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## Chapter 11: Chippewas of Rama First Nation

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## 11 Chippewas of Rama First Nation

### 11.1 Introduction

This chapter contains information on the Rama First Nation Water Treatment Plant that services the Chippewas of Rama First Nation. Various consultants have completed the work presented, all of which was reviewed by, among others, First Nations-, SGBLS Source Water Protection staff, and members of the Source Water Protection Committee.

The system section begins with an introduction of the characteristics of the drinking water system. This includes an overview of the location, number of people served, and source of the water supply. The sections following the system introductions are comprised of a Vulnerability Assessment and Issues and Threats evaluation of the system. The Vulnerability assessment includes the delineation of the Vulnerable Area(s) (Wellhead Protection Area or Intake Protection Zone), and the assignment of a Vulnerability Score for the delineated area. An Uncertainty Rating is also provided for the Vulnerable Area delineation and the Vulnerability Assessment as per Technical Rules 13-15 [Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)] to express the level of confidence in the results based on the information that was available for the study.

The Issues evaluation is intended to identify chemical parameters or pathogens in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now or in the future. Any Issues identified for the systems will be listed in this section, along with a map illustrating the Issues Contributing Area if an Issue is known. The Threats evaluation identifies potential Significant Drinking Water Threats within the delineated Vulnerable Areas. This process includes creating lists for Drinking Water Threats for Activities and Conditions, generating maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats, and a final enumeration of Significant Drinking Water Threats.

For more information, readers are encouraged to read Chapter 5: Methods Overview as well as the applicable consultant reports and memos (found in Appendix MO and RFN) for a more in depth description of the methods used, and the Glossary for any unfamiliar terms.

### 11.2 Drinking Water Systems

The Chippewas of Rama First Nation operate one surface water based supply. As shown in Table 11-1 and Figure 11-1, the surface water supply is located within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). Table 11-1 also indicates the SPR and corresponding lead Source Protection Authority (SPA) for the water supply.

**Table 11-1: Surface Water supply for the Chippewas of Rama First Nation.**

| Local Reserve                 | Community Water Supply                  | Drinking Water Information System (DWIS) Number | Source Protection Region / Lead Source Protection Authority (SPA) |
|-------------------------------|---|---|---|
| Rama First Nation Reserve #32 | Rama First Nation Water Treatment Plant | 220004929                                       | SGBLS SPR<br>&<br>Lakes Simcoe and Couchiching / Black River SPA  |

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### 11.3 Rama First Nation Water Treatment Plant

The Rama First Nation Water Treatment Plant (WTP) is located on the east shore of Lake Couchiching and serves the Rama First Nation Reserve #32. The plant currently serves 625 residents out of a total on reserve population of 720 residents (personal communication Director of Facilities & Operations). The ultimate design capacity of the facility is 3.8ML/day (Severn Sound Environmental Association, SSEA, 2005).

The WTP was constructed in 1996 and was upgraded in 2001 to include more reservoir capacity, pH adjustment using CO<sub>2</sub> and a SCADA system. The intake consists of 100 m of 250 mm diameter polyethylene pipe, extending from the shoreline and terminating at the inlet structure 80 m from shore, at a depth of 4.3 m.

Based on the interview with the representative of the Rama First Nation WTP conducted by personnel from LSRCA on Sept 5, 2006, the WTP can be shut down within 2 hours upon notification.

IPZ delineation and Vulnerability presented in this section is based on Baird (2011) while the Issues and Threats Assessment is based on Genivar, 2010a report.

#### 11.3.1 Methods and Uncertainties

##### 11.3.1.1 Surface Water Vulnerability

The following section describes the methods used to assess Vulnerability of the Rama First Nation Water Treatment Plant. The Rama First Nation intake is classified as a Type-D surface water intake (Rule 55; MOE, 2008a). For Type-D intakes, three zones are to be delineated: the IPZ-1 is based on a fixed radius around the intake crib; the IPZ-2 acts as a secondary protection zone around the IPZ-1; and the IPZ-3 is considered an additional protection zone. For the purposes of delineating the IPZ-3, the Lake Simcoe intakes are also identified as a special case (Rule 68) and those rules applicable to Type-A and Type-B intakes also apply in this regard.

##### 11.3.1.2 Delineating IPZ-1 and IPZ-2

IPZ-1 was delineated according to the Technical Rules and as outlined in Chapter 5. The IPZ-1 was based on the 1km radius and the 120 m setback from the shoreline and was prepared using GIS.

The IPZ-2 is defined based on the area that may contribute water to the intake where the time of travel to the intake is equal to or less than the time that is sufficient to allow the operator of the system to respond to an adverse condition in the quality of the surface water (Rule 65; MOE, 2008a). The two hour minimum response time was used for the Rama First Nation WTP,

as the operator response time to shut-down the intake was within 2 hours of receiving notification.

The IPZ-2 is comprised of four areas:

1. In-lake IPZ-2: the area within each surface water body and an extension up tributaries flowing into the IPZ-2;
2. Up-tributary: IPZ-2 is extended up tributary to the 2-hour time-of-travel limit;
3. Inland setback: Greater of either the 120 m setback inland along the abutted land or the regulation limit;
4. Transport Pathways: an extension to include areas that contribute water to the IPZ-2 through a Transport Pathway.

#### 11.3.1.2.1 In-lake IPZ-2 Delineation

The approach used in this study was to define the in-water IPZ-2 based on the currents predicted by the MIKE3 hydrodynamic model as described in Baird (2011). The Lake Simcoe model is based on the original model developed for the Assimilative Capacity Studies as described in Baird (2006). This previous work demonstrated that DHI's MIKE3 model could successfully simulate both wind driven currents and thermocline development in Lake Simcoe.

