



NUCLEAR WASTE MANAGEMENT ORGANIZATION SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Phase 1 Desktop Assessment, Environment Report

TOWNSHIP OF WHITE RIVER, ONTARIO



APM-REP-06144-0082

OCTOBER 2014

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PHASE 1 DESKTOP ASSESSMENT

Environment Report - Township of White River, Ontario

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REPORT



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ENVIRONMENT REPORT - TOWNSHIP OF WHITE RIVER, ONTARIO



1.0 INTRODUCTION

The Township of White River in north-central Ontario expressed interest in continuing to learn more about a facility to manage Canada's Used Nuclear Fuel through the Nuclear Waste Management Organization's (NWMO) Adaptive Phased Management Site Selection Process (NWMO, 2010). This process is seeking to find a site for a deep geological repository that will provide safe long-term containment and isolation of used nuclear fuel with an informed and willing host community. The process is presently at an early stage.

Part of the process is focussed on determining if there are environmental features that would preclude the potential for a facility to be constructed and operated in the vicinity of White River. To this end, this report provides a general description of the environment in the Township of White River and surrounding area. It is complemented by reports prepared in parallel which characterize the geoscientific conditions and community well-being profile of this area. These reports are summarized, with other information, in an integrated Preliminary Assessment Report.

This report is not an environmental assessment. Its purpose is to provide a high level description of the current human and natural environment based on readily available sources of data. Additional detailed information for specific locations would be sought at subsequent phases of the work.

The White River area here is the same as that used for the Phase 1 Geoscientific Desktop Assessment for White River. This area is shown on Figure 1, and includes the Township of White River and surrounding area.



ENVIRONMENT REPORT - TOWNSHIP OF WHITE RIVER, ONTARIO



2.0 COMMUNITIES AND INFRASTRUCTURE

2.1 Communities

The Township of White River is approximately 102 km² in size¹ and is located near the northeastern end of Lake Superior approximately 390 km east of Thunder Bay, 95 km east of Marathon and 93 km northwest of Wawa, based on distances along major roads (LIO, 2013). The settlement area of White River is shown on Figure 1, south of Highway 17 (Trans-Canada Highway) at the south end of Picnic Lake. Figure 2 presents satellite imagery for the area taken in 2006. Table 1 summarizes the total population and population density for the Township of White River and District of Algoma.

Table 1: Population Statistics for the White River Area

Political Boundary	Population	Population Density per km ²
Township of White River	607	6.3
District of Algoma	115,870	2.4

Source: 2011 Census of Population (Statistics Canada, 2013)

The Township of White River maintains a municipal government (MMAH, 2009). Land ownership within the White River area, including areas of Crown land², Crown Reserve³ lands, parks and reserves and private lands, is shown on Figure 3. Figure 3 shows areas of private land, including one large area representing the full geographic Township of Derry.

There are a number of First Nation and Métis communities and organizations in the White River area including Ojibways of Pic River (Heron Bay) and Ojibways of Pic Mobert. Métis Councils in the area include the Historic Sault Ste. Marie Métis Council and the North Channel Métis Council.

Further information on White River and its surrounding communities, including First Nations and Métis communities, is provided in the Community Well Being profile report for White River.

2.2 Infrastructure

Figure 1 shows the location of the primary infrastructure corridors in the White River area. The main transportation routes include the Trans-Canada Highway (Highway 17) which passes southeast-northwest through the White River area and Highway 631 which passes from White River to the northeast. A Canadian Pacific (CP) railway corridor runs through White River, approximately parallel to the Trans-Canada Highway, and then eastward through the community of Amyot. The Algoma Central Railway, currently operated by Canadian National (CN), intersects the southeast corner of the White River area. One 115kV electrical transmission line runs from White River to the northwest, approximately parallel to the Trans-Canada Highway. As shown on Figure 1, the White River airport, a seaplane base, is located northeast of the town on the south end of Tukanee Lake (NRCan, 2009a). There are no gas pipelines within the White River area (NRCan, 2009b). There is one operating landfill (MOE, 2013a) and a wastewater treatment plant within the White River area.

¹ Area calculated using Geographic Information System (GIS) municipal boundaries from the Ministry of Municipal Affairs and Housing (MMAH, 2009).

² Crown land is divided on the Figure into Crown Leased Land, Non-freehold Disposition Public and Unpatented Public Land. Crown Leased land is acquired by MNR for reasons based on ecological sustainability, including ecosystem health, the protection of natural and cultural assets, recreation, and / or the protection of people and property. Non-freehold Dispositions Public are a tenure holding, usually for a set term and a specific purpose (e.g., Lease, Licence of Occupation, Land Use Permit, Beach Management Agreement and Easement), excluding permanent disposition in the form of a patent. Unpatented Public Land is generally land that has never been granted or sold by the Crown to people or organizations for their private use and are under the mandate or management of the MNR.

³ Crown Reserves are Crown lands that have been withdrawn from dispositioning under Section 21 of the Crown Minerals Act.



2.3 Protected Areas

2.3.1 Parks and Reserves

There are two provincial parks, three conservation reserves and two forest reserves in the White River area. Figure 4 shows the location of these seven protected areas. The Pokei Lake/White River Wetlands Provincial Park covers approximately 18 km² and is located about 2 km south of the Township; it is classed as a nature reserve and has no listed visitor services (MNR, 2013a). The White Lake Peatlands Provincial Park, covering 9.92 km², is also partially located in the White River area, to the north of White Lake. It is classed as a natural reserve and has no park facilities (MNR, 2014a).

Conservation reserves are lands set aside by the government (municipal, provincial or federal) to protect ecosystems that are representative of a natural region, protect significant elements of natural and cultural heritage, and maintain biodiversity. The three conservation reserves in the White River area are the Kwinkwaga Ground Moraine Uplands Conservation Reserve, Kakakiwibik Esker Conservation Reserve and the Strickland River Mixed Forest Wetland Conservation Reserve (MNR, 2013a). The Kwinkwaga Ground Moraine Uplands Conservation Reserve is a rugged area with many hills and numerous lakes and creeks and is located in the western part of the White River area, covering an area of about 127 km² (MNR, 2013a); it contains two smaller areas of Forest Reserve. The Kakakiwibik Esker Conservation Reserve is located to the southeast of the Township of White River and covers an area of about 5 km²; it is a distinct esker ridge of considerable length (over 6 km) extending to the northeast from Highway 17 (MNR, 2013a). In the center of the White River area is the 16 km² Strickland River Mixed Forest Wetland Conservation Reserve, comprising mainly coniferous mixed forest with some deciduous stands and wetland communities (MNR, 2013a).

2.3.2 Heritage Sites

The cultural heritage screening examined known archaeological and historic sites in the White River area, using the Ontario Archaeological Sites Database, the Ontario Heritage Trust Database, the Parks Canada Database and the National Historic sites Database. There is one known archaeological site in the White River area (von Bitter, 2013). There is one provincially designated historic site and one federally designated historic site, both within the town of White River (MTCS, 2013; OHT, 2013; Parks Canada, 2013).

The archaeological site is located outside the Township boundaries, at the mouth of Tedder River where it empties into Kakakiwibik Lake. The archaeological site was identified and recorded in 1970 as a campsite with extensive signs of burning and evidence of fire-cracked rock, but very few artifacts. No cultural affiliation or time period is recorded for the site.

The historical sites include the provincially designated CP Railway Superintendent's House, located on Railway Street and the federally designated CP Railway Station located on Winnipeg Street in the Town of White River (MTCS, 2013; OHT, 2013; Parks Canada, 2013). The Railway Station is a brick-clad railway station comprised of two adjoining parts: a two-storey Telegraph Building; and a one-storey international-style passenger facility built in 1957. The formal recognition is confined to the railway station building itself.

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. In archaeological potential modelling, a distance criterion of 300 m is generally employed for known archaeological resources, water sources and early Euro-Canadian settlements (Government of Ontario, 2011). The presence of local heritage sites would need to be further confirmed in discussion with the community and First Nation and Métis communities and organizations in the area.



2.4 Land Use

Land use described in this section refers to commercial land use such as forestry, mining, trapping and agriculture, but not recreation or Aboriginal spiritual use.

Forested areas support commercial timber harvesting, and forestry is a major industry in the White River area. Forest Management Units⁴ (FMU) in the White River area are shown on Figure 5 (MNR, 2013b). The Township of White River and the western portion of the White River area are located within the White River Forest (FMU 060), managed by Jackfish River Management Ltd (JRML) on behalf of White River Forest Products Ltd (WRFP) (JRML, 2013). The White River Forest covers a total of 612,567 hectares (ha) of which 78% is managed as productive forest and is comprised of seven forest types including upland conifer, jack pine, poplar, white birch, mixed wood, lowland conifers and tolerant hardwood (Domtar, 2008). The northeastern portion of the White River area is within the Nagagami Forest (FMU 390) which is managed by Jackfish River Management Ltd. (JRML) on behalf of the Nagagami Forest Management Ltd. with 99% productive forest (JRML, 2011). The southeastern portion of the White River area falls within the Magpie Forest (FMU 565) with 86% as managed Crown forest (DFPL, 2008). The northeast corner of the White River area is located within the Hearst Forest (FMU 601). In total, the White River area contains 391,704 ha of woodlands, which is 78% of the land coverage (LIO, 2013).

Within forested areas such as those of the White River area, there is a risk of forest fires. There are four locations where forest fires⁴ occurred in the White River area between 1976 and 2010 and affected an area greater than 200 ha, as shown on Figure 5. The 1999 Crocker Lake Fire affected the largest area and burned over the entire Kwinkwaga Ground Moraine Uplands Conservation Reserve (MNR, 2013a).

There are no currently producing mines in the White River area. The closest producing mines, primarily exploiting gold with some secondary antimony, barite, molybdenum and silver, are approximately 25 km to the west of the White River area in the Hemlo greenstone belt⁵. The only mine to briefly operate in the area was the Hiawatha Gold Mine, located in the Kabinakagami greenstone belt (Wilson, 1993). A number of active mining claims and mineral occurrences are documented in the central and northeast part of the White River area, around Dayohessarah Lake, around Kabinakagami Lake and west of the town of White River, south of Highway 17. The "Sugar Zone" is a developed prospect within the Dayohessarah greenstone belt, with gold reserves along the eastern shore of Dayohessarah Lake. There are also a couple of developed prospects on the shores of Lake Kabinakagami (OGS, 2011).

A number of base metal occurrences are documented in the Mineral Deposit Inventory (OGS, 2011) within the White River area, in the Dayohessarah greenstone belt, in the Kabinakagami greenstone belt and in one of the greenstone "slivers" north of the Danny Lake stock. The economic viability of these occurrences has not been proven to date.

Gartner and McQuay (1980) have estimated a low potential for sand and gravel resources in the White River area, however, there are a number of small-scale sand and gravel pits (Figure 6). No quarrying is known to have occurred in the White River area. However, portions of rock outcrops in the area may have the potential to

⁴ Ontario's Crown forest is divided into geographic planning areas, known as Forest Management Units. Most of these units are managed by individual forest companies who carry out various activities which are subject to the Ontario Ministry of Natural Resources (MNR) regulations and approvals. Activities include forest management planning, harvest, forest renewal, access road construction, monitoring and reporting.

⁵ A greenstone belt is a zone of volcanic and sedimentary rocks that have undergone metamorphic alteration. The name comes from the green hue imparted by the colour of the dominant minerals within the rocks.



be used as crushed stone resources and Stott (1999) has identified the Danny Lake stock and other massive homogeneous felsic plutons in the region as having dimension stone potential.

As noted in Section 3.3, other land uses include hunting and trapping.



3.0 DESCRIPTION OF THE ENVIRONMENT

3.1 Physiography

The White River area lies in the Abitibi Upland physiographic region, a broadly rolling surface of Canadian Shield bedrock that occupies most of north-central Ontario (NRCan, 2009c). Within this area, bedrock is typically either exposed at surface or shallowly covered with Quaternary⁶ glacial deposits or post-glacial organic soils (Thurston, 1991). In the White River area, land surface is generally rugged ranging from elevations greater than 622 metres above sea level (masl) to lows of about 311 masl. The highest point of land within the area, 622 masl, occurs approximately 13 km northeast of the settlement area of White River, with high elevation occurring in the upland areas surrounding the Township of White River, in association with exposed granitic rocks to the north, east and south west of the Township. The lowest elevations occur to the northeast around Kabinakagami Lake, and to the northwest.

Figure 7 presents the topography of the White River area as a digital elevation model (DEM).

3.2 Geology

3.2.1 Bedrock Geology

The bedrock geology of the White River area is shown on Figure 8. The bedrock geology is dominated by granitic intrusive complexes, generally of batholithic dimensions. These include the Pukaskwa and Black-Pic batholiths, the Strickland and Anahareo Lake plutons and the Danny Lake stock. In the central part of the White River area, the Dayohessarah greenstone belt runs north-south and in the northeastern part, the Kabinakagami greenstone belt runs southwest-northeast amidst the granitic intrusions (Williams et al., 1991). Geologically, the White River area is situated in the Wawa Subprovince, which is part of the western region of the Superior Province of the Canadian Shield – 3 to 2.6 billion year old rocks that form the core of the North American continent. The Wawa Subprovince is about 900 km long and 150 km wide, extending from central Minnesota in the United States to the Kapuskasing area in northeastern Ontario. It is composed primarily of Archean greenstone belts and granitic intrusions, with smaller mafic intrusive rocks locally present. Approximately 75% of the White River area is underlain by the granitic rocks of the Pukaskwa and Black-Pic batholiths, the Strickland and Anahareo Lake plutons and the Danny Lake stock. These granitic intrusive complexes are typically multi-phased and less well understood compared to the metavolcanic-metasedimentary greenstone belts, which have been the subject of intensive mineral exploration and research over the years. The metavolcanic and metasedimentary rocks of the Dayohessarah and Kabinakagami greenstone belts, as well as the narrow north-south trending bands within the Black-Pic batholith, form part of a discontinuous series of west to east greenstone belts, from the Schreiber-Hemlo greenstone belt west of the White River area, to the Kabinakagami greenstone belt in the northeast of the White River area (Stott, 1999).

3.2.2 Quaternary Geology

The Quaternary geology of the White River area is shown on Figure 6. The oldest known Quaternary deposits in the White River area are thin basal till deposits laid down during the late Wisconsinan glaciations. The glacial retreat from the White River area is estimated to have occurred approximately 9,000 years ago when the ice receded to the northeast (Barnett, 1992; Gartner and McQuay, 1980).

⁶ Quaternary refers to the last 2.6 million years of Earth's history.



Overburden within the White River area consists predominately of till, glaciofluvial outwash deposits and some local glaciolacustrine deposits. The tills, largely located in the southeastern part of the White River area, are generally silty to sandy with stones, cobbles and boulders. Glaciofluvial sediments, deposited by glacial meltwater, exist in the low relief portions of the area, particularly along bedrock valleys. A number of eskers occur as ridges of sand and gravel throughout the White River area. There are some areas of fine-grained glaciolacustrine deposits which would have been deposited in glacial lakes; these areas include south and east of White Lake, northeast of Dayohessarah Lake and in the northeast corner of the White River area (Gartner and McQuay, 1980 Geddes and Kristjansson, 2009). The youngest Quaternary deposits in the White River area are recent organic soils, lake sediments and alluvium accumulated along stream channels and in low-lying areas. Extensive peatlands (i.e., muskeg) are not present within the White River area; however, organic soils are locally important, particularly along some lake and stream margins.

