November 2013

## PHASE 1 DESKTOP ASSESSMENT

# Environment Report
# Township of Ear Falls, Ontario

**Submitted to:**
Nuclear Waste Management Organization
22 St. Clair Avenue East, 6th Floor
Toronto, Ontario
M4T 2S3

REPORT

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# 1.0 INTRODUCTION

The Township of Ear Falls in northwestern Ontario is considering hosting 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 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 in the vicinity of Ear Falls. To this end, this report provides a general description of the environment in the Township of Ear Falls and surrounding area. It is complemented by reports prepared in parallel which characterize the geoscientific conditions and community well-being profile of the 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 will be sought at subsequent phases of the work.

The area considered here is similar to that used for the Phase I Geoscientific Assessment for Ear Falls. This area is shown on Figure 1, and includes the Township of Ear Falls, as well as the areas to the south, east, west and north of this Township.

# 2.0 COMMUNITIES AND INFRASTRUCTURE

## 2.1 Communities

The Township of Ear Falls is approximately 350 km² in size[1], situated in the District of Kenora in northwestern Ontario (LIO, 2012). The settlement area is shown on Figure 1 at the northwestern end of Lac Seul, approximately 98 km northwest of Vermillion Bay and 70 km southeast of Red 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 Ear Falls and District of Kenora.

**Table 1: Population Statistics for Ear Falls Area**

| Political Boundary | Population | Population Density per km² |
|---|---|---|
| Township of Ear Falls | 1,026 | 3.1 |
| District of Kenora | 57,607 | 0.1 |

**Source:** 2011 Census of Population (Statistics Canada, 2012)

The Township of Ear Falls maintains a municipal government (MMAH, 2009). Land ownership within the Ear Falls area, including areas of Crown land[2], Crown Reserve[3] lands, parks and reserves and private lands, is shown on Figure 3.

There are a number of Aboriginal communities and organizations in the Ear Falls area, including Asubspeeschoseewagong Netum Anishinabek (Grassy Narrows First Nation), Eagle Lake First Nation, Lac Seul First Nation, Wabaseemoong Independent Nations (Whitedog First Nation) and Waubuskang First Nation. Métis in the area include Kenora Métis Council, Northwest Métis Council, Sunset Country Métis Council, and Atikokan and Area Métis Council as represented by Lake of Woods/Lac Seul, Rainy Lake/Rainy River and Treaty 3 Traditional Territory Consultation Committee and the Métis Nation of Ontario.

Further information on Ear Falls and its surrounding communities is provided in the Community Well Being Profile Report.

## 2.2 Infrastructure

Figure 1 shows the location of the primary infrastructure corridors in the Ear Falls area. The main transportation route is Highway 105 which passes through the center of the Ear Falls area in a north-south orientation, and through the community of Ear Falls. Highway 804 passes from Manitou Falls eastward toward Highway 105. Highway 657 passes from Ear Falls to the northeast. As well, a natural gas pipeline runs approximately parallel to Highway 105 through the Ear Falls area. A 115 kV transmission line corridor divides south of Ear Falls, one headed northwest to Red Lake along Highway 105 and the other, the E1C transmission corridor, headed northeast to Pickle Lake. A third branch extends to the west of Ear Falls to Manitou Falls. These lines are tied to the grid via the E4D transmission line, which runs from Ear Falls to Dryden. There is an airport, the Ear Falls Airport, located to the northwest of Ear Falls, as shown on Figure 1. Available data indicates that no railways are

[1] Area calculated using Geographic Information System (GIS) lower tier 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.

remaining in the Ear Falls area. There are eight operating landfills within the Ear Falls area (five within the Township boundary) and a wastewater treatment plant.

## 2.3 Protected Areas

### 2.3.1 Parks and Reserves

There are two provincial parks and two conservation reserves in the Ear Falls area. Figure 4 shows the location of these protected areas. The Pakwash Provincial Park is 40 $km^2$ in size; it is classed as a natural environment park (Ontario Parks, 2010; LIO, 2012). Its eastern area occupies part of the Township of Ear Falls on the eastern shores of Pakwash Lake; the park is wholly contained with the Ear Falls area. The park includes a campground and day use areas along the lake operated by the Friends of Pakwash, in partnership with the Ontario Ministry of Natural Resources (MNR) and Ontario Parks (Ontario Parks, 2010). The West English River Provincial Park is a waterway park that extends approximately 60 km along the English River from Barnston Lake, approximately 15 km west of the Township of Ear Falls to Tide Lake.

Conservation and forest 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 Bruce Lake Conservation Reserve is located east of Bruce Lake and encompasses approximately 60 $km^2$ of peatland and upland forest (LIO, 2012). The westernmost portion of the reserve is located within the Township of Ear Falls, and the reserve is wholly contained in the Ear Falls area. The Bruce Lake Conservation Reserve is part of the Ontario Living Legacy Program. The Lac Seul Islands Conservation Reserve includes over 1,700 islands on Lac Seul, some of these falling within the Ear Falls area in the southeast.

### 2.3.2 Heritage Sites

The cultural heritage screening examined known archaeological and historic sites in the Ear Falls area, using the Ontario Archaeological Sites Database, the Ontario Heritage Trust Database and the National Historic Sites Database. There are 77 registered archaeological sites in the Ear Falls area, with the majority concentrated around Lac Seul. There are no National or Provincial Historic Sites in the Ear Falls area (Ontario Heritage Trust, 2012; Parks Canada, 2012a; 2012b).

The 77 registered archaeological sites include 63 sites recorded within the archaeological sites database that provide no information (such as time period or cultural affiliation) aside from their location. Of the remaining 14 sites, 12 are identified as pre-contact (prior to European arrival) Aboriginal sites, with three also having a later Euro-Canadian or historical Aboriginal occupation. Two sites have been identified as pre-contact Aboriginal activity sites: one being a Shield Archaic period fishing station and the other Woodland period chipping station. The remaining two sites are Euro-Canadian railway/marine sites. These sites demonstrate a long duration of occupation by both Aboriginal and Euro-Canadian people in the area.

The potential for archaeological and historical sites along the English River and its associated tributaries is considered to be high as it was used as a major transportation route for both Aboriginal and Euro-Canadian people. There is also a high concentration of archaeological sites along Lac Seul, but no information, other than their location, is known.

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 Aboriginal peoples 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.

Forestry is a major industry in the area and the region includes a number of private timber companies currently managing forestry operations. Forest Management Units (FMU) in the vicinity of Ear Falls are presented on Figure 5. There are four FMUs within the Ear Falls area. The Township of Ear Falls lies in the southwestern limit of the Trout Lake FMU, which extends north of the Town of Ear Falls and is managed by Domtar. South of Ear Falls, the Whiskey Jack Forest has been managed by MNR since it was surrendered by Abitibi-Consolidated in 2009. In the northwest corner of the Township of Ear Falls, the east edge of the Red Lake Forest, operated by the Red Lake Forest Management Company, is found. The Lac Seul Forest, operated by McKenzie Forest Product Inc., includes the Lac Seul islands found within the Township boundary.

Within heavily forested areas such as the Ear Falls area there is a risk of forest fires. Locations where forest fires occurred in the vicinity of the Ear Falls area between 1976 and 2010 affecting an area of greater than 200 ha are also shown on Figure 5.

There are currently no producing mines in the Ear Falls area, however approximately 75 million tonnes of iron ore were extracted from the past-producing Griffith Mine, located along the west side of Bruce Lake in the north part of the Township. An on-going exploration program was initiated in 2010 by Northern Iron on the Griffith Property to assess the remaining reserves (Northern Iron, 2012a; 2012b). No other mineral production is known to have occurred in the Township of Ear Falls to date. Several mineral occurrences have been identified in the Ear Falls area and exploration activities have taken place in the past and continue today. Metallic mineralization in the Ear Falls area includes: rare metal pegmatites and radioactive element-enriched pegmatites; iron formation deposits; cobalt-copper-nickel-platinum group metals; volcanogenic massive sulphide (nickel and copper) deposits; and gold.

A number of sand and gravel pits exist within the Township of Ear Falls, mostly located along the Lac Seul moraine which contains at least 15 sand and gravel pit operations. There are, at present, no rock quarrying operations within the Ear Falls area.

As noted in Section 3.3, other land uses include trapping and a commercial bait fishery.

# 3.0 DESCRIPTION OF THE ENVIRONMENT

## 3.1 Physiography

The Canadian Shield region generally has a low-relief, gently undulating land surface with an elevation of about 150 masl (metres above sea level) in the north and about 450 masl in the south. The Township of Ear Falls lies in the Severn Uplands, which comprises broadly rolling surfaces of Canadian Shield bedrock that occupies most of northwestern Ontario and which is either exposed at surface or shallowly covered with Quaternary[4] glacial deposits. Terrains in the Severn Uplands contain numerous lakes and the terrain of the Ear Falls area is typical in that regard. The land surface within the Ear Falls area varies from 316 masl to 452 masl. The northern part of the Township of Ear Falls is in an area of lower relief, dominated by Bruce and Pakwash lakes. In the central portion of the Township there is an area of high relief that trends roughly east-northeast to west-southwest. Further to the south, the topography is still moderately high, although the terrain has been eroded in places by tributaries of the Chukuni River. Surface topography is also high at the southernmost end of the Township of Ear Falls, in the immediate vicinity of the settlement area of Ear Falls. The southwest boundary of the Township is dominated by the low topography of the Chukuni and English Rivers, which partially form the Township boundary itself. At the periphery of the Township of Ear Falls, higher elevations are identified mostly to the east.

The north-south trending Lac Seul moraine is a dominant topographic feature in the Ear Falls area and represents the western extent of glacial ice during a re-advance of the Hudson Bay ice lobe, approximately 9,900 years ago (Teller, 1985). The moraine passes immediately to the east of the settlement area of Ear Falls in a north-south orientation and extends north and south of the Township. Figure 6 presents the topography of the Ear Falls area as a digital elevation model (DEM).

## 3.2 Geology

### 3.2.1 Bedrock Geology

The bedrock geology of the Ear Falls area is shown on Figure 7. Geologically, the municipal boundaries of Township of Ear Falls are situated in the English River 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 closest regional faults to the Township of Ear Falls are the east-west trending Sydney Lake fault and its related splay, the Long Legged Lake fault (Figure 7). The Sydney Lake fault transects the Township of Ear Falls about 7 km north of the settlement area and runs along the approximate boundary between the Uchi and English River Subprovinces for a distance of about 450 km. The Wapesi Lake fault is another fault in the region that lies approximately 30 km southeast of the Township of Ear Falls and runs in an east-northeast direction for about 140 km.

Approximately 60% of the Township of Ear Falls is underlain by a belt of metasedimentary migmatites, which extends significantly beyond the Township boundaries to the east, west and south. The metasedimentary migmatites are intruded by three plutonic masses within the Township of Ear Falls, the Bruce Lake and Pakwash Lake plutons in the northeast corner of the township and the Wenasaga Lake batholith[5] in the east-central portion of the Township. Both the Wenasaga Lake batholith and the Bruce Lake pluton extend east of the Township boundary while the Pakwash Lake pluton extends to the west. Airborne magnetic surveys show

[4] Quaternary refers to the last 2.6 million years of Earth's history.

[5] Batholiths are made of multiple masses, or plutons, of igneous rock that have melted and intruded surrounding strata at great depths.

several magnetic highs within the metasedimentary rocks, including immediately south of Pakwash Lake Provincial Park and immediately southwest of the Township limits, which may suggest the presence of additional unmapped intrusions in these areas. Large intrusive bodies are also present at the periphery of the Township of Ear Falls including the 700 $km^2$ Bluffy Lake batholith located some 12 km to the east of the Township boundary (Figure 7).

### 3.2.2 Quaternary Geology

The Quaternary geology of the Ear Falls area is shown on Figure 8 and is dominated at surface by deposits of glaciolacustrine silts and clays, which extend outside the Township boundaries to the north, east and south. Glaciofluvial deposits are exposed in several areas within the Township of Ear Falls and include a number of small eskers, portions of the Lac Seul moraine and numerous sand bodies scattered about the area. At surface there are also post-glacial deposits of peat, muck and organic-rich silts and clays found in bogs and swamps throughout the area. Recorded depths to bedrock in the Township of Ear Falls range from 0 to 30 m and are typically less than 10 m.

## 3.3 Natural Environment

### 3.3.1 Natural Environment Overview

The Township of Ear Falls is located at the northwestern end of Lac Seul. It is a popular destination for hunting and fishing and is easily accessible due to its location off Highway 105. Walleye and northern pike are sought after as key species in the English River system. The area is used extensively for timber harvesting of various boreal forest species. Historically, the area supported both commercial fisheries and First Nations fisheries. The forests, wetlands and waters provide substantial habitat for a variety of species such as the bald eagle, as Lac Seul harbours the largest population of returning bald eagles in North America (Township of Ear Falls, 2012). The natural environment of the Ear Falls area contains an abundance of plant and animal communities, some of which have special status or designations. The following sections describe the protected natural areas, the terrestrial ecology and aquatic ecology and focus on rare species that may be most sensitive to impacts from alterations or changes to the landscape.

### 3.3.2 Natural Areas

The Pakwash Provincial Park, the Bruce Lake Conservation Reserve and portions of the West English River Provincial Park (waterway class) and Lac Seul Islands Conservation Reserve are located within the Ear Falls area (Figure 9). The Official Plan for the Township of Ear Falls identifies several Environmental Protection Areas (EPAs), but maps depicting the location of these areas are not publicly available (MMAH, 2004). Further investigation will be required in the future to determine if the footprint of the proposed facility coincides with any of these EPAs. There are no Earth Science Areas of Natural and Scientific Interest (ANSI) within either the Township of Ear Falls or the Ear Falls area. The Bruce Lake Peatland is identified as both a Candidate Life Science ANSI and a Life Science Site.

There are no Provincially Significant Wetlands identified within the Township of Ear Falls. Wetlands identified in the natural resources data layers (LIO, 2012) are depicted on Figure 10. The Ear Falls area contains a total of 23,558 ha of wetlands, which is 6% of the land coverage (LIO, 2012). Ground investigations are likely to reveal additional wetland areas that have not been identified in the LIO data. If wetlands are to be impacted by a proposed activity, they may require evaluation of significance according to the Ontario Wetland Evaluation System (OWES).