For delineating IPZ-2, currents were developed for 10 year return period wind events, for eight wind directions, run at 45° intervals intervals for both the Lake Simcoe and Lake Couchiching models (Baird 2011, Appendix RFN). For each wind condition, the model was run with a constant wind applied to the surface of the lake, until the currents in the lake were fully developed. Reverse particle tracking was used to track the paths that the currents would have transported neutrally buoyant particles to the intake over a 2 hour period. Although the intakes are located near the lakebed, particles were introduced at the surface and near the lakebed. The particles released at both depths were considered in delineating the IPZ-2, as this is a more conservative approach. The impact of the water withdrawn by the intake on the local currents was also investigated, with the model indicating that the intake only significantly influences the currents within a 2 m to 5 m radius of the intake.

Currents inshore of the breaker or surf zone are complex and are not well defined by existing numerical models. However, it is recognized that there is potential for currents in the surf zone to transport a contaminant in an offshore direction from the shoreline. The significance of this increases for intakes located in high wave energy environments and for intakes located within the surf zone. A preliminary assessment of the location of the surf zone was undertaken by Baird (2011). The assumption is that mixing processes inside the surf zone could transport a

contaminant to the offshore limit of the surf zone. Estimated depth at offshore limit of surf zones is presented in Appendix RFN – Table 5.1, Baird 2011.

#### 11.3.1.2.2 Up Tributary

The upstream limit of the IPZ-2 was calculated as (2 hours minus the travel time from the intake to tributary mouth) multiplied by the tributary velocity. Tributary velocity was based on velocity at bank full stage as per the MOE (2006a) recommendation and it was assumed that bank full flow is equivalent to the 2 year return period event.

There is one tributary located within the IPZ-2 for the Rama First Nation intake that has an assumed velocity of 1 m/s. (Appendix F –Baird, 2011). Tributary velocities provided by the LSRCA where used where available. Alternatively, the velocity was estimated from bank full discharge divided by the approximate area of the cross-section at the mouth of the tributary.

The shorelines of Lake Couchiching were used in lieu of the high water mark (HWM). The shoreline was developed by digitizing the lake boundary from the 2002 colour 20 cm orthorectified aerial photography.

It must be noted however that the definition of HWM used in this assessment differs to that provided by the MOE. MOE, 2009b, defines the HWM for water bodies where a long term water level record exists, as the 80<sup>th</sup> percentile for the month within which the highest water level occurs, or where a long term record of water levels does not exist, the level at which flood plains are flooded and leave a mark where natural vegetation changes from predominantly aquatic vegetation to terrestrial vegetation. The HWM is defined by LSRCA in terms of fish habitat, as the average annual high water which is 219.15 m above sea level (masl). A review of the shoreline used to define the HWM for the IPZ delineation and the HWM provided by LSRCA (219.15 masl) was completed in the Baird (2011) report. The review found the two shorelines to be comparable. More information on the difference between these two approaches is documented in Baird (2011) report which is located in Appendix RFN.

#### 11.3.1.2.3 Inland Setback

Where the IPZ-2 abuts land, it includes the greater of either (1) a setback of not more than 120 m inland along the abutted land measured from the high water mark of the surface water body; or (2) the area of land within the Conservation Authority Regulation Limit along the abutted land (Rule 65; MOE, 2008a). However, there are no regulated areas for the lake Couchiching watershed.

#### 11.3.1.2.4 Transport Pathways

The IPZ-2s were modified to include potential Transport Pathways based on Rules 72 to 74. A complete description of the methodology, analysis and Transport Pathway delineation is provided in Baird 2011.

Data were acquired by LSRCA from field surveys, in-house development, and from participating municipalities. Datasets included (but were not limited to) Storm sewersheds; Storm water pond locations; Sewershed outfall locations, diameters, flows and velocities; Ditch locations and cross-sections; Rural drainage networks; Impervious areas; Subsurface tile drains; Watercourse engineered and modelled cross-sections; Soils and land use data; and Ortho-imagery.

The sewersheds discharging into the IPZ-2 were identified from LSRCA and municipal storm water network datasets. Residence time and the velocity were then used to estimate a maximum within-sewershed travel distance. A summary of travel distance calculations for Rama First Nation WTP can be found in Baird 2011. In all sewersheds, the travel distance was greater than the assumed longest flow path in the sewershed, so the entire sewershed was included in the revised IPZ-2.

#### 11.3.1.3 Delineating IPZ-3

For intakes on Lake Couchiching, the IPZ-3 delineation is not associated with an extreme event, as it is for intakes on Lake Simcoe.

For the intakes in Lake Couchiching, the IPZ-3 includes the watershed upstream of the intake, which does not fall within the IPZ-1 or IPZ-2. Lake Couchiching lies within the Black-Severn Watershed. The total drainage area is 2,805 km<sup>2</sup>. The Black River watershed is divided into seven sub-watersheds, one of which is Lake Couchiching. The area of the Lake Couchiching subwatershed is 98 km<sup>2</sup> as described in Chapter 2: Watershed Characterization.

Based on discussions with LSRCA, the IPZ-3 for the intakes in Lake Couchiching has been defined as the entire Lake Couchiching sub-watershed. Because Lake Simcoe drains into Lake Couchiching, the Lake Simcoe watershed has also been included in the IPZ-3 for Rama First Nation WTP. The IPZ-3 has been divided into sub-areas, reflecting varying levels of vulnerability. The sub-areas include the Lake Couchiching watershed, Lake Couchiching (waterbody), Lake Simcoe (waterbody) and the Lake Simcoe sub-watersheds.

#### 11.3.1.4 IPZ Vulnerability Scores

The Vulnerability Score ranks the relative Vulnerability of the intake to contaminants. The Vulnerability Score is based on the Area Vulnerability Factor and the Source Vulnerability Factor using the formula below:

$$B \times C$$

where,

**B** = the Area Vulnerability Factor of the area of the IPZ

**C** = the Source Vulnerability Factor of the surface water of the IPZ

The range of possible Vulnerability Scores can be found in Table 5-5, Section 5.3.2 of Chapter 5: Methods Overview.