3.3 Natural Environment

3.3.1 Natural Environment Overview

The White River flows through the Township and its waters and recreational areas are a popular destination for campers, travellers and fishermen. Many small inland lakes and rivers within the White River area are not easily accessible to the public which make them attractive to fishermen and hunters seeking less traveled areas. The natural environment of the White River area contains an abundance of plant and animal communities, some of which have special status or designations. The following sections describe protected natural areas, and the terrestrial ecology and aquatic ecology, with a focus on rare species that may be most sensitive to impacts from alterations or changes to the landscape.

3.3.2 Natural Areas

As discussed in Section 2.3.1, there are two provincial parks, three conservation reserves and two forest reserves in the White River area. There are no Areas of Natural and Scientific Interest (ANSIs) within the White River area. There are three Life Science Sites, four candidate Life Science Sites and three Earth Science Sites within the White River area; these are shown and numbered on Figure 9. The three Life Science Sites in the White River area are: Kawapitapika Lake Park Reserve (1), Kawaweagama Lakes – Jack Pine Forest (2) and Bremner Watershed (10). White River Wetland (3), White Lake Peatland (4), Bremner River Wetland (5) and Kakakiwibik – Esker-Fen Complex (6) are all Candidate Life Science Sites. There are three Earth Science Sites in the White River area, including: a meandering stream in the Kakakiwibik Lake Park Reserve (7), an esker in the Kakakiwibik Lake Park Reserve (8) and an esker at Kaginagakog Lake (9).

There are no Provincially Significant Wetlands (PSW) identified within the White River area, but some unclassified wetlands are present. Wetlands identified in the Land Information Ontario (LIO) natural resources data layers (LIO, 2013) have been depicted on Figure 10. The White River area contains 39,300 ha of wetlands, representing 8% of the land coverage according to LIO data. The Ontario Ministry of Natural Resources (MNR) periodically updates their LIO information and wetland areas and boundaries are subject to change. Field studies conducted at the appropriate times are able to provide ground truthing and sensitivity/significance analysis for existing wetlands. If wetlands have the potential to be affected by a proposed activity, they would typically require evaluation of significance according to the Ontario Wetland Evaluation System (OWES).



3.3.3 Terrestrial Features and Wildlife

The White River area lies within the Boreal Forest Region. As noted in Section 2.4 and shown on Figure 5, it contains portions of four FMUs. The White River area contains 391,704 ha of woodlands, which is 78% of the surface area according to LIO data (LIO, 2013). Typical forests types in the White River area include: lowland conifer forest, upland conifer forest, poplar forest, mixed-wood forest, jack pine forest, white birch forest and white and red pine forest (Domtar, 2008). Portions of Wildlife Management Units⁷ (WMU) 21B, 22, 32 and 33 are all found within the White River area (MNR, 2013c). These areas are considered important for the trapping of furs and hunting of game. Management of woodland caribou (*Rangifer tarandus*), moose (*Alces alces*), marten (*Martes americana*) and pileated woodpecker (*Dryocopus pileatus*) along with other sensitive wildlife populations are a particular concern to the MNR. The western portion of the White River area is part of discontinuous caribou habitat as identified in Ontario's Woodland Caribou Conservation Plan (MNR, 2009). Known caribou range has been identified within the White River area (Figure 9). Documented feeding, wintering and calving sites for moose are depicted on Figure 9. Concentration and nesting areas for raptors and herons are also considered an important management concern; known locations are also shown on Figure 9.

3.3.4 Aquatic Features and Fish

As discussed in Section 3.5, the White River area spans across several watersheds and two drainage basins. The White River area falls within Fisheries Management Zone⁸ (FMZ) 7 for which the MNR has a Fisheries Management Plan (MNR, 2013d). Fish that are commonly harvested include walleye (*Sander vitreus*), northern pike (*Esox lucius*), lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), smallmouth bass (*Micropterus dolomieu*) and yellow perch (*Perca flavescens*) (MNR, 2013d). Based on the fish species/communities present, water bodies are classified as warm and cool water, interspersed with the occasional smaller cold water body (Figure 10). Aquatic areas comprise 51,440 ha, which is 10% of the White River area according to LIO data. Approximately 60% of lakes in the White River area are less than 5 m deep and nearly 86% are less than 10 m deep (AECOM, 2014). The many small lakes are popular destinations for sport fishermen and tourists. The fish populations are managed to maintain and maximize their size and availability to both locals and tourists.

Fish and fish habitat are managed by the MNR and the Department of Fisheries and Oceans Canada (DFO). General information is available publicly for each FMZ, but more detailed information must be obtained directly from these agencies for further investigations. Publicly available data for each FMZ may not be consistent for each area. Although there is consistency in the types of data collected by MNR for each area, data deemed sensitive within the FMZ may not be reported or shown on mapping. Field verification will be required to determine the actual fish habitat and use by species across the landscape.

3.3.5 Endangered, Threatened and Special Concern Species

The White River area covers a large geographic area consisting of diverse aquatic and terrestrial habitats, and is within many migratory corridors for birds, insects and mammals. The Natural Heritage Information Centre (NHIC) database (NHIC, 2013) shows the occurrence of species that are listed as Endangered (END), Threatened (THR) or Special Concern (SC) either under the provincial *Endangered Species Act* (ESA)

⁷ Wildlife Management Units are geographic units of land on which the Ontario Ministry of Natural Resources (MNR) bases the sustainable management of species, hunting seasons and harvest limits.

⁸ Fisheries Management Zones are the units of management for lakes in Ontario. Fish are monitored and assessed at the zone level and fishing regulations, such as catch limits, are based on these zones.



(Government of Ontario, 2007), or the Federal *Species at Risk Act* (SARA) (Government of Canada, 2012). The Royal Ontario Museum range maps (ROM, 2013) indicate the potential for Species at Risk (SAR) to exist within the White River area, based on the principles of range mapping. Habitats within the White River area could directly or indirectly support the needs of 18 designated SAR. All potentially occurring SAR within the area are listed in Table 2.

Species listed as provincially or federally END are significant because these species and their habitats receive the highest level of protection afforded under applicable legislation. The five END species potentially occurring within the White River area include provincially END eastern cougar (*Puma concolor*), little brown myotis (*Myotis lucifugus*) (bat), northern myotis (*Myotis septentrionalis*) (bat), golden eagle (*Aquila chrysaetos*) and rusty-patched bumble bee (*Bombus affinis*). Five species have been identified that are listed as THR in Ontario, with an additional three species that are THR federally and SC provincially. The remaining five species are listed as SC either provincially or federally.

The ranges of SAR species are generally identified through a reference grid, noting that detailed field study is required to confirm the extent that a listed species or its habitat occurs in a specific geographic area. Based on the available background information, the range of eastern cougar overlaps the White River area, but this species is extremely secretive and can cover a very large home range for each individual. Little brown myotis and northern myotis were recently added to the ESA. The White River area is at the edge of the currently known area where bats are impacted by a novel fungal disease that is causing major mortality. Golden eagles are likely to pass through this area during migration, but typically nest farther north (MNR, 2014b). Since 2002, the only known occurrence of rusty-patched bumble bee is at the Pinery Provincial Park near Grand Bend, Ontario, although its historic range extends to within the White River area.

The records identified here represent either known occurrences or are based on range mapping as published by the MNR, noting that the list is typically updated annually. In addition to species that are listed on the ESA and SARA, species of conservation concern including those that are considered regionally rare, uncommon or in significant decline would also be considered in the evaluation of wildlife of the area. Many of these species are not tracked in public databases, and therefore a complete list could be developed in future through specific data requests to agencies and field investigations.

With reference to Table 2, there were no species of amphibian or reptile or plants, mosses or, lichens identified as END, THR or SC within the White River area.

Table 2: Potential Endangered, Threatened and Special Concern Species in the White River Area

Common Name	Scientific Name	ESA Status ¹	SARA (Schedule) ²	Source ³
Mammals				
Eastern cougar	<i>Puma concolor</i>	END		ROM
Woodland caribou (Forest-dwelling boreal population)	<i>Rangifer tarandus caribou</i>	THR	THR	ROM
Northern myotis	<i>Myotis septentrionalis</i>	END		BCI
Little brown myotis	<i>Myotis lucifugus</i>	END		BCI
Birds				
Bald eagle	<i>Haliaeetus leucocephalus</i>	SC		NHIC; OBBA



Common Name	Scientific Name	ESA Status ¹	SARA (Schedule) ²	Source ³
Barn swallow	<i>Hirundo rustica</i>	THR		OBBA
Black tern	<i>Chlidonias niger</i>	SC		ROM; OBBA
Canada warbler	<i>Cardellina canadensis</i>	SC	THR	OBBA
Chimney Swift	<i>Chaetura pelagica</i>	THR	THR	ROM; OBBA
Common nighthawk	<i>Chordeiles minor</i>	SC	THR	ROM; OBBA
Golden eagle	<i>Aquila chrysaetos</i>	END		ROM
Olive-sided flycatcher	<i>Contopus cooperi</i>	SC	THR	OBBA
Rusty blackbird	<i>Euphagus carolinus</i>	NAR	SC	ROM; OBBA
Short-eared owl	<i>Asio flammeus</i>	SC	SC	ROM; OBBA
Eastern whip-poor-will	<i>Antrostomus vociferus</i>	THR	THR	NHIC; OBBA
Fish and other Aquatic Species				
Lake sturgeon (Great Lakes- Upper St. Lawrence and Northwestern Ontario Population)	<i>Acipenser fulvescens</i>	THR		ROM
Invertebrates				
Monarch butterfly	<i>Danaus plexippus</i>	SC	SC	ROM
Rusty-patched bumble bee	<i>Bombus affinis</i>	END		NHIC

Notes:

blank: species not assessed; Not at Risk: species assessed to be not at risk; SC: special concern species; THR: threatened species; END: endangered species

¹ Status on the Species at Risk of Ontario list of the Endangered Species Act (ESA) (Government of Ontario, 2007)

² Status listed on the federal Species at Risk Act (Government of Canada, 2012)

³ Data obtained from the Natural Heritage Information Centre (NHIC, 2013); Royal Ontario Museum (ROM, 2013) range maps; Ontario Herpetofaunal Summary Database (Herp Atlas) (Oldham and Weller, 2000); Atlas of the Breeding Birds of Ontario (OBBA) (BSC, 2006); Bat Conservation International Species Profiles (BCI, 2013a,b); Ontario Butterfly Atlas (Butterfly Atlas) (Jones et al, 2013); Ontario Odonata Atlas (Odonata) (NHIC, 2005); Mammal Atlas of Ontario (Mammal Atlas) (Dobbyn, 1994)

3.3.6 Aboriginal Interests and Traditional Knowledge

Traditional lifestyles, culturally significant wildlife and the extent of sacred and ceremonial locations important to First Nation and Métis communities and organizations are important factors to be considered when identifying potential repository locations for further detailed study.

For this phase of the work, the extent to which such information has been sought is that which can be found in publicly available sources. Known archaeological sites, many of which are Aboriginal, are noted in Section 2.3.2. Trapline License Areas, which cover much of the White River area, are shown on Figure 3. Figure 9 presents terrestrial ecology mapping and Figure 10 aquatic resource mapping.

It is recognized that this does not fully represent the environmental issues and concerns of First Nation and Métis communities and organizations in the area and that further information and discussion is required before a more complete picture can be developed. Discussions with First Nation and Métis communities and



organizations and field investigations would be undertaken in later phases of the work program to further enhance the environmental understanding of specific locations.

3.4 Background Environmental Conditions

3.4.1 Air Quality

Air quality monitors in north-central Ontario indicate that ground-level ozone and particulate matter fall within normal values compared to the national average (EC, 2013a). Table 3 provides a list of industrial facilities that reported air and water emissions through Environment Canada’s National Pollutant Release Inventory (NPRI) database within the same postal code range as the Township of White River (EC, 2013b). The list includes sites in Copper Cliff, Dubreuilville, Hemlo, Hornepayne, Marathon and Wawa which have local air emissions. Additional sources that may affect background air quality include rail operations and the Trans-Canada Highway, both of which traverse the area.

Table 3: NPRI Regional Sources of Air Emissions

NPRI ID	Facility Name	City
10374	Hydro One Remote Communities Inc. - Armstrong Diesel Generating Station	Armstrong
3238	Ontario Power Generation Inc. - Atikokan Generating Station	Atikokan
10376	Hydro One Remote Communities Inc. - Bearskin Diesel Generating Station	Bearskin Lake
10378	Hydro One Remote Communities Inc. - Biscotasing Diesel Generating Station	Biscotasing
10397	Tembec - Chapleau Sawmill	Chapleau
11238	First Nickel Inc. - Lockerby Mine	Chelmsford
5928	Safety-Kleen Canada Inc. - Chelmsford Branch	Chelmsford
11227	Fisher Wavy Inc. - Fisher Wavy - Sudbury	Copper Cliff
444	Vale Canada Limited - Copper Cliff Smelter	Copper Cliff
1465	Vale Canada Limited - Clarabelle Mill	Copper Cliff
1467	Vale Canada Limited - Copper Cliff Nickel Refinery	Copper Cliff
10203	Vale Canada Limited - Copper Cliff Mine (North)	Copper Cliff
10204	Vale Canada Limited - Copper Cliff Mine (South)	Copper Cliff
11877	Vale Canada Limited - Ellen Pit	Denison Township
7361	King Packaged Materials Co. - Onaping Falls	Dowling
11454	Mines Richmond inc - Island Gold Mine	Dubreuilville
1236	Xstrata Canada Corporation - Sudbury Nickel Smelter Complex	Falconbridge
10381	Hydro One Remote Communities Inc. - Gull Bay Diesel Generating Station	Gull Bay
10144	Union Gas Limited - Hagar LNG Plant	Hagar
3197	Williams Operating Corporation - Williams Mine	Hemlo
10382	Hydro One Remote Communities Inc. - Hillspport Diesel Generating Station	Hillspport
25458	Olav Haavaldsrud Timber Company Limited - Olav Haavaldsrud Timber Company	Hornepayne
10385	Hydro One Remote Communities Inc. - Lansdowne Diesel Generating Station	Lansdowne House
11154	FNX Mining Company Inc. - McCreedy West Mine	Levack
11608	FNX Mining Company Inc. - Levack Mine	Levack



NPRI ID	Facility Name	City
10199	Vale Canada Limited - Coleman Mine	Levack
2869	DB Operating Corporation - David Bell Mine	Marathon
1400	Newmont Canada Corporation - Golden Giant Mine	Marathon
10450	Eacom Timber Corporation - Nairn Centre Sawmill	Nairn Centre
10405	Atlantic Power LP - Nipigon Power Plant	Nipigon
10386	Hydro One Remote Communities Inc. - OBA Diesel Generating Station	OBA
11906	Hydro One Remote Communities Inc. - Marten Falls Diesel Generating Station	Ogoki Post
1233	Xstrata Canada Corporation - Sudbury Operations Mines/Mill - Onaping Area	Onaping
11369	Fisher Wavy Inc. - Fisher Wavy - Sault Ste. Marie	Sault Ste. Marie
11466	FNX Mining Company Inc. - Podolsky Mine	Sudbury
10389	Hydro One Remote Communities Inc. - Sultan DGS	Sultan
2607	Terrace Bay Pulp Inc. - Terrace Bay Pulp	Terrace Bay
6771	TransCanada PipeLines Ltd. - Station 62 - Upsala	Thunder Bay
10010	Wesdome Gold Mines Ltd. - Eagle River Mill	Wawa
10392	Hydro One Remote Communities Inc. - Webequie Diesel Generating Station	Webequie

3.4.2 Background Radiation

The source of background radiation in the White River area is attributed to naturally occurring radioactive materials (NORM), specifically potassium, uranium and thorium-bearing minerals. The background radiation for the White River area is presented on Figure 11. Statistically, the majority of the dose rates in the White River area range from approximately 5 to 110 nGy/h, with an average of approximately 15 nGy/h in the northern half of the White River area and an average of approximately 50 nGy/h in the southern half of the area. This range of dose rates and averages are consistent with regional dose rates for north-central Ontario. NORM minerals are typically elevated in granitic geology and local dose rate highs in the southern half of the area are attributed to granitic batholiths, such as the Pukaskwa batholith and the Anahareo Lake pluton. These highs are consistent with dose rate highs in areas of similar geology in north-central Ontario.