### 3.3.3 Terrestrial Features and Wildlife

The Ear Falls area lies within the boreal forest region. It contains portions of four separate FMUs; the Trout Lake Forest (FMU 120), the Whiskey Jack Forest (FMU 490), the Lac Seul Forest (FMU 702) and the Red Lake Forest (FMU 840), depicted on Figure 5 (Forest Branch, 2012). The Trout Lake FMU is approximately 1,030,000 ha and is comprised of approximately 71% production forest including primarily jack pine (*Pinus banksiana)*, black spruce (*Picea mariana)* and poplar (*Populus ssp.)* stands (ABRCL, 2005). The Whiskey Jack FMU is approximately 1,148,815 ha, including 65% productive forest including a mix of jack pine, black spruce, poplar, white birch (*Betula papyrifera)*, white spruce (*Picea glauca)*, balsam fir (*Abies balsamea*), cedar (*Thuja ssp.*), red and white pine (*Pinus resinosa* and *Pinus strobus)*, black ash (*Fraxinus nigra)* and larch (*Larix ssp*.) (KBM, 2005). The Lac Seul Forest is approximately 1,100,000 ha, including 77% production forest of black spruce, jack pine, poplar, white spruce, white birch and balsam fir (ABRCL, 2006). The Red Lake FMU is approximately 315,613 ha, of which 68% is considered to be production forest including black spruce and jack pine as the principal tree species (KBM, 2006). Overall, the Ear Falls area contains 281,835 ha of woodlands, which is 76% of the land coverage (LIO, 2012).

Portions of Wildlife Management Units (WMU) 3, 4, 5, 6 and 16A are all found within the Ear Falls area. These areas are considered important for the trapping of furs and hunting of game and Ear Falls is a tourist destination for hunting. Management of woodland caribou (*Rangifer tarandus*), moose (*Alces alces),* marten (*Martes americana)*, and pileated woodpecker (*Dryocopus pileatus*) are a particular concern to the MNR. No known caribou habitat has been identified within the Ear Falls area, but there is a migration route just to the northwest of the Ear Falls area, and caribou may inhabit any part of the boreal forest. Known feeding, wintering and calving sites for moose and deer are depicted on Figure 9. Concentration and nesting areas for raptors, herons and waterfowl are also considered an important management concern; known locations are also depicted on Figure 9.

### 3.3.4 Aquatic Features and Fish

The Ear Falls area is located within the Nelson River Basin and the English River Watershed and this terrain cradles wetlands, lakes and rivers that support a diversity of fish and wildlife. Wetlands, including swamps, marshes and peatlands, are often ecologically sensitive. A total of 18% of the Ear Falls area are mapped as waterbodies (LIO, 2012). A Fisheries Management Plan was written by the MNR in 2010 for Fisheries Management Zone (FMZ) 4, which includes the Ear Falls area (MNR, 2010). The plan applies to all waterbodies, with exceptions for seven Specially Designated Waterbodies (SDWs). Lac Seul is the largest water body within FMZ 4, which is one of the SDWs that has a separate management plan. FMZ 4 is known to have at least 46 species of freshwater fish, spread across 15 families with a high diversity of minnows in particular. 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*), muskellunge (*Esox masquinongy*) and lake whitefish (*Coregonus clupeaformis*) (MNR, 2010). Based on the fish species/communities present, waterbodies are mainly cold and cool water classified, interspersed with the occasional smaller warm waterbody.

The Township of Ear Falls is adjacent to Lac Seul, which is considered to be a major fishery for game fish, especially walleye and muskellunge. These fish populations are managed to maintain and maximize their size and availability to both locals and tourists. In addition to the sports fishery, the area also supports a local baitfish industry. Lake sturgeon (*Acipenser fulvescens*) and shortjaw cisco (*Coregonus zenithicus*) are species that are

classified as threatened in the *Species at Risk Act* (SARA) (Government of Canada, 2012), and can be found within this FMZ. Fish and fish habitat are managed by the MNR and the Department of Fisheries and Oceans (DFO). General information is available publicly for each FMZ, but more detailed information must be obtained directly from these agencies for further investigations.

### 3.3.5 Endangered, Threatened and Special Concern Species

The Natural Heritage Information Centre (NHIC, 2012) records show two occurrences of species that are listed as Endangered (END), Threatened (THR) or Special Concern (SC) either under the Ontario *Endangered Species Act* (ESA), (Government of Ontario, 2007) or the Federal SARA (Government of Canada, 2012) within the Ear Falls area; bald eagle (*Haliaeetus leucocephalus)* and wolverine *(Gulo gulo)* (Table 2). The Royal Ontario Museum range maps (ROM, 2012) were queried, which provide general areas where species at risk may occur, including those of listed species. The Ontario Herpetofaunal Summary Data (Oldham and Weller, 2000), Atlas of the Breeding Birds of Ontario (Cadman et al., 2007), Atlas of the Mammals of Ontario (Dobbyn, 1994), the Ontario Odonata Atlas (2005) and the Ontario Butterfly Atlas (Holmes et al., 1991) were also queried for listed species. Species identified from these sources listed as END, THR or SC that have a range overlapping the Ear Falls area are included in Table 2.

Ten END, THR or SC bird species are listed in Table 2, eight of which were identified in the Atlas of the Breeding Birds of Ontario (OBBA), and the ROM range maps for short-eared owl *(Asio flammeus)* and golden eagle (*Aquila chrysaetos)* overlap the area although there are no known local records. The Ear Falls area is known to host the largest returning nesting population of bald eagles (*Haliaeetus leucocephalus*) in North America (Township of Ear Falls, 2012).

There are several records of wolverine identified by the NHIC within the Ear Falls area. Woodland caribou (*Rangifer tarandus)* habitat is identified in each of the WMUs around the Ear Falls area, although none of these identified habitat areas are within the Ear Falls area, they may occur anywhere within the boreal forest which extends throughout the Ear Falls area.

The range for one THR aquatic species (lake sturgeon) was reported to overlap with the Ear Falls area according to ROM. Shortjaw cisco is also listed as THR; however, its occurrence in the Ear Falls area is unconfirmed.

The common snapping turtle (*Chelydra serpentina*), is listed as SC and is known to occur within the Ear Falls area. One SC invertebrate (monarch butterfly, *Danaus plexippus*) range was also reported to overlap with the Ear Falls area according to ROM.

The records identified here represent known occurrences that have been reported in the past. However, more recent occurrences of species at risk may be on record with the MNR, and available upon request. 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 would be obtained as part of the data requests to agencies which would complement the results of field investigations conducted at the site.

With reference to Table 2, no species of plants, mosses or lichens were identified as END, THR or SC within the Ear Falls area.

**Table 2: Potential Endangered, Threatened and Special Concern Species in the Ear Falls Area**

| Common Name | Scientific Name | ESA Status[a] | SARA Status (Schedule)[b] | Source[c] |
|---|---|---|---|---|
| **Mammals** | | | | |
| Wolverine | *Gulo gulo* | THR | Not at Risk | NHIC, ROM |
| Woodland caribou (Forest-dwelling boreal population) | *Rangifer tarandus caribou* | THR | THR (1) | ROM |
| **Birds** | | | | |
| Bald eagle | *Haliaeetus leucocephalus* | SC | | OBBA, ROM, NHIC |
| Barn swallow | *Hirundo rustica* | THR | | OBBA |
| Black tern | *Chlidonias niger* | SC | | OBBA, ROM |
| Canada warbler | *Wilsonia canadensis* | SC | THR (1) | OBBA, ROM |
| Common nighthawk | *Chordelies minor* | SC | THR (1) | OBBA, ROM |
| Eastern whip-poor-will | *Caprimulgus vociferus* | THR | THR (1) | OBBA |
| Golden eagle | *Aquila chrysaetos* | END | | ROM |
| Olive-sided flycatcher | *Contopus cooperi* | SC | THR (1) | OBBA |
| Rusty blackbird | *Euphagus carolinus* | Not at Risk | SC (1) | OBBA, ROM |
| Short-eared owl | *Asio flammeus* | SC | SC (3) | ROM |
| **Reptiles and Amphibians** | | | | |
| Common snapping turtle | *Chelydra serpentina* | SC | SC (1) | Herp Atlas, ROM |
| **Fish and other Aquatic Species** | | | | |
| Lake sturgeon (Northwestern Ontario Population) | *Acipenser fulvescens* | THR | | ROM |
| Shortjaw cisco | *Coregonus zenithicus* | THR | | ROM |
| **Invertebrates** | | | | |
| Monarch butterfly | *Danaus plexippus* | SC | SC (1) | ROM, Butterfly Atlas |

**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

[a] Status on the Species at Risk of Ontario list of the *Endangered Species Act* (ESA), (Government of Ontario, 2007)

[b] Status listed on the federal *Species at Risk Act* (SARA) (Government of Canada, 2012)

[c] Data obtained from the Natural Heritage Information Centre (NHIC) (NHIC, 2012), Royal Ontario Museum (ROM) range maps (ROM, 2012), Ontario Herpetofaunal Summary Database (Herp Atlas) (Oldham and Weller, 2000), Atlas of the Breeding Birds of Ontario (OBBA) (Cadman et al., 2007), or the Ontario Butterfly Atlas (Holmes et al., 1991)

### 3.3.6 Aboriginal Interests and Traditional Knowledge

Traditional lifestyles, culturally significant wildlife and the extent of sacred and ceremonial locations important to Aboriginal communities 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 are noted in Section 2.3.2, many of which are Aboriginal. Trapline License Areas are located in the extreme northwest corner of the Ear Falls area, as shown on Figure 3, and extend further to the northwest. Figure 9 presents terrestrial ecology mapping for the area and Figure 10 presents aquatic resource mapping. It is likely that Traditional Knowledge would enhance the understanding of these features.

It is recognized that this does not fully represent the environmental interests and concerns of Aboriginal communities in the area and that further information and discussion is required before a more complete picture can be developed. Discussions with Aboriginal groups, community members 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 northwestern Ontario indicate that ground-level ozone and particulate matter fall within normal values compared to the national average (EC, 2011a). Table 3 provides a list of industrial facilities that reported air and water emissions through Environment Canada's National Pollutant Release Inventory (NPRI) database (EC, 2012). The list includes sites in the small communities within the region which have local air emissions, including Kingfisher Lake, Ontario. Additional sources that may affect background air quality include the highways that traverse the area and use of diesel generators in the remote First Nations communities in northwestern Ontario.

**Table 3: NPRI Regional Sources of Air Emissions**

| NPRI ID | Facility Name | City |
|---|---|---|
| 2710 | Goldcorp Canada Limited - Red Lake Gold Mines - Red Lake Gold Mines | Balmertown |
| 10377 | Hydro One Remote Communities Inc. - Big Trout Diesel Generating Station | Big Trout Lake |
| 10379 | Hydro One Remote Communities Inc. - Deer Lake Diesel Generating Station | Deer Lake |
| 10380 | Hydro One Remote Communities Inc. - Fort Severn Diesel Generating Station | Fort Severn |
| 10383 | Hydro One Remote Communities Inc. - Kasabonika Diesel Generating Station | Kasabonika Lake |
| 10384 | Hydro One Remote Communities Inc. - Kingfisher Diesel Generating Station | Kingfisher Lake |
| 10387 | Hydro One Remote Communities Inc. - Sachigo Diesel Generating Station | Sachigo Lake |
| 10388 | Hydro One Remote Communities Inc. - Sandy Lake Diesel Generating Station | Sandy Lake |
| 10390 | Hydro One Remote Communities Inc. - Wapekeka Diesel Generating Station | Wapekeka |
| 10391 | Hydro One Remote Communities Inc. - Weagamow Diesel Generating Station | Weagamow |

### 3.4.2 Background Radiation

The source of background radiation in the Ear Falls area is attributed to naturally occurring radioactive materials (NORM), specifically potassium, uranium and thorium-bearing minerals. The background radiation levels for the Ear Falls area is presented on Figure 11. The dose rate in the Ear Falls area ranges from approximately 20 to 60 nGy/h, with an average of approximately 30 nGy/h. This range of dose rates and average are consistent with regional dose rates for northwestern Ontario. NORM minerals are typically elevated in granitic geology and local dose rate highs are attributed to bedrock at or near surface and areas with sparse tree coverage. These highs are consistent with dose rate highs in other areas of northwestern Ontario.

A recent review of background concentrations of radionuclides in surface waters and soils across Canada has been supplemented by measurements of surface waters sampled at various Canadian sites (NWMO, 2011). There were several sites in Ontario, one of which was on the Canadian Shield at Wabigoon River at the crossing at Highway 17, south of Ear Falls. Results included measured concentrations of cosmogenic radionuclides such as Iodine-129, primordial radionuclides such as uranium and man-made radionuclides. Additional detailed information is available in the geophysical interpretation report (Mira, 2013).

### 3.4.3 Soil Quality

There is no specific information available on background soil quality in the Ear Falls area, although soil concentrations would be expected to be consistent with Ontario Typical Background ranges, as noted in Table 1 of Ontario Ministry of the Environment (MOE) Regulation 153/04 (Government of Ontario, 2004).

### 3.4.4 Water Quality

Potable water supply for the Township of Ear Falls is provided by a water treatment plant operated by Northern Waterworks, drawing its supply from the English River (Chukuni Communities Development Corporation, 2012). No information on water quality recorded at the treatment plant is publicly available on the Township website.

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

### 3.4.5 Lake Sediment Chemistry

The desktop review did not identify any information related to lake sediment chemistry for the Ear Falls area.

### 3.4.6 Potential Sources of Pollutants

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

There are five operating landfill sites within the Township of Ear Falls, listed in Table 4. All sites are classified as small landfills. Of these, a mapped location is available in the Land Information Ontario dataset for the Chukuni River Landfill only (Figure 1) (LIO, 2012). As well, there are three additional small landfills within the Ear Falls area outside of the Township boundary for which spatial locations are provided in Figure 1 (LIO, 2012), listed in Table 4.