##### 11.3.1.4.1 Area Vulnerability Factor

Each of the Intake Protection Zones is assigned an Area Vulnerability Factor (B) with the IPZs closest to the intake having the highest factor.

For IPZ-1s, the Area Vulnerability Factor is assigned a value of 10 due to its close proximity to the intake (Rule 88; MOE, 2008a).

For the IPZ-2, a 'base' Area Vulnerability Factor of 8 (the median factor for an IPZ-2) was initially assigned, and then altered by four modifier scores based factors such as land cover, hydrology, slope and the characteristics of the subwatershed that the IPZ-2 is located in (the four potential modifiers can be found in Baird, 2011).

The IPZ-2 base Area Vulnerability Factor, modifiers and final Area Vulnerability Factor for the Rama First Nation WTP intake are listed in Table 11-2.

**Table 11-2: Derivation of IPZ-2 Area Vulnerability Factor (B) for Rama First Nation WTP Intake.**

| Intake            | Sub-watershed Closest to Intake | Base Area Vuln. Factor | IPZ-2 Land % Modifier <sup>1</sup> | Drainage Density Modifier <sup>1</sup> | SCS Curve Number Modifier | Land Use Modifier | Relief/Length Ratio Modifier | IPZ-2 Final Area Vuln. Factor (B) |
|-------------------|---------------------------------|------------------------|------------------------------------|--|---------------------------|-------------------|------------------------------|-----------------------------------|
| Rama First Nation | Lake Couchiching                | 8                      | 0                                  | -1                                     | 0                         | 0                 | 0                            | 7                                 |

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<sup>1</sup> The IPZ-2 Land Modifier and Drainage Density Modifier both reflect the ratio of water to land. The sum of these two modifiers cannot change the Area Vulnerability Factor by more than +/- 1.

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The Area Vulnerability Factors for the IPZ-3 sub-areas were determined, using the same methodology as IPZ-2, with some minor additions. IPZ-3 sub-areas were defined as the sub-watersheds within the Lake Simcoe watershed and Lake Couchiching subwatershed. The Lake Simcoe and Lake Couchiching water bodies were also defined as IPZ-3 sub-areas. As stated previously, the Area Vulnerability Factors that are assigned to the IPZ-3 sub-areas cannot be greater than the Area Vulnerability Factor assigned to the IPZ-2 (Rule 91; MOE, 2008a). The methodology can be found in Baird, 2011.

The IPZ-3 sub-area base Area Vulnerability Factors, modifiers and final Area Vulnerability Factors for the Rama First Nation WTP are listed in Table 11-3.

**Table 11-3: Derivation of IPZ-3 Area Vulnerability Factors for Rama First Nation WTP Intake.**

| IPZ-3 Sub-areas                           | Base Area<br>Vuln.<br>Factor | Distance<br>Modifier <sup>1</sup> | Drainage<br>Density<br>Modifier <sup>2</sup> | SCS Curve<br>Number<br>Modifier <sup>3</sup> | Land Use<br>Modifier <sup>4</sup> | Relief-Length<br>Modifier <sup>5</sup> | Final Area<br>Vuln.<br>Factor (B) <sup>6</sup> |
|---|------------------------------|-----------------------------------|--|--|-----------------------------------|--|--|
| ▲ Lake Couchiching Waterbody              | 6                            | 0                                 | -  | -  | -                                 | -                                      | 6  |
| ▲ Lake Simcoe Waterbody                   | 6                            | 0                                 | -  | -  | -                                 | -                                      | 6  |
| ▲ Lake Couchiching subwatershed           | 6                            | 0                                 | -1   | 0  | 0                                 | 0                                      | 5  |
| ▲ Oro North Creeks subwatershed           | 6                            | -1                                | 0  | 0  | 1                                 | 1                                      | 6  |
| ▲ Ramara Creeks subwatershed              | 6                            | -1                                | 0  | 0  | 0                                 | 0                                      | 5  |
| ▲ Hawkestone Creek subwatershed           | 6                            | -2                                | 0  | -1   | 0                                 | 1                                      | 4  |
| ▲ Oro South Creeks subwatershed           | 6                            | -2                                | 0  | 0  | 0                                 | 0                                      | 4  |
| ▲ Upper + Lower Talbot River subwatershed | 6                            | -2                                | 0  | -1   | 0                                 | -1                                     | 2  |
| ▲ Whites Creek subwatershed               | 6                            | -2                                | 0  | 0  | 0                                 | 0                                      | 4  |

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| IPZ-3 Sub-areas                               | Base Area Vuln. Factor | Distance Modifier <sup>1</sup> | Drainage Density Modifier <sup>2</sup> | SCS Curve Number Modifier <sup>3</sup> | Land Use Modifier <sup>4</sup> | Relief-Length Modifier <sup>5</sup> | Final Area Vuln. Factor (B) <sup>6</sup> |
|---|------------------------|--------------------------------|--|--|--------------------------------|-------------------------------------|--|
| Beaver River subwatershed                     | 6                      | -2                             | 0                                      | -1                                     | 0                              | 0                                   | 3  |
| Black River subwatershed                      | 6                      | -3                             | 0                                      | 0                                      | -1                             | 0                                   | 2  |
| Pefferlaw Brook + Uxbridge Brook subwatershed | 6                      | -3                             | 0                                      | 0                                      | -1                             | 0                                   | 2  |
| Georgina Creeks subwatershed                  | 6                      | -3                             | -1                                     | 1                                      | 0                              | 0                                   | 3  |
| Hewitts Creek subwatershed                    | 6                      | -3                             | 0                                      | 0                                      | 0                              | 0                                   | 3  |
| Lovers Creek subwatershed                     | 6                      | -3                             | 0                                      | 0                                      | 0                              | 0                                   | 3  |
| Innisfil Creeks subwatershed                  | 6                      | -3                             | 0                                      | 0                                      | 0                              | 0                                   | 3  |
| Barrie Creeks subwatershed                    | 6                      | -3                             | 0                                      | 0                                      | 1                              | 1                                   | 5  |
| Maskinonge subwatershed                       | 6                      | -4                             | 0                                      | 1                                      | 0                              | 0                                   | 3  |
| West Holland subwatershed                     | 6                      | -4                             | 1                                      | 0                                      | 0                              | 0                                   | 3  |