A recent survey by Health Canada of radon gas concentrations in Canadian homes shows 91% of residences in the District of Algoma Health Unit area tested below the national guideline of 200 Bq/m³, while 8% were between 200 and 600 Bq/m³ and the remaining 1% were above 600 Bq/m³ (Health Canada, 2013).

Additional detailed information on background radiation is available in the geophysical interpretation report (PGW, 2014).

3.4.3 Soil Quality

A preliminary desktop review indicated that there is no specific information on background soil quality in the White River area. Outside of industrial areas, soil concentrations are expected to be consistent with Ontario Typical Background ranges, as noted in Table 1 of Ontario Ministry of the Environment (MOE) Regulation 153/04, as amended (Government of Ontario, 2004).



3.4.4 Water Quality

The Township of White River obtains its municipal water supply from a mixture of surface water (Tukane Lake) and groundwater, which includes a water treatment plant (MOE, 2013b). Under the Ontario *Safe Drinking Water Act* (O. Reg. 170/03) (Government of Ontario, 2003) municipalities are required to monitor water quality and compare it to the Ontario Drinking Water Standards, Objectives and Guidelines (ODWS) (Government of Ontario, 2006); however, only municipalities with more than 10,000 people are required to make their annual report on drinking water quality available on their website. No information on water quality for the White River Drinking Water System is publicly available on the Township’s website.

Surface water hydrology, groundwater and wells are further discussed in Sections 3.5 and 3.6.

3.4.5 Lake Sediment Chemistry

Lake sediments from 1,382 sites in the White River area, around the Dayohessarah and Kabinakagami greenstone belts, were sampled and analyzed as part of a large study by the Ontario Geological Survey in 2000 and 2001 (Jackson, 2003). The lake sediment survey identified a number of areas with some concentrations of elements elevated above the typical crustal abundance. These elements include: arsenic, gold, nickel, copper, chromium, zinc, lead, silver, cadmium, cobalt, molybdenum and REE (rare earth elements). In some of these cases the anomalous level of these elements are a reflection of the underlying bedrock geology. The anomalous geochemical patterns observed in the lake sediment chemistry, relative to typical abundances, are a result of natural mineralization and Jackson (2003) concludes that nine of the anomalous areas show potential for precious and/or base metal mineralization. These areas include: Dayohessarah Lake (north, south and east), Odlum Lake, Lower Mathews Lake, Kwinkwaga Lake, Cupa Lake, Kwinkwaga River and three small lakes in Odlum Township.

3.4.6 Potential Sources of Pollutants

There are a number of potential sources of pollutants in the White River area including landfills, transportation corridors, domestic septic systems and local industries.

There is one operating landfill site within the White River area, the White River Waste Disposal Site (Table 4), which is shown on Figure 1. It is classified as a small landfill and is operated by the Township of White River. There is one closed landfill within the White River area, located to the west of the Kwinkwaga Ground Moraine Uplands Conservation Reserve (MOE, 2013a).

Table 4: Registered Landfills in the White River Area

Certificate of Approval (C of A) Number	Site Name	Location	Status
A7151501	North Regan Road Waste Disposal Site	Township of Bryant	Closed
	Client: Ministry of Natural Resources		
A562201	White River Waste Disposal Site	Northeastern part of Township White River	Open
	Client: The Corporation of the Township of White River	Township of White River	

Source: Ontario Landfill List (MOE, 2013a)



Transportation corridors, such as Highway 17, secondary roads, logging roads and rail lines, traverse the White River area, and are considered to be potential sources of pollution, as a result of salt application for de-icing and mobile air emissions from internal combustion. There is also a potential for chemical releases along transportation routes as a result of spills or accidents. Local septic systems are a potential source of the release of pollutants, mainly as a result of septic waste and possibly as a result of chemical disposal into the septic system. Industrial operations in the area may be a source of pollutants, due to the potential release of chemicals as a result of spills or improper chemical handling practices. No specific releases of the above-named pollutants into the environment were identified in this review.

3.5 Surface Water Hydrology

The White River area straddles a drainage divide between the Atlantic and Arctic watersheds; the western part is located within the White tertiary watershed of the Lake Superior drainage basin and the eastern part is located within the Michipicoten-Magpie tertiary watershed, also part of the Lake Superior drainage basin, as well as the Nagagami and Upper Kabinakagami tertiary watersheds which form part of the Hudson Bay drainage basin. Surface water drainage for the White River area is shown on Figure 12. In the White watershed, drainage is generally in a northwestward direction into the White River and then into White Lake and in the north to the southwest via the Gum River. Other significant rivers in the White watershed include the Shabotik and Bremner rivers. In the Michipicoten-Magpie watershed, the main drainage is carried by the Michipicoten River and into the Magpie River which occur to the south, outside of the White River area. In the Nagagami watershed, the main drainage is carried by the Beaton River which flows to the northeast. In the Upper Kabinakagami watershed, the principal drainage is through the Kabinakagami River which also flows towards the northeast, through Kabinakagami Lake.

3.6 Groundwater and Wells

The Township of White River obtains its municipal water supply from Tukanee Lake as well as from shallow groundwater (MOE, 2013b). Information concerning groundwater in the White River area was obtained from the MOE Water Well Information System (WWIS) database (MOE, 2013c). The locations of known water wells are shown on Figure 12. Water wells in the White River area are drilled into the overburden or the shallow bedrock. The MOE WWIS database contains records for 33 wells in the White River area, 31 of which provided useful information regarding well yield and other parameters noted in Table 5. Most of the water wells are located along Highways 17 and 631 within the Township of White River (AECOM, 2014).

Table 5: Water Well Record Summary for the White River Area

Water Well Type	Number of Wells	Total Well Depth (m)	Static Water Level (m below surface)	Tested Well Yield (L/min)	Depth to Top of Bedrock (m)
Overburden	15	4.6 to 38.7	0.9 to 3.0	4.5 to 909	N/A
Bedrock	16	15 to 99.1	1.2 to 8.5	4.5 to 1,250	1.5 to 27.1

3.6.1 Overburden Aquifers

There are 15 water well records in the White River area that can be confidently assigned to the overburden aquifer, ranging in depth from 4.6 to 38.7 m. Well yields are variable with recorded values of 4.5 to 909 L/min, with the range being explained by the diversity of materials encountered during drilling; from clay to gravel. These well yields reflect the purpose of the wells (private residential supply) and do not necessarily reflect the



maximum sustained yield that might be available from overburden aquifers. The limited number of well records and their concentration along main roadways limits the available information regarding the extent and characteristics of the overburden aquifers in the White River area.

3.6.2 Bedrock Aquifers

No information was found on deep bedrock groundwater conditions in the White River area at a typical repository depth of approximately 500 m. In the White River area there are 16 well records that can be confidently assigned to the shallow bedrock aquifer, ranging from 15 to 99 m in depth. Measured pumping rates in the bedrock wells ranged from 4.5 to 1,250 L/min. These well yields reflect the purpose of the wells (i.e., private residential supply) and do not necessarily reflect the maximum sustained yield that might be available from the shallow bedrock aquifers.

The MOE WWIS indicates that there are no potable water supply wells which exploit aquifers at typical repository depths in the White River area or anywhere else in northern Ontario (MOE, 2013c). Experience from other areas in the Canadian Shield has shown that active groundwater flow is generally confined to shallow localized systems. In these shallow regions, flow tends to be dependent on the secondary permeability created by fractures. In deeper regions, hydraulic conductivity tends to decrease as fractures become less common and less interconnected. Increased vertical and horizontal stresses at depth tend to close or prevent fractures, thereby reducing permeability and resulting in diffusion-dominated groundwater movement.

3.7 Climate and Meteorology

The climate assessment for White River is based on Environment Canada's Wawa climate station 1971-2000 normals, as this is the closest station to the White River area (the station is located approximately 60 km southeast of White River). The Wawa climate station has 24 years of continuous data during the 1971-2000 climate normal, and the 30 year period from 1971-2000 is the most recent period for which climate normals are available from Environment Canada. Parameters measured at the Wawa climate station include temperature, precipitation and wind.

The White River area is within a temperate and humid continental climate zone, with mild summers and cold winters. The major driver for precipitation is weather systems that cross the Canadian prairies, the American Midwest and deep south that move northward into the region; these weather systems are responsible for transporting moisture from the Great Lakes and the Gulf of Mexico. Most precipitation falls in the late spring into early fall in the form of showers and thunderstorms associated with traversing weather systems. In the winter, snowfall amounts can be greater than 35 cm and are associated with strong winter storm weather. Prolonged periods of extreme cold can also be experienced in the region during the winter.

3.7.1 Temperature

Temperature data were obtained from Environment Canada's 1971-2000 climate normals for the Wawa meteorological station (EC, 2013c). Temperatures in the White River area can reach highs of 33°C in summer months and lows of -50°C in winter months. The annual average temperature is 2°C, where the average summer temperature is approximately 13°C and the average winter temperature is -12°C. Figure 13 shows monthly temperatures for Wawa, displaying daily average, maximum and minimum and extreme values over the calendar year.



3.7.2 Precipitation

As shown on Figure 14, the annual average precipitation in the White River area is 1,002 mm, where one cm of snow is considered to be equal to one mm of equivalent rainfall. The region receives more precipitation in the summer and fall months (June through October), with an average of 100 mm each month during that period. White River is far enough from Lake Superior that lake effect snow plays little role in winter precipitation amounts. Figure 14 presents monthly precipitation data obtained from Environment Canada’s 1971-2000 climate normals for the Wawa meteorological station, including total rainfall, rainfall, snowfall and all-time extreme values over the calendar year (EC, 2013c).

3.7.3 Wind

North winds prevail in the White River area, changing to south and southwest in the summer and early autumn. Table 6 presents the monthly wind data obtained from Environment Canada’s 1971-2000 climate normals for the Wawa meteorological station (EC, 2013c). Wind speed and direction are an average for each month over the calendar year.

Table 6: Monthly Wind Normals for White River, Ontario

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Speed (km/hr)	9.6	9.3	10.2	10	8.9	7.8	6.9	7.9	9.6	9.9	10.6	9.4	9.2
Most Prevalent Direction (from)	N	N	N	N	N	S	S	SW	SW	SW	N	N	N

3.8 Natural Hazards

3.8.1 Earthquakes and Seismicity

The White River area lies within the Canadian Shield, where large parts have remained tectonically stable for the last 2.5 billion years (Percival and Easton, 2007). The White River area has a low seismic hazard rating (NRCan, 2009d). Since 1627, no earthquakes exceeding a magnitude m_N 6 have been known to occur within 1,000 km of the White River area. According to the National Earthquake Database (NEDB) for the period between 1985 to present (NRCan, 2013) there have been three seismic events in the White River area, with magnitudes between 2.2 and 2.5.

In summary, available literature and recorded seismic events indicate that the White River area is located within a region of low seismicity.

3.8.2 Tornadoes and Hurricanes

As noted in Table 6, average monthly wind speeds in the White River area are low, ranging from 7 to 11 km/hr. The White River area experiences thunderstorms in the summer and is located in an area with a low tornado frequency (<0.1 tornadoes per year / 10,000 km²), but where there is a potential for F0-F1 tornadoes (Sills et al., 2012). The White River area is situated too far away from the Atlantic Ocean to be susceptible to hurricanes.



The National Building Code of Canada recommends a design 1/50 maximum⁹ hourly wind pressure for the White River area of 0.30 kPa, which is a typical value for Ontario (NRC, 2010).

3.8.3 Drought and Flooding

According to precipitation climate normals for the region (Figure 14), the White River area experiences on average between 50 and 120 mm of precipitation each month, and is therefore unlikely to experience drought conditions that would affect the viability of local water sources. The single day extreme rainfall and snowfall events on record at the White River station (Figure 14) are 102 mm of rain and 41 cm of snow, respectively. In years where there is a high snowpack accumulation, the spring freshet can result in a nominal increase in water levels in local streams and rivers. As noted on Figure 12, the White River area lies at the head of a number of watersheds, making the size of the upstream catchments areas small to modest. This, in combination with rugged terrain in some areas, makes for a possible risk of flash flooding in some areas. The potential for flooding to affect a repository facility would depend on the specific location.

3.8.4 Snow and Ice

As noted on Figure 14, the White River area receives on average about 320 cm of snowfall per year, primarily between the months of October and April. No single month receives an average snowfall greater than 85 cm. The highest single day snowfall accumulation on record is 41 cm, recorded on October 20, 1989. The National Building Code of Canada recommends a design 1/50 snow load ($S_s + S_r$)¹⁰ for the White River area of 4.9 kPa, which is a typical value for northern Ontario (NRC, 2010). Local lakes and water bodies freeze over in the winter months in the White River area, as average daily temperatures from November to March typically range from -15 to -2°C.

3.8.5 Forest Fires and Lightning

Within heavily forested areas such as the White River area there is a risk of forest fires. Locations where forest fires have occurred in the vicinity of the White River area between 1976 and 2010 affecting an area of greater than 200 ha are shown on Figure 5. These forest fire areas combine to comprise approximately 7% of the total White River area. Forest fires can be initiated by lightning strikes or human activity, particularly if dry conditions are present in the forest understory. As previously noted, thunderstorms occur in the White River area and lightning strikes are not uncommon in the summer months.

3.8.6 Landslides and Tsunamis

There are areas of steep slopes in the White River area, which are generally comprised of crystalline rock with a thin veneer of soil cover. The physical nature of these slopes, combined with a potential for high precipitation events results in a possible landslide risk for some areas. There is no risk of tsunamis in the White River area, owing to the very low seismicity and a lack of large water bodies.

⁹ Hourly wind speeds having the annual probability of occurrence of a 1 in 50 year return period.

¹⁰ The combined snow and rain load that has an annual probability of occurrence in a 1 in 50 year period.



4.0 SUMMARY

This report provides a high level description of the environment in the Township of White River and surrounding area.

Situated in the District of Algoma near the northeastern end of Lake Superior, the Township of White River is approximately 102 km² in size, with a population of 607 (Statistics Canada, 2013). White River is located along Highway 17 (Trans-Canada Highway), between Marathon and Wawa. The White River area is within a temperate and humid continental climate zone, with mild summers and cold winters. White River receives most of its yearly precipitation in the late spring and into the early fall.