**Table 4: Registered Landfills in the Ear Falls Area**

| Certificate of Approval (C of A) Number | Site Name | Location | Status |
|---|---|---|---|
| 6207-698LV7 | Ear Falls Sawmill | Part 1, Plan 23R-9716 | Open |
| | Client: Domtar Inc. | Twp of Ear Falls | |
| A600011 | Chukuni River Landfill | 1800 feet N of Hwy 105 and W of Chukuni River | Open |
| | Client: Ministry of Natural Resources | Twp of Ear Falls | |
| A600013 | Wenasaga Lake Landfill | 1 mile N of an access Rd. off South Bay Mine Rd. and 800 feet west of the Rd | Closed |
| | Client: Ministry of Natural Resources | Twp of Ear Falls | |
| A600016 | Pakwash Lake Landfill | Off Hwy 105 approximately 1000 feet East of Hwy across from entrance to Pakwash Provincial Park | Open |
| | Client: Ministry of Natural Resources | Twp of Ear Falls | |
| A7107001 | Ear Falls Landfill | Hwy 105 | Open |
| | Client: Ear Falls Landfill | Twp of Ear Falls | |
| A7429301 | Ear Falls Landfill - Sludge Site | Hwy 105 | Open |
| | Client: Ear Falls Landfill - Sludge Site | Twp of Ear Falls | |
| A7403101 | Gleave Lake Landfill | 23 km NE of Ear Falls between South Bay Rd. and Gleane Rd., Gleave Lake Rd. | Open |
| | Client: Ministry of Natural Resources | Unorganized | |
| A600019 | Scout Bay Landfill | DR - 13 West side of Hwy 105 south of Scout Bay, Lac Seul | Open |
| | Client: Ministry of Natural Resources | Unorganized | |
| A7433302 | Camping Lake Landfill | Camping Lake | Open |
| | Client: Ministry of Natural Resources | Unorganized | |

**Source:** Ontario Landfills List (MOE, 2010)

Transportation corridors, such as Highway 105, secondary roads and logging roads, traverse the Ear Falls 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 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 Ear Falls area is located within the English River Basin which drains into the Nelson River Drainage Area, and eventually, into Hudson Bay. In the Ear Falls area, the English River Basin can be sub-divided into the following into three sub-basins: Central English, Chukuni and Lower English sub-basins. Surface water

generally flows from the upland areas in the north and east towards lower elevations in the southwest. Watershed boundaries and surface water drainage for the Ear Falls area are shown on Figure 12. The English River is the outflow from Lac Seul and it exits the lake at the southeast corner of the Township of Ear Falls. Water levels in Lac Seul are controlled by a hydroelectric dam operated by Ontario Power Generation. The English River flows to the west, to where it joins the Chukuni River and then flows south into Camping Lake, and further to the southwest, where it is joined by the Wabigoon River, eventually joining the Winnipeg River. Given the moderate sized catchment areas and variable terrain, there may be some potential for flooding in low lying areas along major rivers.

## 3.6 Groundwater and Wells

Information concerning groundwater in the Ear Falls area was obtained from the MOE Water Well Record (WWR) database (MOE, 2012). The locations of known water wells are shown on Figure 12. There are relatively few wells recorded in the Township of Ear Falls, since most of the approximately 1,170 residents obtain water from the municipal system that obtains its water from the English River. A number of scattered wells serving individual private residences exist mostly along Highway 105 and Separation Lake Road.

Water wells in the Ear Falls area obtain water from the overburden or the shallow bedrock. The shallow bedrock is the primary source of exploitable groundwater, while overburden basal sand and gravel deposits, where present, are also used as a groundwater source. The MOE water well database contains 56 discrete water well records containing useable information[6] in the Ear Falls area (Figure 12). A summary of aquifer, yield and other parameters is provided in Table 5.

**Table 5: Water Well Record Summary for the Ear Falls Area**

| Water Well Type | Number of Wells | Total Well Depth (m) | Median Well Depth (m) | Static Water Level (m below surface) | Tested Well Yield (L/min) | Depth to Top of Bedrock (m) |
|---|---|---|---|---|---|---|
| Overburden | 27 | 2.5 to 41 | 17.3 | 0 to 15 | 4.5 to 450 | N/A |
| Bedrock | 29 | 11 to 134 | 39.6 | 0 to 24 | 4.5 to 136 | 0 to 38 |

### 3.6.1 Overburden Aquifers

There are 27 water well records in the Ear Falls area that can be confidently assigned to the overburden aquifer. These wells generally are 2.5 to 41 m deep and have pumping rates of 4.5 to 450 L/min. These values reflect the purpose of the wells (private residential supply) and do not necessarily reflect the maximum sustained yield that might be available from the aquifers.

Water well records indicate that sand or sand/gravel overburden aquifers are present along the Lac Seul Moraine and along Highway 105 and Separation Lake Road. The Lac Seul Moraine is the most readily mapped overburden aquifer in the Ear Falls area (Figure 8).

The limited number of well records and their concentration along the main roadways limits the available information regarding the extent and characteristics of the overburden aquifers in the Ear Falls area. However,

[6] Wells having no depth or stratigraphic information are excluded.

as several of these water wells are located within glaciofluvial terrain, it is likely that similar terrain mapped in the Ear Falls area will also host shallow overburden aquifers.

### 3.6.2 Bedrock Aquifers

No information was found on deep bedrock groundwater conditions in the Ear Falls area at a typical repository depth of approximately 500 m. In the Ear Falls area there are 29 well records that can be confidently assigned to the shallow bedrock aquifer. These wells range from 11 to 134 m in depth, with most wells between 30 to 40 m deep. Measured pumping rates in these wells are variable and range from 4.5 L/min to 136 L/min with yields typically between 30 to 40 L/min. As previously discussed, 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. Long-term groundwater yield in fractured bedrock will depend on the number and size of fractures, their connectivity, transmissivity, storage and on the recharge properties of the fracture network in the wider aquifer.

No potable water supply wells are known to exploit aquifers at typical repository depths in the Ear Falls area or anywhere else in northern Ontario. Experience from other areas in the Canadian Shield has shown that active groundwater flow is generally confined to shallow fractured localized systems. In these shallow regions, flow tends to be dependent on the secondary permeability created by fractures (Singer and Cheng, 2002). 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 Ear Falls area has a typical boreal climate and is characterized by long, usually cold winters, and short, cool to mild summers. The flow of air masses is dominated by Arctic airstreams in winter and spring. In summer and fall, the Arctic air masses are replaced by westerly and southwesterly air currents from the Pacific, Canadian prairies and American upper Midwest.

Most precipitation falls between May through September from low pressure areas that are primarily formed in the American upper Midwest and the Canadian prairies. During the winter, Arctic low pressure areas move southward into the region bringing very cold temperatures and little precipitation.

Climatological information presented in this section is based on meteorological data from Environment Canada's meteorological station located in Ear Falls, Ontario. It has more than 30 years of continuous data, although the hourly records only started approximately 12 years ago.

### 3.7.1 Temperature

Temperature data was obtained from Environment Canada's 1971-2000 climate normals for the Ear Falls meteorological station (EC, 2011b). Figure 13 presents monthly temperatures for Ear Falls, displaying daily average, maximum and minimum and extreme values over the calendar year.

### 3.7.2 Precipitation

Figure 14 presents monthly precipitation data obtained from Environment Canada's 1971-2000 climate normals for the Ear Falls meteorological station, including total rainfall, rainfall, snowfall and all-time extreme values over the calendar year (EC, 2011b).

### 3.7.3 Wind

Figure 15 presents annual and seasonal wind rose diagrams for data obtained from 2002 to 2011 at the Ear Falls meteorological station (EC, 2011b). Wind rose diagrams for the Ear Falls meteorological station shows predominantly westerly to northwesterly winds during summer to winter season, while spring season shows predominantly easterly to southeasterly winds.

At the Red Lake meteorological station, approximately 60 km northwest of the Ear Falls area, 30-year or more of wind observations have been recorded. A comparison between Red Lake meteorological station and 10-year wind observations at the Ear Falls meteorological station is also conducted for this report in order to present an additional overview of long-term wind pattern around the Ear Falls area. The comparison concludes that local wind conditions at Red Lake airport have similar seasonal and annual patterns when compared to Ear Falls. Table 6 illustrates the monthly normal value for winds obtained from Environment Canada's 1971-2000 Red Lake (A) meteorological station (EC, 2011b).

**Table 6: Monthly Wind Normals for Red Lake, Ontario**

| Parameter | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Speed (km/h) | 9.4 | 9.7 | 11 | 11.5 | 11.7 | 11.5 | 10.7 | 10.5 | 11.9 | 12.8 | 12 | 9.9 | 11.1 |
| Most Prevalent Direction | NW | NW | SE | SE | SE | SE | NW | SW | NW | NW | NW | SE | NW |

## 3.8 Natural Hazards

### 3.8.1 Earthquakes and Seismicity

The Ear Falls 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 Ear Falls area has a low seismic hazard rating (NRCan, 2010). Since 1627, no earthquakes exceeding a magnitude $m_N$ 6 have been known to occur within 1,000 km of the Ear Falls area. According to the National Earthquake Database (NEDB) for the period between 1985 and 2011 (NRCan, 2012) all recorded seismic events in the Ear Falls area had magnitudes $m_N$ ranging from less than 1 to 3.2.

Ma et al. (2008) have recently pointed out the existence of small swarms of microseismic activity in the physiographic Severn Highlands of northwestern Ontario, which roughly extends west and north-northwest of Lake Nipigon. The closest such occurrence was the Dryden swarm, which occurred in 2002-2003 just north of the Town of Dryden and southeast of the Ear Falls area, with a total of 22 events recorded, the largest having a magnitude $m_N$ of 3.2. These events may be related to post-glacial rebound and appear to correlate to a particularly thick and cold lithospheric root beneath the Severn Uplands.

In summary, available literature and recorded seismic events indicate that the Ear Falls 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 Ear Falls area are low, ranging from 9 to 13 km/hr. The Ear Falls area experiences thunderstorms in the summer months and is located in an area with a low tornado frequency (<0.5 tornadoes per year / 10,000 km$^2$), but where there is a potential for F2-F5 tornadoes

(Sills et al., 2012). The Ear Falls area is situated is too far away from the Atlantic Ocean to be susceptible to hurricanes. The National Building Code of Canada recommends a design 1/50 maximum hourly wind pressure for the Red Lake area of 0.30 kPa, which is a typical value for northern Ontario (NRC, 2010).

### 3.8.3 Drought and Flooding

According to precipitation climate normals for the region (Figure 14), the Ear Falls area experiences on average between 20 and 100 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 Ear Falls station (Figure 14) are 33 mm of rain and 85 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 Ear Falls area lies within several drainage areas, making size of the upstream catchments areas moderate. The moderate catchment size in combination with variable terrain makes the overall risk of significant flooding in the Ear Falls area low, with a possible risk of flooding in low lying areas along major river systems. The potential risk of drought or flooding affecting the facility will also depend to some degree on the specific location selected.

### 3.8.4 Snow and Ice

As noted on Figure 14, the Ear Falls area receives on average about 170 cm of snowfall per year, primarily between the months of October and April. No single month receives an average snowfall greater than 35 cm. There are usually one or two high snowfall events per year, with accumulations of 30 cm or greater, noting that the highest single day snowfall accumulation on record is 85 cm, recorded on November 23, 1983. The National Building Code of Canada recommends a design 1/50 snow load ($S_s$ + $S_r$) for the Red Lake area of 2.7 kPa, which is a typical value for northern Ontario (NRC, 2010). Local lakes and waterbodies freeze over in the winter months in the Ear Falls area, as average daily temperatures from November to March typically range from -19 to -7$^{o}$C.

### 3.8.5 Forest Fires and Lightning

Within heavily forested areas such as the Ear Falls area there is a risk of forest fires. Locations where forest fires have occurred in the vicinity of the Ear Falls area between 1976 and 2010 affecting an area of greater than 200 ha are shown on Figure 5. These forest fires combine to comprise approximately 3% of the total Ear Falls 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 do occur in the Ear Falls area and lightning strikes are not uncommon in the summer months.

### 3.8.6 Landslides and Tsunamis

Moderately steep slopes in the Ear Falls area, where present, are generally comprised of crystalline rock with only a thin veneer of soil cover. The physical nature of these slopes, combined with typically modest precipitation and low seismicity, results in a low landslide risk for the Ear Falls area. There is no risk of tsunamis in the Ear Falls area, owing to the very low seismicity and lack of large water bodies.

# 4.0 SUMMARY

This report provides a general description of the environment in the Township of Ear Falls and surrounding area.

Situated in the District of Kenora, approximately 98 km northwest of Vermillion Bay and 65 km southeast of Red Lake, the Township of Ear Falls is approximately 350 km² in size, with a population of 1,026 (Statistics Canada, 2012). The Ear Falls area has a typical boreal climate and is characterized by long, usually cold winters, and short, cool to mild summers. Most precipitation falls between May through September from low pressure areas formed in the American upper mid-west and the Canadian prairies. During the winter, Arctic low pressure areas move southward into the region bringing very cold temperatures and little precipitation.

There are a number of Aboriginal communities and organizations in the Ear Falls area, including Asubspeeschoseewagong Netum Anishinabek (Grassy Narrows First Nation), Eagle Lake First Nation, Lac Seul First Nation, Wabaseemoong Independent Nations (Whitedog First Nation) and Waubuskang First Nation. Métis in the area include Kenora Métis Council, Northwest Métis Council, Sunset Country Métis Council, and Atikokan and Area Métis Council as represented by Lake of Woods/Lac Seul, Rainy Lake/Rainy River and Treaty 3 Traditional Territory Consultation Committee and the Métis Nation of Ontario.

The Township of Ear Falls lies in the Severn Uplands, featuring the broadly rolling surfaces of Canadian Shield bedrock that occupies most of northwestern Ontario; either exposed at surface or shallowly covered with Quaternary glacial deposits. The north-south trending Lac Seul moraine is a dominant topographic feature in the Ear Falls area. Geologically, the Township of Ear Falls is situated in the English River Subprovince, which is part of the western region of the Superior Province of the Canadian Shield. There are three intrusive plutonic masses within the Township of Ear Falls, the Bruce Lake and Pakwash Lake plutons in the northeast corner of the township and the Wenasaga Lake batholith in the east-central portion of the Township. Large intrusive bodies are also present at the periphery of the Township of Ear Falls, including the 700 $km^2$ Bluffy Lake batholith located approximately 12 km to the east of the Township boundary.

There are currently no producing mines in the Ear Falls area, however approximately 75 million tonnes of iron ore were extracted from the past-producing Griffith Mine, located along the west side of Bruce Lake in the north part of the Township. There is further exploration underway at the Griffith mine site at present. No other mineral production is known to have occurred in the Township of Ear Falls to date; however, several mineral occurrences have been identified in the Ear Falls area and exploration activities have taken place.

Infrastructure within the Ear Falls area includes Highway 105 heading north-south through the community of Ear Falls. As well, a natural gas pipeline corridor runs approximately parallel to Highway 105 through the Ear Falls area, as do two 115 kV transmission line corridors. There is an airport, the Ear Falls Airport, located to the northwest of Ear Falls. Available data indicates that no railways are remaining in the Ear Falls area. There are two provincial parks: Pakwash Provincial Park and the West English River Provincial Park (waterway park) and two conservation reserves: Bruce Lake Conservation Reserve and Lac Seul Islands Conservation Reserve, located in the Ear Falls area.