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| IPZ-3 Sub-areas              | Base Area<br>Vuln.<br>Factor | Distance<br>Modifier <sup>1</sup> | Drainage<br>Density<br>Modifier <sup>2</sup> | SCS Curve<br>Number<br>Modifier <sup>3</sup> | Land Use<br>Modifier <sup>4</sup> | Relief-Length<br>Modifier <sup>5</sup> | Final Area<br>Vuln.<br>Factor (B) <sup>6</sup> |
|------------------------------|------------------------------|-----------------------------------|--|--|-----------------------------------|--|--|
| East Holland<br>subwatershed | 6                            | -4                                | 0  | 0  | 1                                 | 0                                      | 3  |

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<sup>1</sup> If waterbody area or nearest subwatershed, Modifier = 0. If further subwatershed, Modifier: Within: <-1 S.D. of mean = -1,>1 S.D. and mean = -2, mean and <+1 S.D. = -3, >+1 S.D. = -4.

<sup>2</sup> Drainage density = (Total Length of Streams)/(Subwatershed Area). Modifier: Within +/-1 S.D. of mean = 0: >+1 S.D. of mean = +1: <-1 S.D. of mean = -1

<sup>3</sup> Adjusted SCS Curve Number. Modifier: Within +/-1 S.D. of mean = 0: >+1 S.D. of mean = +1: <-1 S.D. of mean = -1. Lake Couchiching CN is average of all other subwatersheds since no data was available.

<sup>4</sup> Land use: Natural/Forested = -1: Agricultural = 0: Urban/Developed = +1, coarsely interpreted from 1999 LandSat Imagery

<sup>5</sup> Relief-Length Ratio = (Relief)/(Subwatershed Length). Modifier: Within +/-1 S.D. of mean = 0: >+1 S.D. of mean = +1: <-1 S.D. of mean = -1

<sup>6</sup> Final Area Vulnerability Factor plus/minus all modifiers

11.3.1.4.2 **Source Vulnerability Factor**

A Source Vulnerability Factor is assigned to each surface water intake (Rule 94; MOE, 2008a). Source Vulnerability for intakes within the SGBLS Source Protection Region was based on that developed by the Michigan Department of Environmental Quality (MDEQ). The first three rows in Table 11-4 were taken directly from MDEQ (2004), while the fourth row lists the corresponding Vulnerability Factor assigned for the Rama First Nation WTP.

**Table 11-4: Intake Vulnerability Criteria based on Intake Distance from Shore and Depth (adapted from MDEQ, 2004).**

| Category <sup>1</sup>   | Nearshore-<br>Shallow Water       | Nearshore-<br>Deep Water          | Offshore-<br>Shallow Water        | Offshore-<br>Deep Water           |
|---|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Parameters <sup>1</sup>   | <3500 m<br>offshore<br><6 m depth | <3500 m<br>offshore<br>>6 m depth | >3500 m<br>offshore<br><6 m depth | >3500 m<br>offshore<br>>6 m depth |
| Vulnerability <sup>1</sup> (MDEQ)   | High                              | High to<br>Moderate               | High to<br>Moderate               | Moderate                          |
| Recommended Source<br>Vulnerability Factor<br>based on Intake Offset<br>and Depth | 1.0                               | 0.9                               | 0.9                               | 0.8                               |

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<sup>1</sup>Category, parameters and vulnerability based on MDEQ (2004).

None of the water treatment plant operators interviewed by LSRCA for this study reported a plant shut down due to water quality issues. Similarly the Issues Evaluation (below) did not identify any Issues for this intake. As no Water Quality Issues were identified the Source vulnerability Score was based on the water depth and distance offshore only. The Rama First Nation WTP intake is located 80 m from shore at a water depth of 4.3 m. A Source Vulnerability Factor (C) of 1.0 was therefore assigned, based on the values presented in Table 6-11 (MDEQ, 2004).

11.3.1.5 **Uncertainty Assessment**

This section summarizes some of the uncertainty identified by Baird (2011) when delineating IPZs and the assigning Vulnerability Scores; the entire discussion of uncertainties is presented in Baird 2011, Appendix RFN. This assessment was used by Baird (2011) to assign Uncertainty Ratings of either “High” or “Low” for the IPZ and Vulnerability Scores.

#### 11.3.1.5.1 Data Quality and Gaps:

Data gaps and data quality issues identified during the study included: bathymetry and shoreline delineation data sets that may be out of date or too low resolution; wind data from a single location (Lagoon City Buoy) being applied to the entire lake; tributary flow data being limited to the major tributaries; lower level of confidence in the calibration for the Lake Couchiching model, due to the limited measured current data used in the model calibration; and the need for ongoing data collection and raw water sampling. A complete list of data quality and gaps listed in Baird 2011, Appendix RFN.

#### 11.3.1.5.2 Model Capabilities and Application

A model is a tool that is used to improve our understanding of the physical processes. It is important to understand the model limitations, as well as the limitations of the application, that is how the model was set up, the data was used as input to the model, the model runs undertaken, and the interpretation of the results. The limitations of the model used in this study include:

- The MIKE3 model does not consider waves and wave induced currents;
- Separate models for Lake Simcoe and Lake Couchiching means that flow through Atherley Narrows may not be accurately modeled since the Narrows are considered as an open boundary;
- Wind direction (45° intervals) and speed (10 year return periods) data that enables consistency between projects was used, but this does not capture actual shifts in wind speed and direction;
- Complex river networks and flow patterns at the north end of Lake Couchiching with limited gauge data and tributary cross-sections in this area;
- Flow velocities were estimated using either measured cross-section data from the mouth of the tributary or approximated cross-sections developed from the bathymetry field sheets for the lake. However, modeling indicated that the effect of tributary flow was localized, and did not significantly impact the in-lake IPZs
- Model application does not consider temperature induced density currents or lake stratification. Where the temperature of a tributary flowing into a lake differs from the lake temperature, there is potential for reduced travel times to the intake, as a result of density driven currents.

