiing First Nations labour force had other service experience and 55.6% of the Seine River First Nation labour force compared to an HRSA average of 25.3%. Manufacturing employed 23.5% of the Rainy River First Nations labour force, but no manufacturing employment was reported in any other community. Small population size contributed variability to the data. The leading set of employment experience in Naotkamegwanning First Nation which had the highest reported workforce was other services (42.9%) and then health care and social services, educational services (each 14.3%) and then construction (11.1%; Statistics Canada 2007a).

5.14.3.7 Labour Force Participation and Unemployment

In 2006, the participation and employment rates in the HRSA were lower than the rest of Ontario (Table 5-3 in Appendix I-2). The unemployment rate in Emo (4.7%) and La Vallee (3.2%) was considerably lower than the HRSA average of 6.9% and that of Ontario as a whole (6.4%). In the Township of Chapple, the unemployment rate was as low as 2.4%. The highest unemployment rate was found in the Town of Rainy River, where it was 15.2%. The most recent data on the labour market in northwestern Ontario (consisting of Rainy River, Kenora and Thunder Bay census areas) has shown rising unemployment (up to 6.6% in October 2012 from 5.6% in October 2011) and falling participation rates (61.9% in October 2012 from 64.0% in October 2011). Unemployment is still noticeably better than Ontario as a whole which had an

unemployment rate of 7.9% in October 2012, but the participation rate in the region was lower than the Ontario average of 66.7% (Statistics Canada 2012c).

In First Nation communities, unemployment rates in 2006 were generally higher (averaging 13.5%) and participation rates lower (averaging 61%) than the HRSA average (Table 5-4 in Appendix I-2). The unemployment rate was highest in the Seine River First Nation (25%) and the Naicatchewenin First Nation (20%). It was lowest at 10.8% in the Couchiching First Nation (Statistics Canada 2007a).

5.14.3.8 Income Levels and Distribution

In 2005, median earnings varied considerably amongst communities in the HRSA (Table 5-6 in Appendix I-2). The HRSA average of median incomes for those 15 and over was $26,446, lower than the Ontario average of $29,335. This difference is smaller considering only those working fulltime all year ($44,375 compared to $44,748 for Ontario). In Emo, the median earnings of persons 15 and over with earnings was $29,489, slightly higher than the Ontario average of $29,335. In the Township of Chapple however, median earnings were as low as $14,399. Median earnings for those who worked fulltime all year were close to or above the Ontario average in Fort Frances, Emo and Rainy River, but significantly below the Ontario average in the Township of Chapple, at $23,734 compared to the Ontario average of $44,748 (Statistics Canada 2007a).

Median earnings data is only available for the Naotkamegwanning First Nation and Seine River First Nation. This data suggests that residents of First Nation communities in the region could be substantially poorer than other residents of the HRSA. Earnings in these communities for all residents 15 and over averaged only $10,497, about 40% of the HRSA average. For the fully employed, earnings amounted to $24,410, or 55% of the HRSA average. The median earnings for Seine River First Nation were lower than the Naotkamegwanning First Nation and were only $5,968 (compared to $12,384) for all residents 15 and over. Income including government transfers were almost the same for both First Nation communities and averaged $11,692 for all those 15 and over. This is 42% of the HRSA average (Statistics Canada 2007a).

There is a gender divergence in the region as well, particularly among the higher income earners. Men who worked fulltime all year earned a median amount of $55,932 in Fort Frances and $56,883 in Emo, considerably above the Ontario average of $50,057. Nowhere in the HRSA did women who worked fulltime all year meet the Ontario average. Gender differences are less pronounced in First Nation communities and in fact, fulltime earnings and income were higher for women than for men, although this was not true for the earnings of all those 15 and over (Statistics Canada 2007a).

5.14.4 Transportation Infrastructure and Services

The HRSA is serviced by road, rail and air. Situated along the United States border, air courier, truck transportation and rail are important connections to markets in the Upper Midwest of the United States and east-west connections to the Prairies and eastern / southern Ontario. Highway 11 runs along the southern portion of the region, parallel to the Minnesota border and is an important road corridor in the HRSA connecting the Townships of Alberton, Chapple, Dawson, Emo, La Vallee, Morley and Rainy River. Other key highways are Highway 602 (connecting Alberton, Emo and La Vallee), Highway 71 (connecting Chapple and La Vallee) and Highway 600 (connecting Chapple, Dawson and Rainy River). Average annual daily traffic on the Highway 71 major north-south corridor (Appendix I-2) was measured in 2008 as 1,250 average annual daily traffic at the intersection of Highways 600 and 615 for a highway with a capacity of 2,800 average annual daily traffic. The same measure at the Sioux Narrows wooden bridge at the Rainy River - Kenora district boundary was 1,300 average annual daily traffic on a 2,800 average annual daily traffic capacity highway.

Fort Frances is the largest town in the HRSA and has the most diverse transportation system with rail, road, cycling and pedestrian pathways. It also has the only commercial airport with in the HRSA supporting daily flights from Thunder Bay, Kenora and Winnipeg (Town of Fort Frances 2012b).

5.14.5 Housing and Accommodation

5.14.5.1 Current Status

In 2006, Sioux Narrows – Nestor Falls and Township of Alberton had the highest average value (dollar amount expected by the owner if the dwelling were sold) of housing in the HRSA, amounting to (in 2011 dollars) $284,587 and $258,188, respectively. The Town of Rainy River had the lowest value of home, which had declined from already low values relative to the other communities in the HRSA in 2001. Housing fluctuations are expected to continue, all things being equal. The Rainy River Census Subdivision (unorganized), for example, has saw a decline of 11% in the stock of occupied housing since 2006, falling from 567 to 504 in 2011, while total housing declined from 1657 to 1523, a fall of 8%.

The Rainy River District Social Services Administration Board (RRDSSAB) is responsible for the administration of social housing in the Rainy River District. The RRDSSAB directly owns 297 units and administers approximately 15 rent supplement (subsidized) units, amounting to roughly 60% of the supply of public, non-profit and subsidized housing in the HRSA (Table 7-6 in Appendix L; RRDSSAB 2012). There are two types on non-profit housing in the Rainy River District: Private Non-Profit and Urban Native managed by independent boards. There are currently 10 providers of Private Non-Profit and Urban Native housing, with these providers owning and managing their own projects. The Kenora District Services Board provides

administration for social housing in the Kenora District. The Township of Sioux Narrows – Nestor Falls do not have any assisted housing facilities.

Nearly half (45%) of low income housing units are targeted towards seniors, although this does not take into account the larger size of family units. Single unit housing not geared to seniors makes up 26% of housing units, with the remainder oriented to families. There are currently 36 units focused on housing for Aboriginal families in Fort Frances, with 16 additional units planned for development by the United Native Friendship Centre (United Native Friendship Centre 2012).

5.14.5.2 Future Development

Fort Frances has indicated that the creation of residential lots is a priority. The town has purchased a property from the local school board with the intent of preparing it for residential lots. There are a number of residential and industrial lots for sale (Town of Fort Frances 2012b).

The Town of Emo is preparing for growth and has 4 subdivisions are available or proposed for development (some of which are now sold):

- Echo Lake Estates has 70 lots total with zoning for duplexes or single homes;
- Meadowlands of Emo has 24 lots, and the area includes 7 commercial lots and some apartment development; and
- North of Emo, a privately serviced (septic and well) subdivision, has a total of 28 lots.

The Town of Rainy River is currently in preliminary discussions to approve a multi-density subdivision to be created within the next three years. There are 20 fully serviced lots available for development. Another 6 to 10 lots have homes on them which need to be demolished for new housing (Town of Rainy River 2012b). In the Township of Alberton, new lots are created through severances. On average, the Township creates up to four new lots per year (Township of Alberton 2012a). The Township of Morley has no new residential plans in the next five years. There are approximately 10 un-serviced lots available for residential development (Township of Morley 2012).

5.14.5.3 Temporary Accommodation

With the exception of Fort Frances, temporary accommodation in the HRSA is limited to a total of approximately 344 temporary rental rooms available in the HRSA with Fort Frances contributing the majority. While the region is a centre for tourism, most of the accommodation infrastructure reflects the needs of hunters and fishers to access remote locations. As a result, the capacity for housing workers without impacting availability for tourists may be seasonal (Rendez-Vous Hotel 2012).

5.14.6 Power and Communications

All communities within the HRSA are connected to the Provincial electrical power grid. Electricity generation in the District has focused on renewable power from hydroelectricity and biofuels. The main channel of the Seine River system is the only water system on the Crossroute Forest that has been developed for hydro generation. There are three dams which produce power on the Seine River system: the Calm Lake Generating Station, the Sturgeon Falls Generating Station and most recently the Valerie Falls Generating Station. The older dams were intended both for power generation and water level control to facilitate log-drive operations. Seine River runs into Rainy Lake, which is essentially a reservoir controlled by a fourth power-generation / water level control facility at Fort Frances. Resolute also owns and operates a 50 MW plus 61 MW biofuel plant in Fort Frances using wood waste as a primary fuel source, although the continued operation may be threatened by the uncertain future of the local mill.

Telephone and television infrastructure is provided to all communities in the HRSA. Mobile phone reception throughout the study area is limited outside of the communities and the principal highways although the RRP site is within the coverage maps of some cellular providers (Tbaytel 2012).

5.14.7 Water, Wastewater and Solid Waste

The HRSA communities are generally operating below available water capacity and have no significant concerns or issues. The water treatment plant drawing surface water intake from the Rainy River for the Town of Rainy River was built in 1973 and has received several upgrades and extensions since then. A number of lines still require upgrading, but the facility is running well under its total capacity (25%). Fort Frances draws water from Rainy Lake and its facility is operating at 33% capacity.

The sewer system for the Town of Rainy River has undergone numerous upgrades due to issues resulting from high rains events. In order to comply with MOE requests for improvement to the sewer system, the Town of Rainy River added new higher capacity pumps at the lift station, added a third lagoon and replaced a number of waste water collection lines within the community (Town of Rainy River 2012b).

In the Township of Chapple, only the settlement area of Barwick is serviced with municipal water and sewer. Rural lots are on private water (site-specific) and septic systems (Township of Chapple 2012a). The Township of Emo is serviced by municipal water and sewer. Water and sewer capital projects are currently underway, involving expanding the Emo water treatment plant to increase capacity and upgrading infrastructure. Rural lots are on private water drawn from individual wells and septic systems (Township of Emo 2012). The Township of Emo requires water and sewer upgrades of approximately $5.9 million. The upgrades would

accommodate the demands from new subdivisions. The Township of Emo has completed an EA for the water and sewer upgrades and has applied for grants to help cover the costs (Township of Emo 2012).

Most First Nation communities are operating within existing capacity for water and wastewater. The exceptions are the Naicatchewenin First Nation, whose water treatment facility is functioning at maximum capacity and does not have the ability to serve future housing developments; and Seine River First Nation which is at full capacity for both wastewater and water treatment.

In rural communities, solid waste services are limited to landfill site access. Garbage and recycling collection services exist in the Towns of Rainy River and Fort Frances (as well as Couchiching First Nation which has a garbage collection agreement with Fort Frances). There are no known capacity concerns with respect to existing landfills.

5.14.8 Education

5.14.8.1 Educational Attainment

Educational attainment for communities in the HRSA is presented in Tables 4-12 and 4-13 in Appendix L. The percentage of population with less than high school education in the HRSA 27.9%, which is higher than Ontario (22.2%), with the Township of Chapple having the highest percentage at 45.6% (Statistics Canada 2007a). The percentage of the population in the HRSA with a high school diploma or equivalent (29.6%) is slightly higher than the Provincial average of 26.8%. The share of the population with university degrees, certificates or diplomas in the HRSA (9.8%) is lower than the Provincial average (20.5%). This is particularly true for the rural Townships of Chapple (5.1%), La Vallee (3.0%) and Morley (6.3%). The share of the population with apprenticeships or trades certificates across the HRSA (11.8%) is higher than the Ontario average (8.0%) and is particularly high in the rural Township of Morley (20.3%) and La Vallee (14.9%).

In the First Nation communities, the percentage of the population with less than high school education was 46.5%, compared to the HRSA average of 27.7%. Communities with the highest percentage without high school diplomas were the Rainy River First Nations (57.6%), the Naicatchewenin First Nation (54.2%) and the Seine River First Nation (52.8%). The average percentage of university graduates in the First Nation communities was 4.9% compared to an HRSA average of 9.7%. Education levels vary between communities, with Couchiching, Mitaanjigamiing and Nigigoonsiminikaaning First Nations having higher levels of college graduates (22.4%, 25.0% and 17.6%, respectively) than the HRSA average (17.5%; Statistics Canada 2007a).

5.14.8.2 Primary and Secondary Schools

Both primary and secondary schools are present within the HRSA including on reserve secondary school branches of the Seven Generations Education Institute.

Enrolment in Rainy River District schools decreased by 16.5% from 2002 / 2003 school year to the 2009 / 2010 school year (KCB 2011a).

5.14.8.3 Post-Secondary Education

The Seven Generation Education Institute also offers post-secondary opportunities from their Fort Frances campus and technical training at the Kenora campus. The institute is dedicated to learning using Anishinaabemowin (Ojibway culture) as the foundation for learning and providing learning opportunities for Anishinaabeg (Anishnabe people). Programs offered at the Fort Frances campus include: office administration, police foundations, indigenous wellness and addictions prevention, Aboriginal teacher education program, Bachelor of Arts, Andaa Wiinjigewin post-graduate program, Ontario management development program and honours degree in social work (Seven Generations Education Institute 2012).

Confederation College has a Fort Frances campus. This Rainy River District Campus offers a wide variety of programs to meet the education and training needs of the Fort Frances area. The programs range from fulltime postsecondary diploma programs, fulltime and part time certificate programs, continuing education courses, general interest courses and other education training opportunities.

Distance education and training is also accessible through the Contact North offices in Fort Frances, Emo, Rainy River and other locations.

Fort Frances also has an adult learning centre, the Valley Adult Learning Association. Grade 12 equivalency courses are offered as well as basic computer skills, office administration and other general interest courses (Valley Adult Learning Association 2012). Many young people leave the region to pursue advanced education. Popular choices include: Confederation College and Lakehead University (Thunder Bay, Ontario); Red River Community College and University of Manitoba (Winnipeg, Manitoba); and Fanshawe College and the University of Western University (London, Ontario; Confederation College 2012a).

5.14.8.4 Technical Training

The Mining Industry Human Resource Council estimates that mining and mining support industries in Ontario will require about 15,810 new workers between 2011 and 2021 to meet anticipated industry growth, employee turnover and retirements. The leading occupations identified are expected to be production clerks, underground miners, processing labourers and millwrights / industrial mechanics (MIHRC 2012).

Confederation College operates a satellite campus for the Rainy River District in Fort Frances. The campus in Fort Frances offers general interest courses; one and two year Ontario College Diploma programs and contract training. In addition to courses and programs offered at this location, students can remotely access most Confederation college programs (Confederation College 2012b).

High demand trades in the region include millwrights, pipe fitters, electricians, mechanics, heavy equipment operators and transport truck drivers. The College will be offering mechanical techniques, mining techniques, environmental engineering technician and pre-apprentice programs in 2012 / 2013 to meet the anticipated demand of the mining industry for high demand trades (Confederation College 2012b).

5.14.9 Health Infrastructure and Services

The Riverside Health Care Facilities is the Rainy River District health care provider. Riverside Health Care Facilities operates four facilities: La Verendrye Hospital (Fort Frances), Emo Health Centre (Emo), Rainy River Health Centre (Rainy River) and Rainy Crest long term care facility in Fort Frances. Sioux Narrows – Nestor Falls operates a small health unit in Sioux Narrows. Medical services in the Kenora District are concentrated in Kenora.

Due to a physician shortage, wait times and the number of emergency room visits are high. Fort Frances is actively recruiting three family practitioners and one general practice anaesthetist. Locum opportunities are available in Emergency Services, Primary Care and General Practice / Anaesthetists (Town of Fort Frances 2012b). Currently there are vacancies for five general practitioners in Fort Frances and one in Emo. Recruitment and retention of nurses and medical technologists are also a priority. A partnership amongst the Town of Fort Frances, the Fort Frances Community Clinic, Nelson Professional Medical Corporation and Riverside Health Care has been established to address recruitment challenges and work together to ensure that potential candidates from the Northern Ontario School of Medicine receive a positive experience. The committee also works with Health Force Ontario marketing and recruitment agency that stages an annual tour of all seven medical campuses in the Province for communities seeking physicians (Riverside Health Care Facilities 2012).

As the largest centre in the HRSA, Fort Frances offers the widest range of auxiliary medical services such as dentistry, counselling, mental health services, chiropractors, optometrists, physiotherapists, massage therapists and seniors' services.

To help address the physician shortage the Town of Rainy River, Township of Dawson, Township of Lake of the Woods and Big Grassy River First Nation have formed the Rainy River Health Care Committee. The committee is in the process of planned and has now built a new complex to house locum physicians and medical students (Town of Rainy River 2011). Currently

there are four health clinics in the region: two in Fort Frances, one in Emo and another in Rainy River (Riverside Health Care Facilities 2008).

Riverside Health Care Facilities is launching a planning exercise for the 2013 to 2016 period to identify organizational priorities and action plans to best meet the needs of the communities.

The region also offers specialized medical services for First Nations. The Gizhewaadiziwin Access Centre in Fort Frances is a community based primary care service centre that combines western curative care with traditional Ojibway healing philosophies and practices. The Access Centre offers clinical, social, health promotion and prevention as well as access to traditional Ojibway healers. The Access Centre also organizes nurse practitioner visits to First Nation communities in the area. The Access Centre estimates approximately 4,000 patients access services per year (Gizhewaadiziwin Health Access Centre 2008).

5.14.10 Emergency Services

The Ontario Provincial Police (OPP) protect the non-First Nation communities in the HRSA. The OPP in the Town of Fort Frances provides non-contract policing services to the following HRSA communities: Township of Alberton, the Township of La Vallee, the Township of Emo, the Township of Chapple, the Township of Morley, Town of Rainy River and the Township of Dawson. Rainy River and Emo both have satellite OPP offices. The Fort Frances OPP detachment is staffed by 52 constables, 6 sergeants, a staff sergeant and an inspector (OPP 2012). Townships are generally satisfied with the services offered by the OPP in the region (Town of Fort Frances 2012b).

The Fort Frances OPP also provides assistance as required to Treaty 3 Police Services which service First Nation communities in the HRSA. Treaty 3 police services has 25 fulltime officers, 18 administrative staff and 6 casual / guard staff. Treaty 3 police services offer culturally sensitive services by employing local Aboriginal people, regular contact with Chiefs and leaders, and local policing committees that regularly meet to discuss issues (Treaty 3 Police Services 2012). Many First Nation communities have voiced concerns over the effectiveness of the Treaty 3 Police. Common public security issues in the First Nation communities include break-ins and theft as well as drug abuse, although the extent of these problems varies from community to community.

Rainy River District Emergency Medical Service currently has a fleet of 12 vehicles distributed between 4 stations in the Rainy River District. In the HRSA, stations are located in Fort Frances, Emo and Rainy River. The fourth station is located Atikokan (in the Rainy River District but outside of the HRSA). The district is served by approximately 50 paramedics (Town of Fort Frances 2010). Ambulance Services in Sioux Narrows – Nestor Falls are provided by the Kenora District.

Fire Services are mostly run by volunteers in HRSA communities, with the exception of Fort Frances which has a paid core of nine fulltime fire fighters. In the event of emergency there are mutual aid agreements amongst HRSA communities. The majority of fire service incidents responded to are car accidents. HRSA communities reported attending 5 to 10 incidents annually.

Fire Services to First Nation reserves are typically provided locally through volunteer fire departments supplemented by district fire service agreements although some communities (such as with the Nigigoonsiminikaaning First Nation) have relationships with providers outside the community and Lac La Croix First Nation currently has no local fire service.

Ambulance services for First Nation communities are more often contracted from regional centres: in Mitaanjigamiing First Nation, Nigigoonsiminikaaning First Nation and Couchiching First Nation communities, ambulance services are from Fort Frances; in Lac La Croix First Nation ambulance services are from Atikokan; and in the Rainy River First Nations ambulance services are from Emo. Naicatchewenin First Nation operates and manages a Medical Transportation program to transport band members who do not own a vehicle to medical appointments in Emo and Fort Frances daily. The program also allows band members to be transported to Thunder Bay and Winnipeg when needed for medical appointments. Ambulance services are provided by emergency medical services in Fort Frances or Emo.

5.14.11 Regional and Community Social and Recreation Services

Social services are provided in the larger communities in the HRSA, with community counselling services in both Rainy River and Fort Frances. In Fort Frances, the Sister Kennedy Centre provides services for seniors including providing a social setting. The Community Care Access Centre connects residents with the care they may need in the home or community. Fort Frances, Emo and Rainy River have volunteer-based Meals on Wheels programs. Urban Aboriginal populations in Fort Frances are served by the United Native Friendship Centre.

The communities of Alberton, Emo, Fort Frances, La Vallee, Morley, Rainy River and Sioux Narrows – Nestor Falls have public libraries. The Town of Emo has an arena, curling rink and sports field. The Township of La Vallee also shares the arena and associated maintenance costs (Township of Emo 2012). Fort Frances also has a theatre. The Royal Canadian Legion operates chapters in Emo, Fort Frances and Rainy River. There are Masonic chapters in Rainy River and Fort Frances.

The Fort Frances Children's Complex offers a number of programs for young families including day care, home day care, Best Start programs, and before and after school child care (Town of Fort Frances 2012a). La Vallee and Rainy River also have child care facilities.

The HRSA is serviced by the Rainy River District Victims Services Program and the Victim Crisis Assistance and Referral Service in the Kenora District (servicing Sioux Narrows – Nestor

Falls). These programs are provided by phone, in person, or in the office located in Fort Frances (RRDVSP 2012).

All communities have churches: Fort Frances has fourteen churches, Rainy River has six churches and most other communities have two or three. Prominent denominations are Catholicism, Anglican and United as well as a variety of evangelical congregations.

The HRSA offers a variety of community recreation opportunities to residents. Fort Frances offers the largest and most complete recreation centre, the Memorial Sports Centre. The centre includes fitness programs, swimming pool, arena and many other programs (Town of Fort Frances 2012b). Fort Frances also offers marina and waterfront access.

Emo is serviced by a curling rink, arena, water spray park, speedway and a recreation centre (Township of Emo 2011). Just north of the Town of Emo is the Tamarack recreation area. The area is privately owned and includes a motocross track, the Tamjack golf course, campsites and picnic area, all terrain vehicle trails, walking and hiking trails.

The Town of Rainy River has a recreation centre with arena, fitness centre and outdoor fields (Town of Rainy River 2012a). In the Township of La Vallee, there is a ball park and community centre. The Township of La Vallee also has an outdoor rink facility in the winter (Township of La Vallee 2012).

In the Township of Chapple, the Barwick recreation centre offers facilities to residents. In the Township of Alberton, the millennium skating rink and park features a premier outdoor rink build in 2001. In the summer the surface is used for basketball, rollerblading and other sports. A pavilion house with picnic tables and playground were added to the area in 2008. In 2012 outdoor exercise equipment for adults was installed (Township of Alberton 2012a).

5.15 Archaeological and Heritage Resources

5.15.1 History of Northwestern Ontario

The cultural pre-European contact history of the Rainy River District is similar to that in eastern Manitoba and northern Minnesota, and can be divided into the following generalized temporal and cultural sequences:

- **Late Paleo (circa 9000 to 6000 BC):** Late Paleo sites are characterized by projectile points which are lanceolate in shape like fluted points. Sites were situated along glacial lake shorelines such as Lake Agassiz, and often involved quarrying of materials such as quartz and other bedrock sources such as altered silicified volcanics that are similar to chert which were favoured for tool manufacture. There is limited archaeological information available for this time period but it is believed that small groups of people followed a seasonal round and hunted large game such as caribou and other ungulates.

- **Shield Archaic (circa 6000 to 500 BC) and Middle / Late Woodland (circa 500 BC to AD 1600):** The Shield Archaic and Middle Woodland eras are characterized by a transition to a warmer and drier climate, and changes in the distribution of large game and plant communities. The climatic changes triggered a transition in subsistence from larger to smaller game especially during the Woodland times. Plant gathering supplemented small game hunting and projectile points correspondingly become smaller to reflect the new hunting strategy. Fishing technology appears more frequently in the archaeological record. Ceramics appear in about 500 BC and this is a significant material culture development. Subsistence is focused on hunting smaller game and plant gathering, including wild rice. Of note is the prominence of extensive trade and exchange networks that are developed. Exotic artifacts such as marine shell from the coast, beads, and stone tools crafted from distantly sourced materials such as chalcedony quarried from North Dakota appear in the archaeological record. Large burial ceremonialism reaches its peak and is evidenced by the extensive mounds along the Rainy River.

- **Historic (circa AD 1600 to present):** The historic period sees the introduction of non-aboriginal people and settlers into northern Ontario. European goods such as glass beads, scraps of metal, thimbles and other artifacts appear in the archaeological record. Aboriginal people become focused on the hunting and trapping of furbearers to supply to the lucrative fur trade. First Nations begin to transition from a traditional economy to one that is more heavily reliant on European goods (McMillan and Yellowhorn 2004). Treaty #3 was signed in 1873 and included the promise of Federal farming assistance for the First Nations signatories. Researchers also indicated the significance of the sturgeon fisheries to local First Nations' subsistence and commerce during the fur trade era (Holzkamm et al. 2008). Treaty #3 between *Her Majesty the Queen and the Saulteaux Tribe of the Ojibbeway Indians* was signed in 1873. The Treaty resulted in the formation of reserves throughout the region and more concentrated European settlement as pioneers move into the area and take up homesteading.

The people occupying the Rainy River area at the time of European contact were known as the Saulteaux Ojibwa. The term Saulteaux comes from the French Saulteurs or people of the rapids. The Saulteaux occupied the western portion of Ontario into Manitoba and spoke a dialect of the Algonkian language family shared by the Cree, Montagnais and the Algonquins. Many Ojibwa people today prefer to be known as Anishinabeg (meaning original people in their own language).

The French fur trader, Jacques de Noyons was reportedly the first European to traverse the area in the vicinity of Fort Frances in 1688. In 1731, La Vérendrye who managed a trading post on Lake Nipigon and was in search of a northwest passage, applied to the governor of New France authorized by the King of France, to grant permission for La Vérendrye, to explore the region between Lake Superior and Lake of the Woods and be given a monopoly on the furs

traded in that region. In 1731, Charles Dufrost de La Jemeraye, the nephew of La Vérendrye, proceeded to Lac La Pluie or Rainy Lake and established Fort St. Pierre (near present day Fort Frances), while La Vérendrye established Fort St. Charles on Lake of the Woods in 1732 (Nute 1950).

In the 1770s, the Hudson's Bay Company sent traders inland to compete with the North West Company for the rich stores of furs northwest of Lake Superior. In the 18th century, French Canadian traders moved west trading with Aboriginal hunters and trappers in the vicinity of Lake Superior. Fort Frances was established in 1817 as an important Hudson's Bay Company trading post.

Throughout the 1800s, the British government granted land for settlers to establish homesteads along the length of the Rainy River. The Township of Emo was incorporated on July 1, 1899 and was settled by pioneers who were granted these free homesteads. The Town of Rainy River was incorporated on December 9, 1903. It was originally developed on the site of lumber mill established in 1895. The growing community and lumber industry were further supported by the Ontario and Rainy River Railway built through the town in 1901 which was later absorbed by the Canadian Northern Railway and the Canadian National Railway.

5.15.2 Registered Archaeological Sites

In Ontario, archaeological sites are protected under *Ontario Heritage Act*. An archaeological site is any property that contains an artifact or any other physical evidence of past human use or activity that is of cultural heritage value or interest. The following sites are always considered to have cultural heritage value or interest (MTCS 2011):

- Paleo-Indian sites which represent Ontario's earliest human occupants;
- Large, dense concentrations of stone artifacts (lithic scatters);
- Woodland-period archaeological sites from approximately 350 to 3,000 years before present (BP); and
- Archaeological sites identified as sacred or burial sites.

Other archaeological sites that are considered to have cultural heritage value must make an important contribution to our understanding of the history of a place, an event or a people. The level of cultural heritage value associated with an archaeological resource may influence whether it will be conserved as an archaeological site by the MTCS.