Ear Falls lies within the boreal forest, including primarily jack pine, black spruce and poplar stands with some areas of white birch, white spruce, balsam fir, cedar, red and white pine, black ash and larch (ABRCL, 2005; KBM, 2005; ABRCL, 2006; KBM, 2006). Forestry is a major industry in the area and the region includes a number of private timber companies currently managing forestry operations. The Township of Ear Falls lies in the southwestern limit of the Trout Lake FMU, managed by Domtar. South of Ear Falls, the Whiskey Jack Forest

has been managed by MNR since it was surrendered by Abitibi-Consolidated in 2009. In the northwest corner of the Township, the east edge of the Red Lake Forest, operated by the Red Lake Forest Management Company is found and the Lac Seul Forest, operated by McKenzie Forest Product Inc. includes the Lac Seul Islands found within the Township boundary.

The region's forests provide habitat for wildlife including game, furbearing mammals and fish. Management of woodland caribou (threatened provincially and federally), moose, marten and pileated woodpecker are a particular concern to the MNR. No known woodland caribou habitat has been identified within the Ear Falls area, but there is a defined migration route just to the northwest of the Ear Falls area, and caribou may inhabit any part of the boreal forest. The Natural Heritage Information Centre (NHIC, 2012) identified two species - bald eagle and wolverine - observed within the Ear Falls area that are listed as endangered, threatened or special concern either under the Ontario *Endangered Species Act* (Government of Ontario, 2007) or the Federal *Species at Risk Act* (Government of Canada, 2012) Using habitat range mapping, an additional 14 endangered, threatened or special concern species were identified to have a range that overlaps the Ear Falls area (ROM, 2012; Oldham and Weller, 2000; Cadman et al., 2007; Holmes et al., 1991). In particular, several records of wolverine (provincially threatened and special concern nationally) have been recorded within the Ear Falls area. The range for provincially endangered golden eagle may extend to the region. The Ear Falls area is known to host the largest returning nesting population of bald eagles (provincially of special concern) in North America (Township of Ear Falls, 2012).

The Ear Falls area is located within the English River Basin of the Nelson River Drainage Area and this terrain cradles wetlands, lakes and rivers that support a diversity of fish and wildlife. Waterbodies in the Ear Falls area are mainly cold and cool water classified, interspersed with the occasional smaller warm waterbody. The Township of Ear Falls is adjacent to Lac Seul, which is considered to be a major fishery for game fish, especially walleye and muskellunge. In addition to the sports fishery, the area also supports a local baitfish industry. Lake sturgeon and shortjaw cisco are species that are classified as threatened in the SARA, and can be found within the Fisheries Management Zone (FMZ 4) within the Ear Falls area. The northwestern Ontario population of lake sturgeon are also classified provincially as threatened.

Water wells in the Ear Falls area obtain water from the overburden or the shallow bedrock. The MOE water well database contains 56 discrete water well records which contain stratigraphic information in the Ear Falls area. No potable water supply wells are known to exploit aquifers at typical repository depths in the Ear Falls area or anywhere else in northern Ontario.

Air, soil and surface water quality within the Ear Falls area are expected to be within the normal range for northwestern Ontario. Sources of background radioactivity in the Ear Falls 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 northwestern Ontario.

The Ontario Archaeological Sites Database identified 77 registered archaeological sites in the Ear Falls area, with concentration along the shores of Lac Seul. The potential for archaeological and historical sites around Lac Seul is considered to be high given the sites already documented within and around the lake; the presence of local heritage sites would need to be confirmed in discussion with the community and Aboriginal peoples in the area. The potential for archaeological and historical sites around English River and its main tributaries is also considered to be high as it was a major transportation corridor for both Aboriginal and Euro-Canadians.

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# Report Signature Page

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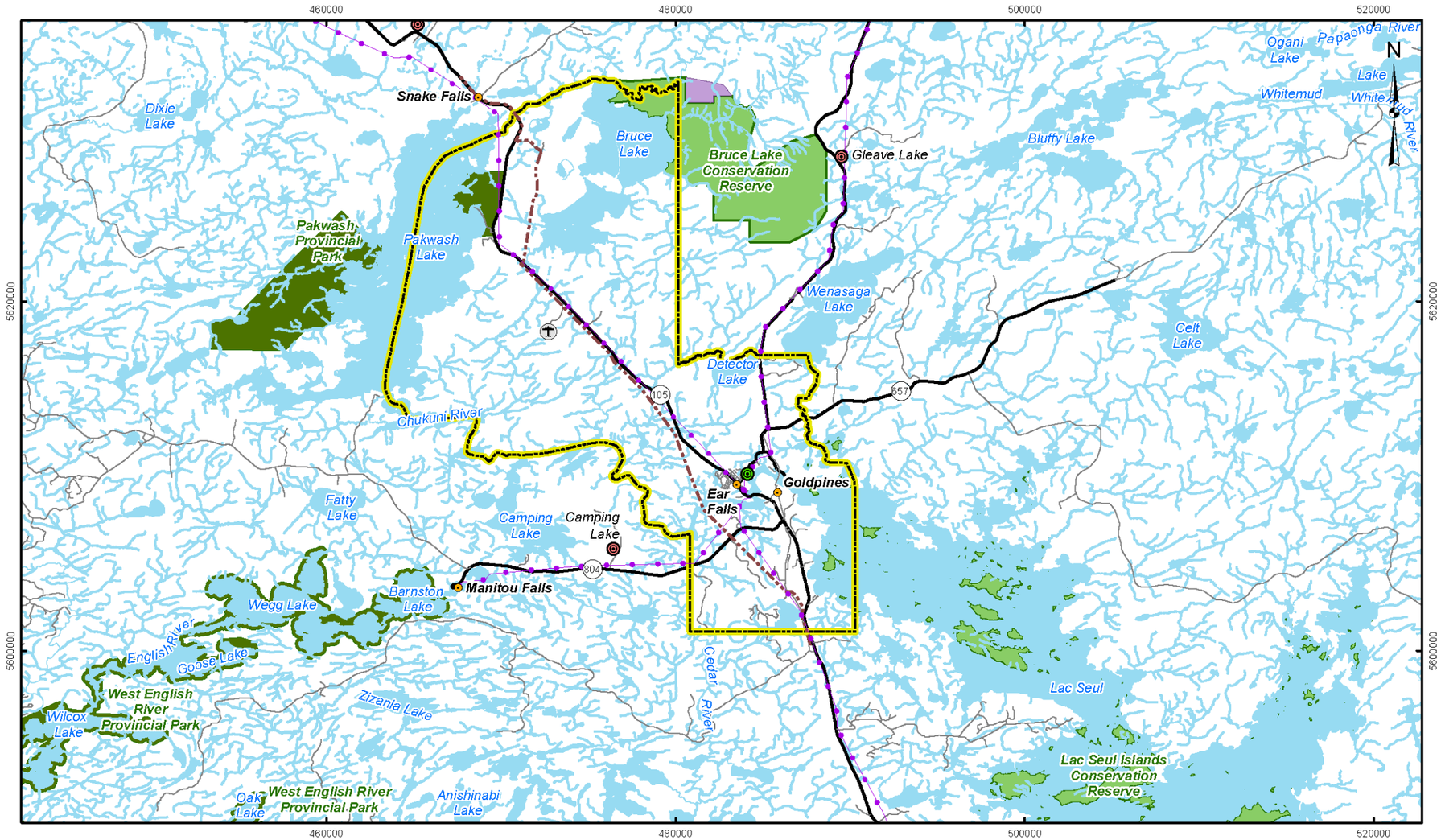
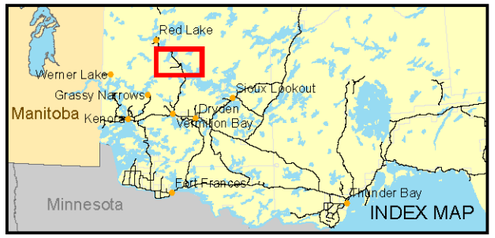
# FIGURES




## LEGEND

- Community
- Airport
- Domestic Waste Site
- Waste Water Treatment Plant
- Main Road
- Local Road
- 115 kV Transmission Line
- Natural Gas Pipeline
- Watercourse, Permanent
- Watercourse, Intermittent
- Water Area, Permanent
- Forest Reserve
- Conservation Reserve
- Provincial Park
- Municipal Boundary
- Municipal Boundary (Township of Ear Falls)




## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

PROJECT
Environment Report
Township of Ear Falls, Ontario

TITLE
**Ear Falls and Surrounding Lands**

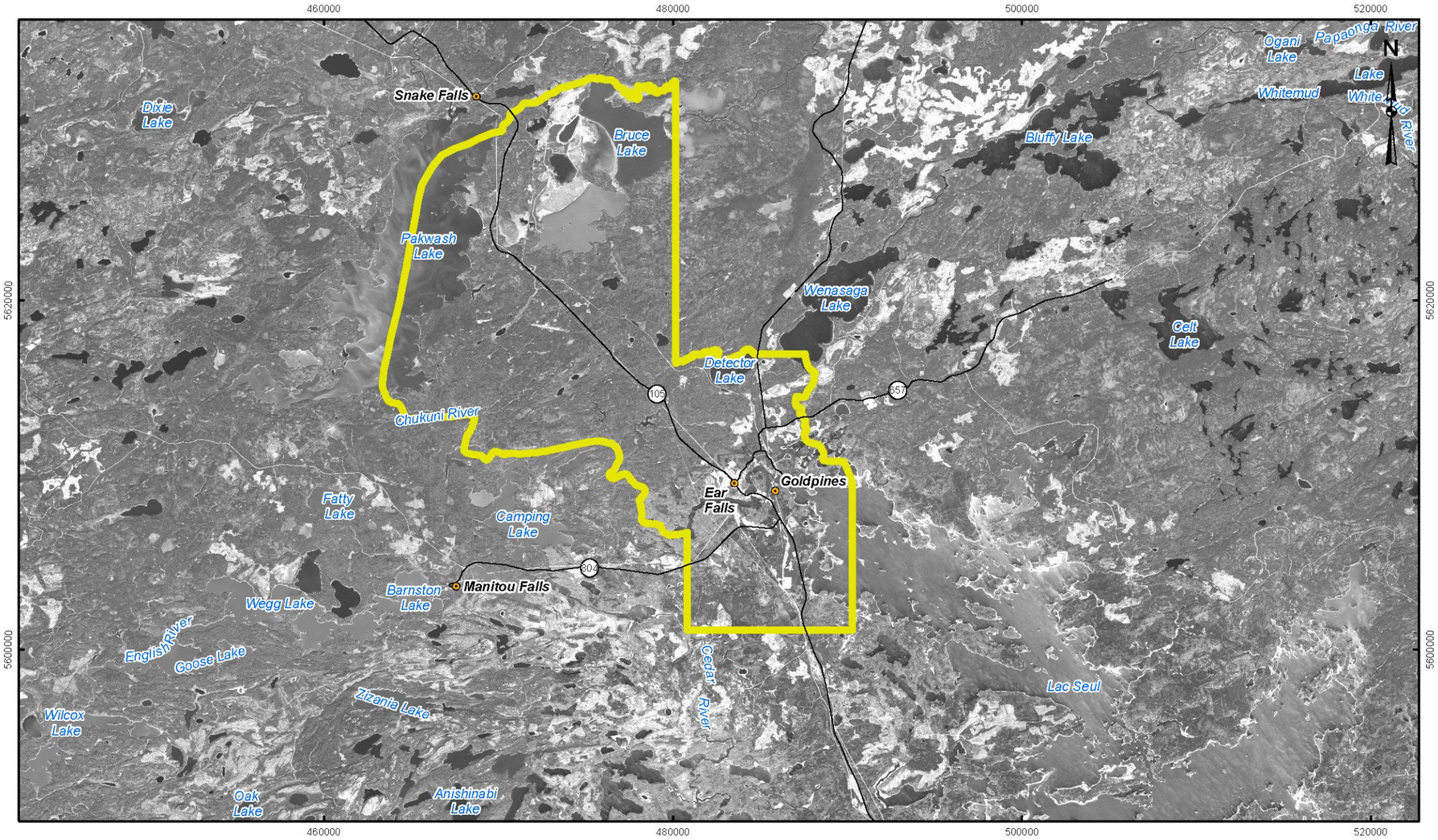
Golder Associates
Mississauga, Ontario

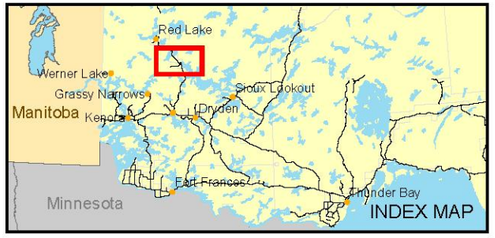
| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 11 May. 2012 | FIGURE: 1 | |
| GIS | PMJB | 21 Oct. 2013 | | |
| CHECK | JH | 21 Oct. 2013 | | |
| REVIEW | GWS | 21 Oct. 2013 | | |

G:\Projects\2012\12-1152-0026_NWMO_Phase1_FeasibilityGIS\MXDs\Reporting\Env_Safety_Report\Ear FallsEarFallsAndSurroundingLands.mxd

## LEGEND

- Community
- Main Road
- Municipal Boundary (Township of Ear Falls)




## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Imagery - Spot 5, Obtained from Geobase (2006, 10m resolution)
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