There are a number of First Nation and Métis communities and organizations in the White River area including Ojibways of Pic River (Heron Bay) and Ojibways of Pic Mobert. Métis Councils in the area include the Historic Sault Ste. Marie Métis Council and the North Channel Métis Council.

Geologically, the Township of White River is situated in the Wawa Subprovince, which is part of the western region of the Superior Province of the Canadian Shield. Approximately 75% of the White River area is underlain by the granitic rocks of the Pukaskwa and Black-Pic batholiths, the Strickland and Anahareo Lake plutons and the Danny Lake stock. These granitic intrusive complexes are typically multi-phased and poorly understood compared to the metavolcanic-metasedimentary greenstone belts, which have been the subject of intensive mineral exploration and research over the years. The metavolcanic and metasedimentary rocks of the Dayohessarah and Kabinakagami greenstone belts, as well as the narrow north-south trending bands within the Black-Pic batholith form a part of a discontinuous series of west to east greenstone belts from the Hemlo greenstone belt west of the White River area to the Kabinakagami greenstone belt in the northeast of the White River area (Stott, 1999). During ice retreat, ice-contact stratified drift was deposited, leaving a thin till veneer on the bedrock surface. This till veneer, when present, is the uppermost deposit across most of the White River area.

There are no currently producing mines in the White River area. The closest producing mines, primarily exploiting gold with some secondary antimony, barite, molybdenum and silver, are approximately 25 km to the west of the White River area in the Hemlo greenstone belt. There are numerous active mining claims and mineral occurrences in the central and northeastern part of the White River area particularly within the Dayohessarah and Kabinakagami greenstone belts. Minerals present include: gold, zinc, copper, nickel and molybdenum.

Infrastructure within the White River area includes the Trans-Canada Highway (Highway 17) which passes southeast-northwest through the White River area and Highway 631 which passes from White River to the northeast. A CP rail corridor runs through White River, approximately parallel to the Trans-Canada Highway, and then eastward through the community of Amyot. The Algoma Central Railway, currently operated by CN, clips the southeast corner of the White River area. One 115kV electrical transmission line runs from White River to the northwest, approximately parallel to the Trans-Canada Highway. The White River airport is located northeast of the town on the south end of Tukanee Lake (NRCan, 2009a). There are no gas pipelines in the White River area (NRCan, 2009b). There is one operating landfill (MOE, 2013a) and a wastewater treatment plant within the White River area.

There are two provincial parks, three conservation reserves and two forest reserves within the White River area. The Pokei Lake/White River Wetlands Provincial Park covers approximately 18 km², about 2 km south of the



Township of White River. The White Lake Peatlands Provincial Park, covering approximately 17 km², is located to the north of White Lake.

The White River area lies in the Boreal Forest Region. The western portion of the White River area is located within the White River Forest (FMU 60), managed by Jackfish River Management Ltd (JRML) on behalf of White River Forest Products Ltd (WRFP) (JRML, 2013). The northeastern portion of the White River area is within the Nagagami Forest (FMU 390) and the Hearst Forest (FMU 601) which is managed by Jackfish River Management Ltd. (JRML, 2011) and the southeastern portion of the White River area falls within the Magpie Forest (FMU 565) (DFPL, 2008). In total, the White River area contains 391,704 ha of woodlands, which is 78% of the land coverage (LIO, 2013). Typical forest types in the White River area include: lowland conifer forest, upland conifer forest, poplar forest, mixed-wood forest, jack pine forest, white birch forest and white and red pine forest (Domtar, 2008).

Trapping of fur bearing species is an important activity in the White River area. Management of woodland caribou, moose, marten and pileated woodpecker along with other sensitive wildlife populations are a particular concern to the MNR. The western portion of the White River area is part of discontinuous woodland caribou habitat as identified in Ontario's Woodland Caribou Conservation Plan (MNR, 2009). There are several known Areas of Natural and Scientific Interest (ANSI), and other Natural Areas within the White River area. No Provincially Significant Wetlands (PSW) have been identified in the White River area.

The Natural Heritage Information Centre (NHIC) database (NHIC, 2013) shows the occurrence of species that are listed as Endangered (END), Threatened (THR) or Special Concern (SC) either under the provincial *Endangered Species Act* (ESA) (Government of Ontario, 2007), or the federal *Species at Risk Act* (SARA) (Government of Canada, 2012). The Royal Ontario Museum range maps (ROM, 2013) is based on range mapping and indicates the potential for Species at Risk (SAR) to exist within the White River area. Habitats within the White River area could directly or indirectly support the needs of 18 SAR. These species include four mammals (eastern cougar, woodland caribou, northern myotis and little brown myotis), 11 birds (bald eagle, barn swallow, black tern, Canada warbler, chimney swift, common nighthawk, golden eagle, olive-sided flycatcher, rusty blackbird, short-eared owl and eastern whip-poor-will), one fish (lake sturgeon) and two invertebrates (monarch butterfly and rusty-patched bumble bee). No END, THR or SC amphibian or reptile species or plants, mosses and lichens are known to occur within the White River area based on available sources.

The White River area straddles a drainage divide with the western part located within the White Lake and Michipicoten-Magpie tertiary watersheds of the Lake Superior drainage basin and the eastern part located within the Nagagami and Upper Kabinakagami tertiary watershed of the Hudson Bay drainage basin. In the White watershed, drainage is generally in a northwestward direction into the White River and then into White Lake and in the north to the southwest via the Gum River. In the Michipicoten-Magpie watershed, the main drainage is carried by the Michipicoten River. In the Nagagami watershed, the main drainage is carried by the Beaton River which flows to the northeast. In the Upper Kabinakagami watershed, the principal drainage is also towards the northeast, through Kabinakagami Lake. Terrain includes wetlands, lakes and rivers that support a diversity of fish and wildlife. Water bodies are mainly warm and cool water classified, interspersed with the occasional smaller cold water body. Fish that are commonly harvested include walleye, northern pike, lake trout, brook trout, smallmouth bass and yellow perch (MNR, 2013d).



Water wells in the White River area obtain water from the overburden or the shallow bedrock. The Ontario Ministry of Environment (MOE) Water Well Information System (WWIS) database contains 33 water well records in the White River area, 31 of which provided useful information regarding well yield and other parameters. There are no records of water wells sourcing potable water aquifers at repository depths in the White River area or elsewhere in the Ontario part of the Canadian Shield. The Township of White River obtains its municipal water supply from Tukane Lake and shallow groundwater.

Air, soil and surface water quality within the White River area are expected to be within the normal range for north-central Ontario. Sources of background radioactivity in the White River area are attributed to naturally occurring radioactive materials, specifically potassium, uranium and thorium-bearing minerals. The range of dose rates and averages are consistent with regional dose rates for north-central Ontario.

There is one known archaeological site in the White River area (von Bitter, 2013). This archaeological site is located outside the Township boundaries, at the mouth of Tedder River where it empties into Kakakiwibik Lake. The archaeological site was identified and recorded in 1970 as a campsite with extensive signs of burning and evidence of fire-cracked rock, but very few artifacts. There is one provincially designated historic site and one federally designated historic site, both within the town of White River (MTCP, 2013; OHT, 2011; Parks Canada, 2013). The historical sites include the provincially designated CPR Superintendent's House, located on Railway Street and the federally designated CP railway Station located on Winnipeg Street in the Town of White River. The presence of local heritage sites would need to be further confirmed in discussion with the community and First Nation and Métis communities and organizations in the area.



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**ENVIRONMENT REPORT - TOWNSHIP OF WHITE RIVER,
ONTARIO**



Report Signature Page

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Geoscientist

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Senior Geoscientist, Principal

JLH/GWS/wlm

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**ENVIRONMENT REPORT - TOWNSHIP OF WHITE RIVER,
ONTARIO**

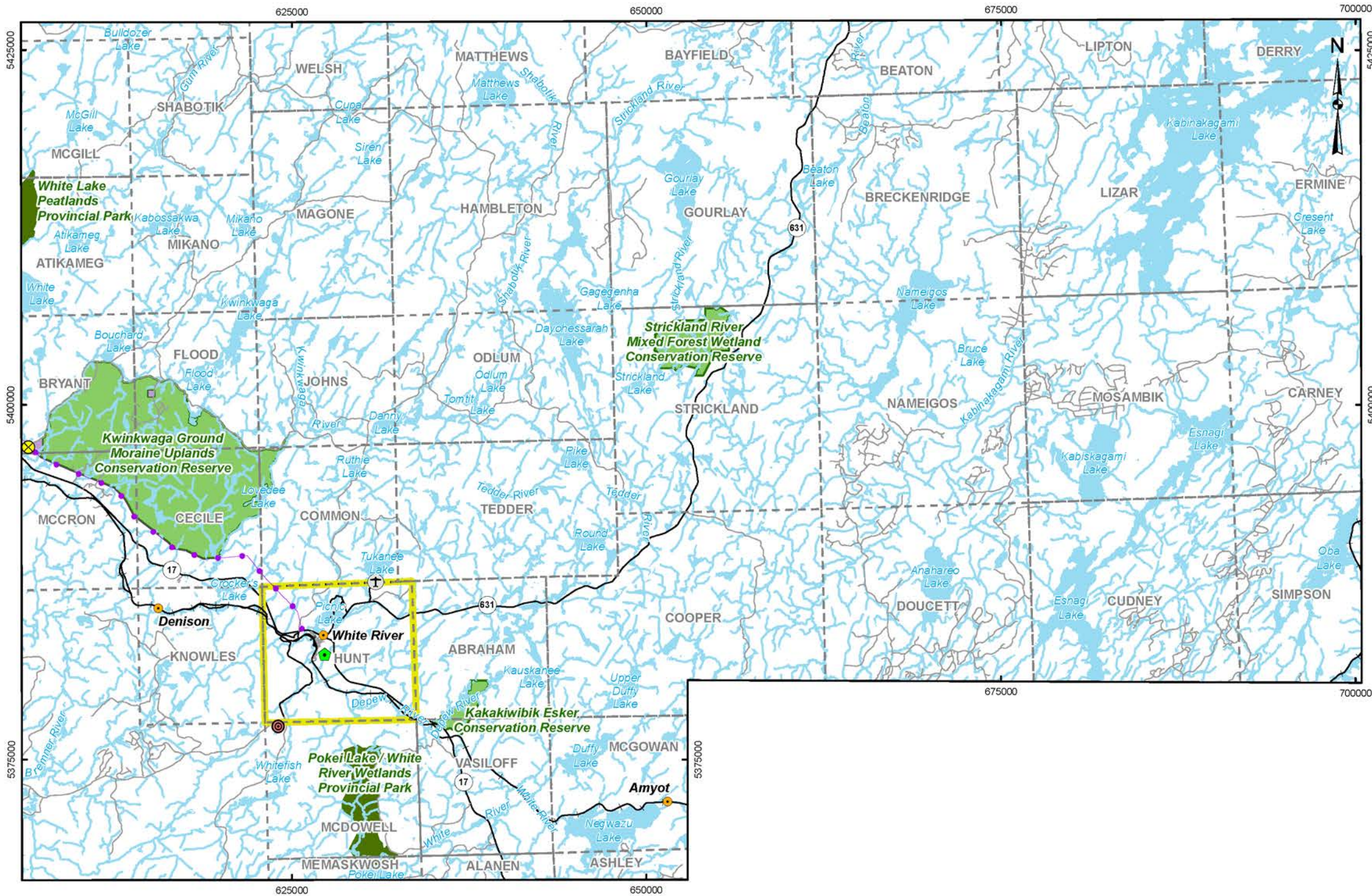


FIGURES



**ENVIRONMENT REPORT - TOWNSHIP OF WHITE RIVER,
ONTARIO**

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LEGEND


- Community
- ✈ Airport
- ⊙ Domestic Waste Site (Operating)
- ⊙ Domestic Waste Site (Closed)
- ⬆ Waste Water Treatment Plant
- Main Road
- Local Road
- Railway
- 115 kV Transmission Line
- Watercourse
- Waterbody
- Forest Reserve
- Conservation Reserve
- Provincial Park
- Municipal Boundary (Township of White River)



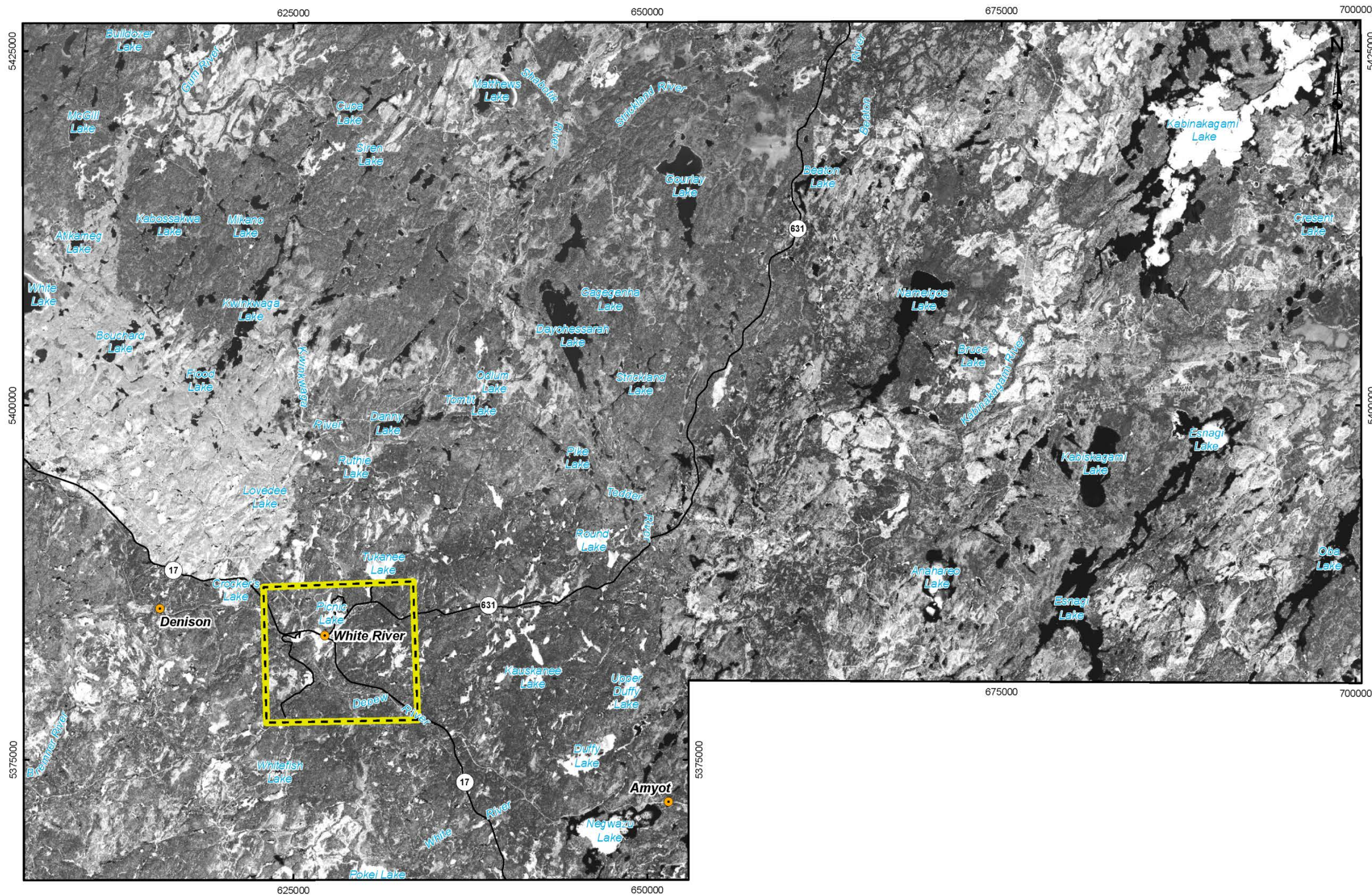
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 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT		Environment Report Township of White River, Ontario	
TITLE		White River and Surrounding Lands	
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 28 Mar. 2012	REV. 0.0
	GIS	JB 2 Apr. 2014	FIGURE: 1
	CHECK	JH 2 Apr. 2014	
REVIEW	GWS 2 Apr. 2014		