A complete list and description of model uncertainties is provided by Baird (2011), Appendix RFN.

#### 11.3.1.5.3 Quality Assurance/Quality Control

In completing this project, Baird followed their established *Project Quality Control Program (QCP)*, which includes: Preparation of the Project Control Plan (PCP); Identification of the Project Manager (PM), Project Team (PT), Quality Control Reviewers (QCRs) and Quality Assurance Manager (QAM); Schedule and Budget; Description of tasks, project phases and/or deliverables to be reviewed; Identification of checklists to be utilized during reviews; Discussion of Quality Assurance procedures to be used during the project life cycle.

#### 11.3.1.5.4 Extent and Level of Model Calibration/Validation

The MIKE3 model was calibrated with measured current data from two locations on Lake Simcoe, and one location in Lake Couchiching. It is important to note that the Acoustic Doppler Current Profiler (ADCP) data sets are of limited duration and spatial coverage. They did not include the extreme events that were modeled for the matrix runs. The level of calibration was based on the available data and in general, the models captured the trends in the surface currents. Based on the calibration undertaken, the model seemed to capture the general trends in current speed and direction.

#### 11.3.1.5.5 Area and Source Vulnerability Factors

The factors considered in assigning the Area Vulnerability values include: the percentage of the area of the IPZ-2 or IPZ-3, as the case may be, that is composed of land; the land cover, soil type, permeability of the land and the slope of any setbacks; the hydrological and hydrogeological conditions in the area that contributes water to the area through Transport Pathways; and in respect of an IPZ-3, the proximity of the area of the IPZ-3 to the intake. The only subwatershed characteristic that is relatively uncertain is the SCS (Soil Conservation Service) Curve, with the uncertainty arising from the fact that the SCS Curve No. is based on many parameters including rainfall, land cover, soil permeability and slope. The parameters considered in assigning the Source Vulnerability Factors were the distance of the intake from shore and the depth of water that it is located in, and the history of water quality concerns. Genivar (2010a) did not report any water quality Issues in their Issues Evaluation report, however limited data were available for the analysis.

### 11.3.2 Results Rama First Nation Water Treatment Plant

#### 11.3.2.1 Intake Protection Zones (IPZ)

The IPZ-1 and IPZ-2 for the Rama First Nation WTP are shown in Figure 11a-1. IPZ-1 consists of a 1 km radius centered on the crib of the intake, extending 120 m inland. The IPZ-2 includes Transport Pathways, such as drains and ditches that extend the IPZ-2 in various locations within the community. The IPZ-3 for Rama First Nation WTP, as with all intakes in Lake Couchiching, has been defined as the entire Lake Simcoe and Lake Couchiching sub-watershed (Figure 11a-2). The Lake Couchiching water body and subwatershed were included as IPZ-3 sub-areas because current flow measurements show that reverse flows (i.e. from Lake Couchiching to Lake Simcoe) do occur.

#### 11.3.2.2 Intake Protection Zone (IPZ) Vulnerability Scores

The Vulnerability Factors and Scores for the IPZ-1, IPZ-2 and IPZ-3 sub-areas are summarized below in Table 11-5 and Figure 11a-1 and Figure 11a-2.

**Table 11-5: Summary of Vulnerability Factors and Scores for Rama First Nation WTP Intake.**

| IPZ                           | Area Vulnerability Factor (B) | Source Vulnerability Factor (C) | Vulnerability Score (V) |
|-------------------------------|-------------------------------|---------------------------------|-------------------------|
| IPZ-1                         | 10                            | 1.0                             | 10.0                    |
| IPZ-2                         | 7                             | 1.0                             | 7.0                     |
| <b>IPZ-3 Sub-zones</b>        | -                             | -                               | -                       |
| Lake Couchiching Waterbody    | 6                             | 1.0                             | 6.0                     |
| Lake Simcoe Waterbody         | 6                             | 1.0                             | 6.0                     |
| Lake Couchiching subwatershed | 5                             | 1.0                             | 5.0                     |
| Oro North Creeks subwatershed | 6                             | 1.0                             | 6.0                     |
| Ramara Creeks subwatershed    | 5                             | 1.0                             | 5.0                     |
| Hawkestone Creek subwatershed | 4                             | 1.0                             | 4.0                     |
| Oro South Creeks subwatershed | 4                             | 1.0                             | 4.0                     |

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| IPZ   | Area Vulnerability Factor (B) | Source Vulnerability Factor (C) | Vulnerability Score (V) |
|---|-------------------------------|---------------------------------|-------------------------|
| Upper + Lower Talbot River subwatershed       | 2                             | 1.0                             | 2.0                     |
| Whites Creek subwatershed                     | 4                             | 1.0                             | 4.0                     |
| Beaver River subwatershed                     | 3                             | 1.0                             | 3.0                     |
| Black River subwatershed                      | 2                             | 1.0                             | 2.0                     |
| Pefferlaw Brook + Uxbridge Brook subwatershed | 2                             | 1.0                             | 2.0                     |
| Georgina Creeks subwatershed                  | 3                             | 1.0                             | 3.0                     |
| Hewitts Creek subwatershed                    | 3                             | 1.0                             | 3.0                     |
| Lovers Creek subwatershed                     | 3                             | 1.0                             | 3.0                     |
| Innisfil Creeks subwatershed                  | 3                             | 1.0                             | 3.0                     |
| Barrie Creeks subwatershed                    | 5                             | 1.0                             | 5.0                     |
| Maskinonge subwatershed                       | 3                             | 1.0                             | 3.0                     |
| West Holland subwatershed                     | 3                             | 1.0                             | 3.0                     |
| East Holland subwatershed                     | 3                             | 1.0                             | 3.0                     |

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### 11.3.2.3 Uncertainty for IPZ Delineation and Vulnerability

Based on the factors discussed above, Baird (2011) recommended an IPZ delineation Uncertainty Rating for the IPZ-1 as Low and IPZ-2 and IPZ-3 as High. The Uncertainty Rating for the IPZ-1, -2 and -3 Vulnerability Scores are all High (Table 11-6).