PROJECT
Environment Report
Township of Ear Falls, Ontario

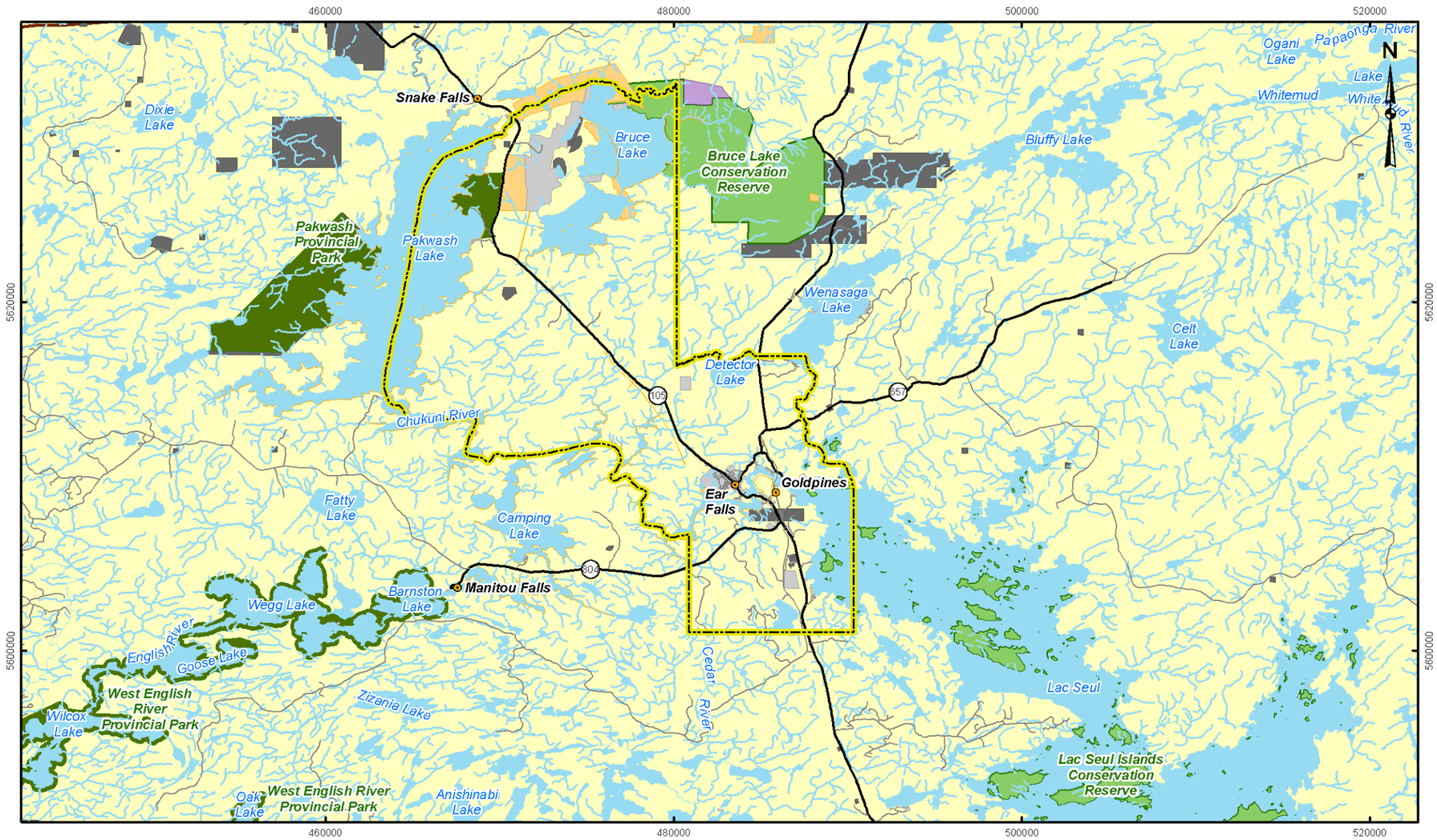
TITLE
**Satellite Imagery of the Ear Falls Area**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-00026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | | |
| GIS | PM/JB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

**FIGURE: 2**

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Ear Falls\EarFallsSatelliteImagery.mxd




## LEGEND

- Community
- Main Road
- Local Road
- Watercourse, Permanent
- Watercourse, Intermittent
- Water Area, Permanent
- Forest Reserve
- Conservation Reserve
- Provincial Park
- Private Land
- Federal Land - Indian Reserve
- Crown Leased Land
- Crown Land - Non-Freehold Dispositions Public
- Crown Land - Unpatented Public Land
- Crown Reserves
- Regular Registered Trapline Area License
- Municipal Boundary
- Municipal Boundary (Township of Ear Falls)


## REFERENCE

Base Data - MNR NRVIS, obtained 2009, CANMAP v2006.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

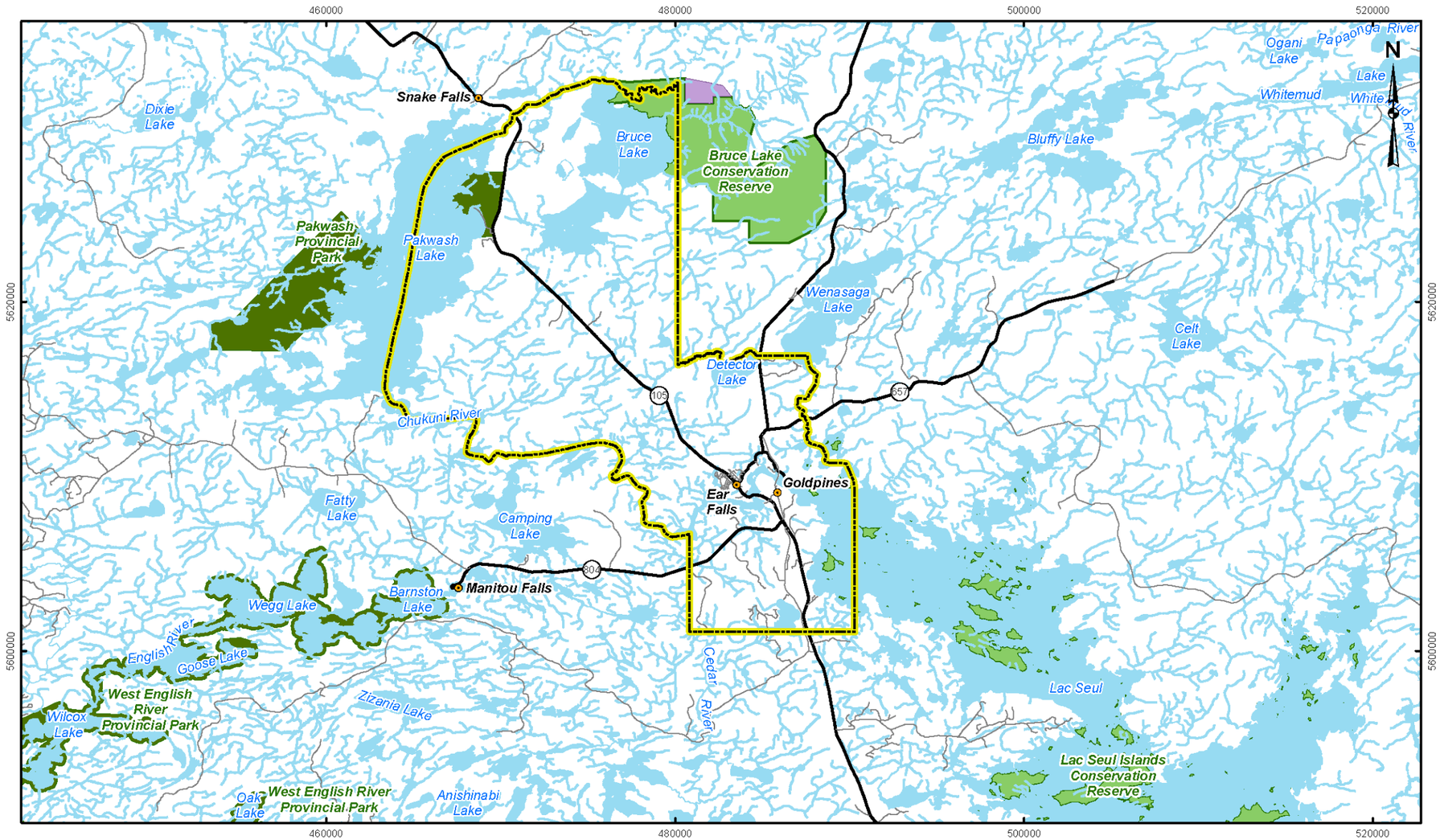
PROJECT
Environment Report
Township of Ear Falls, Ontario

TITLE
**Ear Falls Area Land Ownership**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | **FIGURE: 3** | |
| GIS | PMJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

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




## LEGEND

- Community
- Main Road
- Local Road
- Watercourse, Permanent
- Watercourse, Intermittent
- Water Area, Permanent
- Forest Reserve
- Conservation Reserve
- Provincial Park
- Municipal Boundary
- Municipal Boundary (Township of Ear Falls)


## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP 2006.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

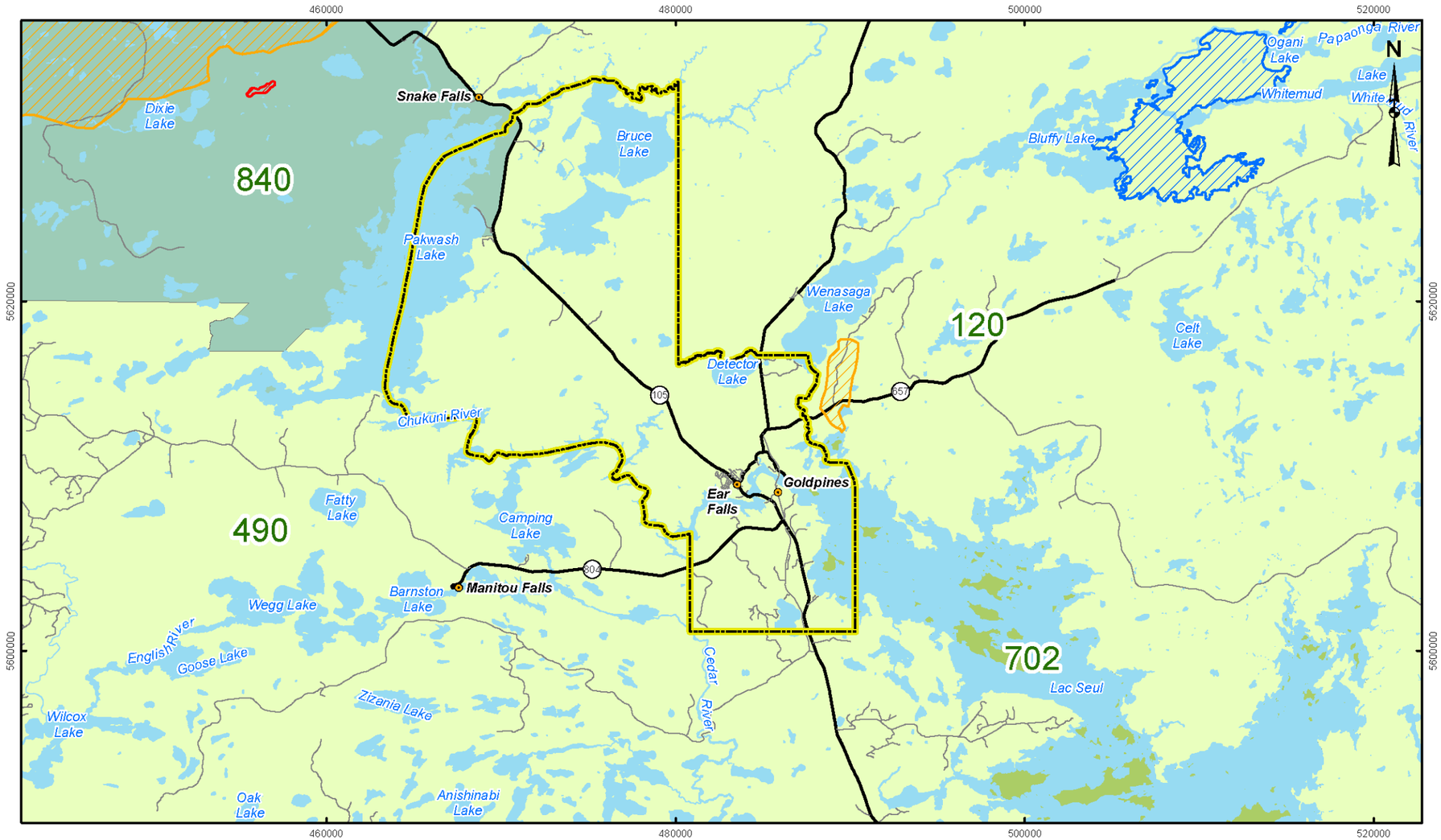
PROJECT
Environment Report
Township of Ear Falls, Ontario

TITLE
**Ear Falls - Parks and Protected Land**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | **FIGURE: 4** | |
| GIS | PMJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

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




## LEGEND

- Community
- Main Road
- Local Road
- Water Area, Permanent
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Ear Falls)

**Forest Fire Areas (greater than 200 hectares)**

- 1976 - 1980
- 1981 - 1990
- 1991 - 2000
- 2001 - 2010

**Plan Renewal Year**

- 2013
- 2014
- 2015
- 2016
- 2017

## FOREST MANAGEMENT UNITS

120 - Trout Lake Forest
490 - Whiskey Jack Forest
702 - Lac Seul Forest
840 - Red Lake Forest


## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, 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.
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15

SCALE 1:275,000 KILOMETRES

PROJECT

Environment Report
Township of Ear Falls, Ontariort

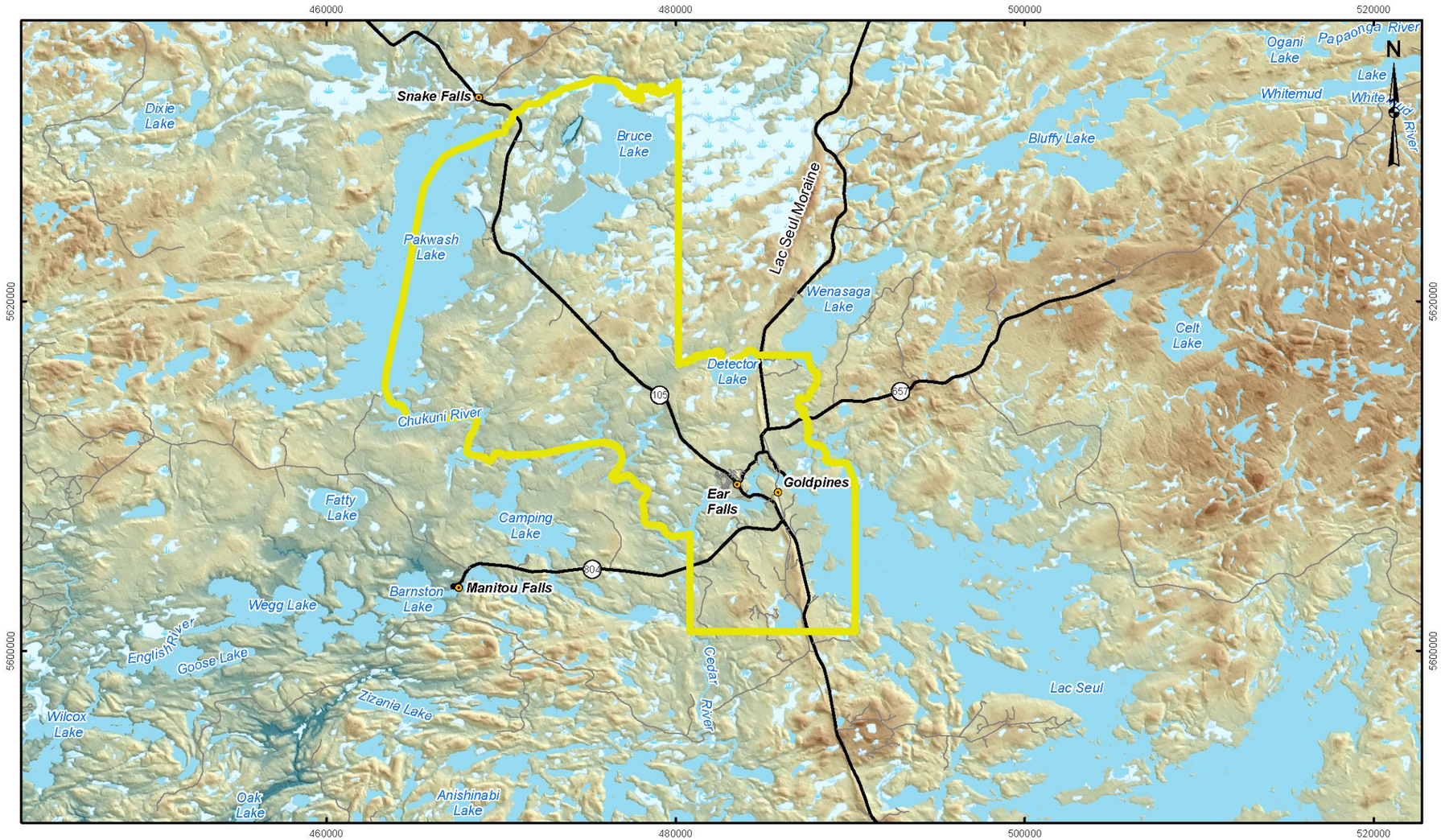
TITLE

**Forest Management Units of the Ear Falls Area**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | **FIGURE: 5** | |
| GIS | PNJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Ear Falls\EarFallsForestManagementUnits.mxd