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LEGEND


- Community
- Main Road
- Municipal Boundary (Township of White River)



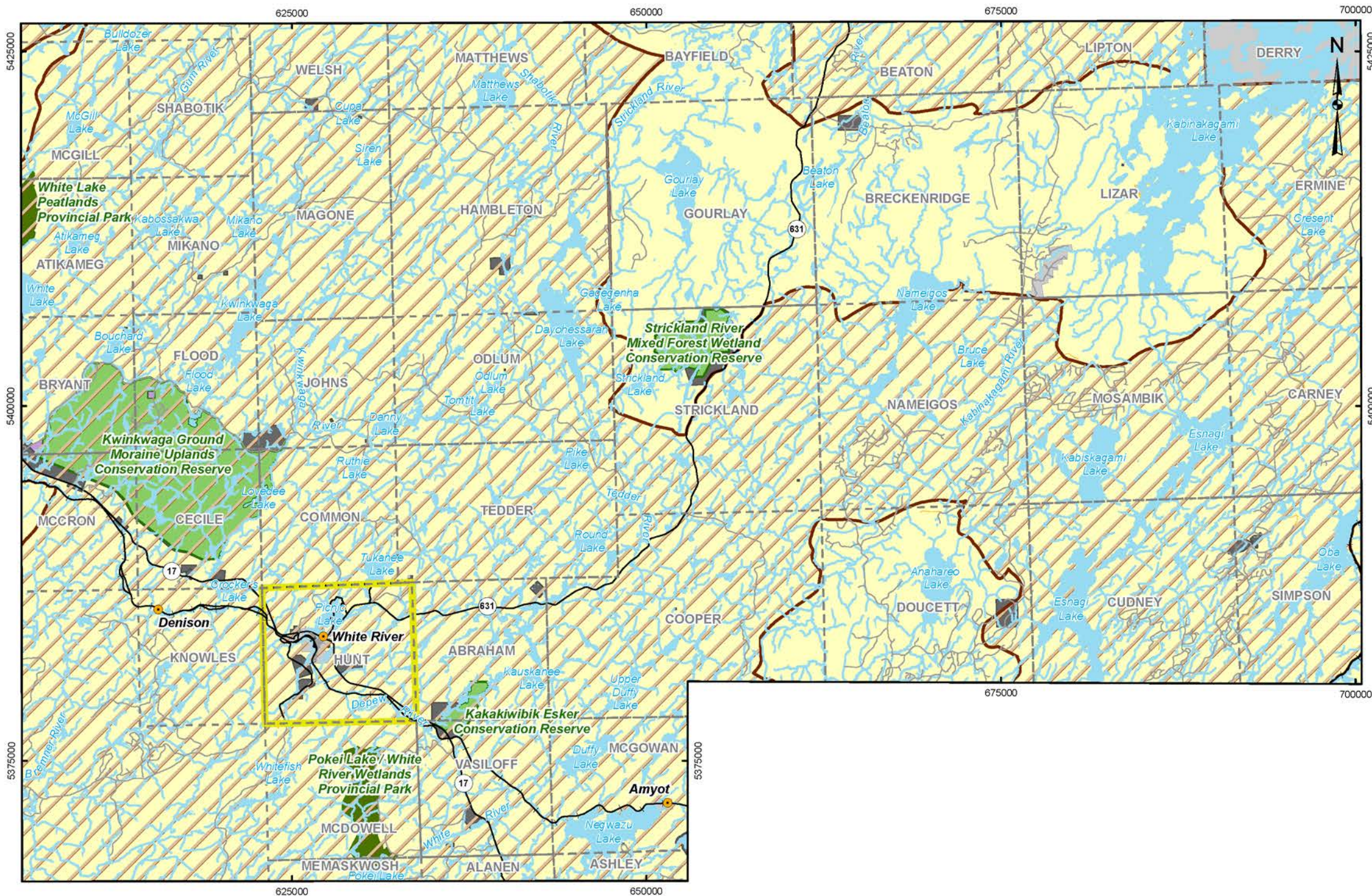
REFERENCE

Base Data - MNR LIO, obtained 2009-2013, CANMAP v2006.4
 Imagery: Spot 5, Obtained from Geobase (2006 to 2007, 10 m resolution)
 Produced by Golder Associates Ltd under licence from
 Ontario Ministry of Natural Resources, © Queens Printer 2013
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT		Environment Report Township of White River, Ontario	
TITLE		Satellite Imagery of the White River Area	
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 27 Jan. 2011	REV. 0.0
	GIS	PM/JB 2 Apr. 2014	FIGURE: 2
	CHECK	JH 2 Apr. 2014	
	REVIEW	GWS 2 Apr. 2014	

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LEGEND

- Community
- Main Road
- Local Road
- Railway
- Watercourse
- Waterbody
- Forest Reserve
- Conservation Reserve
- Provincial Park
- Private Land
- Crown Land - Non-Freehold Dispositions Public
- Crown Reserves
- Crown Land - Unpatented Public Land
- Regular Registered Trapline Area License
- Geographic Township
- Municipal Boundary (Township of White River)



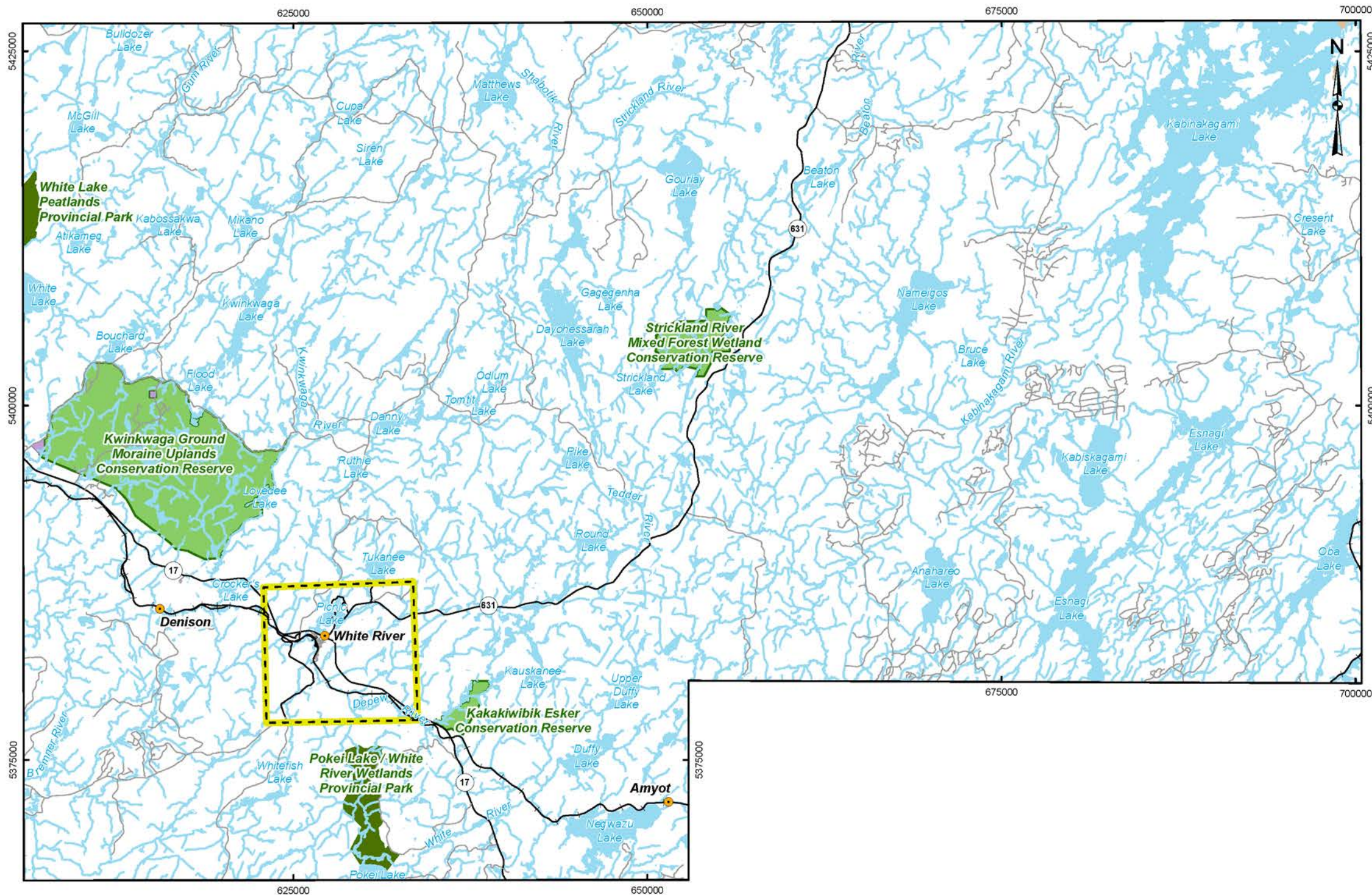
REFERENCE

Base Data - MNR LIO, obtained 2009-2013, CANMAP v2006.4
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 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT		Environment Report Township of White River, Ontario	
TITLE		White River Land Ownership	
	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 28 Mar. 2012	REV. 0.0
	GIS	JB 2 Apr. 2014	FIGURE: 3
	CHECK	JH 2 Apr. 2014	
REVIEW	GWS 2 Apr. 2014		

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LEGEND

- Community
- Main Road
- Local Road
- Railway
- Watercourse
- Waterbody
- Forest Reserve
- Conservation Reserve
- Provincial Park
- Significant Old Growth Forest
- Municipal Boundary (Township of White River)



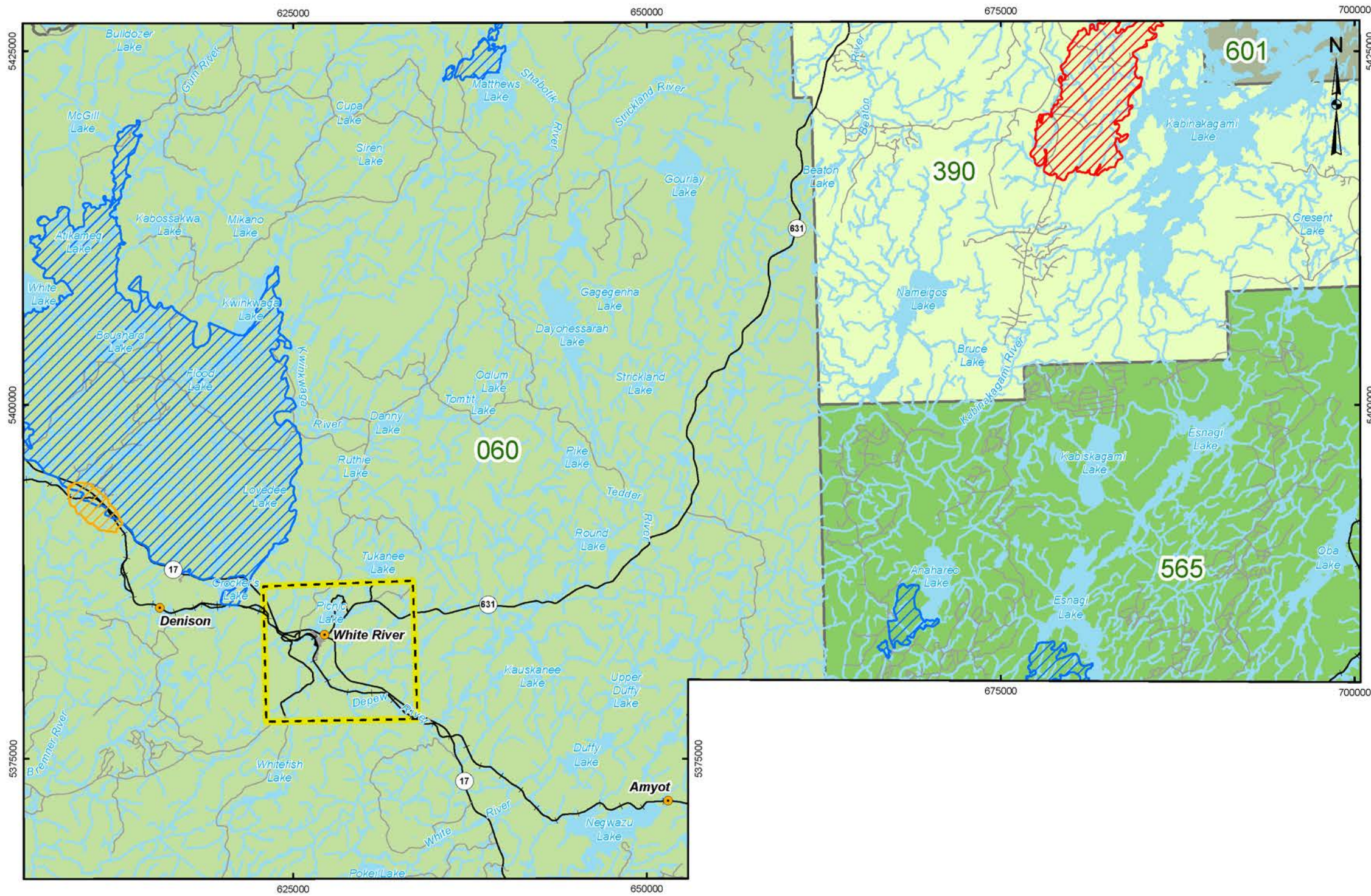
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PROJECT		Environment Report Township of White River, Ontario	
TITLE		White River Parks and Protected Lands	
Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 28 Mar. 2012	REV. 0.0
	GIS	JB 2 Apr. 2014	FIGURE: 4
	CHECK	JH 2 Apr. 2014	
REVIEW	GWS 2 Apr. 2014		

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LEGEND

- Community
- Main Road
- Local Road
- Railway
- Waterbody
- Municipal Boundary (Township of White River)
- Forest Fire Areas (greater than 200 hectares)**
- 1976 - 1980
- 1981 - 1990
- 1991 - 2000
- 2001 - 2010
- Forest Plan Renewal Year**
- 2013
- 2014
- 2015
- 2016
- 2017

FOREST MANAGEMENT UNITS

- 060 - White River Forest
- 390 - Nagagam Forest
- 565 - Magpie Forest
- 601 - Hearst Forest