While the location of the intake was relatively well defined and no Drinking Water Issues were reported (see Section 11.3.3) the Uncertainty of the Vulnerability Score is considered high. This

score is based on the limited data were available for the Issues Evaluation, and because the operator raised some raw water quality concerns (Baird, 2011). A High Uncertainty was therefore assigned to the Vulnerability Score for the IPZ-1.

The IPZ-2 delineation is based on current velocities in the vicinity of the intake. Based on the data, model, model application, and model calibration limitations presented in this section, a “High” rating of uncertainty is recommended. The High levels of Uncertainty are not a reflection of the quality of work, but recognition of the limitations presented. With respect to extension of the IPZ-2 up tributaries, the velocities in small tributaries, in many cases, were assumed, due to lack of data. Similarly, no fieldwork was undertaken to define the characteristics of Transport Pathways and there are significant data gaps. A High level of Uncertainty was therefore assigned to the IPZ-2 delineation. Vulnerability Scores for the IPZ-2 were assigned based on the Area and Source Vulnerability Factors. The Uncertainty Rating for the data used to define the Source Vulnerability Factor (offset from shore, depth and history of water quality concerns) is High as discussed for the IPZ-1. The level of Uncertainty for the Area Vulnerability for the IPZ-2 is also High due to the degree of uncertainty in the methodology used to develop the Area Vulnerability Factor. This in part stems from the fact that the Rules (MOE, 2009a) do not provide specific guidance.

**Table 11-6: Summary of uncertainty Ratings for the Rama First Nation WTP IPZs and Vulnerability Scores.**

| IPZ   | Uncertainty for IPZ Delineation | Uncertainty for Vulnerability Scores |
|-------|---------------------------------|--------------------------------------|
| IPZ-1 | Low                             | High                                 |
| IPZ-2 | High                            | High                                 |
| IPZ-3 | High                            | High                                 |

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The IPZ-3 limits have been defined based on [Rule 70; MOE, 2009a]. The entire watersheds of Lake Couchiching and Lake Simcoe were included in the IPZ-3. Although not required, an analysis to determine whether a spill would result in a contaminant reaching the intake in a concentration that could compromise the drinking water would be beneficial. A High level of Uncertainty has therefore been assigned to the IPZ-3 delineation.

A High level of Uncertainty has also been assigned to the Vulnerability Scoring for the IPZ-3 subareas, for the reasons discussed with respect to the IPZ-1 and IPZ-2.

### 11.3.3 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogens) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114.(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the Rama First Nation Water Treatment Plant has been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for Rama First Nation WTP are provided in Technical Memorandum R1 – Drinking Water Issues Evaluation– Rama First Nation (Appendix RFN).

#### ***No Drinking Water Issues have been identified for the Rama First Nation Water Treatment Plant.***

Several parameters were observed on occasion or in low concentrations that are consistently less than the Ontario Drinking Water Quality Standard (ODWQS). Trends were not observed for the majority of these parameters. Several other naturally occurring water quality parameters are present in the water in concentrations that may exceed the aesthetic or operational guidelines of the ODWQS.

Surface water in Lake Couchiching was observed to have variable concentrations of pathogen parameters typically indicated by presence of total coliform or *E. coli* bacteria. Treatment consisting of adequate filtration and disinfection is in place and maintained in accordance with Provincial standards set under the Safe Drinking Water Act. As this treatment is effective, the coliform and *E. coli* bacteria are not considered to be Drinking Water Issues. The water quality of the surface water source will be benefited by any measures within the contributing area to the water supply intake that will reduce the concentrations of bacterial parameters within the surface water system.

### 11.3.4 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Rama First Nation WTP was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO).

A Drinking Water Threat is defined as “an Activity or Condition that adversely affects, or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any activity or condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic, that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Rama First Nation WTP builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

- A list of Drinking Water Threats for Activities,
- A list of Drinking Water Threats for Conditions,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Activities,
- Maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Conditions, and
- An enumeration of Drinking Water Threats.

#### **11.3.4.1 List of Drinking Water Threats – Activities**

The list of Prescribed Drinking Water Threats considered in the assessment for Rama First Nation WTP is provided in Chapter 5, section 5.5.1.

***No additional Drinking Water Threats were identified for consideration. No local circumstances for prescribed Threats were identified.***

#### **11.3.4.2 List of Drinking Water Threats – Conditions**

The following information sources were consulted to identify existing Conditions that could affect the Rama First Nation WTP:

- Files provided by the Ministry of the Environment, [Conservation and Parks](#) local offices pertaining to licenses, and records of spills in the area of the delineated IPZs.
- Records available from the Ministry of the Environment, [Conservation and Parks](#) website containing registry of Brownfield Sites.
- Records from available technical studies and previous contaminant source inventories that identified situations that may qualify as Conditions.

- Interviews of Rama First Nations operations staff to identify potential Conditions within the identified IPZs for the drinking water supply.

**No confirmed Conditions have been identified for the IPZs of the Rama First Nation WTP. No potential Conditions have been identified for consideration at this time.**

### 11.3.4.3 Identifying Areas of Significant/Moderate/Low Threats – Activities

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. ~~The maps combined with the Technical Rules threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The circumstances can be found at: <https://threats.swpip.ca/>. The maps include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores. The tables can be found at: <http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php>.~~

Field Code Changed

#### 11.3.4.3.1 Pathogen Parameters

~~The Technical Rules can be used in conjunction with the Vulnerability Scores. The Key Table on Figure 11a-3 can be used in conjunction with the Vulnerability Scores~~ to identify the areas where activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Rama First Nation WTP. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is greater than 8.