## LEGEND

- Community
- Main Road
- Local Road
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary (Township of Ear Falls)

**Elevation (masl)**

490
455
425
390
355
325
290


## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Digital Elevation Model - CDED slope raster: Geobase.ca (1:50,000)
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

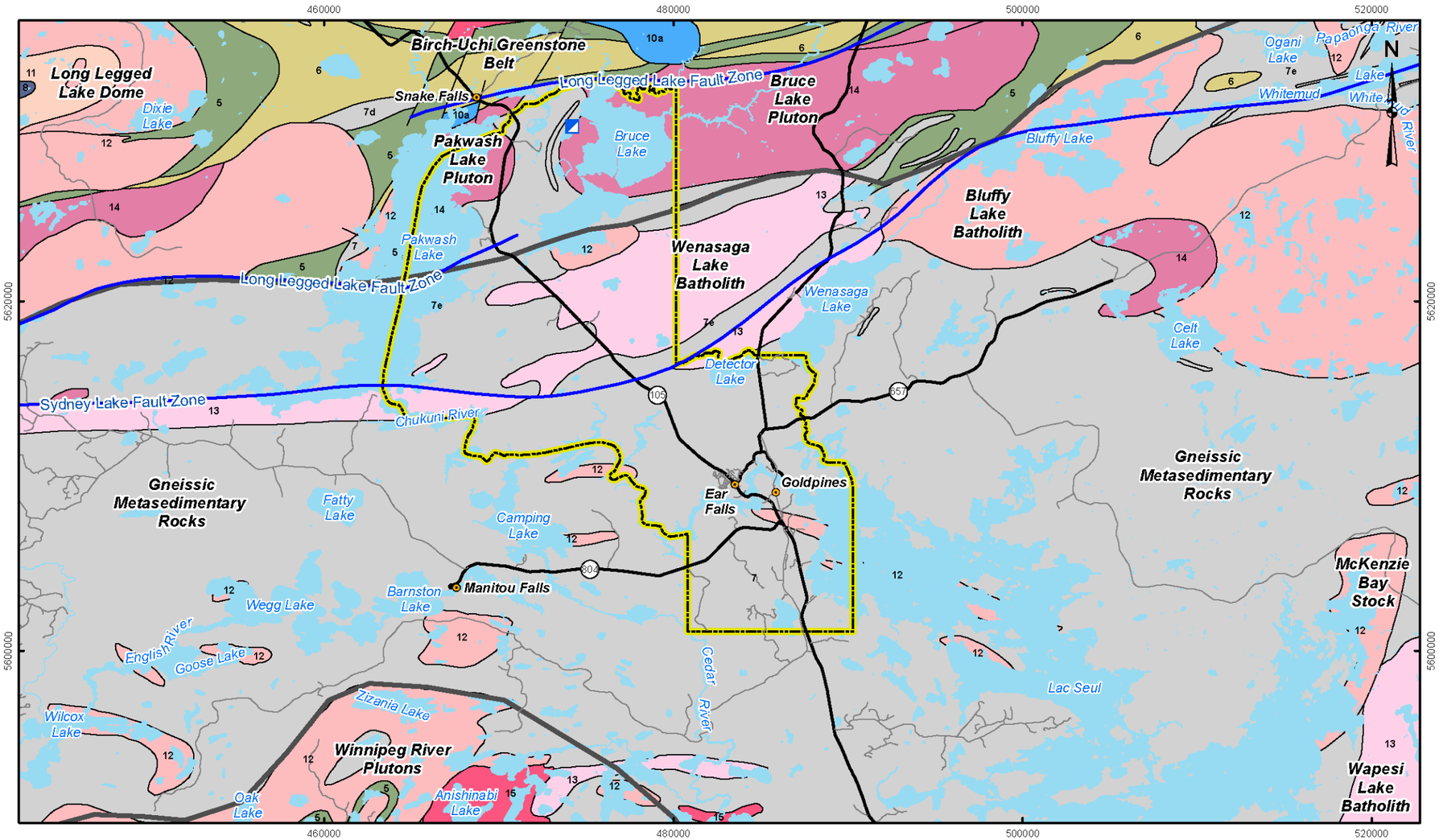
PROJECT
Environment Report
Township of Ear Falls, Ontario

TITLE
**Digital Elevation Model (DEM) of the Ear Falls Area**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | **FIGURE: 6** | |
| GIS | PM/JB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Ear Falls\EarFalls\DigitalElevationModel.mxd




## LEGEND

- Community
- Past Producing Mine with Reserves
- Main Road
- Local Road
- Water Area, Permanent
- Geological Fault
- Geological Contact
- Sub-province Boundary (approximate)
- 15 Massive granodiorite to granite
- 14 Diorite-monzodiorite-granodiorite suite
- 13 Muscovite-bearing granitic rock
- 12 Foliated tonalite suite
- 11 Gneissic tonalite suite
- 10 Mafic and ultramafic rocks
  - 10a Gabbro
- 8 Migmatized supracrustal rocks
- 7 Metasedimentary rocks
  - 7c Marble, chert, iron formation, minor metavolcanic rocks
  - 7d Conglomerate and arenite
  - 7e Paragneiss and migmatites
- 6 Felsic to intermediate metavolcanic rocks
- 5 Mafic to intermediate metavolcanic rocks
- Municipal Boundary (Township of Ear Falls)


## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Geology - MRD126-Bedrock Geology of Ontario, 2011
Physiographic Regions of Ontario - Thurston, P. C. 1991 Geology of Ontario: Introduction in Geology of Ontario, Ontario Geological Survey, Special Volume 4, Part 1, p.26-57
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

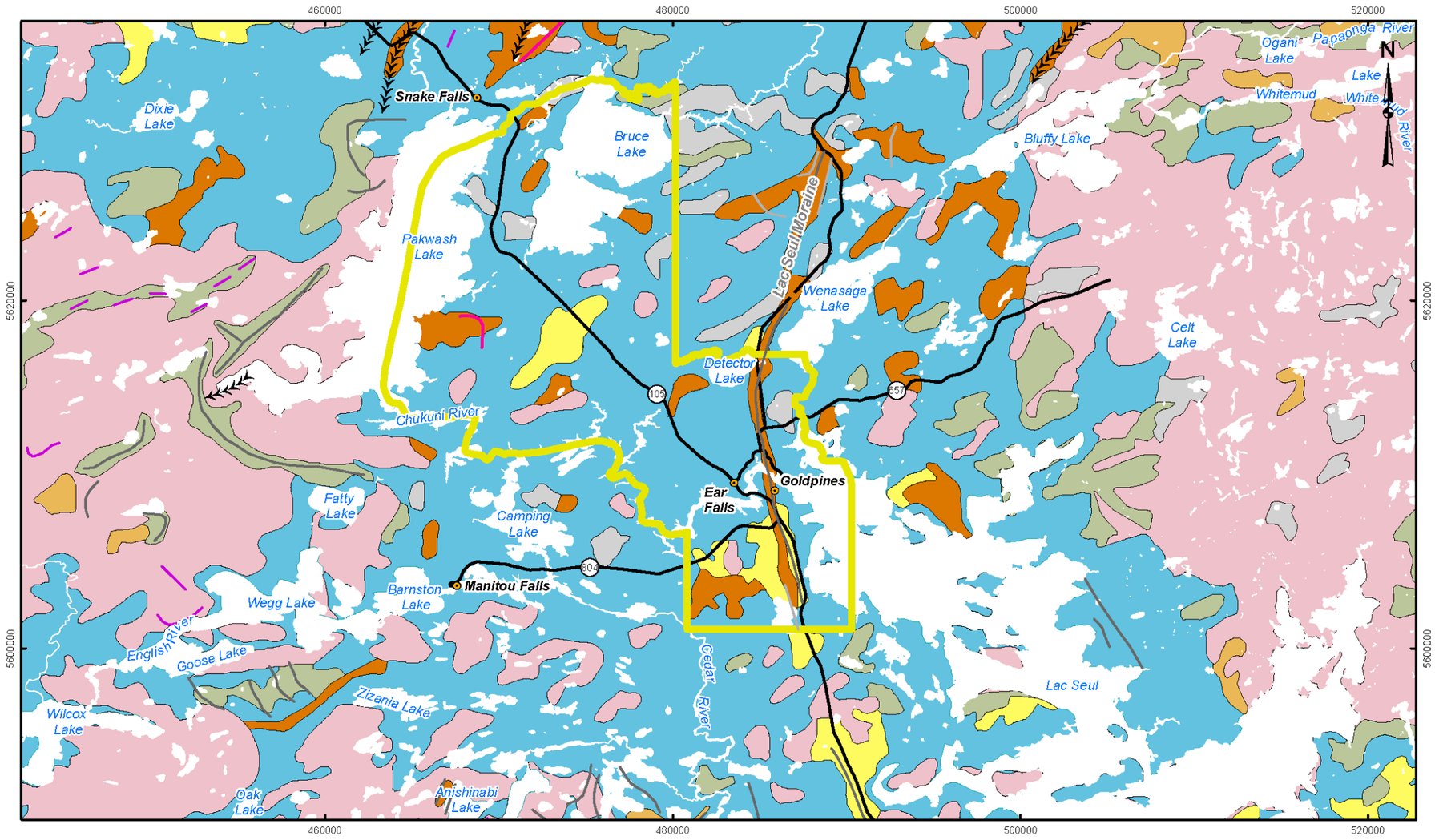
PROJECT
Environment Report
Township of Ear Falls, Ontario

TITLE
**Bedrock Geology of the Ear Falls Area**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Apr. 2010 | **FIGURE: 7** | |
| GIS | PMJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Ear Falls\EarFallsBedrockGeology.mxd




## LEGEND

- Community
- Main Road
- Beach, Bar or Spit
- Drumlin or Area of Drumlins
- Terrace Escarpment (abandoned shore bluff)
- Terrace Escarpment; Fluvial
- Trend of End Moraine Crest
- Esker or Area of Eskers; Direction of Flow Known or Assumed
- 1: Bedrock
- 18: Till
- 22: Glaciofluvial Ice
- 23: Glaciofluvial Outwash Deposit
- 24: Glaciolacustrine deposits - silt and clay
- 25: Glaciolacustrine deposits - sand
- 32: Organic Deposit
- 33: Water Area
- Municipal Boundary (Township of Ear Falls)


## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Geology - Modified EDS014-Surficial Geology of Ontario 1:1,000,000, 2000
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

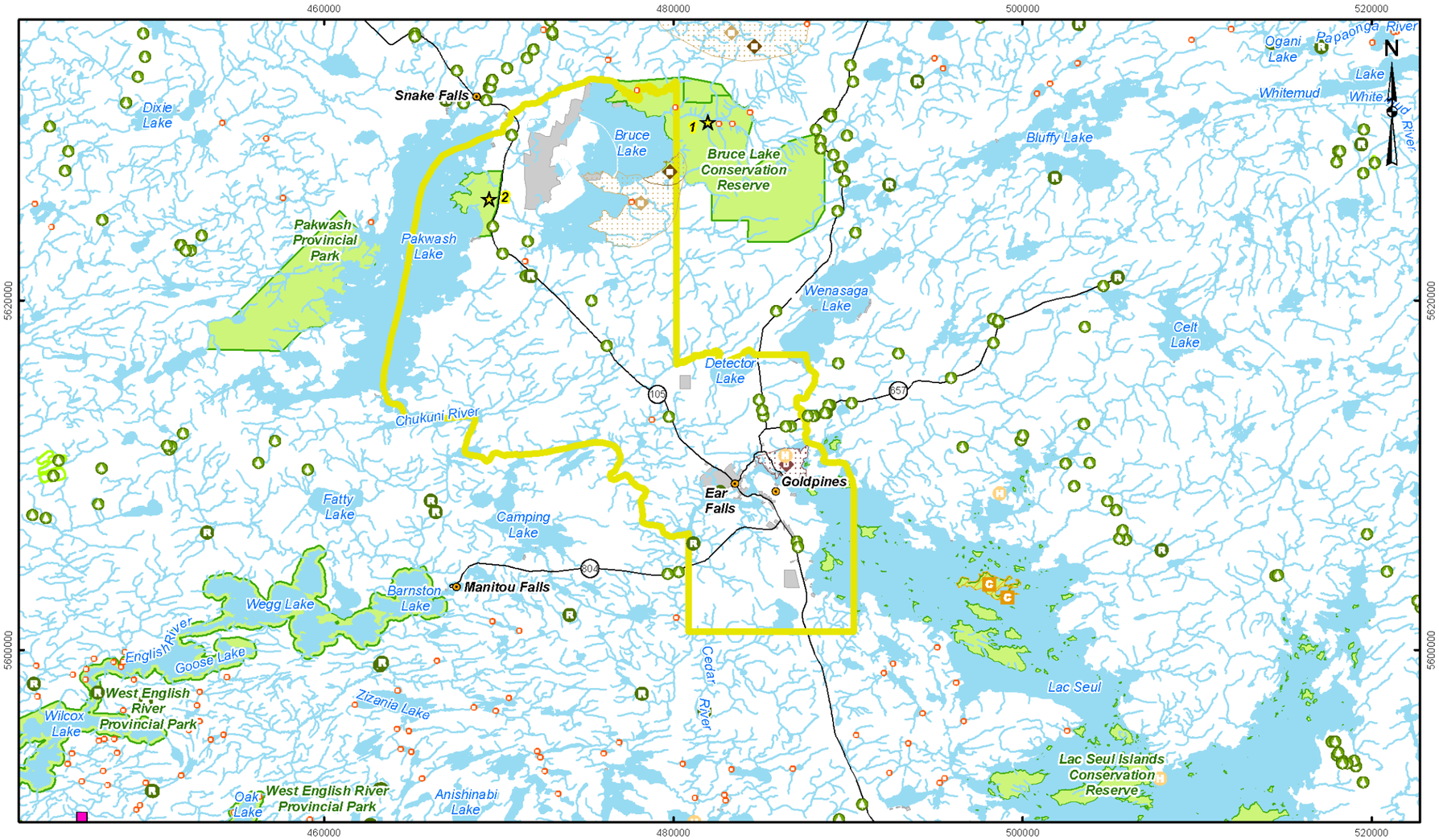
PROJECT
Environment Report
Township of Ear Falls, Ontario