Prior to the Stage 2 work associated with the RRP, there were two previously recorded archaeological registered sites within 15 km of the RRP. Little information is known about these sites but they appear to be surface collections of unknown age.

5.15.3 Stage 1 Property Inspections

Two ground-based Stage 1 field assessments and surveys of areas associated with the proposed development of the RRP were undertaken during 2010 and 2011. A representative sample of topography and landforms were investigated. Sites for potential early farmsteads and former roads were also inspected.

Several different areas of archaeological potential are represented within the RRP study area. Generally, two dramatically different cultural periods are reflected by the areas of archaeological potential: the early Paleo-Indian period associated with glacial lake features; and the historic period which includes European pioneer settlement of the area.

Stage 2 Archaeological and Cultural Heritage Resource Assessments were recommended for early Paleo-Indian period pre-contact site and much later historic and pioneer settlement areas of potential which were identified in the Stage 1 assessment. Specific areas for investigation include development areas within 50 m of any primary water sources and areas where future development was planned for areas within 150 m of identifiable high potential sections of the ancient Lake Agassiz shorelines. These areas would also be subject to Stage 2 archaeological field assessment work consisting of visual inspection to confirm the presence of the relic shorelines, followed by subsurface testing where warranted.

It was further recommended that the earliest pioneer homestead / former farmhouse foundations or ruins and former infrastructure areas be subject where possible to a Stage 2 Archaeological and Cultural Heritage Resource Assessment as required by MTCS.

5.15.4 Stage 2 Archaeological Assessment

During the 2012 and 2013 Stage 2 archaeological assessment within the RRP NLSA, eight pre-contact archaeological sites and six historic sites were located and recorded for a total of fourteen archaeological sites.

As required by regulations, each of the eight pre-contact archaeological sites and six historic sites have been registered with the Province of Ontario site database and have been assigned a Borden Number in the Provincial database. As such, these sites are now afforded protection under the *Ontario Heritage Act* and must not be disturbed until clearance is obtained from the MTCS. No subsurface disturbances or artifact removal is permitted from the sites or within 20 m of the registered site boundary and in addition, there is a 50 m monitoring zone, for a total 70 m area of control around each site (MTCS 2011).

The Stage 2 assessment field tested the proposed RRP development area for archaeological sites, particularly any well drained areas close to water. In accordance with MTCS standards, in high potential areas shovel test pits were placed at a maximum of 5 to 10 m intervals in a grid,

with a minimum width of 30 cm. Test pits were dug to a sufficient depth to expose and intrude into sterile mineral soil. Artifacts found in each test pit were stored in separate bags and brought back to Woodland Heritage Services for analysis. Labels were created for each test pit to ensure provenience was maintained. Working with one test pit at a time, artifacts were washed and left for at least 12 hours to dry. From here, the artifacts were identified, grouped, counted and entered into a database. Important or diagnostic artifacts were labelled, measured and photographed.

In regards to the already identified sites, preliminary application of the MTCS Stage 3 criteria indicate that four pre-contact archaeological sites and two historic archaeological sites will require Stage 3 excavations. Further Stage 4 work may also be required depending on the Stage 3 results. Consultation with Aboriginal people will continue throughout the archaeological research.

5.16 Cultural Heritage Landscapes and Build Heritage Resources

An initial inventory of built heritage was compiled through remote sensing, field global positioning system and photographs. Since the built heritage sites were located largely on private property that had not been acquired by RRR until late 2012 (and into winter conditions), the infield built heritage sites baseline study was not able to be conducted by Unterman McPhail Associates until the spring of 2013. The sections below are sourced from Unterman McPhail (2013). A copy of their report is appended in Appendix M-3.

5.16.1 Local Historical Summary

During first part of the 1900s, the southern part of the Rainy River District grew into a settled rural landscape, comprised of a network of local roads, numerous farms and scattered villages and hamlets, schoolhouses and churches.

The Town of Fort Frances was incorporated in 1903 and Beaver Mills was incorporated as the Township of Rainy River in 1904. The two communities were connected by the River Road or Government Road and settlement was concentrated along there. As the population grew, additional townships were laid out to the north. The Municipality of Chapple on September 14, 1899 and at the time of its incorporation, Chapple was only the third municipality to be organized in the district.

Most of the first buildings were modest structures of log construction. As the farms became more established, some of the original houses and barns were replaced with frame structures constructed of sawn lumber from the local mills. Original snake rail fences gave way to wood post and wire fencing.

The northern part of Chapple Township remained an active agricultural community until the mid 20th century when many farming families moved away. Many of the farms established in the

early 1900s have subsequently been abandoned and the former agricultural lands have returned to bush. The Black Hawk and Dearlock stores and post offices have closed and the small, rural schoolhouses have been removed.

5.16.2 Heritage Recognition

The Minister of MTCS has not designated any of the cultural heritage resources (such as those listed in Table 1 under Part IV of the *Ontario Heritage Act* within or adjacent to the study area. In addition, there are no road bridges listed in the Ontario Heritage Bridge Guideline and no Ontario Heritage Trust easement properties or Federally recognized properties within or adjacent to the study area (Unterman McPhail 2013).

Consultation was also conducted by Unterman McPhail with the Township of Chapple and the Township of Morley to confirm whether properties identified within and adjacent to the RRP are included in a municipal heritage inventory or is listed in the municipal heritage register. None were identified by the Townships.

Unterman McPhail Associates and Jean Simonton, Heritage Consultant, completed a windshield survey in May 2013, to identify cultural heritage landscapes and built heritage resources within the study area. The results of the survey is detailed in Appendix M-3 and summarized in Table 40. Twenty-one sites were identified and described.

Table 5-1: Summary of Mine Rock Mine Rock Proportions and Samples

Lithology	Proportion of Rock Types	Number of Samples
Felsic Metavolcanic	64.9%	158
Mafic Metavolcanic	12.3%	56
Metasediment	11.0%	60
Felsic-Intermediate Intrusive	2.3%	24
Intermediate Metavolcanic	5.7%	20
Chemical Metasediment	0.7%	14
Late Mafic-Ultramafic Intrusive	1.0%	12
Late Felsic-Intermediate Intrusive	0.6%	5
Late Structural Zone	0.9%	4
Diabase	0.4%	3
Early Mafic-Ultramafic Intrusive	0.3%	6
Total	100%	362

Table 5-2: Metal Leaching / Acid Rock Drainage Testing Program

Analytical Procedure	In-pit Mine Rock	Field Cells	Tailings	Overburden
Sobek with Siderite Correction Acid Base Accounting	362	21*	6	0
Modified Sobek Acid Base Accounting	30	0	6	3
Net Acid Generation test	176	21*	6	3
Elemental Content	362	21*	6	3
Shake Flask Extraction	74	0	6	2
Rietveld XRD	39	0	6	0
Humidity Cells	20	0	6	0

*Seven field cells were made up of material represented by 21 individual samples

Table 5-3: Summary of Hydrostratigraphic Units

Hydrostratigraphic Units	Geologic Units
Near-surface system	Mainly the Holocene sediments, including the peat and alluvial deposits of the Pinewood River. May also include locally small amounts of Whitemouth Lake Till and/or Brenna Formation near surface where these comprise fine sand and coarser material or are highly weathered
Pleistocene aquitard	The dominant unit is the Whitemouth Lake Till, but also includes the various glaciolacustrine deposits (primarily the Wylie and Brenna Formations)
Pleistocene lower granular deposits	The dominant unit is the Whiteshell Till, but also includes Labradorean glaciofluvial deposits. Coarser (fine sand and above) parts of the Wylie Formation may be included where this sits immediately above the Whiteshell Till or bedrock
Shallow bedrock	Weathered and/or fractured undifferentiated bedrock, occurring within 10 to 20 m of the bedrock surface
Intermediate and deep bedrock	Undifferentiated bedrock

Table 5-4: RRP Monthly Surface Water Quality Monitoring Stations

Station	Description	Function (potential longer term function)
SW1	Pinewood River 0.3 km upstream of confluence with Clark Creek (Teeple Drain)	Background data for Pinewood River
SW2	West Creek above Highway 600	Background data for West Creek (this portion of West Creek to be diverted by RRP development)
SW3	Pinewood River at Pinewood River Road approximately 3 km downstream of confluence with Loslo Creek (Cowser Drain)	Pinewood River downstream station (permanent downstream station)
SW4	Unnamed Creek which drains Muskrat Lake, Rainy Lake catchment	Small creek control site outside of RRP influence (permanent reference station)
SW7A	West Creek above confluence with Pinewood River	Background data for West Creek (this portion of West Creek to be diverted by RRP development)
SW10	Pinewood River at Highway 600	Long term Pinewood River control station, positioned upstream of all proposed developments (permanent upstream station)
SW11	Clark Creek (Teeple Drain) 1.5 km north of Township landfill	Background data for Clark Creek (Clark Creek / Teeple Drain to be displaced by RRP development)
SW12A	Marr Creek 3.8 km above Highway 600	Background data for Marr Creek (Marr Creek to be displaced by RRP development)
SW13	Loslo Creek above Highway 600	Background data for Loslo Creek (Loslo Creek to be extensively displaced / modified by RRP development)
SW14	West Creek 2.5 km above Highway 600	Background data for West Creek (this portion of West Creek to be diverted by RRP development)
SW15	Pinewood River approximately 2 km above confluence with Rainy River	Pinewood River furthest downstream station (permanent downstream station)
SW16	Rainy River approximately 40 km upstream of confluence with Pinewood River	Rainy River upstream station (permanent upstream station)
SW17	Rainy River approximately 12 km downstream of confluence with Pinewood River	Rainy River downstream station (permanent downstream station)
SW18	Marr Creek at Highway 600	Background data for Marr Creek (Marr Creek to be displaced by RRP development)

Table 5-5: Sediment Sampling Efforts 1997 to 2012

Watercourse	KCB			AMEC	
	2008	2009	2010	2011	2012
Pinewood River					
Pinewood Lake					
Pinewood River US [1]				X	X
Pinewood River MS [2]	X	X		X	X
Pinewood River DS [3]					X
Pinewood River Tributary Creeks					
Blackhawk Creek				X	
Unnamed Drainage A					
Clark Creek (and Teeple Drain)				X	X
McCallum Creek					X
Loslo Creek (and Cowser Drain)				X	X
Marr Creek				X	
Tait Creek				X	X
West Creek	X	X		X	X
Unnamed Creek				X	X
Minor North Tributaries					
Minor South Tributaries					
External Creek Systems (outside of Pinewood River Watershed)					
Muskrat Lake					
Unnamed Creek draining Muskrat Lake					

Notes:
1. Pinewood River: US - upstream of a point 1 km upstream of the Clark Creek (Teeple Drain) inflow
2. Pinewood River: MS - mid-stream between the US and DS points
3. Pinewood River: DS - downstream of a point 1 km downstream of the McCallum (Jones) Creek outlet

Table 5-6: Fish Sampling Effort 1997 to 2012

Watercourse	MNR / Rainy River First Nations	KCB			AMEC	
	1997	2008	2009	2010	2011	2012
Pinewood River						
Pinewood Lake				M, Sn		
Pinewood River US [1]				M	G, S, M	G, M
Pinewood River MS [2]	E		E, G, S, M	G, M	G, S, M	E, G, S, M, D
Pinewood River DS [3]	E					E, G, S, M, D
Pinewood Tributary Creeks						
Blackhawk Creek				M	S, M	
Unnamed Drainage A				M		
Clark Creek (Teeple Drain)				M	E, S, M, D	E, M
McCallum Creek			M	M		G, S, M, D
Loslo Creek (Cowser Drain)				M	G, S, M, D	S, M, D
Marr Creek				M	G, S, M, D	
Tait Creek				M	M, D	S, M, D
West Creek			E, S, M	E, M	E, M, D	E, M, D
Unnamed Creek				M		E, M, D
Minor North Tributaries				M		M, D
Minor South Tributaries				M	E	
External Creek Systems (outside of Pinewood River watershed)						
Muskrat Lake			M			
Unnamed Creek draining Muskrat Lake			M			

Notes:
1. Pinewood River US - upstream of a point 1 km upstream of the Clark Creek (Teeple Drain) inflow
2. Pinewood River MS - mid-stream between the US and DS points
3. Pinewood River DS - downstream of a point 1 km downstream of the McCallum (Jones) Creek outlet

E - electrofishing
G - gill net
S - seine net
M - minnow trap
D - dip net
Sn - snorkel

Table 5-7: Benthos Sampling Efforts 1997 to 2012

Watercourse	MNR / Rainy River First Nations	KCB			AMEC	
	1997	2008	2009	2010	2011	2012
Pinewood River						
Pinewood Lake						
Pinewood River US [1]			X	X	X	X
Pinewood River MS [2]	X		X	X	X	X
Pinewood River DS [3]	X					X
Pinewood Tributary Creeks						
Blackhawk Creek					X	
Unnamed Drainage A						
Clark Creek (Teeple Drain)					X	X
McCallum Creek						X
Loslo Creek (Cowser Drain)					X	X
Marr Creek					X	
Tait Creek					X	X
West Creek				X	X	X
Unnamed Creek					X	X
Minor North Tributaries				X		
Minor South Tributaries						
External Creek Systems (outside of Pinewood River watershed)						
Muskrat Lake			X			
Unnamed Creek draining Muskrat Lake			X			

Notes:
1. Pinewood River: US - upstream of a point 1 km upstream of the Clark Creek (Teeple Drain) inflow
2. Pinewood River: MS - mid-stream between the US and DS points
3. Pinewood River: DS - downstream of a point 1 km downstream of the McCallum (Jones) Creek outlet

Table 5-8: Aquatic Habitat Sampling Effort 1997 to 2012

Watercourse	MNR / Rainy River First Nations	KCB			AMEC	
	1997	2008	2009	2010	2011	2012
Pinewood River						
Pinewood Lake			X	X		
Pinewood River US [1]			X	X	X	X[4]
Pinewood River MS [2]	X		X	X	X	X[4,5]
Pinewood River DS [3]	X					X[4,5,6]
Pinewood Tributary Creeks						
Blackhawk Creek				X	X	
Unnamed Drainage A				X	X	
Clark Creek (Teeple Drain)				X	X	X[4]
McCallum Creek						X[4]
Loslo Creek (Cowser Drain)				X	X	X[4,5]
Marr Creek				X	X	
Tait Creek				X	X	X[5]
West Creek			X	X	X	X[4,5]
Unnamed Creeks						X[4,5]
Minor North Tributaries						
Minor South Tributaries						
External Creek Systems (outside of Pinewood River watershed)						
Muskrat Lake			X			
Unnamed Creek draining Muskrat Lake			X			

Notes:
1. Pinewood River: US - upstream of a point 1 km upstream of the Clark Creek (Teeple Drain) inflow
2. Pinewood River: MS - mid-stream between the US and DS points
3. Pinewood River: DS - downstream of a point 1 km downstream of the McCallum Creek outlet
4. Comprehensive habitat assessment locations
5. Channel cross section morphological assessment locations
6. Bathymetric survey

Table 5-9: Mean Temperature Profiles at Barwick Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Daily Average (°C)	-15.9	-11.6	-5.4	5.2	11.7	16.2	18.8	17.8	12.1	5.5	-3.8	-12.7	3.2
Daily Maximum (°C)	-9.9	-5.4	1.4	10.5	18.5	22.5	25.8	25.0	17.7	10.4	0.1	-7.7	8.9
Daily Minimum (°C)	-22.0	-17.8	-10.2	-2.1	5.9	10.0	12.6	11.6	6.5	0.7	-7.7	-17.7	-2.6

Source: EC 1971 to 2000 Canadian Climate Normals

Table 5-10: Mean Monthly Precipitation at Barwick Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation (mm)	28.3	25.1	29.7	40	68.3	113.8	99	84	80	56.2	41.7	29.7	695.7
Rainfall (mm)	0.3	3.3	11	30.4	67.3	113.8	99	84	79.4	50.4	12.8	0.8	552.4
Snowfall (cm)	28	20.8	18.7	9.6	1	0	0	0	0.6	5.8	28.9	28.9	142.3

Source: EC 1971 to 2000 Canadian Climate Normals

Table 5-11: Minimum and Maximum Precipitation Years at Barwick Station

Precipitation (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Minimum (2006)	28.9	21.9	70.1	30.3	53.4	37.8	41.0	45.4	32.6	51.6	27.8	35.0	475.8
Maximum (2005)	62.8	25.4	12.4	27.2	128.9	233.6	99.4	97.2	51.5	101.6	92.4	33.7	965.1

Source: EC 1971 to 2000 Canadian Climate Normals

Table 5-12: Interpolated Intensity Duration Frequency Return Event for Rainy River Project

Return Period (year)	Interpolated Event (mm) by Storm Duration								
	5 min	10 min	15 min	30 min	1 hr	2 hr	6 hr	12 hr	24 hr
2	8.5	12.3	15.2	19.8	25.2	29.4	38.1	45.6	50.8
5	10.8	15.4	19.6	25.1	29.4	33.4	40.9	45.9	50.9
10	12.9	17.7	21.8	27.8	39.4	48.7	72.2	86.7	92.5
25	13.4	20.3	26.6	39.5	49.7	62.8	80.4	93.8	102.0
50	15.7	22.6	29.8	45.6	56.7	71.4	91.0	106.0	116.0
100	16.1	25.1	33.0	49.8	63.1	80.0	101.0	118.0	129.0

Source: MTO (2010)
min: minute
hr: hour

Table 5-13: Rainfall and Snowmelt Runoff Data from Fort Frances

Duration (days)	Rainfall and Snowmelt Runoff (mm) by Return Period (years)					
	2	5	10	25	50	100
1	17.67	25.78	29.51	35.46	39.88	45.27
2	30.13	42.36	50.47	60.70	68.29	75.83
3	38.40	55.29	65.83	78.12	87.98	97.78
4	46.18	65.36	76.43	91.65	102.93	115.16
5	51.60	72.68	86.67	105.31	117.39	130.40
6	55.00	77.85	93.01	112.14	126.32	140.42
7	58.50	83.33	99.81	120.59	135.99	151.32
8	61.70	88.42	106.15	128.52	145.11	161.60
9	65.60	93.65	112.94	137.26	155.29	173.23
10	67.64	98.49	118.97	145.79	163.94	182.98
15	76.26	110.86	133.82	162.79	185.26	205.62
20	85.97	123.91	149.76	182.36	206.53	230.57
25	91.84	136.29	165.78	202.98	230.56	258.00
30	97.74	145.35	176.95	216.79	246.34	275.72

Table 5-14: Mean Monthly Evaporation and Evapotranspiration

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Annual
Evaporation at Atikokan Station (mm) *	0	109	110	129	104	63	23	0	538
Evapotranspiration at RRP site (mm)	0	101.3	102.2	119.9	96.6	58.6	21.4	0	500

Source: *EC (2012a)

Table 5-15: Mean Annual Regional Background Air Quality Data
Experimental Lakes Area, Ontario

Parameter ($\mu g/m^3$)	2005	2006	2007	2008	2009	Maximum for Period
Chloride (Cl^-)	0.026 (0.060)	0.016 (0.029)	0.021 (0.072)	0.072 (0.230)	0.040 (0.152)	1.760
Potassium (K^+)	0.032 (0.038)	0.030 (0.036)	0.029 (0.020)	0.028 (0.022)	0.034 (0.031)	0.306
Sodium (Na^+)	0.041 (0.066)	0.028 (0.041)	0.031 (0.062)	0.101 (0.166)	0.052 (0.105)	1.096
Ammonium (NH_4^+)	0.392 (0.509)	0.310 (0.389)	0.301 (0.473)	0.432 (0.597)	0.374 (0.457)	6.136
Nitrate (NO_3)	0.393 (0.761)	0.351 (0.697)	0.341 (1.043)	0.748 (1.619)	0.464 (1.001)	15.300
Nitric Acid (HNO_3)	0.356 (0.343)	0.290 (0.264)	0.234 (0.226)	0.281 (0.272)	0.260 (0.259)	2.007
Sulphate (SO_4^{2-})	1.072 (1.274)	0.813 (0.818)	0.779 (0.778)	0.967 (0.660)	0.983 (0.945)	9.167
Sulphur Dioxide (SO_2)	0.561 (0.751)	0.406 (0.466)	0.354 (0.564)	0.801 (0.868)	0.531 (0.798)	6.550
Calcium ($Ca2^+$)	0.139 (0.199)	0.162 (0.297)	0.140 (0.181)	0.117 (0.193)	0.161 (0.287)	3.202
Magnesium ($Mg2^+$)	0.032 (0.041)	0.033 (0.048)	0.032 (0.037)	0.033 (0.037)	0.039 (0.056)	0.365

Source: EC (2012a)
Notes: Standard Deviations provided in brackets

Table 5-16: Mean Regional Background Precipitation Quality Data
Experimental Lakes Area, Ontario

Parameter	Measurement	Value / Concentration	Maximum for Period (1983 to 2008)
pH	pH units	5.16	3.4 to 7.63
Hydrogen ion	mg/L	0.01	0.40
Sulphate	mg/L	1.26	22.77
Nitrate	mg/L	1.76	27.05
Chloride	mg/L	0.10	2.08
Ammonium	mg/L	0.56	11.42
Sodium	mg/L	0.06	2.04
Calcium	mg/L	0.33	8.64
Magnesium	mg/L	0.07	2.59
Potassium	mg/L	0.05	1.04

Source: EC (2012a)

Table 5-17: Mean Annual Regional Background Air Quality Data

Parameter	AAQC AAQO (Desirable / Acceptable)	Thunder Bay, Ontario (AQI Station 63203)					Experimental Lakes Area, Ontario (NAPS Station 64001)					Winnipeg, Manitoba (NAPS Station 070119)				
		2006	2007	2008	2009	2010	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
NO_2 (ppb)	100 (24 hr) 200 (1 hr) *30 / 50*	8.1	8.7	8.1	8.4	7.8	-	-	-	-	-	14 (8)	14 (8)	13 (9)	12 (8)	13 (9)
NO (ppb)	9000 ($\mu g/m^3$) -	6.1	5.4	5.1	5.7	4.6	-	-	-	-	-	9 (16)	9 (15)	9 (16)	8 (13)	7 (12)
O_3 (ppb)	80 *50 / 80*	23.5	24.2	23.0	24.2	25.7	33 (9*)	31 (11)	30 (10)	32 (11)	33 (10)	20 (11)	21 (12)	17 (10)	19 (11)	21 (12)
$PM_{2.5}$ Mean ($\mu g/m^3$)	30 -	4.8	4.4	4.2	3.8	4.1	-	-	-	-	-	6 (6)	5 (5)	4 (4)	5 (7)	5 (5)
$PM_{2.5}$ 98^{th} / 99^{th} ** percentile ($\mu g/m^3$)	- -	22	21	21	17	17	-	-	-	-	-	21	14	13	15	14
CO (ppm)	13 (8 hr) 30 (1 hr) -	-	-	-	-	-	-	-	-	-	-	0.5 (0.3)	0.5 (0.3)	0.4 (0.2)	0.3 (0.2)	0.4 (0.2)

Sources: EC (2012a); MOE (2010)
Notes: AAQC: MOE Ambient Air Quality Criteria
AAQO: National Ambient Air Quality Objectives
* Standard deviations (+ / -) given in brackets
** 99^{th} percentile for Thunder Bay AQI Station, 98^{th} for Winnipeg NAPS Station

Table 5-18: RRP Area Soil Metal and Metalloid Concentrations

Parameter	Project Area Mean Soil Content (ppm)	Provincial Guidelines[1]		Federal Guidelines	
		Agricultural Use	Residential / Parkland Use	Agricultural Use	Residential / Parkland Use
Antimony	0.19 – 1.77	13	13	20	20
Arsenic	2.2 – 25	20 (25)	20 (25)	12	12
Barium	84 -838	750 (1000)	750 (100)	750	500
Beryllium	1.2 – 2.1	1.2	1.2	4	4
Boron	9 – 85	-	-	2	-
Cadmium	0.06 – 1.1	3 (4)	12	1.4	10
Chromium (total)	7 – 221	750 (1000)	750 (1000)	64	64
Cobalt	1.6 – 21.5	40 (50)	40 (50)	40	50
Copper	6 – 80	150 (200)	225 (300)	63	63
Fluoride	73 – 566	-	-	200	400
Lead	10 – 84	200	200	70	140
Mercury	0.02 – 0.41	10	10	6.6	6.6
Molybdenum	1 – 3	5	40	5	10
Nickel	4 – 55	150 (200)	150 (200)	50	50
Selenium	0.05 – 1.27	2	10	1	1
Silver	0.03 – 8	20 (25)	20 (25)	20	20
Thallium	0.02 – 2.8	4.1	4.1	1	1
Vanadium	5 – 190	200 (250)	200 (250)	130	130
Zinc	17 – 125	600 (800)	600 (800)	200	200

[1] Bracketed Provincial values are for medium- to fine-textured soils
Source: KCB (2011a)

Table 5-19: Pinewood River Flows – Water Survey of Canada Station 05PC023

Month	2007 (m^3/s)	2008 (m^3/s)	2009 (m^3/s)	2010 (m^3/s)	2011 (m^3/s)	Average (m^3/s)	Proportions	Runoff (mm)	Monthly Runoff *
January		0.064	0.043	0.147	0.232	0.122	0.0064	1.397	0.0553
February		0.028	0.021	0.112	0.161	0.081	0.0042	0.836	0.0366
March		0.028	2.560	3.570	0.424	1.646	0.0863	18.915	
April	2.050	2.820	12.800	1.790	11.296	6.151	0.3225	68.429	
May	0.393	4.640	3.410	4.040	3.309	3.158	0.1656	36.307	
June	7.430	2.800	0.894	4.490	0.936	3.310	0.1736	36.822	
July	1.380	1.030	0.492	4.910	0.169	1.596	0.0837	18.349	
August	0.013	0.213	0.740	0.130	0.003	0.220	0.0115	2.527	
September	0.004	0.054	0.049	2.730	0.002	0.568	0.0298	6.315	
October	0.702	2.840	0.214	0.934	0.007	0.939	0.0493	10.799	
November	0.372	3.240	0.977	0.736	0.013	1.068	0.0560	11.876	0.4856
December	0.107	0.270	0.306	0.365	0.022	0.214	0.0112	2.460	0.0973
Annual average	1.383	1.502	1.876	1.996	1.381	1.589	-	-	-
Total						19.072	1	-	-
Runoff (mm)	187.2	203.3	253.8	270.2	186.9	215.1	-	215.0	-

Note: Watershed area of 233 km^2
***** Monthly runoff as a proportion of March to October average proportions