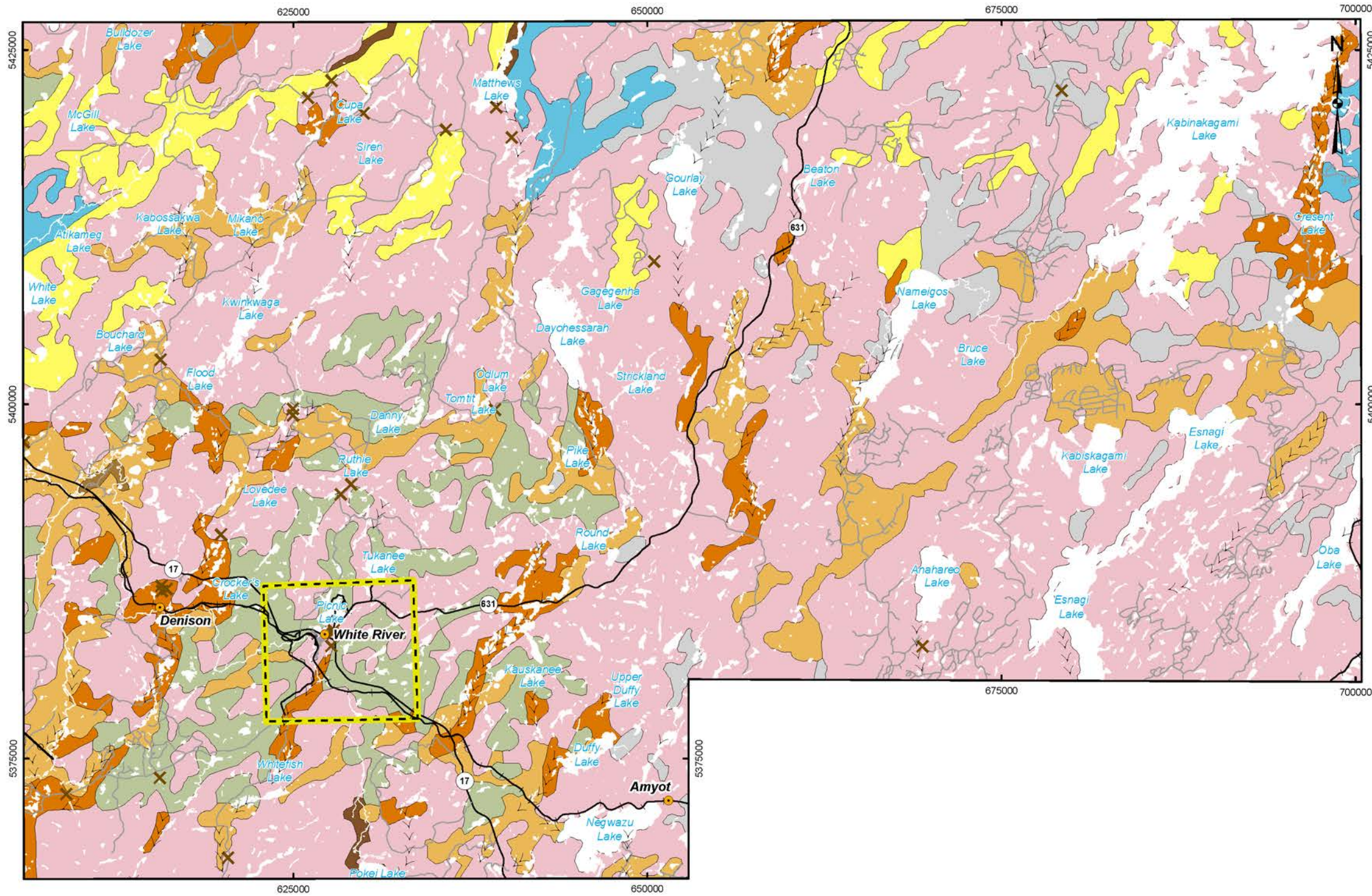
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Base Data - MNR LIO, obtained 2009-2013, CANMAP v2006.4
 Forest Management Units & Forest Fire Areas - Canadian Forest Service. 2010.
 Canadian National Fire Database-Agency Fire Data. Natural Resources Canada,
 Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta.
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 Ontario Ministry of Natural Resources, © Queens Printer 2013
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of White River, Ontario		
TITLE	Forest Management Units of the White River Area		
	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 27 Jan. 2011	REV. 0.0
	GIS	PM/MS 2 Apr. 2014	FIGURE: 5
	CHECK	JH 2 Apr. 2014	
	REVIEW	GWS 2 Apr. 2014	

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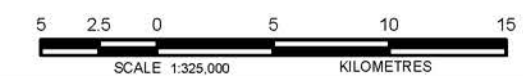
LEGEND

- Community
- Main Road
- Local Road
- Railway
- ✕ Pit (Gravel)
- >> Esker or area of eskers; direction of flow known or assumed
- Minor moraine forms or Area of DeGeer
- 1: Bedrock
- 18: Till
- 22: Glaciofluvial Ice Deposit
- 23: Glaciofluvial Outwash Deposits
- 24: Glaciolacustrine deposits – Fine grained
- 25: Glaciolacustrine Deposits – Coarse grained
- 28: Fluvial Deposits - Pleistocene
- 31: Fluvial Deposits - Recent
- 32: Organic Deposits
- 33: Waterbody
- Municipal Boundary (Township of White River)



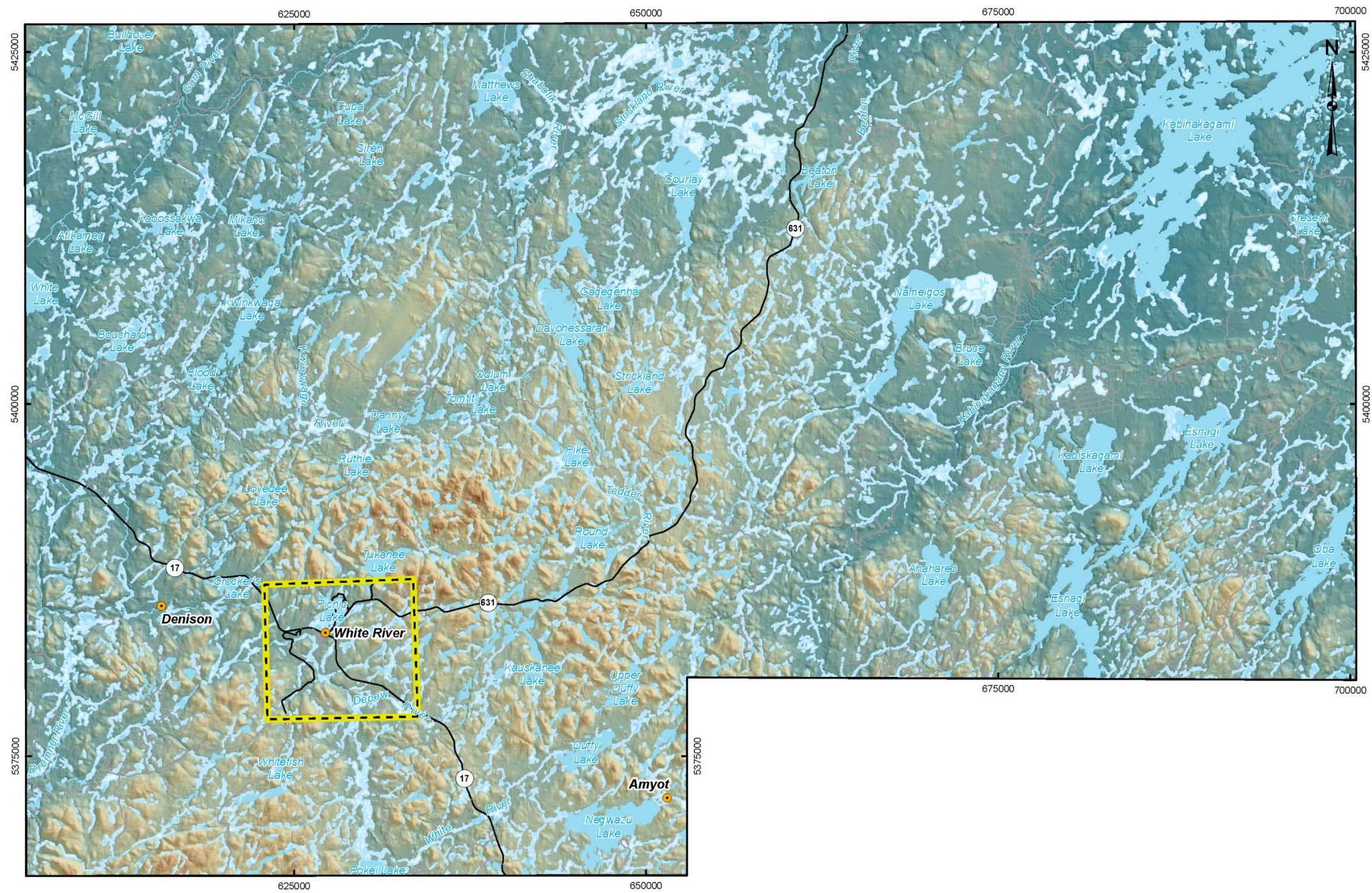
REFERENCE

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 Geology - Modified EDS014-Surficial Geology of Ontario 1:1,000,000, 2000
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 Ontario Ministry of Natural Resources, © Queens Printer 2013
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of White River, Ontario		
TITLE	Quaternary Geology of the White River Area		
 Golder Associates Mississauga, Ontario	PROJECT NO. 12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN	PM	27 Jan. 2011
	GIS	PM/MS	2 Apr. 2014
	CHECK	JH	2 Apr. 2014
	REVIEW	GWS	2 Apr. 2014
FIGURE: 6			

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LEGEND

- Community
- Main Road
- Local Road
- Waterbody
- Wetland
- Municipal Boundary (Township of White River)

Elevation Model (masl)

622
575
525
475
425
375
311



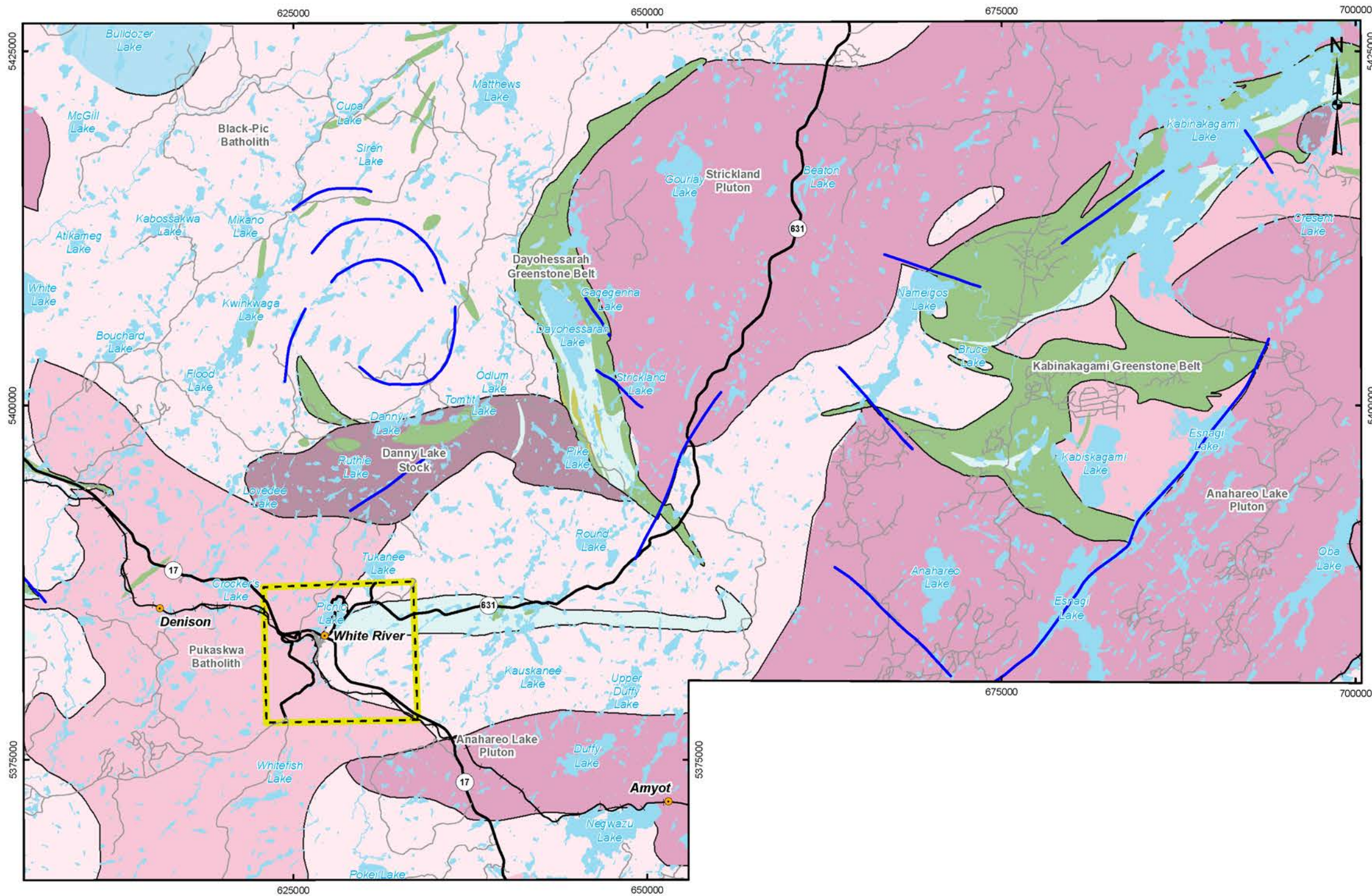
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Base Data - MNR NRVIS, obtained 2009-2012, CANMAP v2006.4
 Digital Elevation Model - CDED slope raster: Geobase.ca (1:50,000)
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 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of White River, Ontario		
TITLE	Digital Elevation Model (DEM) of the White River Area		
 Mississauga, Ontario	PROJECT NO. 12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN	PM	27 Jan. 2011
	GIS	PM/IR	2 Apr. 2014
	CHECK	JH	2 Apr. 2014
	REVIEW	GWS	2 Apr. 2014
FIGURE: 7			