Within the IPZ-3, Activities can be a Threat where the Vulnerability Score is greater than 4 (Figure 11a-4).

#### 11.3.4.3.2 Chemical Parameters

~~The Technical Rules can be used in conjunction with the Vulnerability Scores. The Key Table on Figure 11a-5 can be used in conjunction with the Vulnerability Scores~~ to identify the areas where Activities associated with chemical threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Rama First Nation WTP. Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is greater than 8.

Within the IPZ-3, Activities can be a Threat where the Vulnerability Score is greater than 4 (Figure 11a-6).

#### 11.3.4.4 Identifying areas of Significant/Moderate/Low Threats – Conditions

Further to Section 11.3.4.2, no Conditions have been confirmed within the WHPA for the Rama First Nation WTP.

A Condition or potential Condition that has not been identified would potentially be a Significant, Moderate, or Low Threat to Drinking Water based on the combination of Hazard Rating and Vulnerability Rating as described in Section 5.5.5 (Chapter 5: Methods Overview) and Technical Memorandum A5 (Appendix MO). The Hazard Rating is dependent on whether there is evidence the Condition is causing off-site contamination, and whether the Condition is located on the same property as the supply well.

A Condition would be a threat to municipal drinking water in the following situations:

- **Significant:** where the Vulnerability Score is  $\geq 8$  and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well.
- **Moderate:** (1) where the Vulnerability Score  $\geq 6$  and  $< 8$ , and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well; or (2) Where the Vulnerability Score is 10, and there is no evidence of off-site contamination.
- **Low:** Where the Vulnerability Score  $\geq 8$  and  $< 10$  and there is no evidence of off-site contamination.

Figure 11a-1 and Figure 11a-2 illustrates the Vulnerability Score maps for the Rama First Nation WTP that can be used to determine where a Condition is or would be a Significant, Moderate, or Low Threat to Drinking Water.

#### 11.3.4.5 Enumerating Drinking Water Threats

##### 11.3.4.5

The number of Significant Drinking Water Threats for the Rama First Nation WTP has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO) and refined through consultation with Chippewas of Rama First Nation staff members. There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 11-7 documents the enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the IPZ for the Rama First Nation Water Treatment Plant. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is greater than 8 in IPZ-1.

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A total of 139 activities that are potentially Significant Drinking Water Threats were identified on 138 land parcels within IPZ-1. Within the area of the Rama First Nation Reserve a parcel was considered to be the immediate land area surrounding an identified structure visible from orthophotographs. Stormwater management facilities, storm sewer outfalls, and a sanitary sewage outfall were also counted as parcels.

The use of private individual sewage disposal systems on 129 parcels makes up the majority of the threat activities identified. Twenty (20) of these private sewage systems are on the eastern side of the small island that is included in IPZ-1. Some of the parcels serviced by private sewage systems are not within the Rama First Nation lands and are within the Township of Ramara. One (1) activity has been identified relating to the outfall for the sewage treatment system that is within IPZ-1. There are also four (4) stormwater management facilities and three (3) storm sewer outfalls that are considered to be Significant Threats. The handling and storage of fuel in volumes greater than 2,500 L was identified as a Significant Threat on two (2) parcels.

**Table 11-7: Number of Significant Drinking Water Threats for the Rama First Nation WTP.**

| Threat Number | Threat   | Significant threat counts<br>Number of threats |
|---------------|--|--|
| 1.            | The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act. | 0  |
| 2.            | The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.                | 137  |
| 3.            | The application of agricultural source material to land.   | 0  |
| 4.            | The storage of agricultural source material to land.   | 0  |
| 5.            | The management of agricultural source material.  | 0  |
| 6.            | The application of non-agricultural source material to land.   | 0  |
| 7.            | The handling and storage of non-agricultural source material.  | 0  |
| 8.            | The application of commercial fertilizer to land.  | 0  |
| 9.            | The handling and storage of commercial fertilizer to land.   | 0  |
| 10.           | The application of pesticide to land.  | <del>10</del>                                  |
| 11.           | The handling and storage of pesticide.   | 0  |
| 12.           | The application of road salt.  | 0  |
| 13.           | The handling and storage of road salt.   | 0  |
| 14.           | The storage of snow.   | 0  |

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| Threat Number | Threat  | Significant threat counts*<br>Number of threats               |
|---------------|---|---|
| 15.           | The handling and storage of fuel.   | 2   |
| 16.           | The handling and storage of dense non-aqueous phase liquid.   | 0   |
| 17.           | The handling and storage of an organic solvent.   | 0   |
| 18.           | The management of runoff that contains chemicals used in the de-icing of aircraft.  | 0   |
| 19.           | An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body. | 0   |
| 20.           | Any activity that reduces the recharge of an aquifer.   | 0   |
| 21.           | The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.                                      | 0   |
| <u>22.</u>    | <u>The establishment and operation of a liquid hydrocarbon pipeline</u>   | <u>0</u>  |
| -             | <b>Totals:</b>  | <b>139* significant threats</b><br><b>(on 138 properties)</b> |

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\*9 verified existing Threats and 130 potential Threats that require further verification (2015)

Note for the table above: The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel.

#### 11.3.4.6 Managed Lands

Technical Rule 16(9) (~~August 2009~~) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including IPZ-1, -2 and -3. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a threat in the ~~Director's~~ Technical Rules.

Managed Lands were identified and the Managed Lands proportions were determined for IPZ-1 and IPZ-2 for the water supply to the Rama First Nation WTP as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.4.5). The Managed Lands are used in the identification of Threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material, and commercial fertilizer.

Figure 11a-7 illustrates the location and proportion of Managed Lands within the delineated IPZ-1 and IPZ-2 for the Rama First Nation WTP. The Managed Lands proportions for the IPZ-3 associated with the surface water intakes in Lake Simcoe are presented in Figure 11a-8.