Table 5-20: Pinewood River Flows - Water Survey of Canada Station 05PC011

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean[5]	Annual Runoff (mm)
1952					2.300	4.130	7.690	0.714	0.000	0.076				
1953				0.849	2.160	7.940	1.560	0.709	3.280	0.867	0.364			
1954				12.800	10.100	2.820	0.922	0.183	0.645	0.284	0.541			
1955				13.000	3.770	11.300	0.931	0.150	1.180	4.340				
1956				18.700	9.600	3.840	2.690	0.485	0.105	0.117				
1957				12.900	3.800	3.000	2.610	0.168	0.815	1.330				
1958			0.240	1.360	0.894	2.710	11.700	0.523	0.117	0.514			2.257	
1959			0.091	6.970	5.470	4.950	0.538	0.026	0.294	1.030			2.421	
1960				4.830	1.740	1.770	0.570	0.257	0.124	0.370			1.380	
1961			1.610	5.050	3.530	0.391	0.632	0.339	5.350	2.120			2.378	
1962			0.000	13.600	22.000	10.900	9.030	5.170	3.960	0.942			8.200	
1963			1.080	7.700	5.700	12.000	1.680	0.820	0.056	0.034			3.634	
1964			0.000	4.440	10.300	8.370	1.770	3.590	7.190	7.690			5.419	
1965			0.000	14.700	12.600	7.010	4.490	0.383	3.810	7.720			6.339	
1966			0.378	27.400	15.500	4.610	1.210	5.880	1.080	0.898			7.120	
1967			0.798	22.000	10.600	11.100	2.810	0.952	0.016	0.252			6.066	
1968			1.060	6.810	2.780	19.300	6.420	9.090	11.700	12.800			8.745	
1969			0.000	18.000	5.860	3.490	0.317	3.170	0.173	1.570			4.073	
1970			0.000	13.500	16.800	6.660	1.320	0.015	0.298	1.180			4.972	
1971			0.000	10.000	5.360	2.850	1.200	0.348	0.247	7.800			3.476	
1972			0.028	10.600	7.760	2.340	0.455	0.052	0.159	0.415			2.726	
1973			0.872	1.790	0.754	0.727	0.812	3.580	3.640	6.440			2.327	
1974			0.000	14.400	15.900	12.200	1.460	0.858	0.552	1.410			5.848	
1975			0.000	13.600	9.190	3.040	1.800	0.019	0.044	0.271			3.496	
1976			0.136	8.440	1.290	2.290	0.910	0.014	0.000	0.009			1.636	
1977			0.311	0.945	3.600	3.830	0.698	0.066	2.970	2.730			1.894	
1978			0.002	16.400	9.010	10.600	7.680	1.780	1.120	0.550			5.893	
1979			0.123	25.600	8.250	4.690	0.702	0.157	0.170	0.158			4.981	
1980			0.000	7.020	1.510	0.085	0.049	0.375	2.340	2.130			1.689	
1981			0.138	1.180	1.500	7.310	2.240	0.633	0.513	3.940			2.182	
1982			0.000	10.500	12.600	3.770	4.710	2.020	0.660	8.450			5.339	
1983			0.263	3.860	2.400	7.710	2.190	0.016	0.398	2.680			2.440	
1984			0.228	6.180	2.690	12.600	1.610	0.026	0.000	6.640			3.747	
1985			1.650	9.850	14.100	16.500	5.820	4.770	5.970	6.600			8.158	
1986			1.550	17.000	10.800	0.142	0.036	0.004	0.082	0.058			3.709	
1987			0.419	0.839	2.390	1.480	0.129	0.728	0.251	0.215			0.806	
1988			0.028	3.430	0.272	0.399	0.579	0.502	1.610	0.549			0.921	
1989			0.131	11.900	6.820	8.070	13.400	2.310	0.198	0.080			5.364	
1990			1.570	2.560	2.970	3.990	2.840	0.047	0.001	0.015			1.749	
1991			0.109	2.260	5.590	1.710	6.400	0.055	2.010	1.940			2.509	
1992			0.749	14.100	10.700	1.560	5.120	8.390	12.400	1.930			6.869	
1993			1.530	5.840	5.340	7.170	10.500	3.600	3.380	1.100			4.808	
1994			0.682	2.710	3.510	3.130	9.080	5.530	2.360	2.490			3.687	
1995			4.560	2.540	4.650	0.913	3.370	1.240	0.752	2.990			2.627	
1996			0.214	11.400	26.000	2.980	1.620	0.892	0.192	2.050			5.669	
1997			0.269	20.600	7.400	0.557	1.200	0.022	0.000	0.435			3.810	
1998			0.682	1.210	7.470									
Mean[1]	0.218	0.144	0.538	9.595	7.135	5.412	3.163	1.536	1.787	2.352	1.913	0.383	2.848[2]	194.8
5th [3]	0.073	0.049	0.181	3.228	2.400	1.820	1.064	0.517	0.601	0.791	0.644	0.129	0.958	65.5
95th[4]	0.440	0.292	1.087	19.409	14.432	10.947	6.398	3.107	3.615	4.758	3.870	0.776	5.761	394.1

Average M-O (m^3/s): 4.034 5th P. M-O (m^3/s): 1.357 95th P. M-O (m^3/s): 8.160 Watershed area of 233 km^2

Notes: 1 - Mean monthly data for November to February prorated from Water Survey of Canada Station 05PC023 monthly proportions; 2 - Mean annual runoff January through December; 3 - Calculated as mean monthly flow x (1.357 / 4.034) the monthly values are annualized); 4 - Calculated as mean monthly flow x (8.160 / 4.034) (the monthly values are annualized); 5 - M:March, O:October, P: Percentile

Table 5-21: Measured and Predicted Flows in the Pinewood River - Water Survey of Canada Station 05PC023

Recorded Lowest 7- Day Average Flow Values		
Year	**Lowest 7-Day Flow at East Lake Outlet (m^3/d)**	**Ln Values**
2007 (August 30 to September 5)	111	4.714
2008 (August 26 to September 1)	432	6.068
2009 (February 24 to March 1)	1,172	7.067
2010 (August 23 to August 29)	3,231	8.081
2011 (September 14 to September 20)	12	2.493
Mean	992	-
Mean Ln	5.684	-
SD of Mean Ln	2.175	-

Projected Return Period 7-Day Low Flows		
Return Period	**7Q Ln Value**	**Predicted Lowest 7Q Flow (m^3/d)**
2 Years	5.684	294
3 Years	4.745	115
5 Years	3.853	47
10 Years	2.896	18
20 Years	2.106	8

TABLE 5-22: 2010 TO 2012 SURFACE WATER ANALYTICAL RESULTS

		pH	Conductivity	Hardness as $CaCO_3$	Dissolved Organic Carbon	TSS	Total Ammonia-N	Fluoride	Nitrate	Nitrite	Cyanide-Total	Aluminum-Dissolved	Aluminum-Total	Antimony-Total	Arsenic-Total	Boron-Total	Cadmium-Total	Chromium-Total	Cobalt-Total	Copper-Total	Iron-Total	Lead-Total	Mercury-Total	Molybdenum-Total	Nickel-Total	Phosphorus-Total	Selenium-Total	Thallium-Total	Uranium-Total	Vanadium-Total	Zinc-Total
PWQO		6.5-8.5	-	-	-	-	-	-	-	-	0.005[A]	0.075[LB]	-	0.02[I]	0.1(0.005[I])	0.2[I]	0.0002	0.001 / 0.0089[E]	0.0009	0.005 (0.005)[FI]	0.3	0.020 / 0.025 (0.003 / 0.005)[HI]	0.0002	0.04[I]	0.025	0.03[I]	0.1	0.0003[I]	0.005[I]	0.006[I]	0.03(0.02[I])
CEQG		6.5-9.0	-	-	-	-	-	0.12	2.935	0.06	0.005[A]	0.1[C]	-	-	0.005	1.5	0.000015-0.000088[D]	0.001 / 0.0089[E]	-	0.002 - 0.00622[EJ]	0.3	0.00102 - 0.01343[J]	0.000026	0.073[I]	0.025[J]	-	0.001	0.0008	0.015	-	0.03
RDL		0.10	3.0	5.0	1.0	2.0	0.020	0.030	0.030	0.020	0.0020	0.0050	0.0050	0.00010 / 0.00050 / 0.00060 / 0.0050	0.0010	0.050	0.000010 / 0.000017 / 0.000090[D*]	0.00050 / 0.0010	0.00050	0.00070 / 0.0010	0.020	0.00010 / 0.0010	0.000010 / 0.0010	0.00020 / 0.0010	0.0020	0.0050	0.00050 / 0.00040 / 0.00020 / 0.0010 / 0.0020	0.000030 / 0.000050 / 0.00030	0.0050	0.0010	0.0020 / 0.0030 / 0.0050
		units	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
SW1A	Min	7.17	180.0	79.0	11.1	4.7	0.020	0.030	0.030	0.01	0.0020	0.0025	0.042	0.0001	0.0007	0.010	0.00001	0.0005	0.0002	0.0009	0.266	0.0002	0.00001	0.0003	0.0010	0.028	0.0002	0.00001	0.0003	0.0006	0.0010
	Max	8.83	574.0	301.0	38.9	74.0	0.134	0.107	0.795	0.02	0.0050	0.0570	0.521	0.0050	0.0030	0.050	0.0001	0.0050	0.0006	0.0020	**0.942**	0.0036	0.0001	0.0010	0.0079	**0.130**	**0.0020**	0.00030	0.0050	0.0020	0.03
	Median	7.70	331.0	183.0	21.4	10.0	0.033	0.090	0.048	0.02	0.0020	0.0095	0.256	0.0005	0.0013	0.021	0.00004	0.0012	0.0005	0.0010	**0.615**	0.0005	0.00005	0.0010	0.0020	**0.063**	0.0010	0.00005	0.0007	0.0012	0.0048
	St Dev.	0.29	97.3	56.9	6.9	15.5	0.026	0.025	0.143	0.01	0.0013	0.0116	0.132	0.0009	0.0008	0.015	0.00004	0.0018	0.0001	0.0004	0.195	0.0007	0.00004	0.0003	0.0012	0.027	0.0006	0.00012	0.0019	0.0005	0.0064
	N	28	28	23	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.90	384.5	216.5	25.2	18.6	0.050	0.100	0.100	0.02	0.0050	0.0143	0.369	0.0005	0.0026	0.033	0.00010	0.0050	0.0005	0.0013	**0.775**	0.0010	0.0001	0.0010	0.0022	**0.093**	**0.0020**	0.00011	0.0031	0.0020	0.0053
SW2	Min	7.30	136.0	72.1	8.9	2.0	0.020	0.030	0.030	0.01	0.0020	0.0021	0.019	0.00005	0.00050	0.0050	0.000005	0.00050	0.00007	0.0005	0.174	0.00005	0.000010	0.00031	0.0010	0.0128	0.00020	0.000003	0.00010	0.00050	0.0022
	Max	9.38	447.0	256.0	28.4	142.0	0.088	0.114	0.383	0.02	0.0050	0.035	0.610	0.0050	0.0030	0.050	**0.000100**	0.0050	0.0010	**0.0040**	**1.03**	**0.0012**	0.0001	0.0010	0.0030	**0.126**	**0.0020**	0.00030	0.0050	0.0032	**0.0506**
	Median	7.83	244.0	155.5	19.9	6.9	0.029	0.076	0.050	0.01	0.0025	0.0130	0.140	0.0005	0.0010	0.011	0.000050	0.0025	0.00050	0.0011	**0.550**	0.0005	0.000075	0.0010	0.0020	**0.038**	**0.0020**	0.00005	0.0003	0.0010	0.0050
	St Dev.	0.44	86.5	56.1	4.6	24.2	0.019	0.025	0.064	0.01	0	0.0087	0.122	0.0008	0.00062	0.0144	0.000037	0.00189	0.00017	0.0009	0.268	0.00031	0.00004	0.00026	0.0006	**0.029**	0.00063	0.00010	0.0017	0.00053	0.0082
	N	35	35	20	35	35	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	30	33	33	33	20	33	33	33	33	33
	75th %	8.00	293.5	205.3	22.7	17.0	0.050	0.100	0.100	0.02	0.0050	0.020	0.215	0.0005	0.0012	0.015	0.000100	0.0050	0.00050	0.0020	**0.860**	0.0005	0.0001	0.0010	0.0020	**0.060**	**0.0020**	0.00005	0.0008	0.0012	0.0050
SW3	Min	7.27	181.0	83.0	9.0	4.0	0.020	0.030	0.030	0.005	0.0020	0.0029	0.082	0.00008	0.00050	0.010	0.000011	0.0005	0.00022	0.00050	**0.290**	0.00014	0.000010	0.00041	0.0010	0.0292	0.00031	0.000004	0.00030	0.00050	0.0025
	Max	8.61	780.0	450.0	39.4	45.2	0.47	0.136	0.381	0.020	0.0050	0.038	2.77	0.0050	**0.0074**	0.050	0.000100	0.0050	0.0047	**0.0038**	**3.72**	**0.0017**	0.0001	0.0015	0.0050	**0.194**	**0.0020**	0.00030	0.0050	**0.0084**	0.0130
	Median	7.80	343.0	195.0	21.1	12.4	0.025	0.093	0.050	0.020	0.0020	0.0101	0.300	0.00050	0.0018	0.019	0.000050	0.0025	0.00050	0.0013	**0.789**	0.0005	0.00005	0.0010	0.0020	**0.069**	0.00100	0.00005	0.0010	0.0014	0.0050
	St Dev.	0.30	125.0	75.7	6.7	10.8	0.08	0.026	0.070	0	0	0.0083	0.505	0.0009	0.0015	0.015	0.000035	0.0018	0.00107	0.00076	0.74	0.00037	0.00004	0.00030	0.0012	0.044	0.00063	0.00012	0.0019	0.0015	0.0029
	N	29	29	23	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.97	366.0	208.5	25.6	18.0	0.050	0.100	0.100	0.020	0.0050	0.015	0.389	0.00053	0.0031	0.037	0.000100	0.0050	0.00065	0.0020	**0.93**	0.0010	0.0001	0.0010	0.0033	**0.105**	**0.0020**	0.00011	0.0027	0.0020	0.0063
SW4	Min	6.64	74.0	34.9	7.9	1.0	0.020	0.030	0.030	0.005	0.0020	0.0056	0.018	0.00003	0.00030	0.0050	0.000005	0.00050	0.000085	0.00050	0.140	0.00009	0.000010	0.00005	0.0004	0.0123	0.00020	0.000003	0.000012	0.00020	0.0024
	Max	8.32	168.0	81.0	32.7	13.0	0.20	0.100	0.100	0.020	0.0050	0.028	0.244	0.0050	0.0010	0.050	0.000100	0.0050	0.00070	0.0010	**1.200**	0.0010	0.0001	0.0010	**0.092**	**0.037**	**0.0020**	0.00030	0.0050	0.0010	0.0129
	Median	7.00	131.5	61.8	18.5	4.1	0.050	0.038	0.050	0.020	0.0020	0.010	0.042	0.00050	0.0010	0.010	0.000040	0.00175	0.00050	0.0010	**0.345**	0.0005	0.00005	0.0008	0.0010	0.0217	0.00100	0.00005	0.0028	0.0008	0.0035
	St Dev.	0.30	22.1	11.6	7.1	3.3	0.056	0.030	0.030	0	0	0.0054	0.058	0.0009	0.00025	0.018	0.000038	0.00185	0.00017	0.00021	0.271	0.00034	0.00004	0.00038	0.01717	0.00682	0.00064	0.000119	0.0025	0.00032	0.0027
	N	28	28	23	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.18	150.3	68.5	26.5	6.4	0.091	0.100	0.100	0.020	0.0050	0.016	0.067	0.00053	0.0010	0.022	0.000100	0.0050	0.00050	0.0010	**0.430**	0.0006	0.0001	0.0010	0.0020	0.0266	**0.0020**	0.00017	0.0050	0.0010	0.0050
SW6	Min	6.87	95.5	48.0	10.5	1.0	0.020	0.000	0.030	0.010	0.0020	0.0023	0.030	0.00004	0.00064	0.0087	0.000009	0.00050	0.00018	0.00083	**0.130**	0.00009	0.000010	0.00009	0.0010	0.0141	0.0002	0.000004	0.00002	0.00043	0.0029
	Max	8.65	456.0	270.0	41.0	238.0	0.77	**0.145**	0.300	0.020	0.0050	0.038	1.44	0.0050	0.0040	0.050	0.000100	0.0050	0.0032	**0.0041**	**6.74**	0.0011	0.0001	0.0011	0.0040	**0.208**	**0.0020**	0.00030	0.0050	0.0039	**0.046**
	Median	7.78	240.0	122.0	20.7	8.2	0.050	0.065	0.035	0.020	0.0020	0.009	0.150	0.00050	0.0010	0.018	0.000020	0.0012	0.00050	0.0010	**0.560**	0.0005	0.000010	0.0010	0.0020	**0.043**	0.001	0.00005	0.0010	0.0010	0.0042
	St Dev.	0.45	106.6	66.5	6.5	52.2	0.15	0.036	0.073	0	0	0.011	0.346	0.0010	0.00081	0.017	0.000041	0.00194	0.00057	0.0008	1.32	0.00033	0.00005	0.00031	0.00083	0.055	0.0007	0.00013	0.0022	0.0009	0.009
	N	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	20	23	23	23	23	23	23	23	23
	75th %	7.98	352.5	211.0	24.2	21.4	0.058	0.100	0.100	0.020	0.0050	0.018	0.384	0.00060	0.0018	0.050	0.000100	0.00500	0.00055	0.0013	**0.90**	0.0010	0.0001	0.0010	0.0023	**0.089**	**0.0020**	0.00030	0.0050	0.0019	0.0050
SW7A	Min	7.58	202.0	110.0	8.6	2.0	0.020	0.030	0.030	0.005	0.0020	0.0023	0.018	0.00004	0.00050	0.010	0.000005	0.00050	0.00008	0.00052	0.096	0.00007	0.000010	0.00050	0.0007	0.0196	0.0002	0.000003	0.00040	0.00056	0.0025
	Max	10.10	829.0	462.0	23.3	60.5	1.36	0.102	0.262	0.020	0.0050	0.065	1.000	0.0050	0.0030	0.050	0.000100	0.0050	0.0012	0.0018	**1.90**	0.0010	0.0001	0.0025	0.0034	**0.458**	**0.0020**	0.00030	0.0050	0.0040	0.0140
	Median	7.98	383.0	210.0	15.8	8.0	0.046	0.094	0.050	0.010	0.0025	0.0090	0.205	0.00050	0.0010	0.017	0.000050	0.0025	0.00050	0.0011	**0.587**	0.0005	0.00005	0.0010	0.0019	**0.058**	0.001	0.00005	0.0010	0.0010	0.0050
	St Dev.	0.47	137.2	82.6	3.7	13.7	0.27	0.024	0.054	0	0	0.0127	0.230	0.0010	0.00060	0.015	0.000037	0.00186	0.00024	0.003	0.482	0.00031	0.00004	0.00049	0.00069	**0.097**	0.0006	0.00011	0.00179	0.00081	0.00234
	N	25	25	19	25	25	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	22	24	24	19	24	24	24	24	24
	75th %	8.10	472.0	258.0	18.8	21.6	0.07	0.100	0.100	0.020	0.0050	0.011	0.334	0.00050	0.0018	0.032	0.000100	0.0050	0.00050	0.00187	**0.868**	0.0006	0.0001	0.0013	0.0020	**0.102**	**0.0020**	0.00005	0.0026	0.0015	0.0050
SW10	Min	7.29	167.0	71.1	12.7	2.0	0.020	0.030	0.030	0.005	0.0020	0.0028	0.029	0.00007	0.00064	0.010	0.000006	0.00050	0.00019	0.0007	**0.287**	0.00012	0.000010	0.00035	0.0010	0.0243	0.00020	0.000004	0.00030	0.00050	0.0025
	Max	8.89	558.0	323.0	38.6	1340.0	0.22	0.111	0.606	0.020	0.0050	0.081	32.3	0.0050	**0.013**	0.050	**0.00074**	0.062	0.022	**0.036**	**42.3**	**0.023**	0.0001	0.0013	**0.051**	**1.400**	**0.0028**	0.00039	0.0050	**0.072**	**0.20**
	Median	7.81	318.0	185.0	22.9	7.0	0.032	0.088	0.050	0.020	0.0020	0.0080	0.155	0.00050	0.0013	0.022	0.000050	0.0019	0.00050	0.0010	**0.550**	0.0005	0.00005	0.0010	0.0020	**0.061**	0.0010	0.00005	0.0010	0.0010	0.0050
	St Dev.	0.30	112.2	69.0	7.1	247.2	0.039	0.026	0.108	0.0	0	0.0164	6.1	0.0009	0.0023	0.016	0.00014	0.011	0.0040	0.007	7.9	0.0043	0.00004	0.00026	0.009	0.279	0.00068	0.00013	0.0019	0.013	0.04
	N	29	29	23	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	24	28	28	23	28	28	28	28	28
	75th %	7.97	397.0	228.5	29.2	12.1	0.050	0.100	0.100	0.020	0.0050	0.0175	0.239	0.00053	0.0020	0.048	0.000100	0.0050	0.00050	0.0010	**0.671**	0.0010	0.0001	0.0010	0.0024	**0.087**	**0.0020**	0.00030	0.0035	0.0015	0.008
SW11	Min	6.84	83.0	53.0	10.7	1.0	0.020	0.030	0.030	0.005	0.0020	0.0064	0.023	0.00004	0.00043	0.0050	0.000009	0.00050	0.00018	0.00050	0.190	0.00006	0.000010	0.00009	0.0005	0.0152	0.0002	0.000004	0.000050	0.00023	0.0024
	Max	7.67	364.0	208.0	53.2	65.8	1.060	0.100	0.348	0.020	0.0050	0.046	1.050	0.0050	0.0030	0.050	0.000100	0.0050	0.0045	**0.0032**	**11.0**	0.0010	0.0001	0.0010	0.0030	**0.693**	**0.0020**	0.00030	0.0050	0.0026	0.013
	Median	7.25	190.0	115.0	27.2	5.0	0.040	0.055	0.050	0.020	0.0020	0.019	0.079	0.00050	0.0010	0.010	0.000042	0.0019	0.0012	0.0010	**1.64**	0.0005	0.00005	0.0010	0.0013	**0.042**	0.0010	0.00005	0.0027	0.0010	0.0050
	St Dev.	0.21	67.9	41.5	8.6	15.2	0.20	0.025	0.062	0	0	0.013	0.263	0.0009	0.00072	0.018	0.000038	0.00180	0.0012	0.00049	2.48	0.00033	0.00004	0.00038	0.00066	0.138	0.00064	0.00012	0.0025	0.00055	0.0020
	N	29	29	23	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.44	246.0	146.5	35.8	13.0	0.069	0.100	0.100	0.020	0.0050	0.030	0.147	0.00053	0.0020	0.023	0.000100	0.0050	0.0021	0.0010	**2.13**	0.0007	0.0001	0.0010	0.0020	**0.070**	**0.0020**	0.00011	0.0050	0.0010	0.0053
SW12	Min	6.54	57.1	23.1	1.9	2.0	0.020	0.030	0.030	0.005	0.0020	0.0094	0.063	0.00003	0.00050	0.0050	0.000006	0.00050	0.00018	0.0005	**0.317**	0.00011	0.000010	0.00005	0.0005	0.0186	0.00020	0.000004	0.000050	0.00050	0.0010
	Max	7.49	238.0	123.0	47.1	108.0	0.74	0.100	0.200	0.020	0.0050	0.31	1.85	0.0050	0.0026	0.050	0.000100	0.0050	0.0051	**0.0055**	**8.09**	**0.0011**	0.0001	0.0010	0.0041	**0.205**	**0.0020**	0.00030	0.0050	0.0041	0.017
	Median	6.95	95.1	50.3	17.5	11.0	0.025	0.046	0.050	0.020	0.0020	0.037	0.245	0.00050	0.0010	0.010	0.000046	0.0021	0.00055	0.0014	**0.98**	0.0005	0.00005	0.0010	0.0016	**0.033**	0.0010	0.00005	0.0002	0.0010	0.0049
	St Dev.	0.26	50.0	28.0	9.3	22.3	0.17	0.030	0.045	0	0	0.064	0.394	0.0009	0.00061	0.019	0.000037	0.00178	0.0015	0.0011	2.06	0.00031	0.00004	0.00038	0.00082	0.045	0.00062	0.00012	0.0025	0.0010	0.0033
	N	29	29	23	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.21	116.0	70.8	22.6	23.0	0.096	0.100	0.100	0.020	0.0050	0.075	0.400	0.00060	0.0014	0.024	0.000100	0.0050	0.00105	**0.0020**	**1.50**	0.0010	0.0001	0.0010	0.0020	**0.040**	**0.0020**	0.00011	0.0050	0.0015	0.0065
SW13	Min	7.35	172.0	83.3	10.7	0.5	0.020	0.030	0.030	0.005	0.0020	0.0018	0.021	0.00006	0.00046	0.010	0.000010	0.00050	0.000062	0.00050	0.037	0.00010	0.000010	0.00025	0.0005	0.0113	0.00020	0.000004	0.00010	0.00050	0.0020
	Max	8.90	662.0	409.0	37.2	39.0	0.71	**0.133**	0.260	0.020	0.0050	0.017	0.785	0.00500	0.0039	0.050	0.000100	0.0050	0.0048	0.015	**4.77**	0.0010	0.0001	0.0010	0.0037	**0.253**	**0.0020**	0.00030	0.0050	0.0040	0.0068
	Median	7.79	326.0	192.0	18.6	8.3	0.025	0.081	0.050	0.020	0.0020	0.0055	0.128	0.00050	0.0010	0.013	0.000037	0.00119	0.00050	0.0010	**0.350**	0.0005	0.00005	0.0010	0.0020	**0.042**	0.0010	0.00005	0.0010	0.0010	0.0034
	St Dev.	0.36	109.1	73.6	5.1	11.6	0.13	0.031	0.063	0	0	0.0029	0.153	0.0009	0.0008	0.017	0.000037	0.00184	0.0009	0.00266	0.93	0.00031	0.00004	0.00030	0.00090	0.051	0.00061	0.00012	0.0020	0.00077	0.0013
	N	29	29	23	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.95	380.0	251.0	22.1	17.3	0.05	0.100	0.100	0.020	0.0050	0.0066	0.220	0.00053	0.0020	0.028	0.000100	0.0050	0.00050	0.0011	**0.646**	0.0007	0.0001	0.0010	0.0021	**0.066**	**0.0020**	0.00011	0.0044	0.0012	0.0050
SW14	Min	6.99	91.0	48.2	11.7	0.5	0.020	0.030	0.020	0.005	0.0020	0.0060	0.023	0.00004	0.00033	0.0043	0.000005	0.00050	0.000073	0.00050	0.111	0.00007	0.000010	0.00009	0.0005	0.0068	0.00020	0.000002	0.00004	0.00016	0.0020
	Max	9.38	297.0	169.0	33.7	28.0	1.23	0.100	0.282	0.906	0.0050	0.046	0.602	0.0050	0.0020	0.050	0.000100	0.0050	0.0018	0.0012	**1.60**	0.0010	0.0001	0.0010	0.0020	**0.052**	**0.0020**	0.00030	0.00500	0.0016	0.0100
	Median	7.40	156.0	96.0	24.1	5.0	0.028	0.050	0.050	0.020	0.0020	0.017	0.062	0.00050	0.0010	0.010	0.000043	0.00105	0.00050	0.0010	**0.335**	0.0005	0.00005	0.0010	0.0010	0.0220	0.00100	0.00005	0.00500	0.0010	0.0038
	St Dev.	0.49	53.7	32.4	5.5	6.9	0.24	0.029	0.053	0	0	0.0125	0.116	0.0009	0.00033	0.019	0.000038	0.00186	0.00031	0.00022	0.334	0.00035	0.00004	0.00038	0.00053	0.0109	0.00063	0.00012	0.00251	0.00036	0.0019
	N	29	29	23	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.70	189.0	111.0	28.2	9.9	0.06	0.100	0.100	0.020	0.0050	0.027	0.097	0.00060	0.0010	0.020	0.000100	0.0050	0.00050	0.0010	**0.633**	0.0006	0.0001	0.0010	0.0013	**0.028**	**0.0020**	0.00011	0.00500	0.0010	0.0050
SW15	Min	7.38	140.0	60.6	8.7	2.0	0.020	0.030	0.030	0.005	0.0020	0.0050	0.069	0.00007	0.00056	0.0096	0.000013	0.00050	0.000072	0.0010	0.146	0.00014	0.000010	0.00021	0.0010	0.0229	0.00020	0.000004	0.00016	0.00020	0.0010
	Max	9.54	338.0	200.0	42.6	55.9	0.28	0.100	0.523	0.020	0.0050	0.200	1.70	0.0050	0.0030	0.050	0.000200	0.0050	0.9000	**0.0036**	**2.00**	0.0010	0.0001	0.0020	0.0052	**0.150**	**0.0020**	0.00030	0.0050	0.0050	0.03
	Median	7.77	178.0	90.7	23.6	13.0	0.025	0.052	0.050	0.020	0.0020	0.028	0.426	0.00050	0.0012	0.014	0.000050	0.0023	0.00050	0.0020	**0.885**	0.0007	0.00005	0.0010	0.0020	**0.061**	0.0010	0.00005	0.0006	0.0020	0.0047
	St Dev.	0.39	55.3	37.6	11.4	13.1	0.052	0.026	0.121	0	0	0.038	0.388	0.0009	0.00061	0.017	0.000046	0.00173	0.20076	0.00072	0.496	0.00030	0.00004	0.00038	0.00104	**0.035**	0.00062	0.00012	0.0021	0.0010	0.0070
	N	29	29	23	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.96	239.0	135.0	30.4	25.0	0.050	0.100	0.100	0.020	0.0050	0.047	0.809	0.00060	0.0020	0.039	0.000100	0.0050	0.00073	**0.0029**	**1.11**	0.0010	0.0001	0.0010	0.0030	**0.085**	**0.0020**	0.00011	0.0050	0.0030	0.0073
SW17	Min	6.80	74.0	31.0	6.6	1.0	0.020	0.030	0.030	0.005	0.0020	0.011	0.048	0.00006	0.00042	0.0050	0.000010	0.00050	0.000050	0.0010	0.083	0.00008	0.000010	0.00017	0.0005	0.0168	0.00020	0.000004	0.000050	0.00020	0.0003
	Max	9.73	180.0	76.0	26.3	74.0	0.080	0.100	0.300	0.020	0.0050	0.073	0.900	0.0050	0.0010	0.050	0.00015	0.0050	0.00055	**0.003**	**1.110**	0.0010	0.0001	0.0010	0.0020	**0.062**	**0.0020**	0.00030	0.0050	0.0026	0.016
	Median	7.51	103.0	41.0	10.9	6.8	0.025	0.046	0.050	0.020	0.0020	0.022	0.129	0.00050	0.0010	0.010	0.000050	0.00150	0.00050	0.0013	0.230	0.0005	0.00005	0.0010	0.0010	0.0278	0.0010	0.00005	0.0002	0.0010	0.0040
	St Dev.	0.48	22.6	10.9	5.5	17.0	0.017	0.029	0.059	0	0	0.0156	0.170	0.0009	0.00025	0.018	0.000040	0.00182	0.00017	0.00050	0.253	0.00033	0.00004	0.00035	0.00048	0.0151	0.00064	0.00012	0.0022	0.00043	0.0030
	N	29	29	23	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	25	28	28	23	28	28	28	28	28
	75th %	7.59	112.0	42.8	13.6	16.0	0.