TITLE
**Quaternary Geology of the Ear Falls Area**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | **FIGURE: 8** | |
| GIS | PM/JB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Ear Falls\EarFallsQuaternaryGeology.mxd




## LEGEND

- Community
- Main Road
- Watercourse
- Water Area, Permanent
- Provincial Park / Reserve
- Private Land
- Municipal Boundary (Township of Ear Falls)
- Earth or Life Science Site

**Wildlife and Forestry**

- Mineral Lick
- Moose Aquatic Feeding Area
- Forest Research Area

**Nesting**

- Heron
- Raptor

**Wintering Area**

- Deer Wintering Area
- Moose Early Wintering Area
- Moose Late Wintering Area
- Deer Wintering Area
- Moose Early Wintering Area
- Moose Late Wintering Area

**Calving/Fawning Sites**

- Caribou Calving Site


## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

PROJECT

Environment Report
Township of Ear Falls, Ontario

TITLE

**Ear Falls - Terrestrial Ecology**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | **FIGURE: 9** | |
| GIS | PMJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

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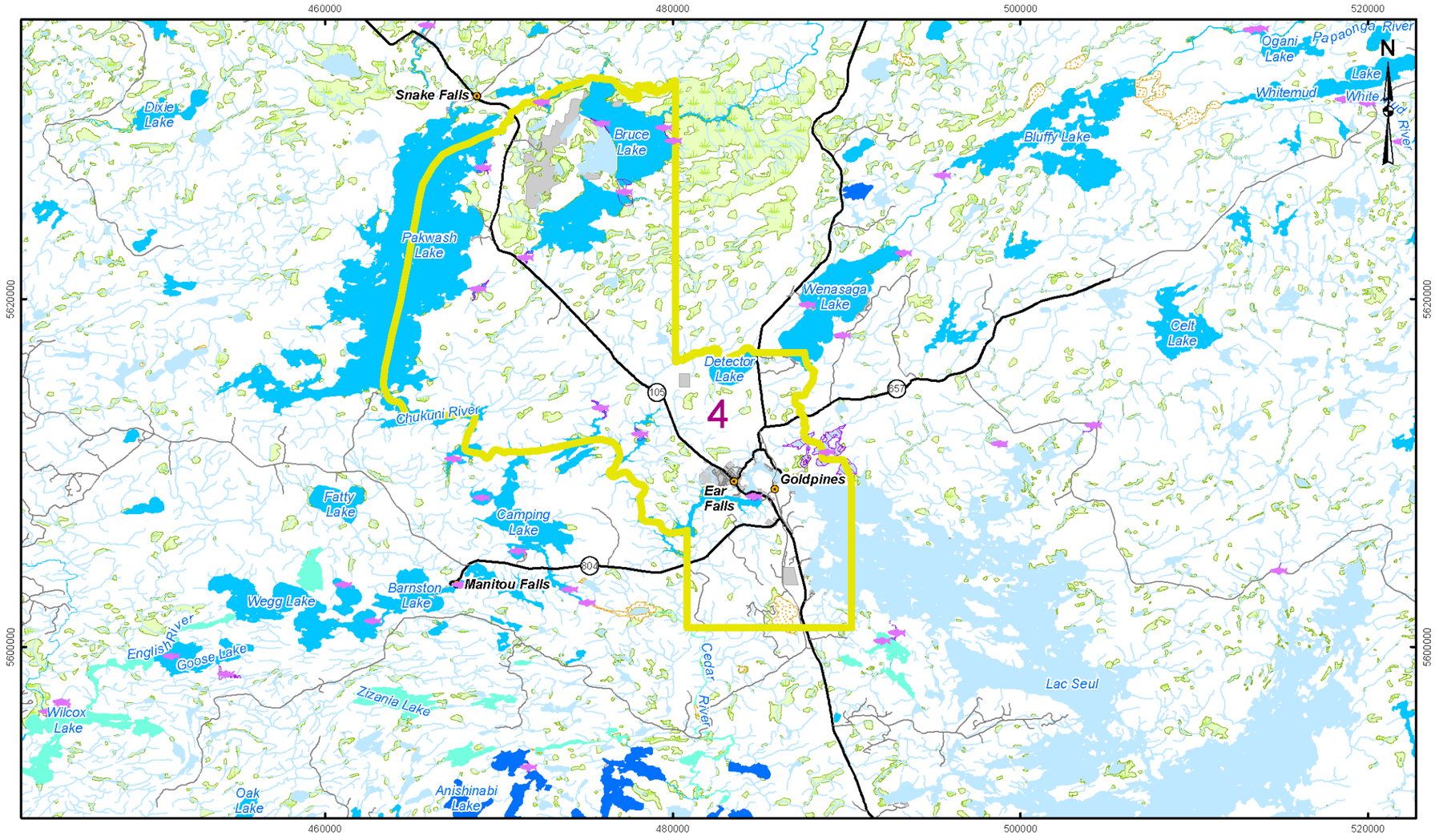


## LEGEND

- Community
- Main Road
- Local Road
- Watercourse
- Private Land
- Fisheries Management Zone (4)
- Municipal Boundary (Township of Ear Falls)

**Fisheries and Wetlands**

- Spawning Area
- Spawning Area
- Wild Rice Stand
- Waterbody (unspecified)
- Cold
- Cool
- Warm

**Natural Heritage**

- Wetland


## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Fisheries and Wetlands Maps - Nagagami Forest and Hearst Forest
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

PROJECT

Environment Report
Township of Ear Falls, Ontario

TITLE

**Ear Falls - Aquatic Ecology**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | **FIGURE: 10** | |
| GIS | PMJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

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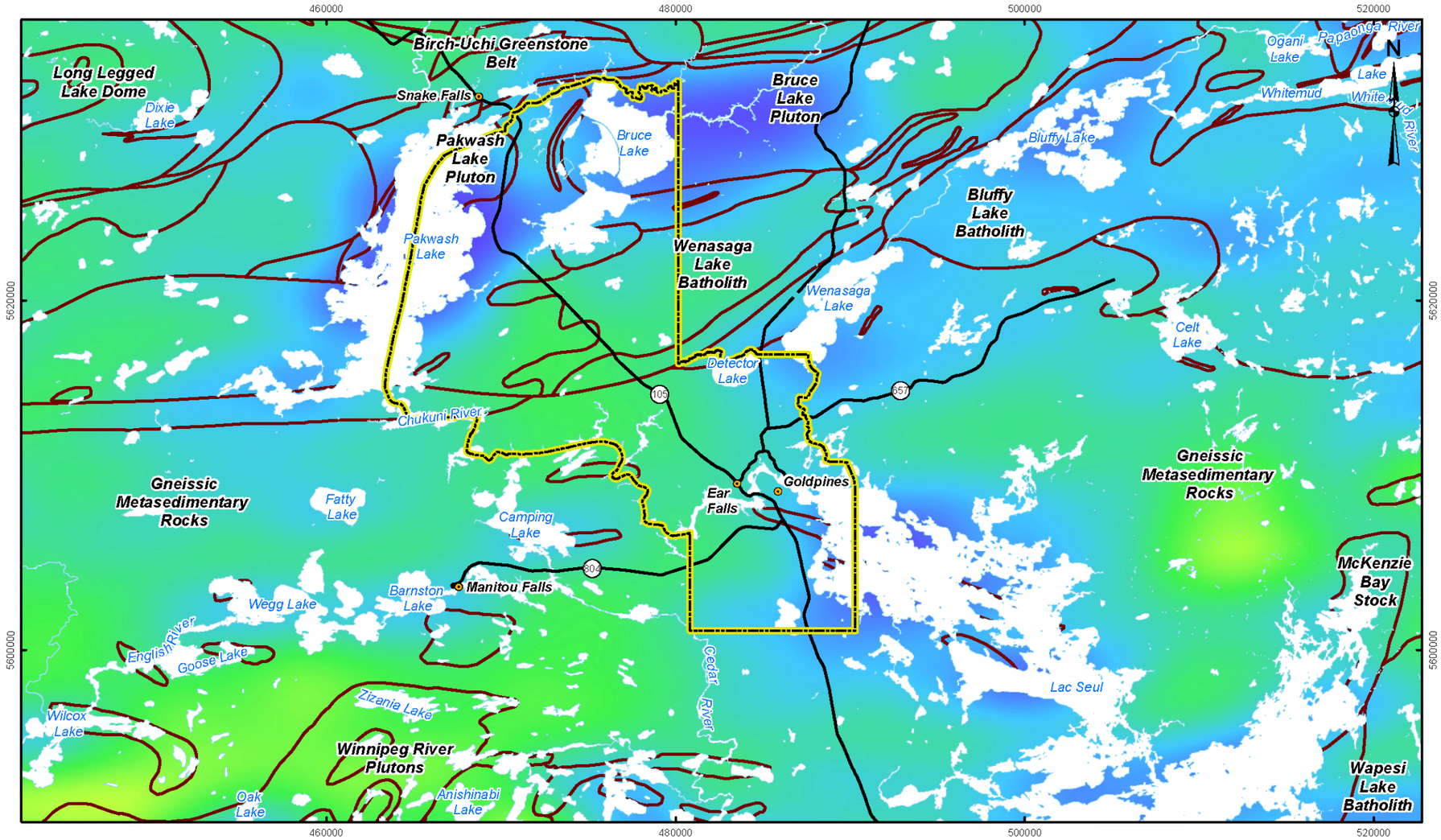


## LEGEND

- Community
- Main Road
- Water Area, Permanent
- Geological Contact
- Municipal Boundary
- Municipal Boundary (Township of Ear Falls)

Air Absorbed Radiation Levels (nGy/h )

110
100
90
80
70
60
50
40
30
20
10
0


## REFERENCE

Base Data - MNR LIO, obtained 2009-2012
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
Geology: MRD126-Bedrock Geology of Ontario, 2011
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15

SCALE 1:275,000 KILOMETRES

PROJECT

Environment Report
Township of Ear Falls, Ontario

TITLE

**Ear Falls - Background Radiation Levels**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 10 May. 2012 | **FIGURE: 11** | |
| GIS | PMJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

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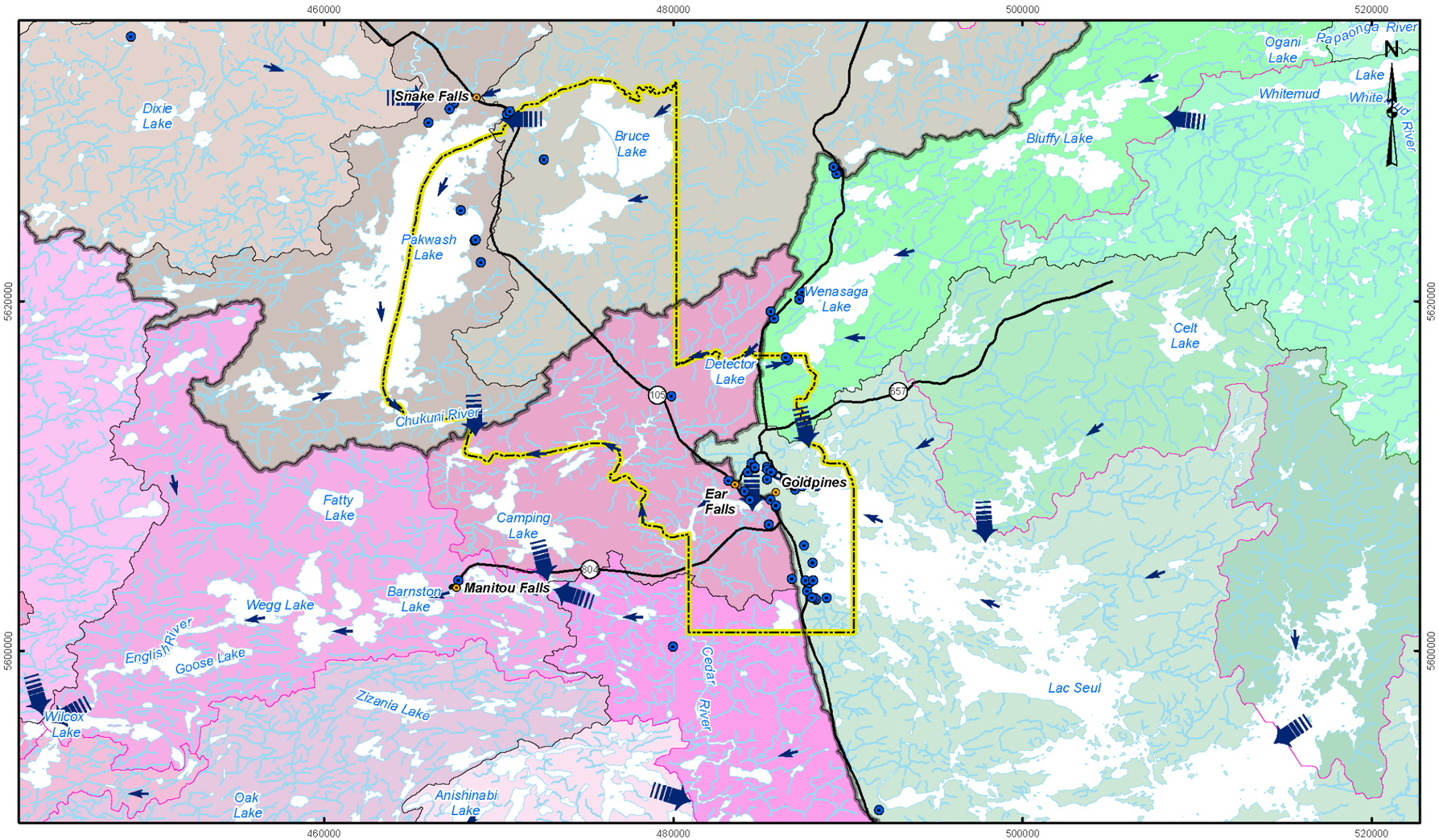