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LEGEND

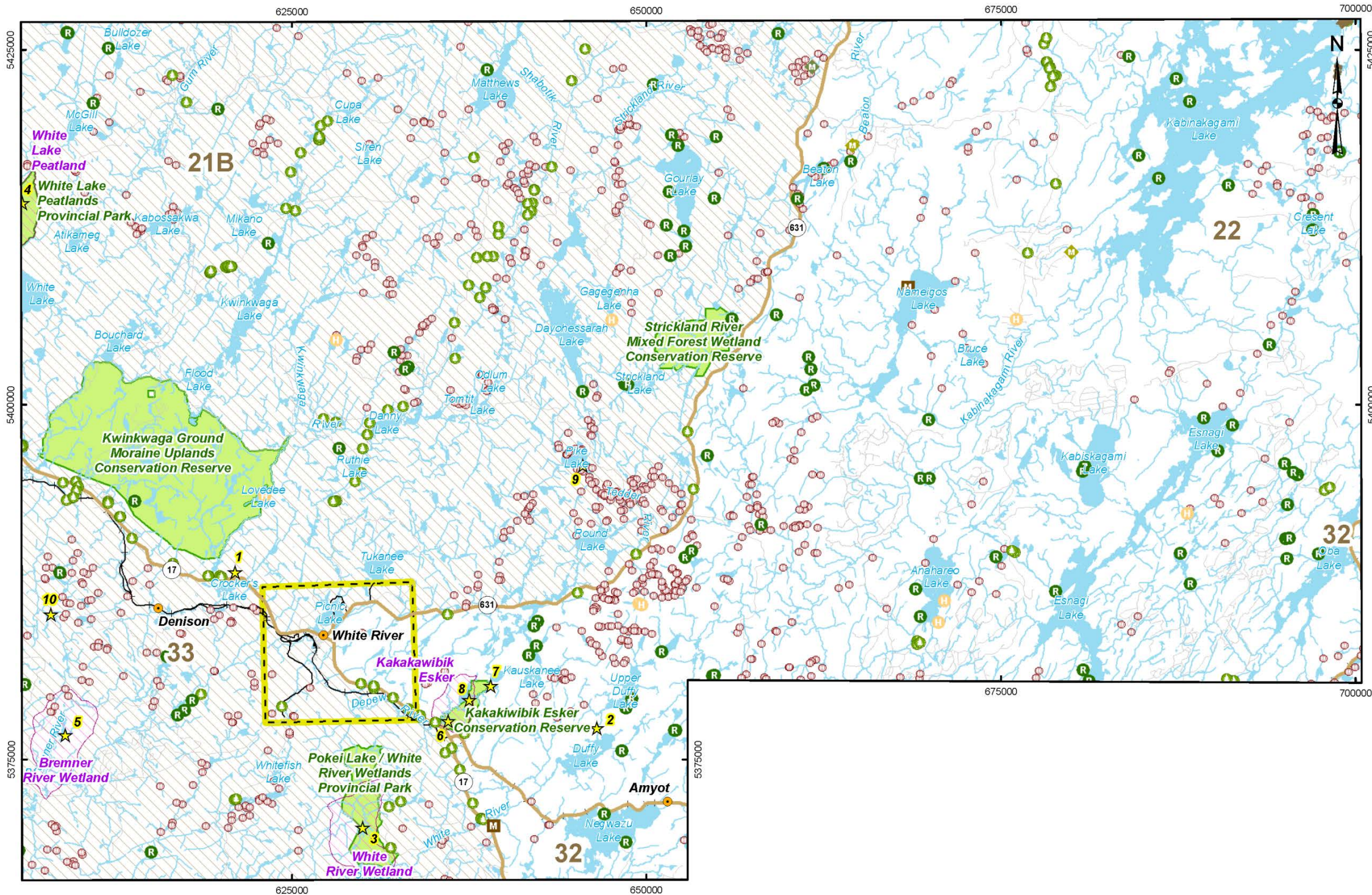
- Community
- Main Road
- Local Road
- Railway
- Waterbody
- Geological Fault
- Geological Contact
- ▭ Municipal Boundary (Township of White River)
- Bedrock Geology**
- 13: Granite-granodiorite
- 12: Diorite-monzonite- granodiorite
- 10: Foliated tonalite suite
- 9: Gneissic tonalite suite
- 8: Gabbro
- 5: Metasedimentary rocks
- 4: Felsic volcanic rocks
- 3: Felsic and immediate metavolcanic rocks
- 2: Mafic metavolcanic Rocks

REFERENCE

Base Data - MNR LIO, obtained 2009-2013, CANMAP v2006.4
 Bedrock Geology - OGS M2666, 2001 (1:250,000)
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 Ontario Ministry of Natural Resources, © Queens Printer 2013
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of White River, Ontario		
TITLE	Bedrock Geology of the White River Area		
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 27 Jan. 2011	REV. 0.0
	GIS	EM/ES 2 Apr. 2014	FIGURE: 8
	CHECK	JH 2 Apr. 2014	
	REVIEW	GWS 2 Apr. 2014	



- LEGEND**
- Community
 - Main Road
 - Local Road
 - Railway
 - Watercourse
 - Waterbody
 - Provincial Park / Reserve
 - Municipal Boundary (Township of White River)
 - ★ Earth or Life Science Site
 - Candidate ANSI, Life Science Site
- Wildlife and Forestry**
- Forest Research Site
 - Moose Aquatic Feeding Area
 - Discontinuous Caribou Habitat
 - Wildlife Management Unit (21B, 22, 32, 33)
- Nesting**
- Heron
 - Raptor
- Significant Ecological Area**
- Significant Woodland
- Wintering Area**
- Moose Early Wintering Area
 - Moose Late Wintering Area
 - Moose Early Wintering Area
 - Moose Late Wintering Area
- Calving/Fawning Sites**
- Moose Calving Site



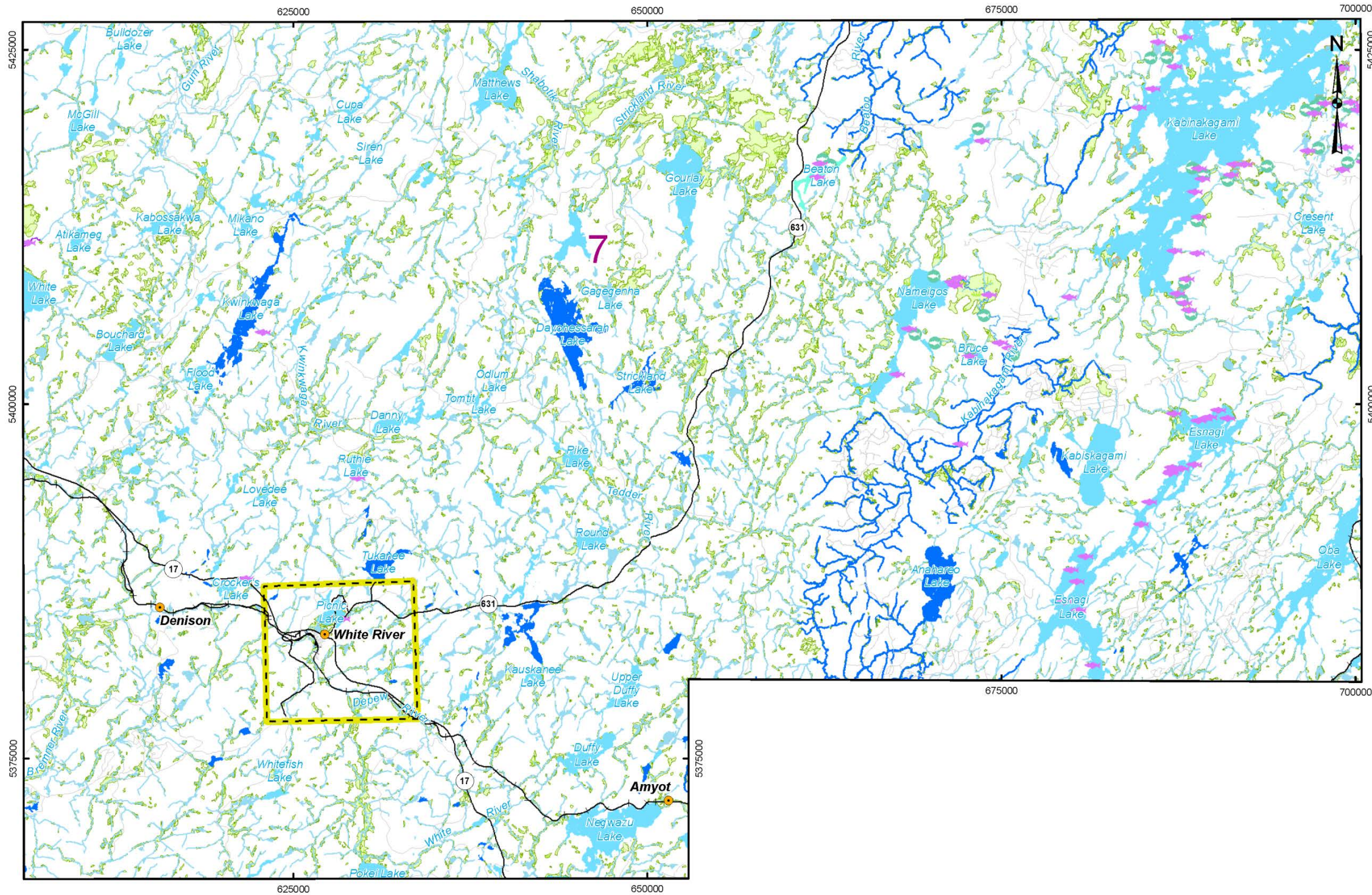
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 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 18N



PROJECT				
Environment Report Township of White River, Ontario				
TITLE				
White River - Terrestrial Ecology				
<p>Golder Associates Mississauga, Ontario</p>	PROJECT NO.	12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN	JB	3 Jul. 2013	
	GIS	JB	2 Apr. 2014	
	CHECK	JH	2 Apr. 2014	
	REVIEW	GWS	2 Apr. 2014	
FIGURE: 9				

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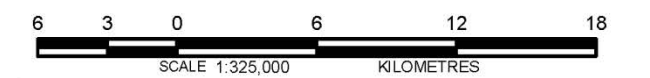
LEGEND


- Community
 - Main Road
 - Local Road
 - Railway
 - ▭ Fisheries Management Zone (Whole Site is Zone 7)
 - ▭ Municipal Boundary (Township of White River)
- Fisheries and Wetlands**
- Fish Nursery Area
 - ◆ Spawning Area
 - ▨ Spawning Area
 - ▨ Wild Rice Stand
 - Watercourse (unspecified)
 - Cold Watercourse
 - Cool Watercourse
 - Warm Watercourse
 - Waterbody (unspecified)
 - Cold
 - Cool
 - Warm
- Natural Heritage**
- ▨ Wetland



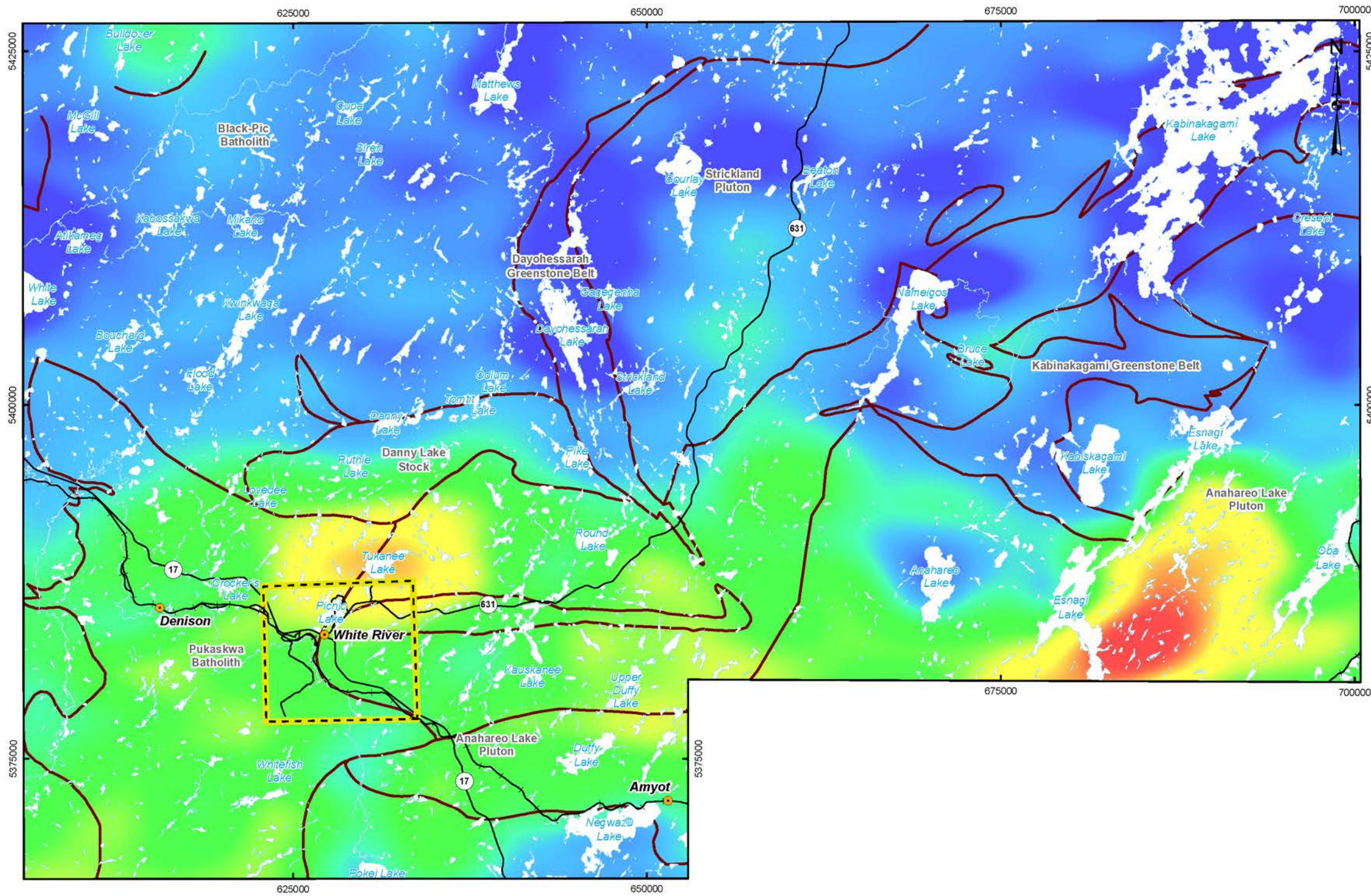
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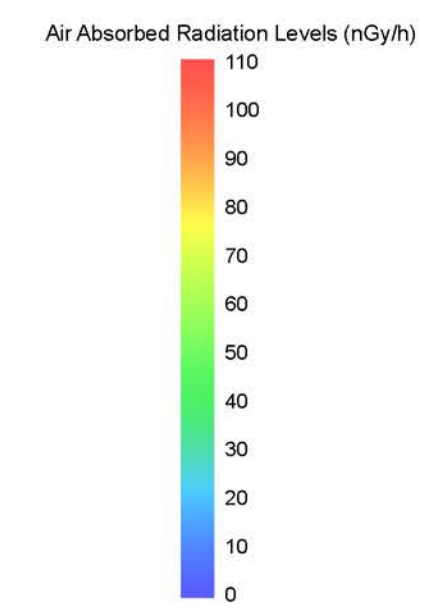
PROJECT	Environment Report Township of White River, Ontario		
TITLE	White River - Aquatic Ecology		
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	GIS	JB 2 Apr. 2014	FIGURE: 10
	CHECK	JH 2 Apr. 2014	
REVIEW	GWS 2 Apr. 2014		

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LEGEND

- Community
- Major Road
- +— Railway
- Waterbody
- ▭ Geological Contact
- ▭ Municipal Boundary (Township of White River)