Table 5-23: Aquatic Habitat Type Classification Criteria

Typical Watershed Association	Habitat Type Classi-fication	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	Habitat 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: >8 • Pools: <20 • Primarily flat morphology • Occasional pools in thalweg meanders	• Mixed forest: 80 • Grass/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 vegetation (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
	Habitat 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	• Grass/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	Habitat 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	• Grass/sedge floodplain: 80 • Mixed forest: 20 • Beaver influenced/ floodplain • Speckled Alder/Willow spp. 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.
	Habitat 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	• Grass/sedge floodplain: 50 • Agricultural: 40 • Mixed forest: 10	• Detritus: 20 – 40 • Silt/muck: 20 – 40 • 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.
	Habitat 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	• Grass/sedge floodplain: 80 • Mixed forest: 20 • Beaver influenced/ floodplain • Speckled Alder/Willow spp. 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 Classi-fication	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	Habitat 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 • Grass/sedge floodplain: 10 • 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
	Habitat 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 • Grass/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
	Habitat 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 • Grass/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 • Grass/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
	Habitat 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 • Grass/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 5-24: Fish Species Distribution, 2008 to 2012 Field Surveys and MNR Data

Family	Common Name	Scientific Name	Pinewood River	McCallum Creek	Tait Creek	Loslo Creek	Unnamed Tributary 5	Marr Creek	Core Shack Creek	West Creek	Unnamed Tributary 6	Clark Creek	Blackhawk Creek	Unnamed Tributary 8A	Muskrat Lake and Creek	Other RSA Waterbodies*
Acipenseridae	Lake Sturgeon	*Acipenser fulvescens*	X													
Catostomidae	Shorthead Redhorse	*Moxostoma macrolepidotum*	X													
	White Sucker	*Catostomus commersonii*	X			X				X		X	X			X
Centrarchidae	Black Crappie	*Pomoxis nigromaculatus*	X													X
	Largemouth Bass	*Micropterus salmoides*														X
	Pumpkinseed	*Lepomis gibbosus*	X													X
	Rock Bass	*Ambloplites rupestris*	X													
	Smallmouth Bass	*Micropterus dolomieu*	X													X
Cyprinidae	Blackchin Shiner	*Notropis heterodon*	X			X				X						
	Blacknose Dace	*Rhinichthys atratulus*	X									X				
	Brassy Minnow	*Hybognathus hankinsoni*	X		X	X	X	X		X	X	X	X		X	
	Common Shiner	*Luxilus cornutus*	X					X		X		X	X			
	Creek Chub	*Semotilus atromaculatus*	X		X	X		X		X		X	X	X		
	Emerald Shiner	*Notropis atherinoides*	X			X		X		X		X				
	Fathead Minnow	*Pimephales promelas*						X		X		X	X		X	
	Finescale Dace	*Phoxinus neogaeus*	X	X		X		X		X		X	X	X		
	Golden Shiner	*Notemigonus crysoleucas*	X									X				
	Hornyhead Chub	*Nocomis biguttatus*	X													
	Lake Chub	*Couesius plumbeus*	X			X		X		X		X				
	Mimic Shiner	*Notropis volucellus*	X													
	Northern Pearl Dace	*Margariscus margarita*	X	X	X			X		X		X	X	X		
	Northern Redbelly Dace	*Phoxinus eos*	X		X	X		X		X		X	X			
	Spottail Shiner	*Notropis hudsonius*	X			X		X		X		X				
Esocidae	Northern Pike	*Esox lucius*	X													X
Gasterosteidae	Brook Stickleback	*Culaea inconstans*	X	X	X	X	X	X	X	X	X	X	X	X	X	
Ictaluridae	Brown Bullhead	*Ameiurus nebulosus*	X													
Percidae	Blackside Darter	*Percina maculata*	X							X		X				
	Iowa Darter	*Etheostoma exile*								X						
	Johnny Darter	*Etheostoma nigrum*	X													
	Log Perch	*Percina caprodes*	X													
	Sauger	*Sander canadensis*	X													
	Walleye	*Sander vitreus*	X													X
	Yellow Perch	*Perca flavescens*	X													X
Percopsidae	Trout-perch	*Percopsis omiscomaycus*	X													
Umbridae	Central Mudminnow	*Umbra limi*	X	X	X	X	X	X		X		X	X	X	X	

* Data from RRR studies and as provided by MNR Fort Frances District Office (2013)

Table 5-25: Ecological Land Classification Vegetation Communities

Broad Vegetation Community	Northwest Ontario Ecosite Code	Ontario Boreal ELC Ecosite Code	ELC Ecosite Community Name	Area in NLSA (ha)
Hardwood Forest	ES19	B055	Dry to Fresh, Coarse: Aspen – Birch Hardwood	1,640.3
	ES28	B104	Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood	176.8
	ES29	B088	Fresh, Clayey: Aspen – Birch Hardwood	10,523.8
	ES30	B089, B105	Black Ash Hardwood: Fresh, Silty Clayey Soil	139.3
	ES33	B119	Moist, Fine: Aspen – Birch Hardwood	219.1
Coniferous Swamp	ES35	B127	Organic Poor Conifer Swamp	2,260.5
	ES36	B128	Organic Intermediate Conifer Swamp	1,646.2
	ES37	B129	Organic Rich Conifer Swamp	705.7
	ES38	B130	Intolerant Hardwood Swamp	262.2
Coniferous Forest	ES11	B011	Very Shallow, Dry to Fresh: Red Pine – White Pine Conifer	397.0
	ES12	B012	Very Shallow, Dry to Fresh: Pine – Black Spruce Conifer	1,109.8
	ES13	B034	Dry, Sandy: Jack Pine – Black Spruce Dominated	61.2
	ES14	B035	Dry, Sandy: Pine – Black Spruce Conifer	31.1
	ES16	B040	Dry, Sandy: Red Pine – White Pine Dominated	56.1
	ES17	B051, B066, B115	Cedar (Hemlock) Conifer (Dry to Fresh, Coarse; Moist, Coarse; or Moist, Fine)	30.3
	ES18	B048, B054	Dry to Fresh, Coarse: Red Pine – White Pine Conifer and Dry to Fresh, Coarse: Red Pine – White Pine Mixed Wood	285.6
	ES20	B049	Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated	79.9
	ES21	B052	Dry to Fresh, Coarse: Spruce – Fir Conifer	202.9
	ES22	B065	Moist, Coarse: Black Spruce – Pine Conifer	3.9
	ES25	B098	Fresh, Silty to Fine Loamy: Black Spruce – Jack Pine Dominated	35.8
	ES26	B082, B083	Spruce-Pine / Feathermoss: Fresh, Fine Loamy-Clayey Soil	64.3
	ES27	B101	Fir-Spruce Mixedwood: Fresh, Silty-Fine Loamy Soil	75.5
	ES31	B114	Moist, Fine: Black Spruce – Pine Conifer	138.1
	ES32	B116	Fir-Spruce Mixedwood: Moist, Silty-Clayey Soil	65.7
Meadow and Shallow Marsh	ES46	B142 B144	Mineral or Organic Meadow Marsh	1,106.5
	ES46 or ES47	B142, B144, B149	Meadow or Shallow Marsh	8.5
	ES47	B149	Organic Shallow Marsh	124.8
Thicket Swamp	ES44	B134, B135	Mineral Thicket Swamp or Organic Thicket Swamp	865.2
Fen	ES40	B136	Sparse Treed Fen	462.6
	ES41	B139	Poor Fen	88.9
	ES42	B140	Open Moderately Rich Fen: Ericaceous Shrub / Sedge: Organic Soil	13.9
	ES45	B147	Shrub Shore Fen	389.4
Bog	ES39	B138	Open Bog: Ericaceous Shrub / Sedge / Sphagnum: Organic Soil	2.2
Rock and Mineral Barren	ES7	B164	Rock Barren	71.1
	ES9	B007	Active Mineral Barren	5.9
Agricultural Land	--	Agriculture	Agriculture	2,044.3
Cultural Meadow	**	CUM	Cultural Meadow	569.5
Open Water	--	Open Water	Open Water	714.4
Total Area of NLSA				26,678.3

Notes: * Derived from Forest Resources Inventory community type Cedar - Barren and Scattered Regular
** Derived from Forest Resources Inventory community type Grass and Meadow
ELC Ecological land classification

Table 5-26: Woodland Characteristics and Wildlife Habitat Features

Woodland ID in the NLSA	Size (ha)	Interior Habitat (ha)	Wildlife Survey Points	Wildlife Habitat Features	Areas-sensitive Species	Adjacent Habitat Features
1	0.4	0	None	None	Not surveyed	None
2	329.7	107.62	None	Deer Yarding Habitat (MNR 2006)	Not surveyed	None
3	156.1	54.7	None	Deer Yarding Habitat (MNR 2006)	Not surveyed	None
4	0.3	0	None	None	Not surveyed	None
5	13.9	0	None	None	Not surveyed	None
6	173.9	12.9	None	Deer Yarding Habitat (MNR 2006)	Not surveyed	None
7	6.1	0	None	None	Not surveyed	None
8	2.1	0	None	None	Not surveyed	None
9	1.2	0	None	None	Not surveyed	None
10	0.1	0	None	None	Not surveyed	None
11	861.8	191.78	BBS-2-18, BBS-2-19, CB1, CB2	Deer Yarding Habitat MNR 2006); Area-Sensitive Woodland Bird Habitat	Ovenbird, Ruffed Grouse Veery, Winter Wren, Yellow-bellied Sapsucker	None
12	0.8	0	None	None	Not surveyed	None
13	2.8	0	None	None	Not surveyed	None
14	<0.1	0	None	None	Not surveyed	None
15	3.9	0	None	None	Not surveyed	None
16	11.6	0	None	None	Not surveyed	None
17	22.4	0	B18, B19	None	None	None
18	6.1	0	None	None	Not surveyed	None
19	0.5	0	None	None	Not surveyed	None
20	<0.1	0	None	None	Not surveyed	None
21	<0.1	0	None	None	Not surveyed	None
22	<0.1	0	None	None	Not surveyed	None
23	<0.1	0	None	None	Not surveyed	None
24	<0.1	0	None	None	Not surveyed	None
25	<0.1	0	None	None	Not surveyed	None
26	<0.1	0	None	None	Not surveyed	None
27	<0.1	0	None	None	Not surveyed	None
28	2.0	0	None	None	Not surveyed	None
29	2.0	0	None	None	Not surveyed	Adjacent to Pinewood River (likely animal movement corridor)
30	1.5	0	B23	None	None	None
31	4,315.9	1869.8	BBS-1-16, BBS-2-18, BBS-2-19, BBS-2-20, BBS-2-21, T1, T2, T3, T4, T5, B7, B11, B14, B15, B24, CB11, OW6, OW8, OW9, WF1, AM1, AM1206	Deer Yarding Habitat (MNR 2006); Area-Sensitive Woodland Breeding Bird Habitat; Habitat of Species of Special Concern (Golden-winged Warbler) and Provincially rare species (Little Brown Myotis)	American Redstart, Black-and-white Warbler, Black-throated Gr. Warbler, Blue-headed Vireo, Hermit Thrush, Least Flycatcher, Northern Parula, Ovenbird, Red-breasted Nuthatch, Scarlet Tanager, Veery, Eastern Whip-poor-will, Winter Wren, Yellow-bellied Sapsucker, Yellow-rumped Warbler, Wolf species	Adjacent to Pinewood River (likely animal movement corridor)

Woodland ID in the NLSA	Size (ha)	Interior Habitat (ha)	Wildlife Survey Points	Wildlife Habitat Features	Areas-sensitive Species	Adjacent Habitat Features
32	0.2	0	None	None	Not surveyed	None
33	1,786.5	427.0	BBS-2-2, BBS-2-22, BBS-2-15, BBS-2-16, FBMP32, FBMP34, FBMP36, FBMP90, B25, B26, B27, B29, B30, B38, B39, B40, B41, B42, B43, B44, B45, B46, B47, B49, B50, B51, B52, B54, B55, B56, B57, B62, B63, B64, B65, B66, B68, CB2, CB3, CB4, CB5, CB6, CB7, CB10, OW6, AM6, AM1205	Deer Yarding Habitat (MNR); Area-Sensitive Woodland Breeding Bird Habitat; Habitat of Species of Special Concern (Common Nighthawk, Golden-winged Warbler and Olive-sided Flycatcher) and Provincially rare species (Little Brown Myotis)	American Redstart, Am Three-toed Woodpecker, Black-and-white Warbler, Black-backed Woodpecker, Blackburnian Warbler, Black-throated Gr. Warbler, Blue-headed Vireo, Broad-winged Hawk, Golden crowned Kinglet, Hermit Thrush, Least Flycatcher, Magnolia Warbler, Northern Parula, Ovenbird, Red-breasted Nuthatch, Sharp-shinned Hawk, Veery, Winter Wren, Yellow-bellied Sapsucker, Yellow-rumped Warbler, Yellow-throated Vireo	Adjacent to 3 significant waterfowl (Trumpeter Swan) nesting features
34	<0.1	0	None	None	Not surveyed	None
35	<0.1	0	OW6	None	None	None
36	<0.1	0	OW6	None	None	None
37	10.8	0	BBS-2-21	Area-Sensitive Woodland Breeding Bird Habitat	Black-and-white Warbler, Blackburnian Warbler, Hermit Thrush, Ovenbird, Ruffed Grouse, Veery, Yellow-rumped Warbler	None
38	25.5	0	B48, B55, B67	Area-Sensitive Woodland Breeding Bird Habitat	Black-throated Gr. Warbler, Hermit Thrush, Ovenbird, Pileated Woodpecker, Red-breasted Nuthatch, Veery, Winter Wren	None
39	0.2	0	None	None	Not surveyed	None
40	1.4	0	None	None	Not surveyed	None
41	0.1	0	BBS-2-15	None	None	None
42	1.4	0	BBS-2-16, AM2	None	None	None
43	3.6	0	None	None	Not surveyed	None
44	2.7	0	None	None	Not surveyed	None
45	3.3	0	None	None	Not surveyed	None
46	27.9	0	None	None	Not surveyed	None
47	50.4	0	None	None	Not surveyed	None
48	137.7	35.6	BBS-2-14, B31, B32, B34, AM2	Deer Yarding Habitat (MNR 2006); Area-Sensitive Woodland Breeding Bird Habitat; Habitat of Species of Special Concern (Golden-winged Warbler)	Blackburnian Warbler, Hermit Thrush, Ovenbird	Adjacent to Pinewood River (likely animal movement corridor)
49	8.6	0	None	None	Not surveyed	None
50	31.35	0	BBS-2-14, B35	Area-Sensitive Woodland Breeding Bird Habitat	Black-and-white Warbler, Black-throated Gr. Warbler, Blue-headed Vireo, Hermit Thrush, Red-breasted Nuthatch	None
51	0.6	0	BBS-2-14	None	None	None
52	35.0	0	None	None	Not surveyed	None
53	0.1	0	None	None	Not surveyed	None

Woodland ID in the NLSA	Size (ha)	Interior Habitat (ha)	Wildlife Survey Points	Wildlife Habitat Features	Areas-sensitive Species	Adjacent Habitat Features
54	0.3	0	None	None	Not surveyed	None
55	<0.1	0	None	None	Not surveyed	None
56	27.3	0.1	BBS-2-13, B36, CB8, AM3, OW5	Area-Sensitive Woodland Breeding Bird Habitat; Habitat of Species of Special Concern (Golden-winged Warbler)	Black-and-white Warbler, Hermit Thrush, Magnolia, Warbler, Ovenbird	None
57	12.6	0	FBMP49, FBMP92	None	Ovenbird Veery	None
58	1.3	0	None	None	Not surveyed	None
59	1.8	0	BBS-2-13, CB8, AM3, OW5	Habitat of Species of Special Concern (Olive-sided Flycatcher)	None	None
60	6.1	0	FBMP48, CB9, OW3	None	Ovenbird, Veery	None
61	0.4	0	BBS-2-12	None	None	None
62	2.7	0	BBS-1-17	None	None	None
63	36.7	0.3	BBS-2-1, AM7	Habitat of Species of Special Concern (Olive-sided Flycatcher)	Hermit Thrush Veery	None
64	<0.1	0	None	None	Not surveyed	None
65	107.2	25.2	BBS-2-12, FBMP04, FBMP05, AMEC 12, B33	Area-Sensitive Woodland Breeding Bird Habitat; Habitat of Species of Special Concern (Canada Warbler and Golden-winged Warbler)	American Redstart, Black-and-white Warbler Canada Warbler, Least Flycatcher, Ovenbird, Veery	Shrub / successional breeding bird habitat
66	0.7	0	None	None	Not surveyed	None
67	0.4	0	None	None	Not surveyed	None
68	<0.1	0	None	None	Not surveyed	None
69	0.9	0	None	None	Not surveyed	None
70	<0.1	0	None	None	Not surveyed	None
71	0.1	0	BBS-2-1	None	None	None
72	<0.1	0	BBS-2-1	None	None	None
73	<0.1	0	None	None	Not surveyed	None
74	<0.1	0	None	None	Not surveyed	None
75	5.6	0	BBS-2-4	None	Hermit Thrush Ovenbird Veery	None
76	<0.1	0	AMEC33	None	None	None
77	<0.1	0	AMEC33	None	None	None
78	0.4	0	None	None	Not surveyed	None
79	<0.1	0	BBS-2-11	None	None	None
80	240.9	20.4	BBS-2-5, BBS-2-6, BBS-2-7, BBS-2-8, BBS-2-11, FBMP37, FBMP38, FBMP39, FBMP40, FBMP41, FBMP52, FBMP53, FBMP54, FBMP55, FBMP56, FBMP72, FBMP73, FBMP74, FBMP75, FBMP94, FBMP98, CB12, OW4, AM5, AM1207	Deer Yarding Habitat (MNR 2006); Area-Sensitive Woodland Breeding Bird Habitat; Habitat of Provincially rare species (Little Brown Myotis)	American Redstart, Black-and-white Warbler, Hermit Thrush, Least Flycatcher, Ovenbird, Ruffed Grouse, Veery	None
81	1.1	0	FBMP18	None	Veery	Adjacent to Pinewood River (likely animal movement corridor)

Woodland ID in the NLSA	Size (ha)	Interior Habitat (ha)	Wildlife Survey Points	Wildlife Habitat Features	Areas-sensitive Species	Adjacent Habitat Features
82	55.2	0	FBMP25, FBMP21, FBMP93, FBMP100	Area-Sensitive Woodland Breeding Bird Habitat	American Redstart, Hermit Thrush, Ovenbird, Veery	None
83	1349.1	277.1	BBS-1-7, BBS-1-8, BBS1-10, BBS-1-12, BBS-1-13, BBS-1-14, BBS-1-15, BBS-1-16, BBS-1-17, BBS-1-18, BBS-1-19, AMEC33, OW8, OW9	Area-Sensitive Woodland Breeding Bird Habitat; Habitat of Species of Special Concern (Golden-winged Warbler)	American Redstart, Barred Owl, Black-and-White Warbler, Blackburnian Warbler, Hermit Thrush, Least Flycatcher, Ovenbird, Ruffed Grouse, Veery, Yellow-rumped Warbler	None
84	0.3	0	None	None	Not surveyed	None
85	3.6	0	None	None	Not surveyed	Adjacent to Pinewood River (likely animal movement corridor)
86	48.7	0.19	BBS-2-10, FBMP01, FBMP03	Area-Sensitive Woodland Breeding Bird Habitat	American Redstart, Least Flycatcher, Ovenbird, Veery, Winter Wren	
87	54.7	1.16	BBS-2-23, FBMP09, FBMP10, FBMP11, FBMP12	Area-Sensitive Woodland Breeding Bird Habitat	American Redstart, Least Flycatcher, Ovenbird, Ruffed Grouse, Veery	Adjacent to Pinewood River (likely animal movement corridor)
88	0.2	0	None	None	Not surveyed	None
89	1.8	0	None	None	Not surveyed	None
90	0.5	0	None	None	Not surveyed	None
91	21.6	0	None	None	Not surveyed	None
92	<0.1	0	AM5	None	None	None
93	<0.1	0	AM5	None	None	None
94	<0.1	0	CB13, AM1208	None	None	None
95	<0.1	0	BBS-2-7	None	None	None
96	<0.1	0	None	None	Not surveyed	None
97	2.8	0	CB12, AM1208	None	None	None
98	71.0	8.4	B8, B9, AMEC31	Deer Yarding Habitat (MNR 2006); Area-Sensitive Woodland Breeding Bird Habitat	Black-and-white Warbler, Hermit Thrush, Ovenbird, Veery, Yellow-bellied Sapsucker	Adjacent to Pinewood River (likely animal movement corridor)
99	68.3	0	FBMP46, FBMP71, FBMP82, WF3, WF4, WF5	Area-Sensitive Woodland Breeding Bird Habitat	Black-and-white Warbler, Hermit Thrush, Least Flycatcher, Pileated Woodpecker, Veery	
100	5.1	0	None	Woodland Raptor Nest (Common Raven - Active)	Not surveyed	None
101	5.7	0	None	None	Not surveyed	None
102	0.1	0	None	None	Not surveyed	None
103	3.9	0	None	None	Not surveyed	None
104	5.5	0	BBS-1-20, WF6, AM10	None	None	Adjacent to Pinewood River (likely animal movement corridor)
105	36.2	1.4	BBS-1-21	Deer Yarding Habitat (MNR 2006); Area-Sensitive Woodland Breeding Bird Habitat	Black-and-white Warbler, Hermit Thrush, Veery	None
106	0.33	0	None	None	Not surveyed	None
107	<0.1	0	None	None	Not surveyed	None
108	<0.1	0	None	None	Not surveyed	None
109	<0.1	0	BBS-1-10	None	None	None
110	<0.1	0	None	None	Not surveyed	None
111	<0.1	0	None	None	Not surveyed	None
112	<0.1	0	None	None	Not surveyed	None

Woodland ID in the NLSA	Size (ha)	Interior Habitat (ha)	Wildlife Survey Points	Wildlife Habitat Features	Areas-sensitive Species	Adjacent Habitat Features
113	<0.1	0	None	None	Not surveyed	None
114	0.1	0	None	None	Not surveyed	None
115	181.7	29.2	BBS1-9, BBS-1-10, BBS-1-11	Deer Yarding Habitat (MNR 2006); Area-Sensitive Woodland Breeding Bird Habitat	Golden crowned Kinglet, Hermit Thrush, Veery	None
116	16.7	0	None	None	Not surveyed	None
117	40.4	0	BBS-1-11	None	Hermit Thrush, Veery	None
118	2.4	0	None	None	Not surveyed	None
119	74.2	1.2	BBS-1-5, BBS-8	Area-Sensitive Woodland Breeding Bird Habitat	Black-and-white Warbler, Golden-crowned Kinglet, Hermit Thrush, Ovenbird, Red-breasted Nuthatch, Ruffed Grouse, Veery	None
120	272.5	79.4	CB16, CB17, WF6, AM10, AMEC24	Deer Yarding Habitat (MNR 2006); Adjacent to Pinewood River (likely animal movement corridor)	None	None
121	2,875.2	675.41	BBS-1-22, BBS-1-23, BBS-1-24, BBS-1-26, BBS-2-1, FBMP57, FBMP58, FBMP59, FBMP60, FBMP61, FBMP62, FBMP63, FBMP64, FBMP65, FBMP66, FBMP67, FBMP68, FBMP69, B1, B2, B3, B4,B5, B6, B60,B61, B69, B70, B71, B72, B73, B74, B75, B76, B77, B78, B79, B80, B81, WF1, WF7, WF8, WF9, CB13, CB14, CB15, CB17, CB18, CB19, AM12, AM13, AM14, AM1208, AM1209	Deer Yarding Habitat (MNR 2006); Woodland Raptor Nest (Common Raven - Active); Area-Sensitive Woodland Breeding Bird Habitat; Habitat of Species of Special Concern (Golden-winged Warbler and Red-shouldered Hawk) and Provincially rare species (Little Brown Myotis)	American Redstart, Barred Owl, Black-and-white Warbler, Black-throated Blue Warbler, Black-throated Gr. Warbler, Golden crowned Kinglet, Hairy Woodpecker, Hermit Thrush, Least Flycatcher, Magnolia Warbler Northern Parula, Ovenbird, Pileated Woodpecker, Red-breasted Nuthatch, Ruffed Grouse, Scarlet Tanager, Veery, Winter Wren, Yellow-bellied Sapsucker, Yellow-rumped Warbler	Adjacent to Muskrat Lake and Mudd Lake
122	2.1	0	None	Bald Eagle Nest (active 2012), adjacent to Pinewood River (likely animal movement corridor)	Not surveyed	None
123	0.5	0	None	None	Not surveyed	None
124	45.7	1.8	None	None	Not surveyed	None
125	11.7	0	None	None	Not surveyed	None
126	0.3	0	None	Adjacent to Pinewood River (likely animal movement corridor)	Not surveyed	None
127	76.9	1.7	BBS-1-3, BBS-1-4, BBS-1-5	Adjacent to Pinewood River (likely animal movement corridor)	Hermit Thrush, Least Flycatcher, Ovenbird, Veery	None
128	1.8	0	None	None	Not surveyed	None
129	82.8	7.5	BBS-1-3	Area-Sensitive Woodland Breeding Bird Habitat	Black-and-white Warbler, Ovenbird, Veery	None
130	1.4	0	None	None	Not surveyed	None
131	3.2	0	None	None	Not surveyed	None
132	38.9	4.2	None	None	Not surveyed	None

Woodland ID in the NLSA	Size (ha)	Interior Habitat (ha)	Wildlife Survey Points	Wildlife Habitat Features	Areas-sensitive Species	Adjacent Habitat Features
133	24.4		CB22, OW11, AM16	None	None	None
134	3.7	0	BBS-1-27	None	None	None
135	29.0	0	BBS-1-3	None	Black-throated Blue Warbler	None
136	<0.1	0	None	None	Not surveyed	None
137	17.8	0	None	None	Not surveyed	None
138	<0.1	0	None	None	Not surveyed	None
139	128.6	26.3	None	Deer Yarding Habitat (MNR 2006)	Not surveyed	None
140	139.0	7.4	BBS-1-2, CB20, AM1236	Deer Yarding Habitat (MNR 2006); Habitat of Species of Special Concern (Red-headed Woodpecker), Adjacent to Pinewood River (likely animal movement corridor)	Barred Owl, Black-and-white Warbler, Least Flycatcher	None
141	6.2	0	None	Adjacent to Little Pine Lake	Not surveyed	None
142	119.0	8.7	OW11, CB21, CB22,CB51, WF14, AM16	None	Ruffed Grouse	None
143	104.9	2.6	CB22, OW11, AM16	Deer Yarding Habitat (MNR 2006); Woodland Raptor Nest (American Kestrel - Active)	None	None
144	56.4	2.5	BBS-1-2	None	Black-and-white Warbler, Least Flycatcher	None
145	7.7	0	None	None	Not surveyed	None
146	8.1	0	None	None	Not surveyed	None
147	5.1	0	CB23, OW12, AM15	Adjacent to Muskrat Lake	None	None
148	<0.1	0	None	None	Not surveyed	None
149	3.1	0	None	None	Not surveyed	None
150	5.2	0	None	None	Not surveyed	None
151	5.4	0	None	None	Not surveyed	None
152	0.5	0	None	None	Not surveyed	None
153	0.1	0	None	None	Not surveyed	None
154	261.	34.8	None	None	Not surveyed	None
155	1.9	0	None	None	Not surveyed	None
156	1,179.4	151.4	TL6, TL7, TL8, TL9, TL10, TL11, TL17, CB29, CB30, CB31, CB32, CB33, CB34, CB35, CB36, OW1207, OW1208, OW1209, OW1210, OW1211, OW1212, OW1213, AM1216, AM1217, AM1218, AM1219, AM1220	Deer Yarding Habitat (MNR 2006); Habitat of Species of Special Concern (Common Nighthawk) and Provincially rare species (Little Brown Myotis)	Barred Owl, Black-and-white Warbler, Black-backed Woodpecker, Hermit Thrush, Least Flycatcher, Magnolia Warbler, Northern Parula, Ovenbird, Red-breasted Nuthatch, Scarlet Tanager, Winter Wren, Yellow-rumped Warbler	Adjacent to Little Pine Lake
157	143.6	17.3	None	None	Not surveyed	None
158	716.2	93.66	AM1210	None	None	None
159	5.0	0	None	None	Not surveyed	None
160	7.8	0	None	None	Not surveyed	None
161	0.1	0.0	CB32, AM1219	None	None	None