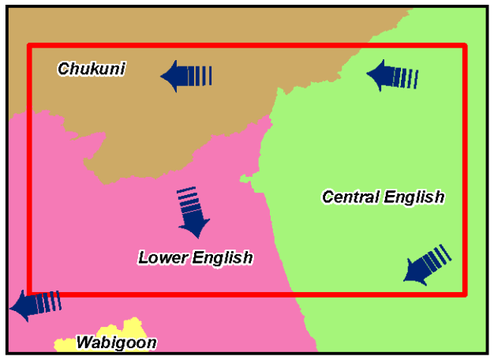

## LEGEND

- Community
- MOE Well Location
- Main Road
- Watercourse, Permanent
- Watercourse, Intermittent
- Water Area, Permanent
- Surface Water Flow Direction
- Watershed Outflow Point

**Drainage Divide**

- Delineated by JDMA/MNR
- Delineated by JDMA
- Delineated by MNR
- Municipal Boundary (Township of Ear Falls)

TERTIARY WATERSHEDS




## REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v 2006.4
Wells - Ministry of the Environment, 2010
Watershed - LIO Quaternary watershed (updated by JDMA)
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15

5 2.5 0 5 10 15
SCALE 1:275,000 KILOMETRES

PROJECT
Environment Report
Township of Ear Falls, Ontario

TITLE
**Ear Falls Surface Water Drainage and Water Wells**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 30 Aug. 2010 | FIGURE: 12 | |
| GIS | PNJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

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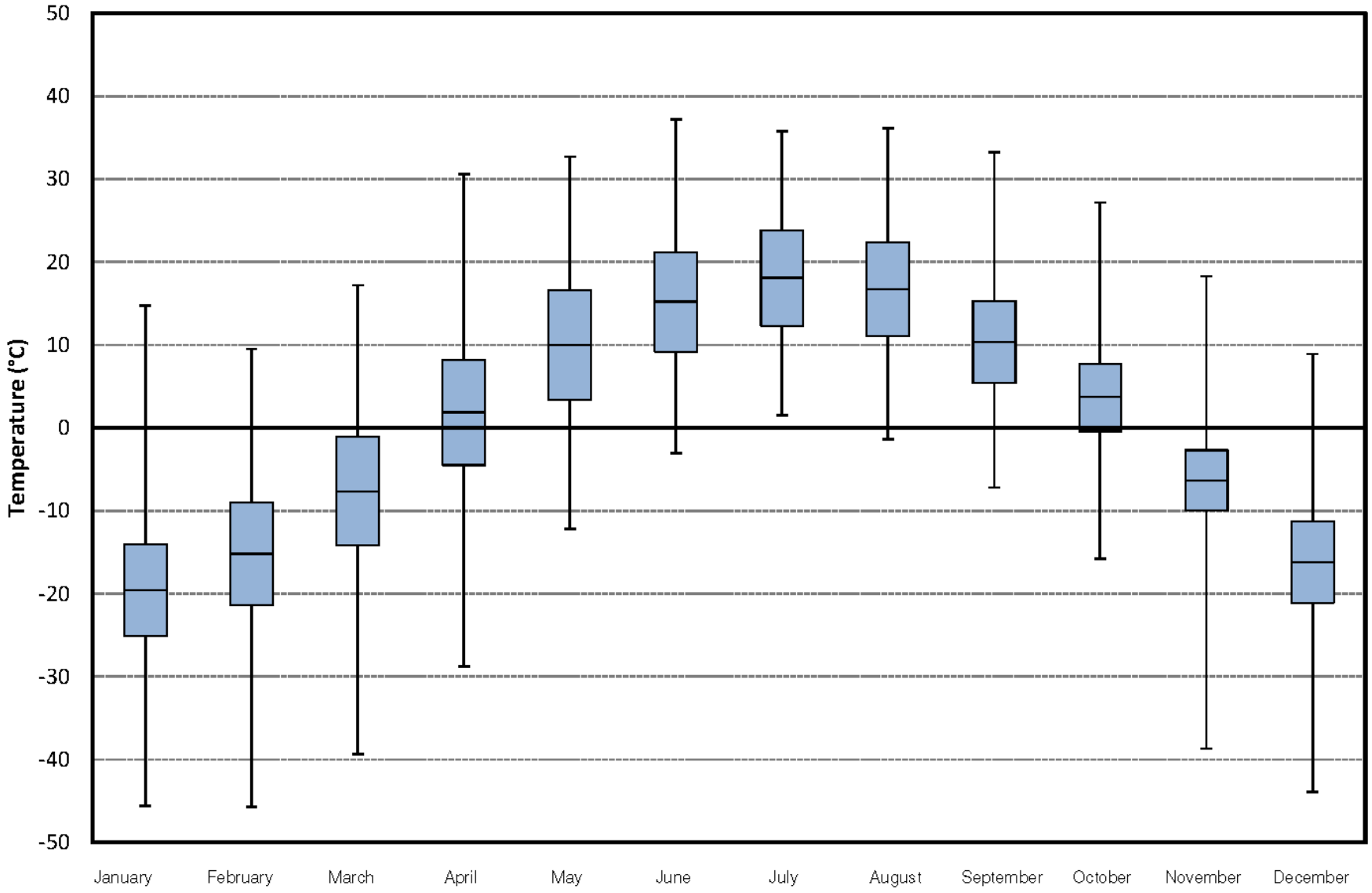


**LEGEND**

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

**DATA SOURCE**

Environment Canada

PROJECT

Environment Report
Township of Ear Falls, Ontario

TITLE

**Ear Falls 1971-2000 Temperature Data Summary**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 28 Mar. 2011 | FIGURE: 13 | |
| GIS | PM/JB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

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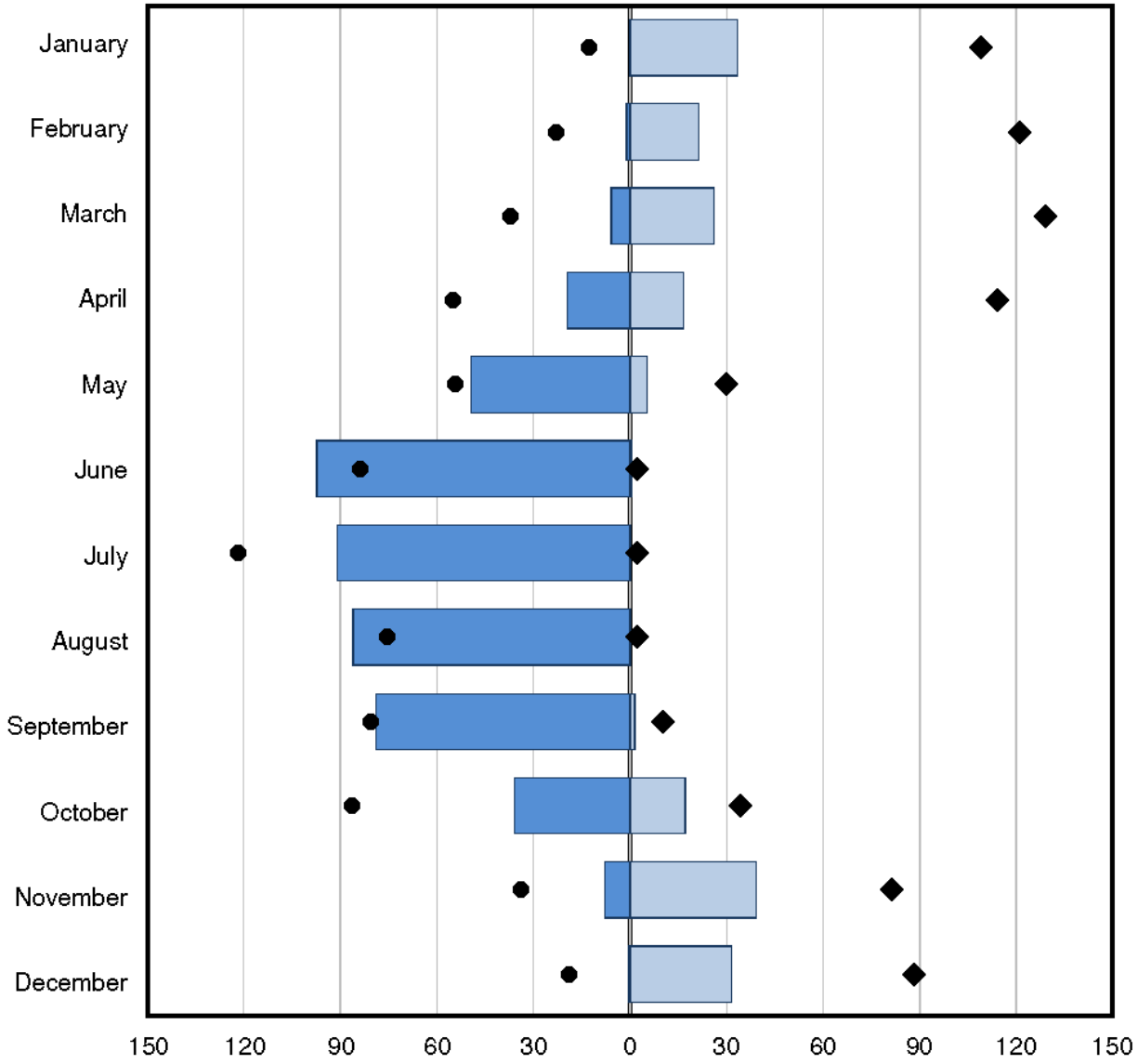



**LEGEND**

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

**DATA SOURCE**

Environment Canada

PROJECT

Environment Report
Township of Ear Falls, Ontario

TITLE

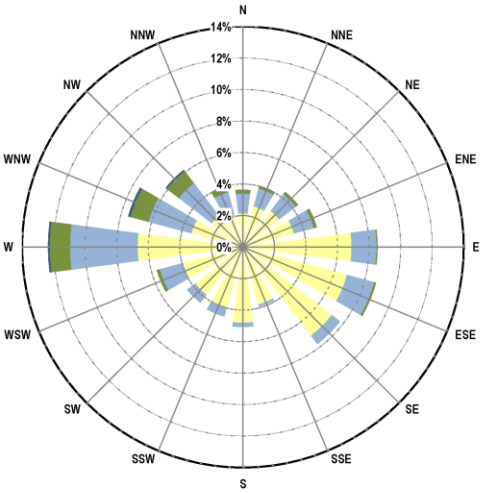
**Ear Falls 1971-2000 Precipitation Data Sumary**

Golder Associates
Mississauga, Ontario

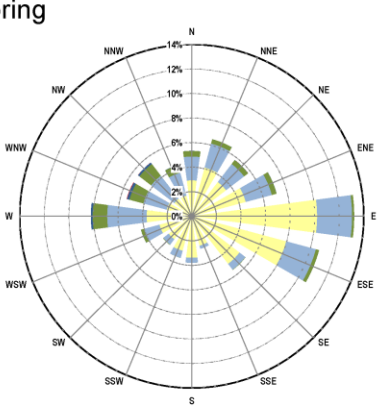
| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PRM | 29 Mar. 2012 | FIGURE: 14 | |
| GIS | PMJB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Ear Falls\EarFallsPrecipitationDataSumary.mxd

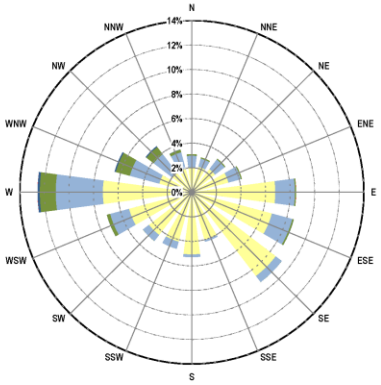
Annual



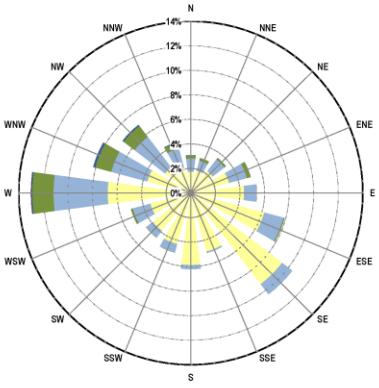

Spring



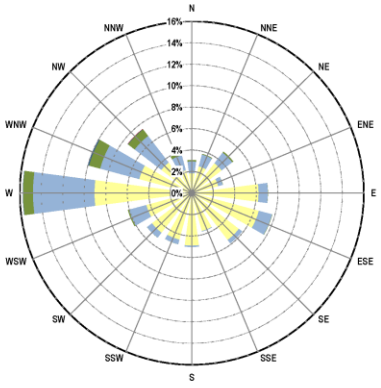

Summer




Fall




Winter




## LEGEND

**Wind Speed (m/s)**

- >9 m/s
- 7 to 9 m/s
- 5 to 7 m/s
- 3 to 5 m/s
- 0.01 to 3 m/s

**DATA SOURCE**

Environment Canada

PROJECT

Environment Report
Township of Ear Falls, Ontario

TITLE

**Ear Falls Annual and Seasonal Wind Rose**
**January 1, 2002 – December 31, 2011**

Golder Associates
Mississauga, Ontario

| PROJECT NO. 12-1152-0026 | | | SCALE AS SHOWN | REV. 0.0 |
|---|---|---|---|---|
| DESIGN | PM | 5 Apr. 2012 | FIGURE: 15 | |
| GIS | PM/JB | 24 Sep. 2013 | | |
| CHECK | JH | 24 Sep. 2013 | | |
| REVIEW | GWS | 24 Sep. 2013 | | |

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