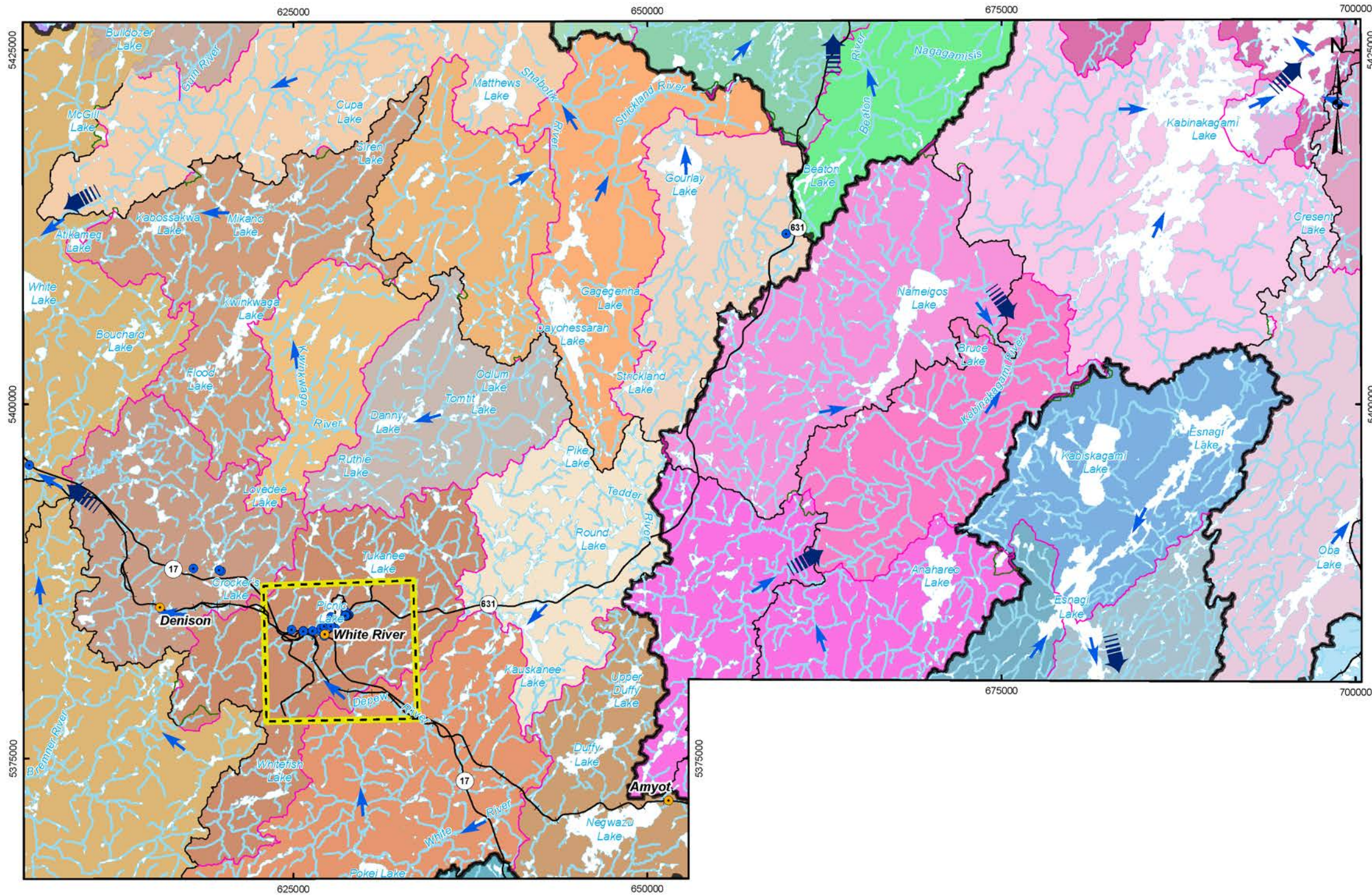
REFERENCE

Base Data - MNR LIO, obtained 2009-2013, CANMAP v2006.4
 Bedrock Geology - OGS M2666, 2001 (1:250,000)
 Geophysics - GSC Canada - 2km resolution - Bouguer Gravity Anomalies, 2010;
 Canadian Aeromagnetic Data Base, Airborne Geophysics Section, GSC - Central
 Canada Division, Geological Survey of Canada, Earth Sciences Sector, Natural
 Resources Canada
 Produced by Golder Associates Ltd under licence from
 Ontario Ministry of Natural Resources, © Queens Printer 2013
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of White River, Ontario		
TITLE	White River - Background Radiation Levels		
 Golder Associates Mississauga, Ontario	PROJECT NO. 12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN	PM	27 Jan. 2011
	GIS	EM/ES	2 Apr. 2014
	CHECK	JH	2 Apr. 2014
	REVIEW	GWS	2 Apr. 2014
FIGURE: 11			

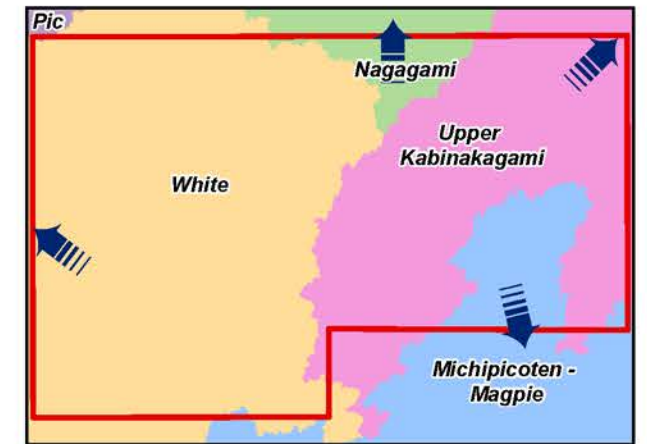
G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\White_River\WhiteRiverSurfaceWaterDrainageAndWaterWells.mxd



LEGEND

- Community
 - MOE Well Location
 - Main Road
 - Watercourse
 - Waterbody
 - ➔ Surface Water Flow Direction
 - ▬▬▬ Watershed Outflow Point
- Drainage Divides**
- Delineated by MNR/AECOM
 - Delineated by AECOM
 - Delineated by MNR
 - ▭ Tertiary Watershed
 - ▭ Municipal Boundary (Township of White River)

TERTIARY WATERSHEDS

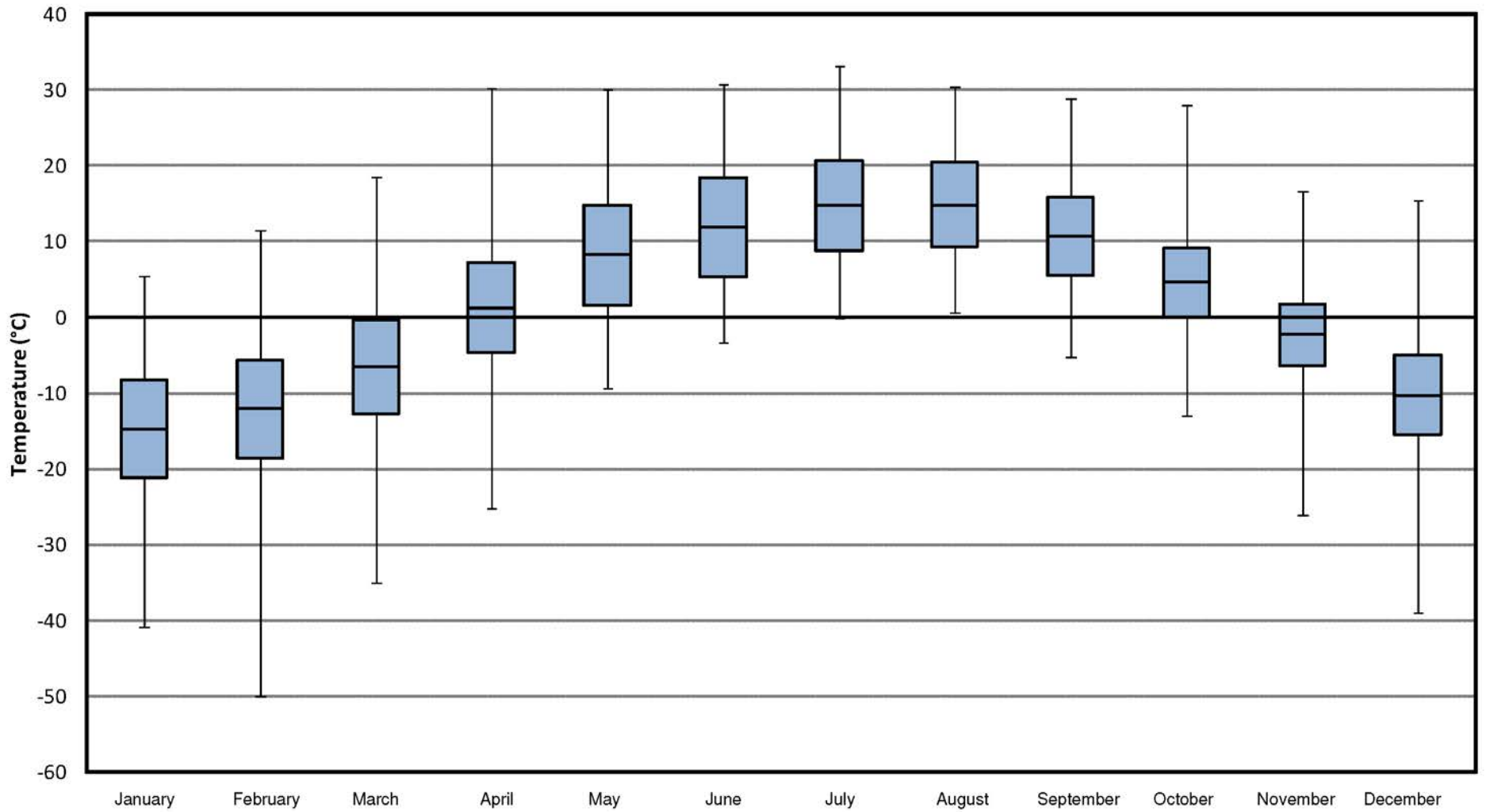


REFERENCE

Base Data - MNR LIO, obtained 2009-2013, CANMAP v2008.4
 Wells - Ministry of the Environment, 2010
 Watershed - LIO Quaternary watershed (updated by AECOM)
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 Ontario Ministry of Natural Resources, © Queens Printer 2013
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT		Environment Report Township of White River, Ontario		
TITLE		White River Surface Water Drainage and Water Wells		
<p>Golder Associates Mississauga, Ontario</p>	PROJECT NO.	12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN	PM	27 Jan. 2011	
	GIS	EM/ES	9 Jun. 2014	
	CHECK	JH	9 Jun. 2014	
	REVIEW	GWS	9 Jun. 2014	
			FIGURE: 12	



LEGEND

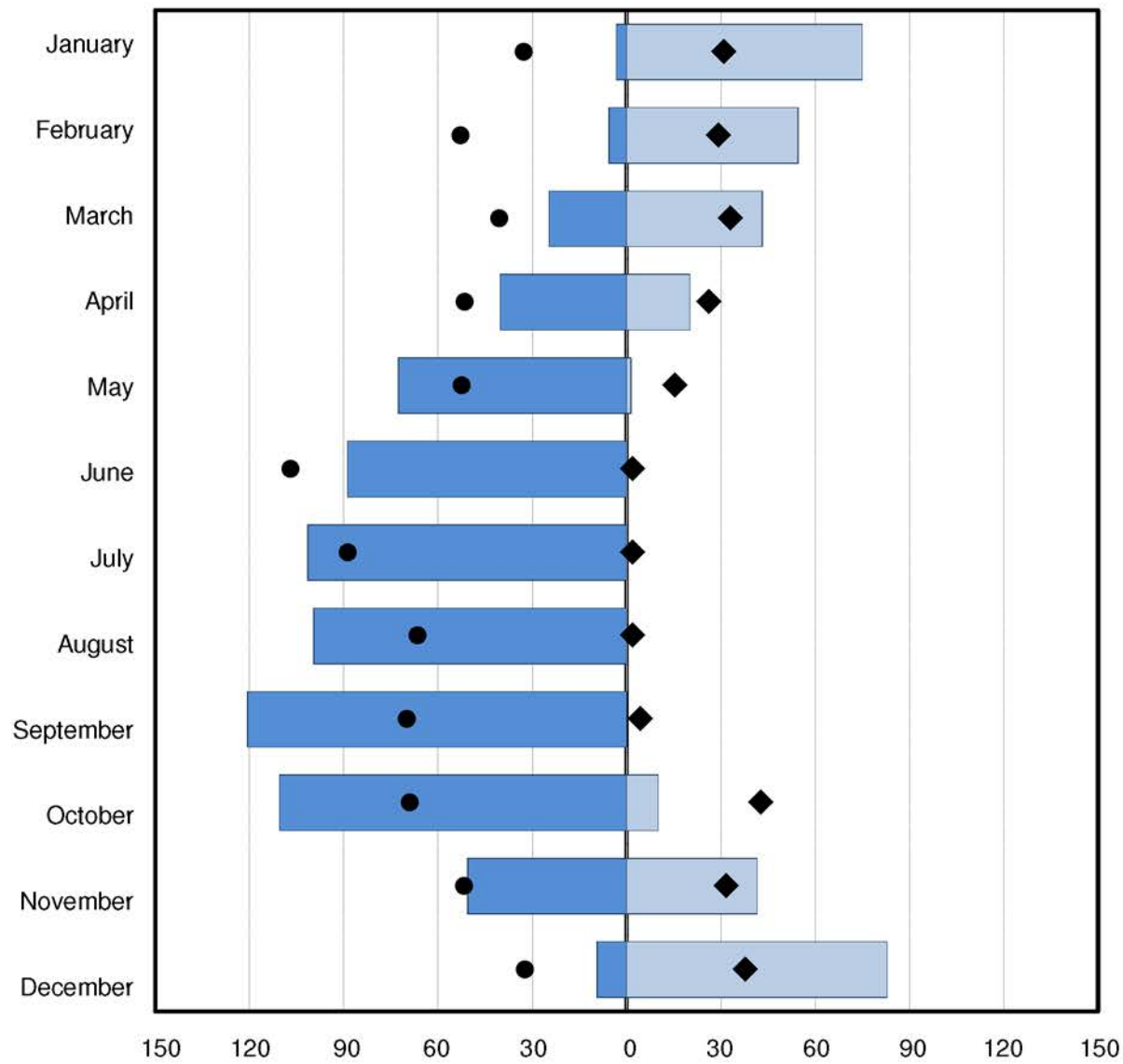
- Extreme Maximum (°C)
- Daily Maximum (°C)
- Daily Average (°C)
- Daily Minimum (°C)
- Extreme Minimum (°C)

DATA SOURCE

Environment Canada

PROJECT		Environment Report Township of White River, Ontario	
TITLE		Wawa 1971-2000 Temperature Data Summary	
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 7 Jun 2012	REV. 0.0
	CHECK	JH 2 Apr 2014	
	REVIEW	GWS 2 Apr 2014	

FIGURE: 13



LEGEND

- Monthly Rainfall (mm eq.)
- Monthly Snowfall (cm or mm eq.)
- Extreme Daily Rainfall (mm eq.)
- ◆ Extreme Daily snowfall (cm or mm eq.)

DATA SOURCE

Environment Canada


PROJECT		Environment Report Township of White River, Ontario	
TITLE		Wawa 1971-2000 Precipitation Data Summary	
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 7 Jun 2012	REV. 0.0
	GIS	PM 3 Apr 2014	
	CHECK	JH 3 Apr 2014	
	REVIEW	GWS 3 Apr 2014	

FIGURE: 14

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