Woodland ID in the NLSA	Size (ha)	Interior Habitat (ha)	Wildlife Survey Points	Wildlife Habitat Features	Areas-sensitive Species	Adjacent Habitat Features
162	208.2	5.3	CB29, CB30, CB31, CB32, CB33, OW1207, OW1208, AM1216, AM1217, AM1218, AM1219, AM1220	Habitat of Species of Special Concern (Common Nighthawk) and Provincially rare species (Little Brown Myotis)	None	None
163	0.1	0.0	None	None	Not surveyed	None
164	5.6	0	None	None	Not surveyed	None
165	6.7	0	None	None	Not surveyed	None
166	8.3	0	CB34, CB35, OW1209	None	None	None
167	1.0	0	None	None	Not surveyed	None
168	44.0	0	None	Bald Eagle Nest (inactive)	Not surveyed	None
169	0.1	0	None	None	Not surveyed	None
170	8.8	0	None	None	Not surveyed	None
171	49.2	0	CB48, OW1216, AM1231	None	None	None
172	53.4	0.4	None	None	Not surveyed	None
173	330.6	10.02	TL22, TL23, TL24, CB42, CB43, CB44, CB45, CB46, CB48, OW1215, OW1216, OW1217, AM1229, AM1230, AM1231, AM1233, AM1234, AM1235	Deer Yarding Habitat (MNR); Area-Sensitive Woodland Breeding Bird Habitat, Habitat of Species of Special Concern (Olive-sided Flycatcher)	Black-and-white Warbler, Blackburnian Warbler, Black-throated Blue Warbler, Black-throated Gr. Warbler, Blue-headed Vireo, Golden crowned Kinglet, Hermit Thrush, Least Flycatcher, Magnolia Warbler, Northern Parula, Ovenbird, Red-breasted Nuthatch, Veery, Winter Wren, Yellow-bellied Sapsucker, Yellow-rumped Warbler	None
174	0.0	0	None	None	Not surveyed	None
175	0.4	0	None	None	Not surveyed	None
176	0.0	0	OW1217	None	None	None
177	49.2	0	CB44, CB45, CB46, OW1217, AM1233, AM1234, AM1235	None	None	None
178	1.2	0	None	None	Not surveyed	None

Table 5-27: Likelihood of Potential SAR Occurring within the NLSA

Species	*Species at Risk Act*	*Endangered Species Act*	NHIC S-rank	Critical Habitat	Observed* [Likelihood of Occurrence]
Plants					
Muskroot (*Adoxa moschatellina)*	--	--	S1	Muskroot grows in moist, rich hardwood forests. It flowers in the spring season (April to May) although its distinctive foliage may persist until late summer (Minnesota Department of Natural Resources 2012).	[**Moderate** – Suitable habitat occurs within the NLSA.]
Eastern Swamp Saxifrage (*Micranthes pensylvanica)*	--	--	S1	The Eastern Swamp Saxifrage grows in swamp and marsh habitats and blooms in May and June (Michigan Flora Online 2011).	[**Moderate** – Suitable habitat in the form of swamps and marshes is common within the NLSA.]
Small-flowered Lipocarpha (*Lipocarpha micrantha)*	END (Sched. 1)	THR	S2	This species is confined to moist sandy beaches which have some protection from waves (COSEWIC 2002).	[**Low** – Sandy beaches not occur in the NLSA.]
Western Silvery Aster *(Symphyotrichum sericeum)*	THR (Sched. 1)	END	S1	This plant species grows in open bur oak savannahs on shallow soils over bedrock (MNR 2008).	[**Low** – Prairie habitat does not occur in the NLSA.]
Mammals					
Little Brown Myotis *(Myotis lucifugus)*	--	END	S4	Little Brown Myotis requires cavity trees of large diameter to use as maternity roots as well as foraging habitat such as wetlands and open woodlands. Bat hibernacula generally consist of caves, abandoned mine shafts, and underground foundations (MNR 2012c).	**Observed.** The study area provides an abundance of forest edge interface as well as low-lying swamplands which provide ample foraging habitat. Woodlands consisting of large-diameter Trembling Aspen likely provide suitable cavities for maternal roosts.
Northern Myotis *(Myotis septentrionalis)*	--	END	S3	Northern Myotis requires cavity trees of large diameter to use as maternity roots as well as foraging habitat such as wetlands and open woodlands. Bat hibernacula generally consist of caves, abandoned mine shafts, and underground foundations (MNR 2012c)	**Observed.** The study area provides an abundance of forest edge interface as well as low-lying swamplands which provide ample foraging habitat. Woodlands consisting of large-diameter Trembling Aspen likely provide suitable cavities for maternal roosts.
Franklin's Ground Squirrel (*Spermophilus franklinii)*	--	--	S3	This species has a strong affinity for tall grass and mid-grass prairies. It generally avoids short grass habitats. Nests are in underground burrows (IUCN 2012)	[**Low** – Prairie habitat does not occur in the NLSA].

Species	*Species at Risk Act*	*Endangered Species Act*	NHIC S-rank	Critical Habitat	Observed* [Likelihood of Occurrence]
American Badger (*Taxidea taxus jacksonii)*	END	END	S2	Preferred areas include natural and undisturbed grasslands, shrubby areas and woodlots (Ontario American Badger Recovery Team 2010).	[**Low – Moderate** - While this habitat does occur within the NLSA, the American Badger is a very rare species and two sightings were confirmed in the Rainy River – Fort Frances area between 2000 and 2008 (Ontario American Badger Recovery Team 2010)].
Grey Fox (*Urocyon cinereoargenteus)*	THR	THR	S1	In Ontario, the Grey Fox prefers deciduous forests, especially swampy areas (Royal Ontario Museum 2008). Grey Fox occurrence in Ontario generally hugs the border with the United States.	[**Moderate** – The NLSA provides suitable habitat. Three commercial traplines partially intersect the NLSA. MNR records from fur harvest between 1993 and 2008 show that Grey Fox had been captured in the general area].
Birds					
Black-billed Magpie *(Pica pica)*	--	--	S3?	This species is a resident of open country with scattered trees, riparian corridors, open woodland, forest edge, farmland, and suburban clearings. The species was first noted in Rainy River in 1975 and has since been increasing significantly (Cadman et al. 2007).	**Observed.** Suitable habitat is widespread within the NLSA including open country, open woodlands, and forest edges bordering extensive farmlands (primarily hayfields and pasture lands). This species has been increasing in abundance in the area (Cadman et al. 2007).
Eastern Whip-poor-will *(Antrostomus vociferous)*	THR (Sched. 1)	THR	S4B	This species prefers rock or sand barrens with scattered trees, savannahs, old burns in early succession, and open conifer plantations (Cadman et al. 2007). Accordingly, pine (barrens and plantations), oak (barrens and savannahs), and aspen and birch (early to mid-succession) are common tree species associations (COSEWIC 2009a).	**Observed.** Suitable habitat in the form of rocky outcrops and open forests is widespread within the NLSA.
Common Nighthawk (*Chordeiles minor*)	THR (Sched. 1)	Special Concern	S4B	Common Nighthawks utilize a wide variety of natural open country habitats including sand dunes, cutovers, burns, rocky outcrops, bogs, short-grass prairies, open forests, marshes, lakeshores, rock barrens, and forest clearings (COSEWIC 2007). This species has also adapted to anthropogenically modified habitats including mine tailings, quarries, urban parks, airports, gravel roads, and flat-topped buildings. Despite this species' tolerance of disturbed lands, it prefers natural habitats.	**Observed.** This species was observed both in proximity to the proposed mine footprint and along the proposed transmission line corridor. Cumulative studies between 2010 and 2011 indicated that nighthawks were most readily observed where cleared forest and rocky outcrops were present, particularly in proximity to the proposed transmission line. Cleared forest in this area undoubtedly provides both nesting habitat and open foraging habitat for this species.

Species	*Species at Risk Act*	*Endangered Species Act*	NHIC S-rank	Critical Habitat	Observed* [Likelihood of Occurrence]
Short-eared Owl (*Asio flammeus*)	Special Concern (Sched. 1)	Special Concern	S3S4	This species nests in areas of tall grass in grasslands, agricultural lands and wetlands (Cadman et al. 2007). This species uses similar habitat for foraging.	**Observed.** One individual was observed in 2010. Subsequent surveys between 2011 and 2013 did not provide additional observations.
Bobolink (*Dolichonyx oryzivorus)*	THR (Sched. status pending)	THR	S4B	The Bobolink nests primarily in forage crops (e.g., hayfields and pastures) and old field habitat. It can adapt to low-moderate livestock grazing, but not intensive grazing. The preferred habitat characteristics are often found in old (≥8 years) forage crops (COSEWIC 2010a). Nesting success is positively correlated to larger habitat size, although this species will utilize smaller areas of 10 to 30 ha.	**Observed.** The presence of agricultural lands is extensive within the NLSA, consisting primarily of hay fields and pasture lands (row cropping is rare in the area). Scattered populations of Bobolink are known to exist in the Rainy River District.
American White Pelican *(Pelecanus erythrorhynchos)*	NAR	THR	S2B	In Ontario, this species breeds on small, remote, low bedrock islands in fresh water lakes. Breeding colonies occur on islands within Lake of the Woods (Cadman et al. 2007).	**Observed.** The closest known pelican colony to the NLSA exists on Lake of the Woods (Cadman et al. 2007). Pelicans are known to forage at considerable distances (50 to 100 km) from breeding colonies and may use the NLSA as foraging habitat only.
Bald Eagle (*Haliaeetus leucocephalus)*	NAR	Special Concern	S4	Bald Eagles use shoreline habitat associated with lakes and large rivers (rarely small lakes and rivers) for nesting and foraging and often prefer nesting on islands (MNR 2000). Hunting areas consist of productive areas of open water or deep water marshes supporting large quantities of fish (MNR 2000).	**Observed.** Bald Eagles feed primarily on fish and thus usually require large open waterbodies to hunt. The Pinewood River, located within the NLSA, may support suitable fish populations.
Peregrine Falcon *(Falco peregrines)*	Special Concern (Sched. 1)	Special Concern	S2S3	Peregrine Falcons nest on ledges found on vertical cliff faces, but will also utilize manmade structures such as: tall buildings, bridges and the walls of open pit mines. In Ontario, suitable vertical faces are generally 50 to 200 m high and will typically overlook water bodies and forested areas.	**Observed.** One individual was observed in 2010, flying across the NLSA during migration. No cliff faces are present in the study area, and therefore, no nesting habitat is present.

Species	*Species at Risk Act*	*Endangered Species Act*	NHIC S-rank	Critical Habitat	Observed* [Likelihood of Occurrence]
Olive-sided Flycatcher *(Contopus cooperi)*	THR (Sched. 1)	Special Concern	S4B	This species prefers natural forest openings created by forest fires or other natural disturbance. Snags of large trees remaining on disturbed landscapes are an important ecological element of flycatcher habitat as they provide elevated perches used for foraging and may provide habitat for insects.	**Observed.** The Olive-sided Flycatcher is a widespread species in Northern Ontario. The NLSA provides suitable breeding habitat in the form of forests with natural openings created by rocky outcroppings.
Canada Warbler (*Cardellina Canadensis)*	THR (Sched. 1)	Special Concern	S4B	Canada Warbler will nest in the interior of wet mixed woodlands or swamps (Cadman et al. 2007).	**Observed.** Moist mixed forests and slopes representing suitable Canada Warbler habitat are rare in the NLSA and likely inhibit this species from occurring in greater numbers.
Least Bittern (*Ixobrychus exilis)*	THR (Sched. 1)	THR	S4B	Least Bittern breed strictly in marshes with tall emergent vegetation (usually cattails) that have relatively stable water levels (less than 1 m, and usually 10 to 50 cm) and about 50% open water interspersed in small pockets throughout the vegetated areas (COSEWIC 2009b). Larger wetlands (>5 to 10 ha) are said to be particularly important.	[**Low–** Records in the OBBA show that Least Bittern is not common within the Rainy River District and those records are from cattail marshes near Fort Frances (Cadman et al. 2007). Cattail marshes are sporadic within the NLSA].
Black Tern (*Chlidonias niger)*	NAR	Special Concern	S3B	Black Terns nest in loose colonies and prefer large marshes with 50:50 open water and emergent vegetation (Cadman et al. 2007).	[**Low –** Black Tern colonies are known to occur at Lake of the Woods, west of the NLSA. No known colonies occur within the NLSA where suitable large, open marshes are rare].
Yellow Rail (*Coturnicops noveboracensis)*	Special Concern (Sched. 1)	Special Concern	S4B	This species breeds in damp, sedge-dominated habitat that maintains up to 15 cm of standing water throughout the breeding season (Cadman et al. 2007).	[**Low – Moderate –** This species is known to occur in the Rainy River District; however, suitable breeding habitat is uncommon in the NLSA. The presence of this secretive species may be difficult to confirm].
Eastern Meadowlark (*Sturnella magna)*	THR (Sched. status pending)	THR	S4B	This species prefers native grasslands but will nest in pastures and agricultural hay fields. It also uses old fields and meadows, often over-grown with shrubs, and prefers dry habitat to wet and tall grass to short (COSEWIC 2011b).	[**Low – Moderate** – The presence of agricultural lands is extensive within the NLSA, consisting primarily of hay fields and pasture lands (row cropping is rare in the area). Scattered populations of Eastern Meadowlark are known to exist in the Rainy River District. The NLSA occurs in a region where the ranges of Eastern and Western Meadowlark overlap].

Species	*Species at Risk Act*	*Endangered Species Act*	NHIC S-rank	Critical Habitat	Observed* [Likelihood of Occurrence]
Western Meadowlark *(Sturnella neglecta)*	--	--	S3B	Like the Eastern Meadowlark, Western Meadowlarks prefer native grasslands but generally nest in pastures and agricultural hay fields in Ontario (Cadman et al. 2007).	[**Moderate –** The presence of agricultural lands is extensive within the NLSA, consisting primarily of hay fields and pasture lands (row cropping is rare in the area). A viable population of this species is known to occur in the southwestern Rainy River District. The NLSA occurs in a region where the ranges of Eastern and Western Meadowlark overlap].
Chimney Swift (*Chaetura pelagic)*	THR (Sched. 1)	THR	S4B, S4N	Chimney Swifts nest and roost predominantly in old chimneys, although some may utilize hollow trees, other tree cavities, and cracks in cliffs (Cadman et al. 2007). This species requires the presence of dated human settlement, cliffs, or large trees of large diameter or snags.	[**Moderate** – The Chimney Swift is known to occur in the Rainy River District (Cadman et al. 2007). The NLSA contains a small rural settlement which may provide suitable habitat. Rocky outcroppings occur within the NLSA and may provide suitable cliff nesting habitat. Cavity trees of large diameter likely occur in forested areas of the NLSA, although swift nesting in such locations is uncommon].
Red-headed Woodpecker *(Melanerpes erythrocephalus)*	THR (Sched. 1)	Special Concern	S4B	Red-headed Woodpeckers are associated with the Carolinian forest where they inhabit open woodlands, oak savannah, riparian forest, and hedgerows. This species is particularly drawn to American Beech trees on which they forage for beach nuts and insects (Cadman et al. 2007).	**Observed.** It is estimated that 30 to 50 pairs occur in 10 OBBA survey squares in the Rainy River Clay Plain (Cadman et al. 2007). Although oak savannah is not present in the NLSA, open woodlands and riparian forest may provide suitable habitat.
Wilson's Phalarope (*Phalaropus tricolor)*	--	--	S3B	This species nests among grasses and sedges near water, frequently on small islands. It also nests in swales, on muskeg, and at sewage lagoons. Grassy areas with vegetation about 30 cm tall are preferred for nesting; those taller than 60 cm are avoided (Cadman et al. 2007).	[**Low – Moderate –** The Lake of the Woods area is known to support populations of this species (Cadman et al. 2007). Although wetlands are common within the NLSA, most support vegetation which is over 60 cm and are unsuitable. Some suitable habitat may be present along the edges of open waterbodies].
Western Kingbird (*Tyrannus verticalis)*	--	--	S1B	This species occurs in open habitats such as grasslands, savannahs, desert scrub, pastures, cultivated fields, and urban areas (Cadman et al. 2007).	[**Low** – **Moderate –** The presence of agricultural lands is extensive within the NLSA, consisting primarily of hay fields and pasture lands (row cropping is rare in the area). However, the Western Kingbird is a rare breeder in the western Rainy River District has been recorded in the vicinity of the Town of Rainy River (Cadman et al. 2007)].

Species	*Species at Risk Act*	*Endangered Species Act*	NHIC S-rank	Critical Habitat	Observed* [Likelihood of Occurrence]
Barn Swallow (*Hirundo rustica)*	THR (Sched. status pending)	THR	S4B	Barn Swallows nest largely in and on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts. Barn Swallows prefer various types of open habitat for foraging, including grassy fields, pastures, various kinds of agricultural crops, lake and river shorelines, cleared right-of ways, cottage areas and farmyards, islands, wetlands, and subarctic tundra (COSEWIC 2011a).	**Observed.** The NLSA contains a small rural settlement which may provide artificial structures with suitable breeding habitat. The presence of agricultural lands, suitable for foraging habitat, is extensive within the NLSA, consisting primarily of hay fields and pasture lands (row cropping is rare in the area).
Yellow-headed Blackbird *(Xanthocephalus xanthocephalus)*	--	--	S2B	Yellow-headed Blackbirds nest in colonies in marshes and require permanent water 0.5 m deep. It nests in emergent vegetation, particularly cattails and Common Reed (Cadman et al. 2007). In Ontario, colonies are restricted to the Lake of the Woods and near Rainy River.	[**Moderate –** Suitable habitat in the form of cattail marshes is common within the NLSA].
Golden-winged Warbler *(Vermivora chrysoptera)*	THR (Sched. 1)	Special Concern	S4B	Golden-winged Warblers breed in successional / shrub, or old field habitats surrounded by forests. This species is associated with deciduous of mixed forests occurring over upland landscapes (Cadman et al. 2007).	**Observed.** This species is known to occur near Rainy River. The NLSA contains ample suitable breeding habitat in the form of successional forests, old fields, and upland deciduous or mixedwood forests.
Reptiles					
Snapping Turtle (*Chelydra serpentine)*	Special Concern (Sched. 1)	Special Concern	S4	Snapping Turtles inhabit a wide variety of aquatic habitats including ponds, sloughs, shallow bays or river edges, and slow streams. Snapping Turtles are tolerant of disturbance and will inhabit man-made ponds, ditches and canals. This species nests in sand and gravel banks along waterways and well as within a variety of man-made features (COSEWIC 2008).	**Observed.** Suitable Snapping Turtle habitat in the form of slow streams, ponds and ditches are present within the NLSA. Beaver ponds are widespread. Natural sand and gravel substrates are not common.

Species	*Species at Risk Act*	*Endangered Species Act*	NHIC S-rank	Critical Habitat	Observed* [Likelihood of Occurrence]
Invertebrates					
Monarch Butterfly (*Danaus plexippus)*	Special Concern	--	S2N, S4B	Monarch Butterfly habitat exists primarily wherever milkweed (Asclepius) and wildflowers such as goldenrods, asters, and Purple Loosestrife exist, including abandoned farmland, along roadsides, and other open spaces where these plants grow (COSEWIC, 2010b).	[**Moderate –** This wide-ranging, strong-flying species may occur anywhere milkweed or flowering meadow plants occur within 500 km of the Great Lakes].
Midland Clubtail (*Gomphus fraternus)*	--	--	S3	This species is usually found along rivers with moderate to fast flow, and lakes with plenty of wave action (Jones et al. 2008).	[**Moderate** – The Pinewood River occurs within the NLSA and may provide suitable habitat)].
Green-faced Clubtail *(Gomphus viridifrons)*	--	--	S1	This species occurs in clear rocky rivers and streams. It is known to occur on several sections of the Rainy River (Jones et al. 2008).	[**Moderate** – The Pinewood River occurs within the NLSA and may provide suitable habitat].
Variegated Meadowhawk *(Sympetrum corruptum)*	--	--	S3	This species is found in a variety of wetlands and is often associated with relatively shallow water, often with a sandy bottom (Jones et al. 2008).	[**Moderate** – Wetlands are widespread throughout the NLSA; however, sandy soils are not overly common].

Notes: ***** Observed in the NLSA during AMEC or KCB field investigations to date.
SARA *Species at Risk Act* and is the Federal Status. Rankings are provided by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
SARO *Species at Risk in Ontario* and is the Provincial Status. Rankings are provided by the Committee on the Status of Species at Risk in Ontario (COSSARO)
NHIC Natural Heritage Information Centre and is a database maintained by the MNR
ESA *Endangered Species Act*

SARA

NAR	Not at Risk
SC	Special Concern
THR	Threatened
END	Endangered

SARO

NAR	Not at Risk
SC	Special Concern
THR	Threatened
END	Endangered

NHIC S-rank

S1	Critically Imperilled
S2B	Imperilled - Breeding Migrants
S3?	Vulnerable - Rank uncertain
S4	Apparently Secure
S4B	Apparently Secure Breeding Migrants
S4N	Apparently Secure Non-breeding Migrants
S5	Secure
S5B	Secure Breeding Migrants
S5N	Secure Non-breeding Migrants
SNA	Status Rank not Applicable

Table 5-28: Anishinaabeg of Naongashiing First Nation Reserves

No.	Name	Location	Area (ha)
06240	Agency 30	Aulneau Peninsula in Lake of the Woods, 28 miles southerly from Kenora	379
06230	Big Island 31D	70 km southeast of Kenora	370
06231	Big Island 31E	69 km south of Kenora	777
06232	Big Island 31F	65 km south of Kenora	354
06233	Big Island Mainland 93	77 km southeast of Kenora	43
06234	Lake of the Woods 31b	Northwest shore of Lake of the Woods, 40 km southwest of Kenora	294
06235	Lake of the Woods 31C	Island in Lake of the Woods, 57 km southwest of Kenora	324
06236	Lake the Woods 31G	Island in Lake of the Woods, 59 km southwest of Kenora	111
06237	Lake of the Woods 31H	South of Lake of the Woods	964
06238	Naongashing 31A	On the south edge of Aulneau Peninsula in Lake of the Woods	518
06144	Saug-a-gaw-sing 1	Southeast shore of Lake of the Woods, 77 km southeast of Kenora	58
06239	Shoal Lake 31J	Southwest end of Shoal Lake, northwest of Lake of the Woods	518

Source: AANDC (2013)

Table 5-29: Registered Anishinaabeg of Naongashiing First Nation Members

Residency	# of People
Registered males on own Reserve	86
Registered females on own Reserve	75
Registered males on other Reserves	12
Registered females on other Reserves	12
Registered males on own Crown Land	0
Registered females on own Crown Land	0
Registered males on other Band Crown Land	0
Registered females on other Band Crown Land	0
Registered males on no Band Crown Land	1
Registered females on no Band Crown Land	1
Registered males off Reserve	104
Registered females off Reserve	118
Total registered population	**409**

Source: AANDC (2013)

Table 5-30: Mishkosiminiziibing First Nation Reserves

No.	Name	Location	Area (ha)
06240	Agency 30	Aulneau Peninsula in Lake of the Woods 28 mi southerly from Kenora District	379
09670	Assabaska		1,098
06226	Big Grassy River 35G	77 km southeast of Kenora	3,615
06227	Lake of the Woods 35J	40 km southeast of Kenora	1,409
06228	Naongashing 35A	South edge of Aulneau Peninsula in Lake of the Woods	518
06229	Obabikong 35B	On southeast edge of Aulneau Peninsula	712

Source: AANDC (2013)

Table 5-31: Registered Mishkosiminiziibiing First Nation Members

Residency	# of People
Registered males on own Reserve	124
Registered females on own Reserve	115
Registered males on other Reserves	25
Registered females on other Reserves	14
Registered males on own Crown Land	0
Registered females on own Crown Land	0
Registered males on other Band Crown Land	0
Registered females on other Band Crown Land	0
Registered males on no Band Crown Land	0
Registered females on no Band Crown Land	0
Registered males off Reserve	219
Registered females off Reserve	257
Total registered population	**754**

Source: AANDC (2013)

Table 5-32: Naicatchewenin First Nation Reserves

No.	Name	Location	Area (ha)
06336	Agency 1	Southwest of Rainy Lake	14
06243	Rainy Lake 17a	On north shore of northwest bay in northwest Rainy Lake	1,502
06244	Rainy Lake 17b	8 km west of Rainy Lake on Manonin River and Bremna Creek	988

Source: AANDC (2013)

Table 5-33: Registered Naicatchewenin First Nation Members

Residency	# of People
Registered males on own Reserve	143
Registered females on own Reserve	143
Registered males on other Reserves	0
Registered females on other Reserves	0
Registered males on own Crown Land	0
Registered females on own Crown Land	0
Registered males on other Band Crown Land	0
Registered females on other Band Crown Land	0
Registered males on no Band Crown Land	0
Registered females on no Band Crown Land	0
Registered males off Reserve	79
Registered females off Reserve	74
Total registered population	**439**

Source: AANDC (2013)

Table 5-34: Naotkamegwanning First Nation Reserves

No.	Name	Location	Area (ha)
06240	Agency 30	Aulneau Peninsula in Lake of the Woods 28 mi southerly from Kenora District	379
06291	Sabaskong Bay 32C	East of Lake of the Woods	518
06292	Whitefish Bay 32A	48 km southeast of Kenora	1,954
06293	Yellow Girl Bay 32B	32 km southeast of Kenora	1,803

Source: AANDC (2013)

Table 5-35: Registered Naotkamegwanning First Nation Members

Residency	# of People
Registered males on own Reserve	373
Registered females on own Reserve	352
Registered males on other Reserves	11
Registered females on other Reserves	7
Registered males on own Crown Land	0
Registered females on own Crown Land	0
Registered males on other Band Crown Land	0
Registered females on other Band Crown Land	0
Registered males on no Band Crown Land	0
Registered females on no Band Crown Land	0
Registered males off Reserve	141
Registered females off Reserve	236
Total registered population	**1,220**

Source: AANDC (2013)

Table 5-36: Ojibways of Onigaming First Nation Reserves

No.	Name	Location	Area (ha)
06240	Agency 30	Aulneau Peninsula in Lake of the Woods 28 mi southerly from Kenora District	379
09670	Assabaska		1,098
06250	Sabaskong Bay 35C	35 km south of Sioux Narrows	777
06251	Sabaskong Bay 35D	On east shore of Sabaskong Bay on Eastern Lake of the Woods	504
06252	Sabaskong Bay 35F	On southeast shore of Sabaskong Bay	518
06253	Sabaskong Bay 35H	On north shore of Sabaskong Bay	260

Source: AANDC (2013)

Table 5-37: Registered Ojibways of Onigaming First Nation Members

Residency	# of People
Registered males on own Reserve	238
Registered females on own Reserve	214
Registered males on other Reserves	6
Registered females on other Reserves	12
Registered males on own Crown Land	1
Registered females on own Crown Land	0
Registered males on other Band Crown Land	0
Registered females on other Band Crown Land	0
Registered males on no Band Crown Land	0
Registered females on no Band Crown Land	0
Registered males off Reserve	117
Registered females off Reserve	176
Total registered population	**764**

Source: AANDC (2013)

Table 5-38: Buffalo Point First Nation Reserves

No.	Name	Location	Area (ha)
06240	Agency 30	Aulneau Peninsula in Lake of the Woods 28 mi southerly from Kenora District	379
06366	Buffalo Point 36	Southeast corner of Manitoba	2332
09604	Buffalo Point First Nation 1		37
09616	Buffalo Point First Nation 2		348
09689	Buffalo Point First Nation 3		92
09638	Reed River 36A	At mouth of Reed River on Lake of the Woods, in southeast corner of Manitoba	1162

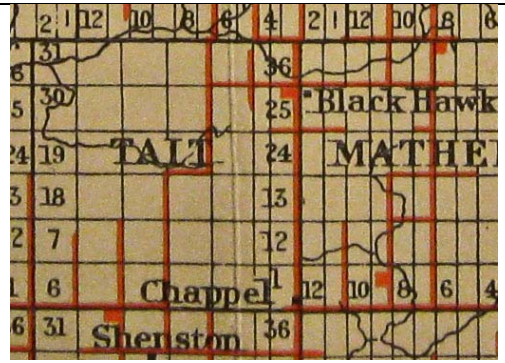
Source: AANDC (2013)

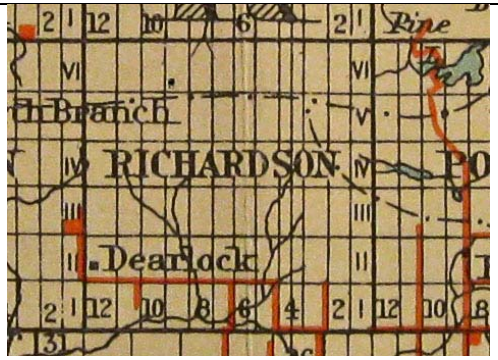
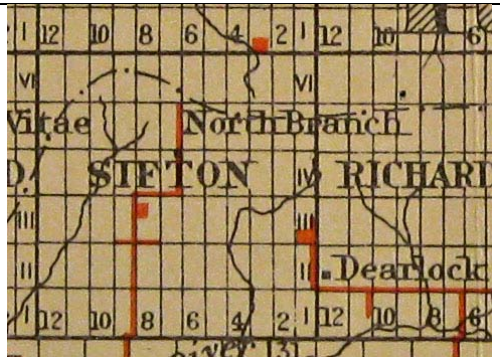
Table 5-39: Registered Buffalo Point First Nation Members

Residency	# of People
Registered males on own Reserve	19
Registered females on own Reserve	21
Registered males on other Reserves	3
Registered females on other Reserves	0
Registered males on own Crown Land	0
Registered females on own Crown Land	0
Registered males on other Band Crown Land	0
Registered females on other Band Crown Land	0
Registered males on no Band Crown Land	0
Registered females on no Band Crown Land	0
Registered males off Reserve	35
Registered females off Reserve	44
Total registered population	**122**

Source: AANDC (2013)

Table 5-40: Summary of Identified Cultural Heritage Landscapes and Built Heritage Resources

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
1.	CHL / Rural Landscape: Agriculture	A settled rural landscape with farm complexes, both active and abandoned, fenced fields, road network, hamlets and schoolhouses developed in the first part 1900s in the geographic Townships of Tait, Richardson and Sifton. Some farm complexes remain active and continue the historic use. Other farmsteads were abandoned, some up to 50 years ago. Important landscape and built heritage resources related to historic use are still visible.	 An aerial photograph (1952) shows open fields interspersed with bush and a discontinuous network of local roads.	 Active and abandoned farm complexes, cultivated fields with wood post and wire fencing and gravel roads remain distinctive components of the landscape.
2.	CHL / Township Survey	The Township of Tait was surveyed in 1876 by Canadian government surveyors based on the one-mile square section plan that had been used in the west. The six-mile square township was divided into 36 numbered sections, each approximately one-mile square or 640 acres. A road allowance was provided around each section. The sections were divided into quarter sections for patent purposes. Vestiges of the historic road network, farm complexes, fence lines and field patterns remain visible in the landscape.	 A portion of a District of Rainy River and Kenora map (1929) depicts the section layout and numbering of Tait Township.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
3.	CHL / Township Survey	The survey of Richardson Township, completed in 1903 followed the more typical Ontario arrangement of lots and concessions. The six-mile square townships were laid out into six concessions, numbered from south to north. Each concession comprises 12 lots that were organized from east to west. Each lot was divided into north and south halves of approximately 160 acres for patent purposes. Road allowances were provided between concessions and every second lot. Vestiges of the historic road network, farm complexes, fence lines and field patterns remain visible in the landscape.	 A portion of a District of Rainy River and Kenora map (1929) shows the lot and concession survey of Richardson Township.	
4.	CHL / Township Survey	The Township of Sifton was laid out in a similar manner to the Township of Richardson. The date of survey has not been identified, but early settlers arrived in the southeastern part of the township after 1910. Settlement appears to have been limited and concentrated in areas along the Sifton-Richardson townline and the road between Stratton and North Bend. The township remained part of the Unincorporated District of Rainy River until 2004 when it joined the incorporated Township of Morley. Vestiges of the historic road network, farm complexes, fence lines and field patterns remain visible in the landscape in the Dearlock area.	 A portion of a District of Rainy River and Kenora map (1929) shows the lot and concession survey of Sifton Township.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
5.	CHL / Transport-ation: Roadscape	Department of Highways Ontario (DHO) designated Secondary Highway 600 in 1956. The route absorbed a number of earlier township roads into the provincial highway system. An Ontario Road Map (1956) indicates the highway initially ran from Highway 70 (later Highway 71) to Lake of the Woods. By 1962, Secondary Highway 600 connected with Highway 11 at Rainy River through the incorporation of Secondary Highway 623 into the route. The highway extends approximately 87 km from Highway 71 through Black Hawk, Dearlock, North Bend, Bergand to Highway 11 at Rainy River. It has retained a gravel surface throughout its history. Realignments in the eastern part of the study area replaced some of the original right angle turns with gentler curves.	 A DHO road map illustrates the route of Highway 600 in Chapple Township.	 A view east along Highway 600 in the geographic Township of Richardson depicts the straight alignment of the roadway of the road allowance between Concessions 1 and 2.
6.	CHL / Settlement: Hamlet	The crossroads settlement of Black Hawk developed in the early 1900s on the townline of Mather and Tait Townships, approximately 18 km north of Barwick. The hamlet developed as a service centre to the surrounding farming community and included: a sawmill, a store and post office, a school, and later, a dance hall. Barwick Road was an important link to the community of Barwick and the railway to the south. The Black Hawk post office opened in 1904 and closed in 1986. S.S. #7 Tait on Section 25 of Tait opened in 1906. Mapping continued to depict the Black Hawk school through the 1950s.	 A view north along Barwick Road to Highway 600 indicates few buildings remain in Black Hawk area.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
7.	CHL / Agricultural: Farm Complex	The Angus and Sarah McRae family, early settlers in the Black Hawk area, located on SE ¼ of Section 36, Tait Township, in 1901 and received the property title in 1907. Members of the Teeple family acquired the property and continue to operate a farm on the site. The farmstead on the Pinewood River comprises a residence, at least six outbuildings and fenced fields. Two or three of the outbuildings are older frame structures; the farmhouse is a contemporary structure.	 View northwest to the farm complex located 2923 Tait Road.	
8.	CHL / Agriculture: Farm Complex	John McCarthy received title to the SW ¼ Section 36, Tait Township, in 1926. The Agriculture Rehabilitation and Development Directorate of Ontario acquired the property in 1968 and Ellard Teeple in 1978. The land is still owned by the Teeple family, who operate a cattle farm on the site. The farmstead contains a contemporary house, an older frame barn, outbuildings and fenced fields.	 View northwest to the farm complex located 2635 Tait Road.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
9.	CHL / Agriculture: Farm Complex	David Guthrie Hughes located on the SW ¼ Section 35, Tait Township, in 1906 and received title to the property in 1919. David Hughes sold the property the following year. The site has been vacant for a number of years. A one and-a-half storey frame residence with a front gable roof, shiplap siding, a stone foundation, and a one storey rear wing is located to the north of the laneway from Sheppard Road. The ruins of three collapsed structures are located to the northeast of the residence. Fields formerly extended to the south and east along Tait Road.	 View northeast to the former farmhouse on the property.	 The collapsed buildings are situated to the northeast of the farmhouse.
10.	CHL / Agriculture: Farm Complex	Judson Harry Neville located on the south part of Lot 3, Concession 1, Richardson Township, in 1904 and received the property title in 1910. The Teeple family later acquired the property. The farm was used as part of a cattle operation until its acquisition by RRR. Buildings remaining onsite include a contemporary farmhouse and approximately five outbuildings of which three appear to be older structures Fields with wood post and wire fencing extend to the north and west. Clark Creek runs through the property.	 View northwest to the farm complex located 1006 Teeple Road.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
11.	CHL / Agriculture: Farm Complex	William Henry Wilson settled on the south part of Lot 4, Concession 2, Richardson Township, in 1908 and received the property title in 1921. William Randall, an American, purchased the property in mid 20th century and operated a tourist camp at this location for a period of time. Stones collected from the fields border Roen Road. The property retains a one and-a-half storey frame residence with shiplap siding, side gable roof and a one storey rear wing. The front elevation faces south and contains a centre entranceway with a window to either side. Six outbuildings, which include three collapsed log structures, are located in proximity to the house. A log building at the road may relate to the property.	 View northwest to the residence located 116 Roen Road.	 View east to the collapsed outbuildings situated to the east of the residence.
12.	BHR / Residence	A small house was constructed on the north part of Lot 5, Concession 2, Richardson Township, in the mid 20th century for Herb Tibbs who moved to the area from the nearby community of Emo. The small, one-storey frame structure is set on sleepers and clad in insulbrick siding. The side gable roof has wood shingles and a centre brick chimney. The front elevation has a side entrance door and two window openings. The interior is divided into two rooms.	 View southwest to the residence situated on the property at 365 Roen Road on the former Johnson property.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
13.	CHL / Agriculture: Farm Complex	Charles Nekolie Roen located on the south part of Lot 5, Concession 3, Richardson Township, in 1915 and obtained the property title in 1926. A one and-a-half storey frame farmhouse with a side gable roof is clad in wood shingles. It does not appear to have been inhabited for some time. A contemporary residence is located to the southeast of the older house. Outbuildings onsite include a frame barn with a gable roof and horizontal plank siding, one large shed, and two smaller sheds.	 South elevation of the former farmhouse at 414 Roen Road.	 View northeast to the frame barn located on the property.
14.	BHR / Residence	The south part of Lot 6, Concession 3, Richardson Township, does not appear to have been taken up as part of a free grant. The Public School Trustees for School Section No. 5 of the Township of Richardson purchased two acres in 1939. The school built fronting on Marr Road no longer exists. Charles Nekolie Roen acquired balance of the south half c1958. A small residence was constructed for a member of the Roen family. The one-storey, frame house with a gable roof is clad in fibreboard over wood sheathing. Outbuildings include two sheds and a privy.	 View north to the residence at 614 Roen Road. Two of the outbuilding are set in the conifers to the left of the house.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
15.	CHL / Recreation: Trail	The Richardson Trail, named locally for the township, is an approximately 12 km circular trail within the northwestern part of Richardson Township. It is comprised of old logging roads, some municipal and private roads and, in some parts, animal trails. Some local residents use the trail for hiking, snowshoeing, snowmobiling and for all terrain vehicles as well as for access to remote hunting areas.	 The Richardson Trail route is marked in red in the top left corner of an aerial photograph.	
16.	CHL / Settlement: Hamlet	**Dearlock** The community of Dearlock grew up on the boundary of Richardson and Sifton Townships in the first part of the 20th century. The Grennier family operated a store on Lot 12, Concession 1 in Richardson Township. P. Grennier was the first postmaster when the Dearlock post office opened in 1915. It remained in operation until 1952. A school was built on the west side of the road in Sifton Township c1912. The original log building was replaced in the 1940s. The Dearlock School closed in the 1970s and the building has been removed.	 View northwest to the community of Dearlock.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
17.	CHL / Agriculture: Farm Complex	Clarence Howard Haney was located on the north part of Lot 12, Concession 1, Richardson Township, in 1926 and received the property title 1936. The Haney family was an early settlement family in the Dearlock area. The Neilson family later acquired the property and continues to operate the farm. The farmstead contains a large two-storey barn with distinctive arched roof and one storey side wings. Metal silos and a long one-storey shed are situated in proximity to the barn.	 View southwest to the barn and silos at 3175 Secondary Highway 600.	
18.	BHR / Residence	Philorum Grennier was located on the south part of Lot 12, Concession 2, Richardson Township, in 1912 and received the property title in 1922. A store and post office operated from the one and-a-half storey frame building prominently sited at the corner where Highway 600 turns at Dearlock. The building also served as the Grennier residence. Descendants of the Grennier family own the property. The original LeBlanc log house was moved to the property. The one and-a-half story building has a side gable roof and features centre gables fitted with diamond-shaped window openings. There is a side brick chimney on the roof peak. The building is clad in wood clapboard siding accented by cornerboards. The building has been vacant since c1955.	 View northeast to the Grennier residence at 3226 Highway 600. A store and the Dearlock post office operated out of the building.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
19.	CHL / Agriculture: Farm Complex	Oliver Rondeau was located on the north half of Lot 12, Concession 2, Richardson Township, in 1912 and received title in 1921. He farmed the land until his death in 1944. The LeBlanc family later acquired the property and continues to farm the fields that extend to the south of the buildings. The property comprises a one and-a-half storey log residence dating to c1915, and two, collapsed one-storey log outbuildings. The house features a side gable roof with front and rear gable dormers with window openings fitted with shutters.	 View northeast to the former farm complex located 3522 Highway 600.	 View northeast to the log farmhouse.
20.	CHL / Agriculture: Farm Complex	John and Adeline (née Grennier) LeBlanc moved from Minnesota and settled the south part of Lot 1, Concession 2, Sifton Township, c1912. LeBlanc descendants continue to own the property and operate a cattle farm. The farmstead comprises a contemporary residence, a timber frame barn featuring horizontal siding and gambrel roof with belcast eaves dating to 1944 and fenced fields to the north of the buildings.	 View south to the farm complex located 3221 Highway 600.	

Site #	Resource Category / Type	Resource Description	Digital Image / Map	
21.	CHL / Agriculture: Farm Complex	George Haney and family relocated to Sifton Township from Deep River Falls, Minnesota in 1913. He received title to his land grant comprising the north part of Lot 12, Concession 1 in 1924. After George's death, his widow sold all but one-acre of land to a niece, a member of the Jones family. Mrs. Haney built a small residence on the remaining plot of land. The vacant and derelict frame building with gable roof remains on the larger farm property.	 View northwest to the small residence located on the farm complex at 2923 Tait Road.	

Source: Unterman McPhail (2013)
Notes: CHL: cultural heritage landscape
BHR: built heritage resource

397500 405000 412500 420000 427500 435000 442500 450000

5422500 5415000 5407500 5400000

Bergland
Hwy-600
Little Grassy River
Sifton Township Conservation Reserve
Cranberry Lake Provincial Park
Hwy-621
Hwy-619
Marsh Lake
Agassiz Peatlands Provincial Park
Cranberry Lake
Gameland
Kishkakoesis River
North Branch
Hwy-617
Dearlock
Hwy-600
Pinewood River
Spruce Island Provincial Park
Little Pine Lake
Muskrat Lake
Hwy-71
Finland
Hwy-615
Burditt Lake
Off Lake
Burditt Lake
West Jackfish Lake
Rainy Lake I.R. No. 17B
Lake Despair
Pinewood Lake
Abbott Lake
Sturgeon Creek
La Vallée River
Hwy-613
CANADA
U.S.A.
Hwy-11
Pinewood
Rainy River

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LEGEND

- RRP Site
- Natural Environment Local Study Area Boundary (NLSA)
- Natural Environment Regional Study Area Boundary (NRSA)
- Transmission Line
- Regional Road / Highway
- Waterbody / Large Watercourse
- Wooded Area
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park

NOTES:
- All base data on this map was extacted from Land Information Ontario (MNR), Queen's Printer for Ontario, 2011-2012
- USA land extracted from ESRI base map service, USGS Topo maps

Datum: NAD83
Projection: UTM Zone 15N

0 5 10 20 30 40 Kilometres

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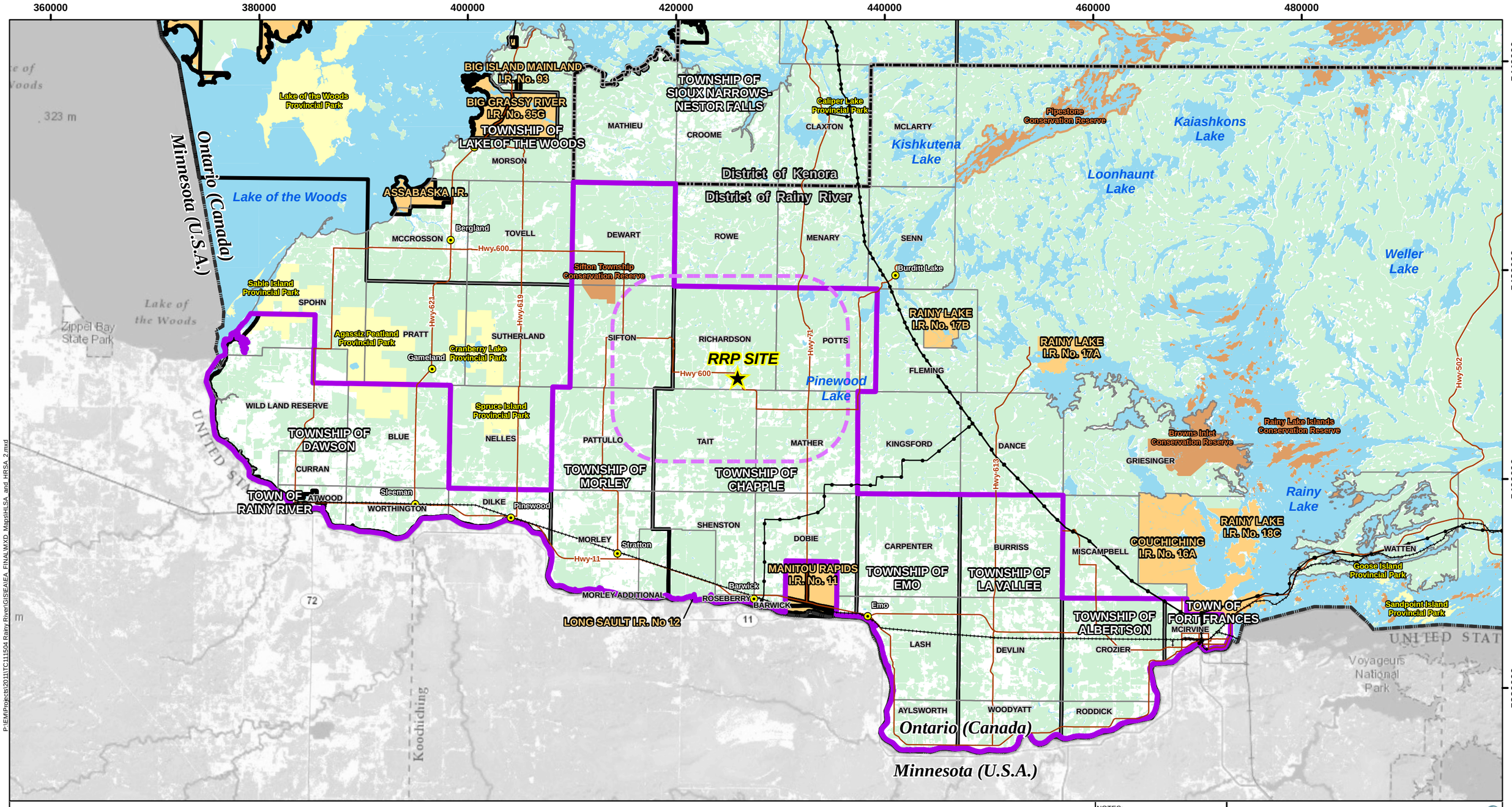
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RAINY RIVER PROJECT

Local and Regional Study Areas Natural Environment

PROJECT N°: TC111504 | **FIGURE: 5-1**

SCALE: 1:150,000 | DATE: October 2013



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LEGEND

- RRP Site
- Human Environment Local Study Area (HLSA)
- Human Environment Regional Study Area (HRSA)
- Regional Road / Highway
- Transmission Line
- Railway
- Small Town/Community
- Upper Tier Municipality Boundary
- Lower Tier Municipality Boundary
- Township Boundary
- First Nation Land
- International (Canada - U.S.A.) Border
- Provincial Park
- Conservation Reserve (Regulated)
- Waterbody / Large Watercourse
- Wooded Area

0 10 20 40 60 80 100 Kilometres

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Ontario base data extracted from Land Information Ontario (MNR) data warehouse. Queen's Printer for Ontario, 2011-2012
- Base data outside of Ontario extracted from ESRI DeLorme World Basemap
- First Nation Land extracted from GeoBase, NRCan, 2012

Datum: NAD83
Projection: UTM Zone 15N

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RAINY RIVER PROJECT

Local and Regional Study Areas Human Environment

PROJECT N°: TC111504 | **FIGURE: 5-2**

SCALE: 1:350,000 | DATE: October 2013

330000 360000 390000 420000 450000 480000 510000 540000 570000 600000

5490000 5460000 5430000 5400000 5370000

Kenora Dryden Sioux Narrows Rainy River Pinewood Emo Fort Frances

Hwy 71 Hwy 600 Hwy 621 Hwy 613 Hwy 502 Hwy 11 Hwy 622

Manitoba Ontario (Canada) Minnesota (USA)

Lake of the Woods Kakagi Lake Lower Manitou Lake Kaiashkons Lake Rainy Lake Clearwater West Lake

L of the Woods

INTL SWEDE CARLSON FIELD FALLS INTL

Roseau R Rapid R

View INSET A

INSET A

Minahico Bergland Burditt Lake Gameland Sleeman Pinewood Stratton Barwick Emo

Sifton Township Conservation Reserve

Cranberry Lake Provincial Park

Spruce Island Provincial Park

10 km

LEGEND

- RRP Site
- Local / Regional Non-Aboriginal Communities
- International (Canada - U.S.A.) Border
- Regional Road / Highway
- Railway
- 25 First Nation Land
- Conservation Reserve
- Provincial Park

1 Northwest Angle Indian Reserve 37C
2 Buffalo Point 1
3 Buffalo Point 3
4 Buffalo Point 2
5 Buffalo Point 36
6 Rainy Lake 26A
7 Wabigoon Lake 27
8 Rainy Lake 17B
9 Shoal Lake 31J
10 Sabaskong Bay 35C
11 Neguaguon Lake 25D
12 Lake of the Woods 31H
13 Rainy Lake 26B
14 Shoal Lake 39A
15 Saug-A-Gaw-Sing 1
16 Shoal Lake 39
17 Shoal Lake 34B1
18 Couchiching 16A
19 Northwest Angle 34C & 37B
20 Shoal Lake 34B2
21 Agency 30
22 Assabaska
23 Big Island Mainland 93
24 Shoal Lake 37A
25 Lake of the Woods 31C
26 Lake of the Woods 37B
27 Sabaskong Bay 35H
28 Sabaskong Bay 32C
29 Seine River 23B
30 Lake of the Woods 37
31 Sabaskong Bay 35D
32 Big Island 31F
33 Big Grassy River 35G
34 Naongashing 31A & 35A
35 Lake of the Woods 34
36 Lake of the Woods 31B
37 Sturgeon Falls 23
38 Seine River 23A
39 Agency 1
40 Kenora 38B
41 Obabikong 35B
42 Rat Portage 38A
43 Yellow Girl Bay 32B
44 Manitou Rapids 11
45 Lake of the Woods 35J
46 Rainy Lake 26C
47 Rainy Lake 18C
48 Rainy Lake 17A
49 Shoal Lake 40
50 Long Sault 12
51 Lake of the Woods 31G
52 Eagle Lake 27
53 Northwest Angle 33B
54 Sabaskong Bay 35F
55 Big Island 31D
56 Whitefish Bay 33A
57 Big Island 37
58 Big Island 31E
59 Whitefish Bay 34A
60 Whitefish Bay 32A

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR
- Ontario base data extracted from Land Information Ontario (MNR) data warehouse, Quenn's Printer for Ontario, 2011-2012
- Base data outside of Ontario extracted from ESRI DeLorme World Basemap
- First Nation Land extracted from GeoBase, NRCAn

Datum: NAD83
Projection: UTM Zone 15N

0 20 40 80 120 160 200 Kilometres

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RAINY RIVER PROJECT

Surrounding Communities and First Nation Reserves

PROJECT N°: TC111504 | FIGURE: 5-3

SCALE: (see bar scale) | DATE: October 2013

P:\EM\Projects\2011\TC111504 Rainy River\GIS\EA\EA_FINAL\MXD_Maps\Surrounding_First_Nation_Communities_2.mxd

420000 425000 430000

5425000 5420000 5415000 5410000

Big Grassy River
Splitrock River
Pinewood River
Pinewood River
Highway 600
HIGHWAY 600
HIGHWAY 71
Roen Rd.
TAIT ROAD
BARWICK ROAD
Dearlock
Black Hawk
Domestic Waste

Unit 1A N5 Unit 6E Unit 3 Unit 5 Unit 2A Unit 6D Unit 4D Unit 2 Unit 5B N1(A) N1(B) HIGHWAY 600 Unit 1 N6 Unit 2B Unit 3A N3 N4 Unit 6C N8 N7 Unit 4E Unit 6F Unit 4C Unit 6B Unit 4B Unit 4 Unit 1C Unit 5A Unit 4A Unit 6A Unit 3C Unit 1B Unit 3E Unit 3B Unit 3 Unit 2

P:\EM\Projects\2011\TC111504 Rainy River\GIS\EA\EA_FINAL\MXD_Maps\Sound_Monitoring_Locations_2.mxd

LEGEND

- RRP Site
- Klohn Crippen Berger Baseline Sound Station (2009-2010)
- Ministry of Natural Resources and Trent University Exploration Sound Station (2011)
- Ministry of Natural Resources and Trent University Exploration Sound Station (2012)
- Rainy River Resources Baseline Sound Station (2012)

0 0.5 1 2 3 4 5 Kilometres

NOTES:
- Background provided by Toporama, NRCan, 2011-2012

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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RAINY RIVER PROJECT

Sound Monitoring Locations

PROJECT NO: TC111504	**FIGURE: 5-4**
Scale 1:62,500	Date: October 2013

415000 417500 420000 422500 425000 427500 430000 432500

5412500 5410000 5407500 5405000

Marr Rd
Muskrat Lake
Hwy 600
McCallum Creek
Loslo Rd
Roen Rd
West Creek
Pine River Rd
Loslo Creek
Clark Rd
Clark Creek
Hwy 71
Teeple Rd
Pinewood River
Heatwole Rd
Tait Rd
Blackhawk Rd

P:\EM\Projects\2011\TC111504 Rainy River\GIS\EA\EA_FINAL.WXD_MapsBoreholes_3.mxd

LEGEND

- RRP Site
- Residence-House
- Lodging Cabin-Occasional Use
- Building - Unknown Use
- Roads
- Contours, 10 m interval (LIO-MNR)
- Watercourses
- Low-lying Area

Elevation Colour Ramp
High ground
Low ground

- Boreholes (AMEC 2012)
- Test Pits (AMEC 2012)
- Boreholes (AMEC 2011)
- Boreholes (KCB 2010)
- Test Pits (KCB 2010)
- CPT (KCB 2010)

0 1.5 3 6 9 12 Kilometres

Notes:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Background topographic and elevation data extracted from MNR Land Information Ontario, Queen's Printer for Ontario, 2011-2012

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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RAINY RIVER PROJECT

Borehole Locations

PROJECT N°: TC111504	**FIGURE: 5-5**
SCALE: 1:48,000	DATE: October 2013

395000 400000 405000 410000 415000 420000 425000 430000 435000 440000

5420000 5415000 5410000 5405000 5400000 5395000

Hwy-621
Hwy-619
Hwy-600
Hwy-11
Hwy-71

McCallum Creek Watershed
Loslo Creek Watershed
Upper Trib 5 - Marr Creek Watershed
West Creek Watershed
Kishkakoesis River Watershed
Spruce Is. Watershed
Mid-Pinewood Watershed
Dearlock - Tait Creek Watershed
Upper Pinewood - Clark Creek Watershed
Lower Pinewood Watershed

Little Pine Lake
Boundary Lake
Off Lake
Muskrat Lake
Pinewood Lake
Pinewood River
Rainy River

Ontario (Canada)
Minnesota (USA)

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LEGEND

- RRP Site
- Regional Road / Highway
- Railway
- Waterbody
- Low-Lying Wetland Area
- Permanent Watercourse
- Intermittent Watercourse
- 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)
  - -Upper Trib 5 - Marr Cr. approx. 1,230 ha
  - -Loslo Cr. approx. 1,620 ha
  - -West Cr. approx. 1,635 ha
  - -McCallum Cr. approx. 2,490 ha
  - -Upper Pinewood - Clark Cr. approx. 6,130 ha
  - -Mid-Pinewood approx. 6,530 ha
  - -Dearlock - Tait Cr. approx. 7,600 ha
  - -Kishkakoesis R. approx. 9,200 ha
  - -Spruce Is. approx. 9,580 ha
  - -Lower Pinewood approx. 11,435 ha

0 3.5 7 14 21 28 35 Kilometres

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

Datum: NAD83
Projection: UTM Zone 15N

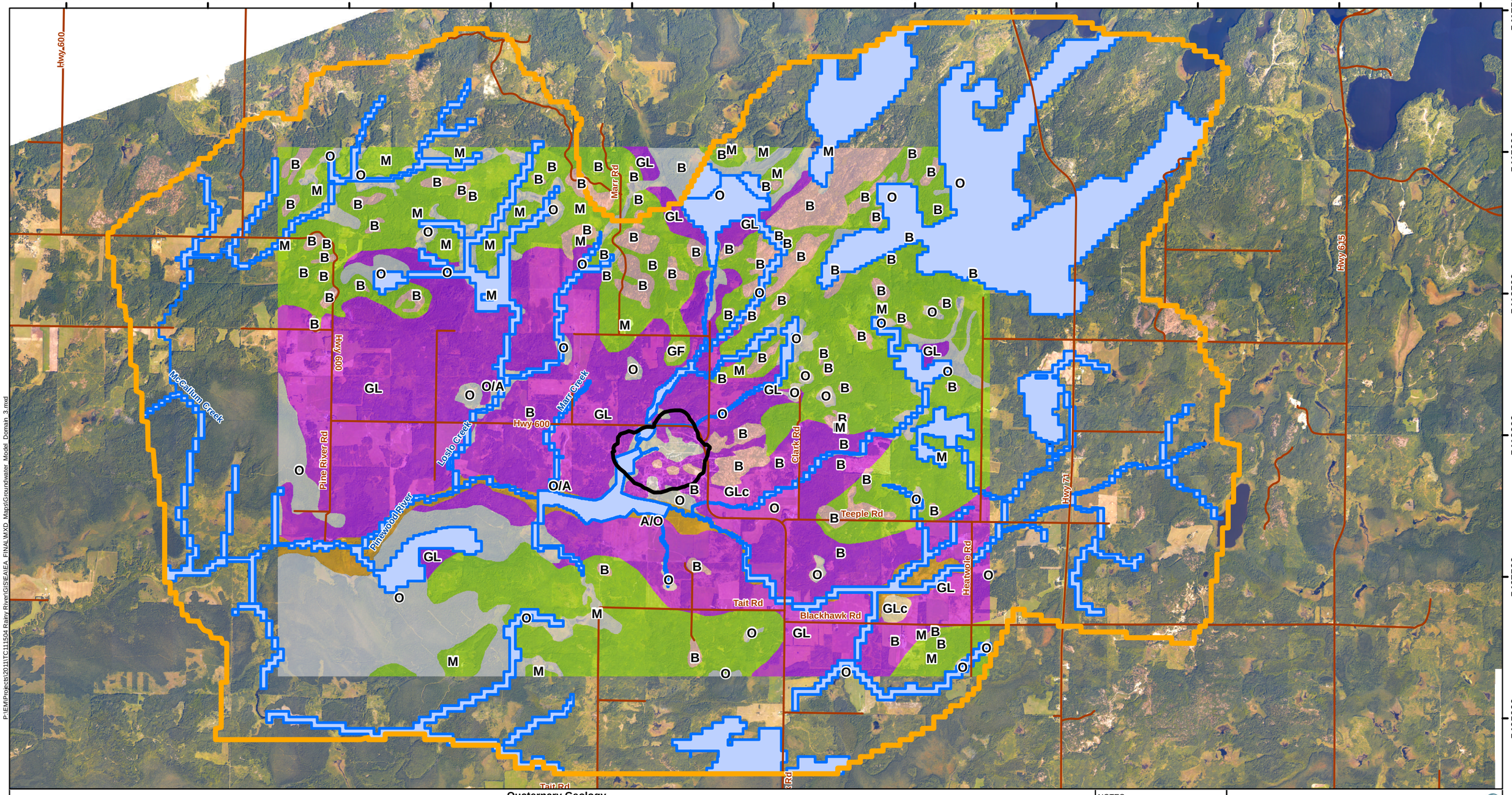
N W E S

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RAINY RIVER PROJECT

Regional Topography, Watershed and Subwatershed Boundaries

PROJECT N°: TC111504	**FIGURE: 5-6**
SCALE: 1:127,000	DATE: October 2013



LEGEND

- Approximate Open Pit Outline
- Model Domain Boundary
- Roads
- Cells used to Simulate Surface Water Features

Quaternary Geology

- O — Organic: peat and organic clay; includes bogs, fens, marsh, ponds and standing water along poorly defined creeks.
- A — Alluvium: fine sand, silt, and clay; deposits of Pinewood River and tributaries
- B — Bedrock: exposures or with very thin cover
- GL — Glaciolacustrine: clay, silt, and minor sand; glacial lake bottom
- GLc — Glaciolacustrine Coarse Grained: sand and gravel; beach, bar and, near-shore deposits
- GF — Glaciofluvial: sand, gravel, and boulders, minor till; deposited from glacial meltwater in ice-contact environment.
- M — Moraine: glacial till with some interbedded glaciolacustrine clay and silt; inferred to mostly Whitemouth Lake Till, clay rich with carbonate rocks and matrix.

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Surficial geology based on air photo analysis and review of published geology maps. Surficial materials may vary from those indicated

Datum: NAD83
Projection: UTM Zone 15N

0 1.5 3 6 9 12 15 Kilometres

N W E S

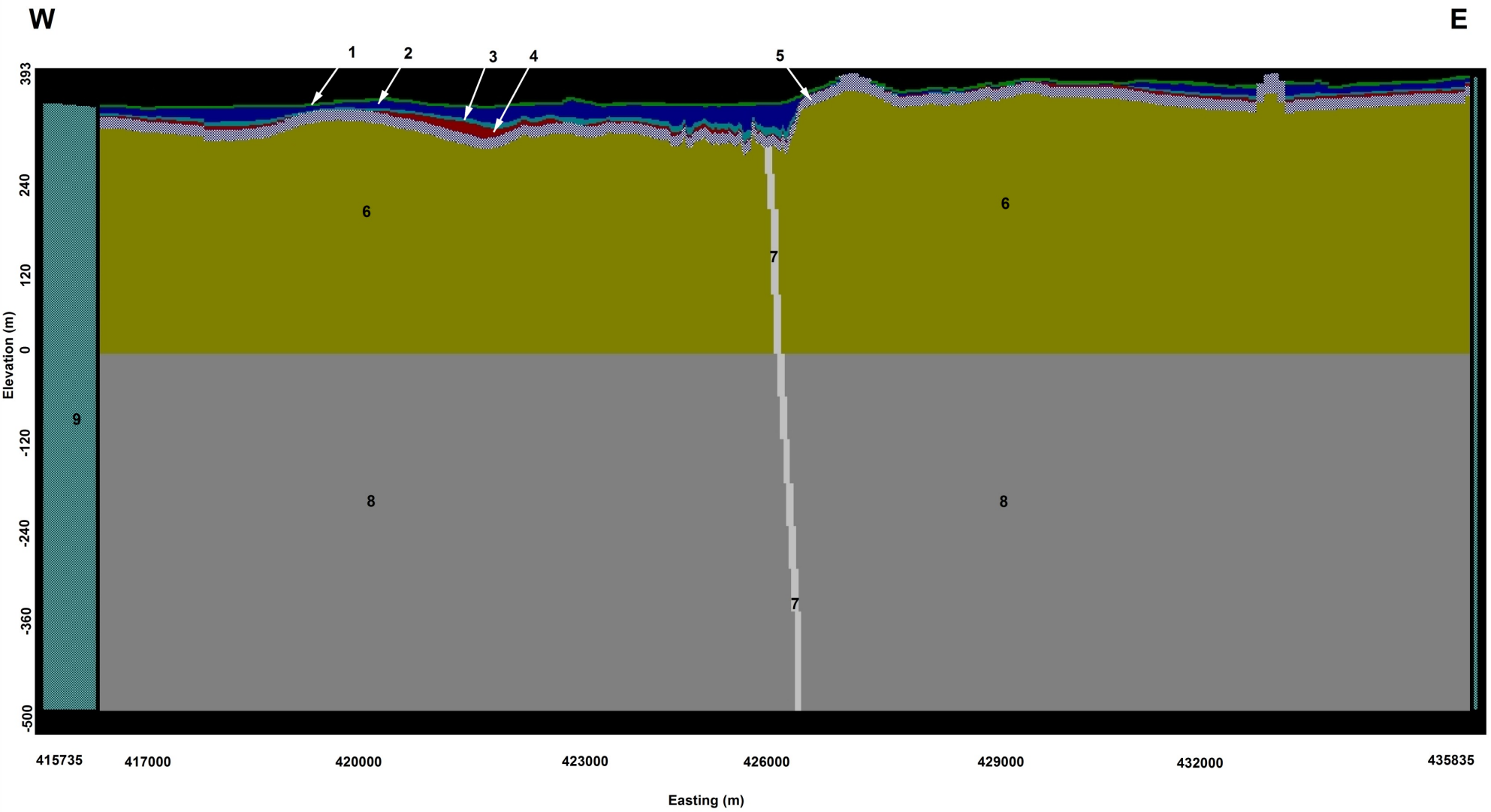
newgold™ Rainy River Project amec

RAINY RIVER PROJECT

Groundwater Flow Model Domain

PROJECT N°: TC111504 | **FIGURE: 5-7**

SCALE: 1:64,500 | DATE: October 2013



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LEGEND

- (1) Near-Surface System
- (2) Whitemouth Lake Till & Upper GL Clay (Brenna)
- (3) Lower GL Clay (Wylie)

Pleistocene Aquitard

- (4) PLGD
- (5) Shallow Bedrock
- (6) Intermediate Bedrock
- (7) EFLT Fault
- (8) Deep Bedrock
- (9) Area Outside of Model Domain (inactive cells)

NOTES:
-

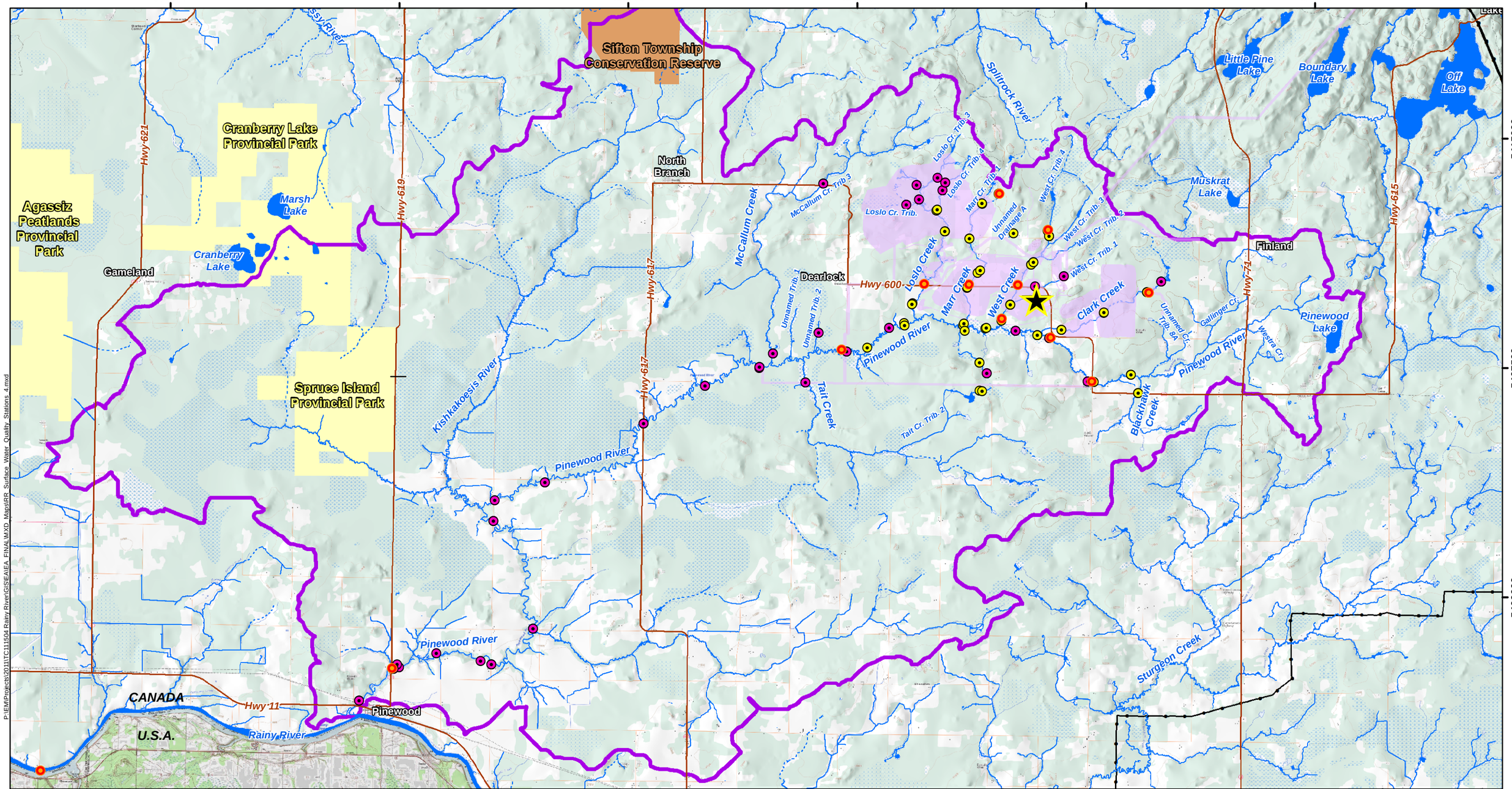
Datum: NAD83
Projection: UTM Zone 15N

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RAINY RIVER PROJECT

Groundwater Flow Model Cross Section

PROJECT N°: TC111504	**FIGURE: 5-8**
SCALE: As Shown	DATE: October 2013



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LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Regional Road / Highway
- Permanent Watercourse
- Intermittent Watercourse
- Transmission Line
- Waterbody
- Pinewood River Watershed
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park

Water Quality Sampling Locations (within study area)

- Water Quality Sampling Location (AMEC 2012)
- Water Quality Sampling Location (AMEC 2011)
- RRR Monthly Surface Water Quality Stations

NOTES:
- All base data on this map was extacted 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 3 6 12 18 24 30 Kilometres

newgold™ Rainy River Project

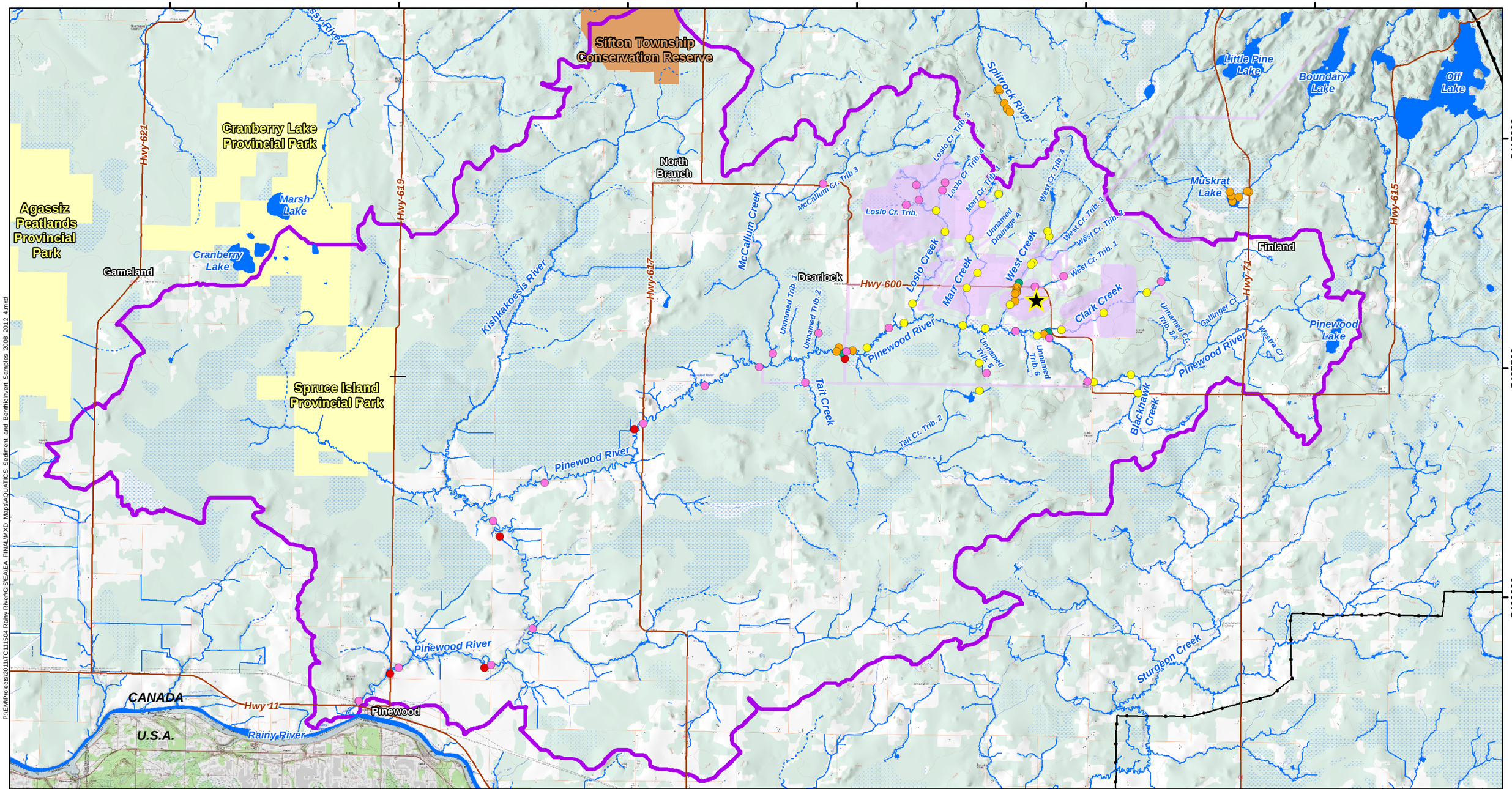
amec

RAINY RIVER PROJECT

Surface Water Quality Stations

PROJECT N°: TC111504 | **FIGURE: 5-9**

SCALE: 1:119,500 | DATE: October 2013



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LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Regional Road / Highway
- Permanent Watercourse
- Intermittent Watercourse
- Transmission Line
- Waterbody
- Pinewood River Watershed
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park

Sediment and Benthic Invertebrate Community Samples

- Sediment and Benthic Invertebrate Sample Locations (AMEC 2012)
- Sediment and Benthic Invertebrate Sample Locations (AMEC 2011)
- Benthic Invertebrate Sample Locations (KCB 2009-2010)
- Sediment Sample Locations (KCB 2008-2009)
- Sediment and Benthic Invertebrate Sample Locations (MNR 1997)

NOTES:
- All base data on this map was extacted 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 3 6 12 18 24 30 Kilometres

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RAINY RIVER PROJECT

Sediment and Benthic Invertebrate Community Sampling Locations

PROJECT N°: TC111504	**FIGURE: 5-10**
SCALE: 1:119,500	DATE: October 2013

397500 405000 412500 420000 427500 435000

5415000 5407500 5400000

INSET A

INSET B

VIEW INSET A

VIEW INSET B

Sifton Township Conservation Reserve

Agassiz Peatlands Provincial Park

Spruce Island Provincial Park

Gameland

Dearlock

North Branch

Pinewood

CANADA

U.S.A.

Hwy-600 Hwy-621 Hwy-617 Hwy-11 Hwy-615 Hwy-71

Loslo Cr. Loslo Cr. Trib. 2 Marr Cr. Trib. 1 Marr Cr. Unnamed Drainage A West Cr. Trib. 4 West Cr. Trib. 3 West Cr. Trib. 2 West Cr. Trib. 1 West Cr.

Loslo Creek Marr Creek West Creek McCallum Creek McCallum Cr. Trib. 3 Unnamed Trib. 1 Unnamed Trib. 2 Tait Creek Tait Cr. Trib. 2 Clark Creek Blackhawk Creek Unnamed Trib. 8A Gallinger Cr. Westra Cr.

Kishkakoesis River Pinewood River Rainy River Splitrock River

Little Pine Lake Off Lake Muskrat Lake Pinewood Lake

1,000 m

Loslo Cr. Marr Cr. West Cr. Clark Cr. Pinewood R. Unnamed Trib. 3 Unnamed Trib. 5 Unnamed Trib. 6

P:\EM\Projects\2011\TC111504 Rainy River\GIS\EA\EA_FINAL.MXD MapsAQUATICS Fish Community Sampling 2008_2012_4.mxd

LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Regional Road / Highway
- Permanent Watercourse
- Intermittent Watercourse
- Transmission Line
- Waterbody
- Pinewood River Watershed
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park

Fish Community Sampling Locations

- Fish Community Sampling Locations (AMEC 2012)
- Fish Community Sampling Locations (AMEC 2011)
- Fish Community Sampling Locations (KCB 2009-2010)
- Fish Community Sampling Locations (MNR 1997)

NOTES:
- All base data on this map was extacted 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

0 3 6 12 18 24 30 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

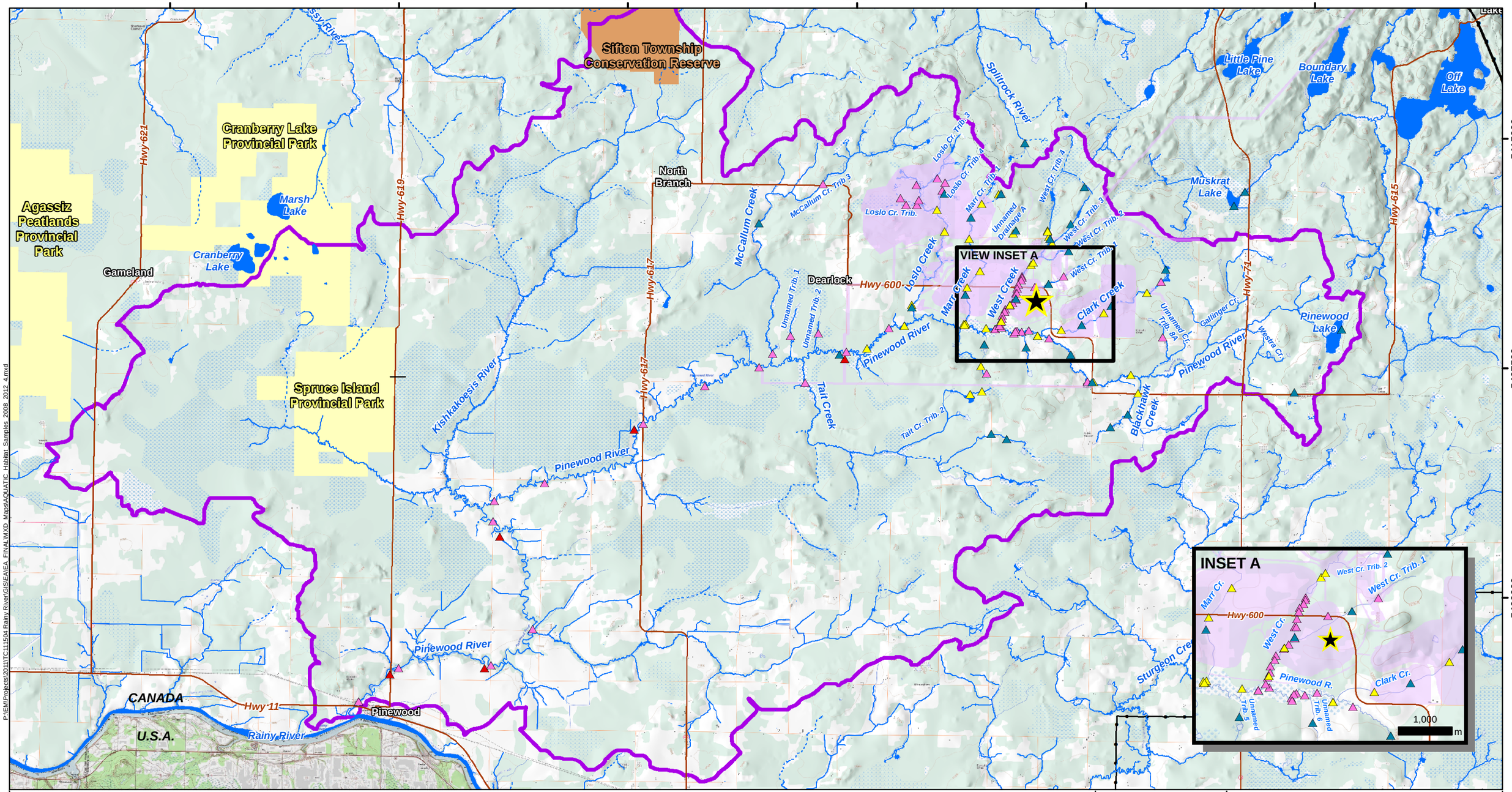
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RAINY RIVER PROJECT

Fish Community Sampling Locations

PROJECT N°: TC111504 | **FIGURE: 5-11**

SCALE: 1:119,500 | DATE: October 2013



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LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Regional Road / Highway
- Permanent Watercourse
- Intermittent Watercourse
- Transmission Line
- Waterbody
- Pinewood River Watershed
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park

Aquatic Habitat Sampling Locations

- Habitat and Bathymetry Sampling Locations (AMEC 2012)
- Habitat and Bathymetry Sampling Locations (AMEC 2011)
- Habitat Sampling Locations (KCB 2008-2010)
- Habitat Sampling Locations (MNR 1997)

NOTES:
- All base data on this map was extacted 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 3 6 12 18 24 30 Kilometres

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amec

RAINY RIVER PROJECT

Aquatic Habitat Sampling Locations

PROJECT N°: TC111504

FIGURE: 5-12

SCALE: 1:119,500

DATE: October 2013

405000 412500 420000 427500 435000 442500

5422500

5415000

5407500

Sifton Township Conservation Reserve

Spruce Island Provincial Park

Hwy 619

Hwy 617

Hwy 600

Hwy 615

Hwy 71

Kishkakoesis River

Pinewood River

Little Pine Lake

Boundary Lake

Muskrat Lake

Burdit Lake

Off Lake

Rainy Lake I.R. No. 17B

Pinewood Lake

Abbott Lake

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LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Natural Environment Local Study Area (NLSA)
- Regional Road / Highway
- Secondary Road
- Existing Transmission Line
- Permanent Watercourse
- Intermittent Watercourse
- Waterbody
- First Nation Reserve Lands
- Conservation Reserve (Regulated)
- Provincial Park

AMEC 2012 Survey Areas

- Detailed Vegetation Survey Areas

KCB 2010 Survey Stations

- Vegetation Survey Stations

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Base map data from Geogratis NRCan Toporama DRG 1:50,000 NTS sheets

Datum: NAD83
Projection: UTM Zone 15N

0 5 10 20 30 Kilometres

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RAINY RIVER PROJECT

Vegetation Survey Locations

PROJECT N°: TC111504 | **FIGURE: 5-13**

SCALE: 1:112,000 | DATE: October 2013

405000 412500 420000 427500 435000 442500

5422500 5415000 5407500

Sifton Township Conservation Reserve

Little Pine Lake

Boundary Lake

Burdit Lake

Off Lake

Rainy Lake I.R. No. 17B

Muskrat Lake

Hwy 619

Hwy 617

Hwy 600

Hwy 615

Hwy 71

Kishkakeesis River

Pinewood River

Pinewood Lake

Abbott Lake

Spruce Island Provincial Park

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LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Natural Environment Local Study Area (NLSA)
- Regional Road / Highway
- Secondary Road
- Existing Transmission Line
- Permanent Watercourse
- Intermittent Watercourse
- Waterbody
- First Nation Reserve Lands
- Conservation Reserve (Regulated)
- Provincial Park

AMEC 2012 Survey Stations
- Owl Survey Stations
- Bat Detector Locations
- Crepuscular Bird Survey Stations
- Aerial Survey Flight Lines (2012 and 2013)

AMEC 2011 Survey Stations
- Owl Survey Stations
- Crepuscular Bird Survey Stations

KCB 2010 Survey Stations
- Waterfowl / Marsh Bird Survey Stations
- Owl Survey Stations
- Forest Bird Survey Stations

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Base map data from Geogratis NRCan Toporama DRG 1:50,000 NTS sheets

Datum: NAD83
Projection: UTM Zone 15N

0 5 10 20 30 Kilometres

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RAINY RIVER PROJECT

Various Wildlife Survey Locations

PROJECT N°: TC111504 | **FIGURE: 5-14**

SCALE: 1:112,000 | DATE: October 2013

415000 420000 425000 430000 435000 440000

5420000 5415000 5410000

Burditt Lake
Little Pine Lake
Boundary Lake
Off Lake
Muskrat Lake
Pinewood Lake
Pinewood River
Hwy 600
Hwy 615
Hwy 71

5
3
2
4
1

P:\EM\Projects\2011\TC111504 Rainy River\GIS\EA\EA_FINAL\MXD_Maps\Bat_Detector_Locations_3.mxd

LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Natural Environment Local Study Area (NLSA)
- Regional Road / Highway
- Existing 230 kV Transmission Line
- Bat Detector Location (Labelled with ID, AMEC 2012)

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Base map data from Geogratis NRCan Toporama DRG 1:50,000 NTS sheets

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 Kilometres

N W E S

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RAINY RIVER PROJECT

Bat Detector Locations

PROJECT N^{o}: TC111504 | **FIGURE: 5-15**

SCALE: 1:72,000 | DATE: October 2013

405000 412500 420000 427500 435000 442500

5422500 5415000 5407500

Sifton Township Conservation Reserve
Spruce Island Provincial Park
Hwy 619
Hwy 617
Kishkakoesis River
Pinewood River
Hwy 600
Little Pine Lake
Boundary Lake
Muskrat Lake
Hwy 615
Hwy 71
Burdit Lake
Off Lake
Rainy Lake I.R. No. 17B
Pinewood Lake
Abbott Lake

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LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Natural Environment Local Study Area (NLSA)
- Regional Road / Highway
- Secondary Road
- Existing Transmission Line
- Permanent Watercourse
- Intermittent Watercourse
- Waterbody
- First Nation Reserve Lands
- Conservation Reserve (Regulated)
- Provincial Park

AMEC 2012 Survey Stations
- Breeding Bird Point Count Stations

AMEC 2011 Survey Stations
- Breeding Bird Point Count Stations

KCB 2010 Survey Stations
- Breeding Bird Point Count Stations

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Base map data from Geogratis NRCan Toporama DRG 1:50,000 NTS sheets

Datum: NAD83
Projection: UTM Zone 15N

0 5 10 20 30 Kilometres

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RAINY RIVER PROJECT

Breeding Bird Survey Locations

PROJECT N°: TC111504 | **FIGURE: 5-16**

SCALE: 1:112,000 | DATE: October 2013

405000 412500 420000 427500 435000 442500

5422500 5415000 5407500

Sifton Township Conservation Reserve

Spruce Island Provincial Park

Hwy 619 Hwy 617 Hwy 600 Hwy 615 Hwy 71

Kishkakoesis River Pinewood River

Little Pine Lake Boundary Lake Muskrat Lake Burdit Lake Off Lake Pinewood Lake Abbott Lake

Rainy Lake I.R. No. 17B

(2)

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LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- Natural Environment Local Study Area (NLSA)
- Regional Road / Highway
- Secondary Road
- Existing Transmission Line
- Permanent Watercourse
- Intermittent Watercourse
- Waterbody
- First Nation Reserve Lands
- Conservation Reserve (Regulated)
- Provincial Park

AMEC 2012 Survey Stations
- Amphibian Survey Stations

AMEC 2011 Survey Stations
- Amphibian Survey Stations

KCB 2010 Survey Stations
- Amphibian Survey Stations

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Base map data from Geogratis NRCan Toporama DRG 1:50,000 NTS sheets

Datum: NAD83
Projection: UTM Zone 15N

0 5 10 20 30 Kilometres

N W E S

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RAINY RIVER PROJECT

Amphibian Survey Locations

PROJECT N°: TC111504 | **FIGURE: 5-17**

SCALE: 1:112,000 | DATE: October 2013

395000 400000 405000 410000 415000 420000 425000 430000 435000 440000 445000

5420000 5415000 5410000 5405000 5400000

Hwy-621 Hwy-619 Hwy-617 Hwy-600 Hwy-71

Little Pine Lake
Boundary Lake
Off Lake
Muskrat Lake
Pinewood Lake
Pinewood River
Pinewood River

05PC023
05PC011

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LEGEND

- RRP Site
- 05PC011 Water Survey of Canada Station
- Natural Environment Local Study Area (NLSA)
- Regional Road / Highway
- Railway
- Waterbody
- Permanent Watercourse
- Intermittent Watercourse
- General Surface Flow Direction

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

Datum: NAD83
Projection: UTM Zone 15N

0 3.5 7 14 21 28 35 Kilometres

N W E S

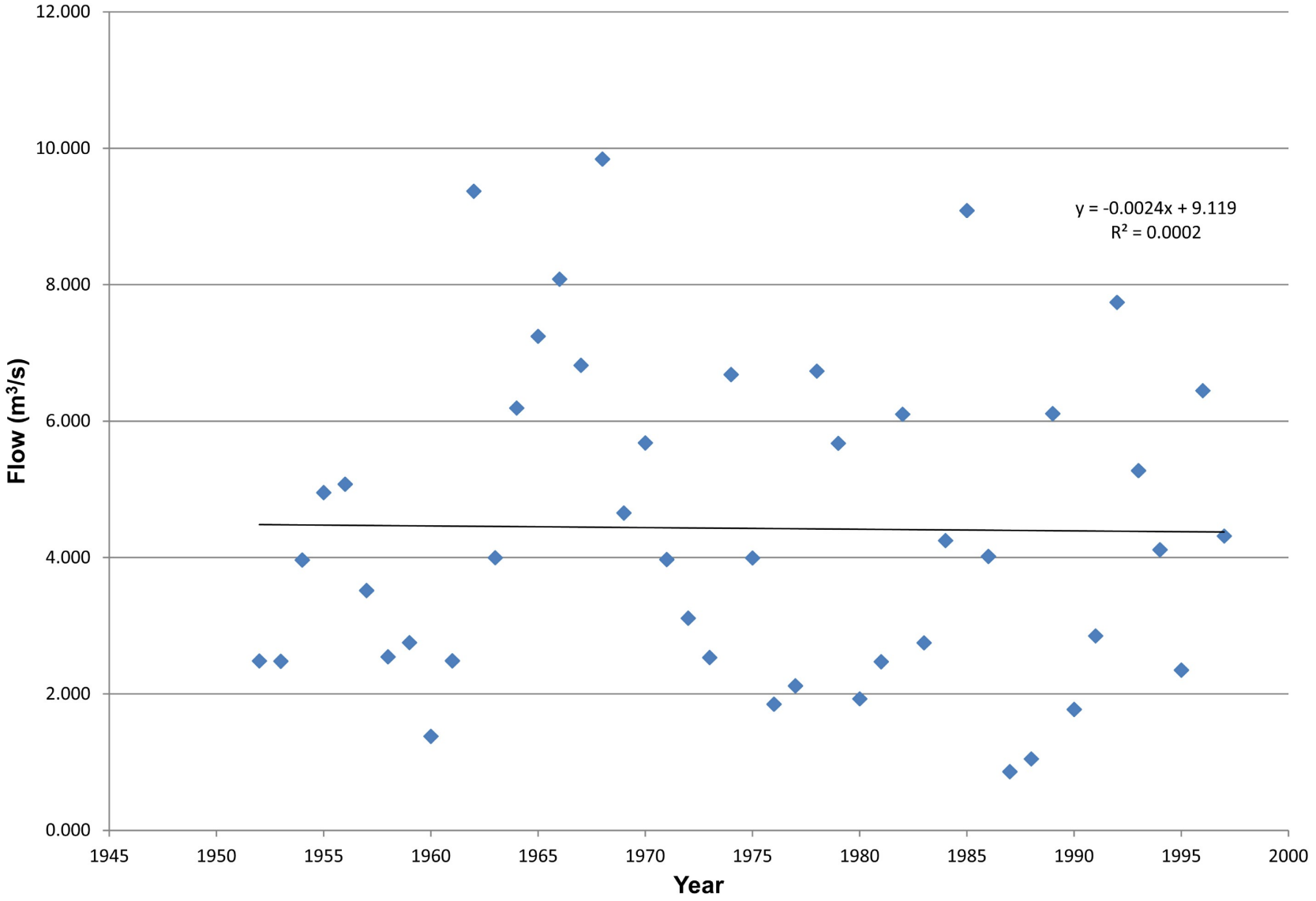
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RAINY RIVER PROJECT

Surface Water Flow and Stations

PROJECT N°: TC111504 | **FIGURE: 5-18**

SCALE: 1:127,000 | DATE: October 2013



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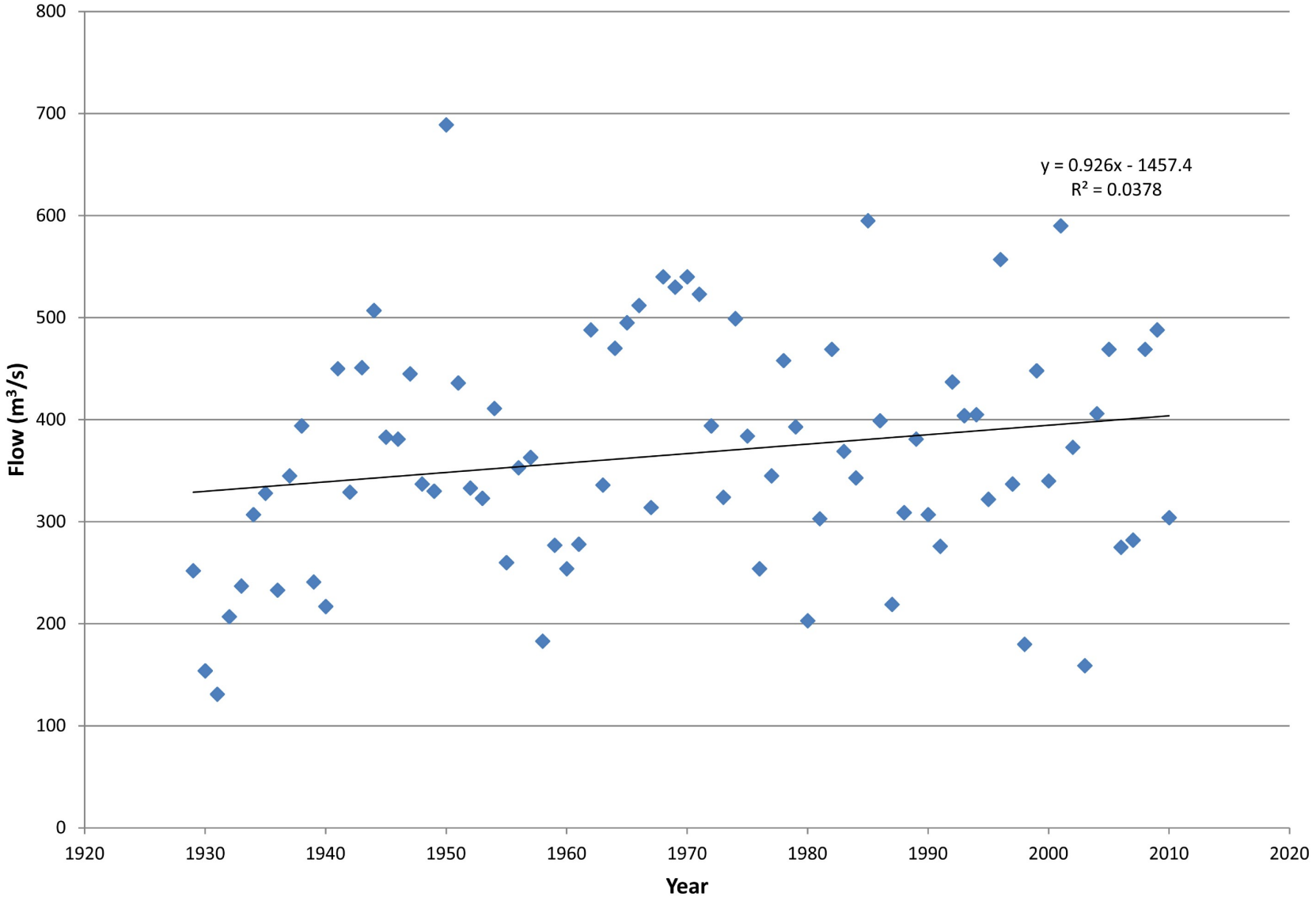
NOTES:
- Mean Flow, March - October
  WSC station 05PC011

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RAINY RIVER PROJECT

Pinewood River Hydrologic Analysis

PROJECT N°: TC111504	**FIGURE: 5-19**
SCALE:	DATE: October 2013



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NOTES:
- Mean annual flow WCS Station 05PC018 at Manitou Rapids

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RAINY RIVER PROJECT

Rainy River Hydrologic Analysis

PROJECT N°: TC111504	**FIGURE: 5-20**
SCALE:	DATE: October 2013

412500 420000 427500 435000 442500

5422500 5415000 5407500

Sifton Township Conservation Reserve

North Branch

Dearlock

Hwy 617 Hwy 600 Hwy 615 Hwy 71

Splitrock River

McCallum Creek McCallum Cr. Trib 3

Loslo Cr. Trib. 3 Loslo Cr. Trib. 4 Loslo Cr. Trib. Loslo Creek

Marr Cr. Trib 1 Marr Creek

Unnamed Drainage A

West Cr. Trib. 4 West Cr. Trib. 3 West Cr. Trib. 2 West Cr. Trib. 1 West Creek

Clark Creek

Unnamed Trib. 1 Unnamed Trib. 2 Unnamed Trib. 5 Unnamed Trib. 6

Pinewood River

Tait Creek Tait Cr. Trib. 2

Unnamed Cr. Trib 9A Gallinger Cr. Westra Cr. Blackhawk Creek

Beadle Lake Preachers Lake Burditt Lake Little Pine Lake Boundary Lake Off Lake Muskrat Lake Pinewood Lake

Rainy Lake I.R. No. 17B

INDEX MAP

MAP A

MAP B

P:\EM\Projects\2011\TC111504 Rainy River\GIS\EA\EA_FINAL\MXD_Maps\AQUATICS_Habitat_Reach_Types_a_8.mxd

LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- 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 extacted 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 Map A

PROJECT N°: TC111504	**FIGURE: 5-21a**
SCALE: 1:90,000	DATE: October 2013

397500 405000 412500 420000 427500

5407500

5400000

Agassiz Peatlands Provincial Park

Spruce Island Provincial Park

Marsh Lake

Cranberry Lake

Gameland

Hwy 619

Kishkakoesis River

North Branch

Hwy 617

McCallum Creek

McCallum Cr. Trib.

Loslo Cr. Trib.

Unnamed Drainage A

West Cr. Trib. 3

West Cr. Trib. 2

West Cr. Trib. 1

West Creek

Loslo Creek

Marr Creek

Clark Creek

Dearlock

Hwy 600

Unnamed Trib. 1

Unnamed Trib. 2

Pinewood River

Unnamed Trib. 5

Unnamed Trib. 6

Tait Creek

Tait Cr. Trib. 2

Pinewood River

Pinewood River

Pinewood River

CANADA

U.S.A.

Hwy 11

Pinewood

Rainy River

INDEX MAP

MAP A

MAP B

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LEGEND

- RRP Site
- Approximate Principal RRP Facilities
- 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 extacted 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 Map B

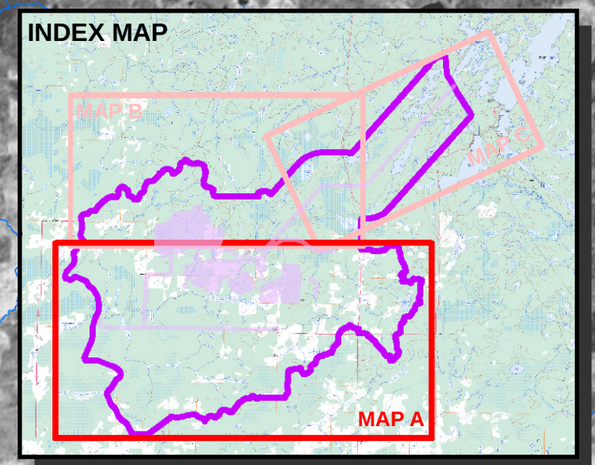
PROJECT N^{o}: TC111504	**FIGURE: 5-21b**
SCALE: 1:90,000	DATE: October 2013

415000 417500 420000 422500 425000 427500 430000 432500 435000

5410000 5407500 5405000 5402500

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INDEX MAP



LEGEND

Ecological Land Classifications

- (1) Agriculture
- (2) Cultural Meadow (CUM)
- (3) Open Bog (B138)
- (4) Open Water

Rock and Mineral Barren

- (5) Rock Barren (B164)
- (6) Active Mineral Barren (B007)

Hardwood Forest

- (7) Dry to Fresh, Coarse: Aspen – Birch Hardwood (B055)
- (8) Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood (B104)
- (9) Fresh, Clayey: Aspen – Birch Hardwood (B088)
- (10) Moist, Fine: Aspen – Birch Hardwood (B119)
- (11) Intolerant Hardwood Swamp (B130)
- (12) Fresh, Silty to Fine Loamy : Elm - Ash Hardwood (B105)
- (13) Fresh, Clayey : Elm - Ash Hardwood (B089)

Coniferous Forest

- (14) Very Shallow, Dry to Fresh: Red Pine – White Pine Conifer (B011)
- (15) Very Shallow, Dry to Fresh: Pine – Black Spruce Conifer (B012)
- (16) Dry, Sandy: Jack Pine – Black Spruce Dominated (B034)
- (17) Dry, Sandy: Pine – Black Spruce Conifer (B035)
- (18) Dry, Sandy: Red Pine – White Pine Dominated (B040)
- (19) Moist, Fine: Cedar (Hemlock) Conifer (B115)
- (20) Dry to Fresh, Coarse: Red Pine – White Pine Mixed Wood (B054)
- (21) Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated (B049)
- (22) Dry to Fresh, Coarse: Spruce – Fir Conifer (B052)
- (23) Moist, Coarse: Black Spruce – Pine Conifer (B065)
- (24) Fresh, Silty to Fine Loamy: Black Spruce – Jack Pine Dominated (B098)
- (25) Fresh, Clayey: Black Spruce – Pine Conifer (B083)
- (26) Fresh, Silty-Fine Loamy: Spruce – Fir Conifer (B101)
- (27) Moist, Fine: Black Spruce – Pine Conifer (B114)
- (28) Moist, Fine: Spruce – Fir Conifer (B116)

Coniferous Swamp

- (29) Organic Poor Conifer Swamp (B127)
- (30) Organic Intermediate Conifer Swamp (B128)
- (31) Organic Rich Conifer Swamp (B129)

Fen

- (32) Sparse Treed Fen (B136)
- (33) Poor Fen (B139)
- (34) Open Moderately Rich Fen (B140)
- (35) Shrub Shore Fen (B147)

Meadow and Shallow Marsh

- (36) Mineral Meadow Marsh (B142)
- (37) Organic Shallow Marsh (B149)
- (38) Organic Meadow Marsh (B144)

Thicket Swamp

- (39) Organic Thicket Swamp (B135)
- (40) Mineral Thicket Swamp (B134)

- Approximate Principal RRP Facilities
- Natural Environment Local Study Area (NLSA)

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR
- Ontario base data extracted from Land Information Ontario (MNR) data warehouse, Queen's Printer for Ontario, 2011-2012
- Watershed delineations are approximate and are derived from MNR Ontario
- Most ecosite data provided by MNR, some ecosite data derived from FRI data provided by MNR.
- Base map data from Geogratis NRCan Toporama DRG 1:50,000 NTS sheets
- ELC data derived from ecosite classifications

Datum: NAD83
Projection: UTM Zone 15N

0 1.5 3 6 9 12 15 Kilometres

N W E S

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RAINY RIVER PROJECT

Vegetation Cover Types Map A

PROJECT N°: TC111504 | **FIGURE: 5-22a**

SCALE: 1:57,000 | DATE: October 2013

415000 417500 420000 422500 425000 427500 430000 432500

5420000 5417500 5415000 5412500

INDEX MAP

MAP B

MAP C

MAP A

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LEGEND

Ecological Land Classifications

(1) Agriculture
(2) Cultural Meadow (CUM)
(3) Open Bog (B138)
(4) Open Water

Rock and Mineral Barren

(5) Rock Barren (B164)
(6) Active Mineral Barren (B007)

Hardwood Forest

(7) Dry to Fresh, Coarse: Aspen – Birch Hardwood (B055)
(8) Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood (B104)
(9) Fresh, Clayey: Aspen – Birch Hardwood (B088)
(10) Moist, Fine: Aspen – Birch Hardwood (B119)
(11) Intolerant Hardwood Swamp (B130)
(12) Fresh, Silty to Fine Loamy : Elm - Ash Hardwood (B105)
(13) Fresh, Clayey : Elm - Ash Hardwood (B089)

Coniferous Forest

(14) Very Shallow, Dry to Fresh: Red Pine – White Pine Conifer (B011)
(15) Very Shallow, Dry to Fresh: Pine – Black Spruce Conifer (B012)
(16) Dry, Sandy: Jack Pine – Black Spruce Dominated (B034)
(17) Dry, Sandy: Pine – Black Spruce Conifer (B035)
(18) Dry, Sandy: Red Pine – White Pine Dominated (B040)
(19) Moist, Fine: Cedar (Hemlock) Conifer (B115)
(20) Dry to Fresh, Coarse: Red Pine – White Pine Mixed Wood (B054)
(21) Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated (B049)
(22) Dry to Fresh, Coarse: Spruce – Fir Conifer (B052)
(23) Moist, Coarse: Black Spruce – Pine Conifer (B065)
(24) Fresh, Silty to Fine Loamy: Black Spruce – Jack Pine Dominated (B098)
(25) Fresh, Clayey: Black Spruce – Pine Conifer (B083)
(26) Fresh, Silty-Fine Loamy: Spruce – Fir Conifer (B101)
(27) Moist, Fine: Black Spruce – Pine Conifer (B114)
(28) Moist, Fine: Spruce – Fir Conifer (B116)

Coniferous Swamp

(29) Organic Poor Conifer Swamp (B127)
(30) Organic Intermediate Conifer Swamp (B128)
(31) Organic Rich Conifer Swamp (B129)

Fen

(32) Sparse Treed Fen (B136)
(33) Poor Fen (B139)
(34) Open Moderately Rich Fen (B140)
(35) Shrub Shore Fen (B147)

Meadow and Shallow Marsh

(36) Mineral Meadow Marsh (B142)
(37) Organic Shallow Marsh (B149)
(38) Organic Meadow Marsh (B144)

Thicket Swamp

(39) Organic Thicket Swamp (B135)
(40) Mineral Thicket Swamp (B134)

Approximate Principal RRP Facilities
Natural Environment Local Study Area (NLSA)

0 1 2 4 6 8 10 Kilometres

NOTES:
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- ELC data derived from ecosite classifications

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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RAINY RIVER PROJECT

Vegetation Cover Types Map B

PROJECT N°: TC111504 | **FIGURE: 5-22b**

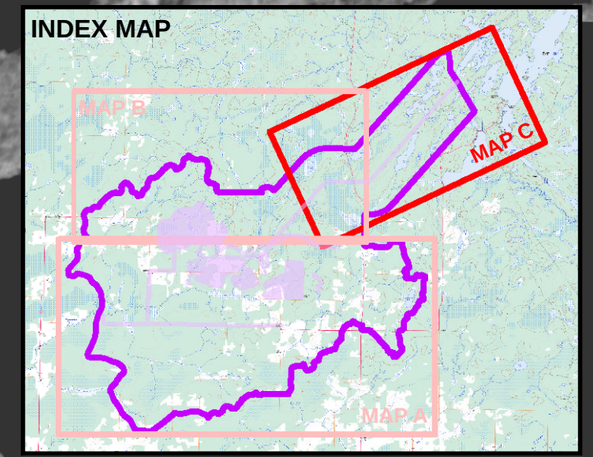
SCALE: 1:44,000 | DATE: October 2013

427500 5420000 430000 432500 435000 437500 440000

5425000 5422500 5420000

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INDEX MAP



LEGEND

Ecological Land Classifications

(1) Agriculture
(2) Cultural Meadow (CUM)
(3) Open Bog (B138)
(4) Open Water

Rock and Mineral Barren
(5) Rock Barren (B164)
(6) Active Mineral Barren (B007)

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(18) Dry, Sandy: Red Pine – White Pine Dominated (B040)
(19) Moist, Fine: Cedar (Hemlock) Conifer (B115)
(20) Dry to Fresh, Coarse: Red Pine – White Pine Mixed Wood (B054)
(21) Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated (B049)
(22) Dry to Fresh, Coarse: Spruce – Fir Conifer (B052)
(23) Moist, Coarse: Black Spruce – Pine Conifer (B065)
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(25) Fresh, Clayey: Black Spruce – Pine Conifer (B083)
(26) Fresh, Silty-Fine Loamy: Spruce – Fir Conifer (B101)
(27) Moist, Fine: Black Spruce – Pine Conifer (B114)
(28) Moist, Fine: Spruce – Fir Conifer (B116)

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(30) Organic Intermediate Conifer Swamp (B128)
(31) Organic Rich Conifer Swamp (B129)

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(39) Organic Thicket Swamp (B135)
(40) Mineral Thicket Swamp (B134)

Approximate Principal RRP Facilities
Natural Environment Local Study Area (NLSA)

0 1 2 4 6 8 10 Kilometres

NOTES:
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- Ontario base data extracted from Land Information Ontario (MNR) data warehouse, Queen's Printer for Ontario, 2011-2012
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- Base map data from Geogratis NRCan Toporama DRG 1:50,000 NTS sheets
- ELC data derived from ecosite classifications

Datum: NAD83
Projection: UTM Zone 15N

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RAINY RIVER PROJECT

Vegetation Cover Types Map C

PROJECT N°: TC111504 | **FIGURE: 5-22c**

SCALE: 1:37,000 | DATE: October 2013

405000 412500 420000 427500 435000 442500

5422500 5415000 5407500

Sifton Township Conservation Reserve

Spruce Island Provincial Park

Rainy Lake I.R. No. 17B

Hwy 619 Hwy 617 Hwy 600 Hwy 615 Hwy 71

Kishkakoesis River Pinewood River

Little Pine Lake Boundary Lake Muskrat Lake Burdit Lake Off Lake Pinewood Lake Abbott Lake

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LEGEND

- RRP Site
- Natural Environment Local Study Area (NLSA)
- Regional Road / Highway
- Secondary Road
- Existing Transmission Line
- First Nation Reserve Lands
- Conservation Reserve (Regulated)
- Provincial Park
- Woodland Features

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR Queen's Printer for Ontario, 2011-2012
- Base map data from Geogratis NRCan Toporama DRG 1:50,000 NTS sheets

Datum: NAD83
Projection: UTM Zone 15N

0 5 10 20 30 Kilometres

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RAINY RIVER PROJECT

Woodland Features

PROJECT N°: TC111504 | **FIGURE: 5-23**

SCALE: 1:112,000 | DATE: October 2013