#### 11.3.4.7 Livestock Density

Technical Rule 16(10) (~~August 2009~~) requires the Assessment Report to include maps showing the livestock density within IPZ-1, -2 and -3. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the ~~Table of Drinking Water Threats~~ Technical Rules.

The Livestock Density was determined for IPZ-1 and IPZ-2 for the water supply to the Rama First Nation WTP as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.4.5). Nutrient units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 11a-9 illustrates the distribution of Livestock Density within the delineated IPZ-1 and IPZ-2 for the Rama First Nation WTP. The Livestock Density for the IPZ-3 associated with the surface water intakes in Lake Simcoe is presented Figure 11a-10.

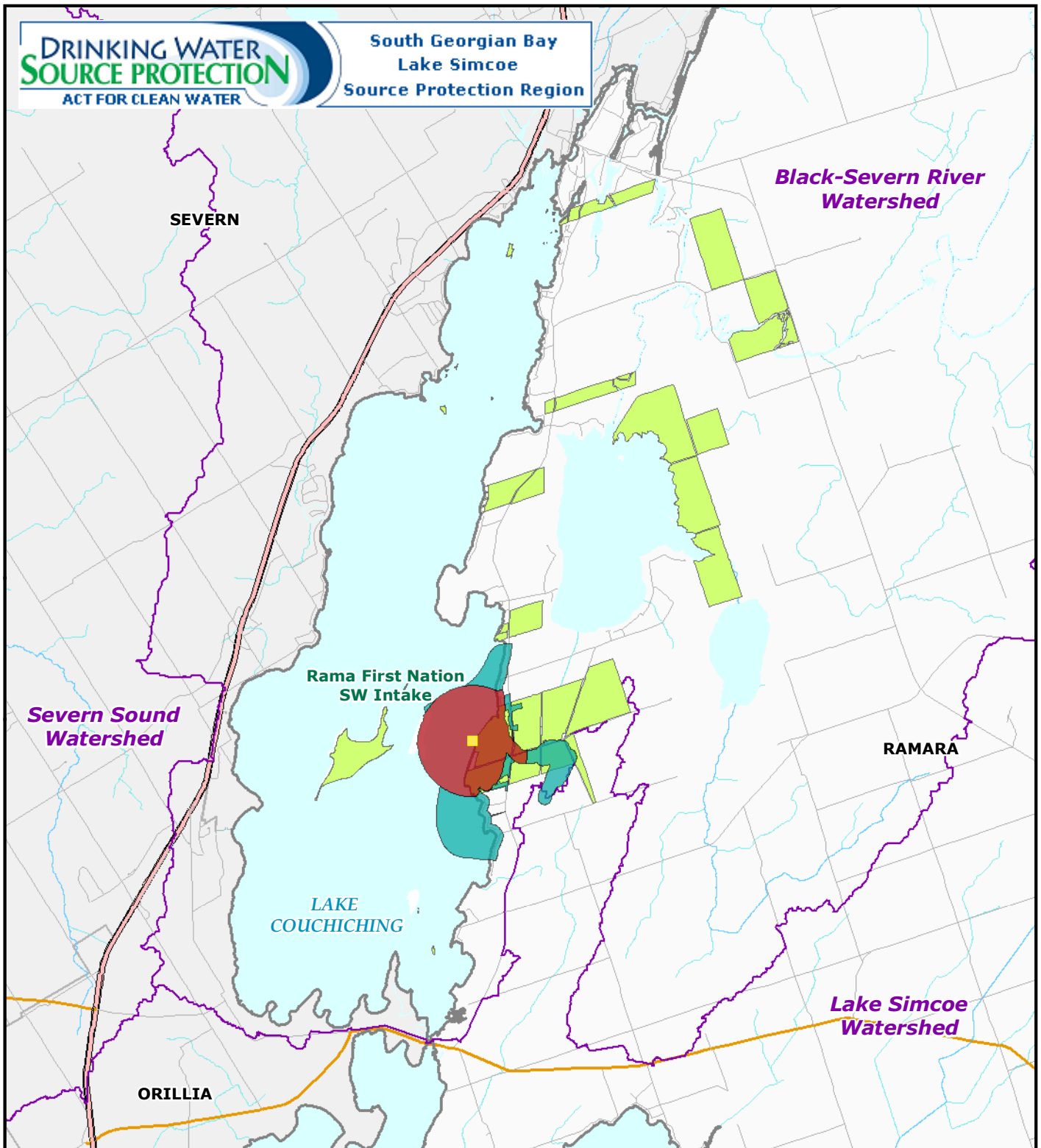
#### 11.3.4.8 Impervious Surfaces

Technical Rule 16(11) (~~August 2009~~) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within including IPZ-1, -2 and -3. This mapping is not required where the Vulnerability Scores for the

area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the [Table of Drinking Water Threats Technical Rules](#).

The proportion of Impervious Surfaces within the delineated IPZ-1 and IPZ-2 for the water supply to the Rama First Nation WTP was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). [Methodology in Technical Memorandum A5.1 \(Appendix MO\) was used in 2023 to update the proportion of Impervious Surfaces within the delineated Intake Protection Zones using the 2021 Technical Rules](#). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.4.5). The Impervious Surfaces are used in the identification of Threat activities associated with the application of winter de-icing agents (salt).

Figure 11a-11 illustrates the distribution of Impervious Surfaces within the delineated IPZ-1 and IPZ-2 for the Rama First Nation WTP. The proportion of Impervious Surfaces for the IPZ-3 associated with the surface water intakes in Lake Simcoe are presented in Figure 11a-12.



- Municipal Surface Water Intakes
- IPZ-1 (1000m on water or 120m inland)
- IPZ-2 (2 hr time of travel)
- First Nation Lands
- SWP Watershed Area
- Municipality Boundary

**Drinking Water System  
Vulnerable Areas in  
Chippewas of Rama First Nation**

Created by: LSRCA  
Date: 2011-05-11

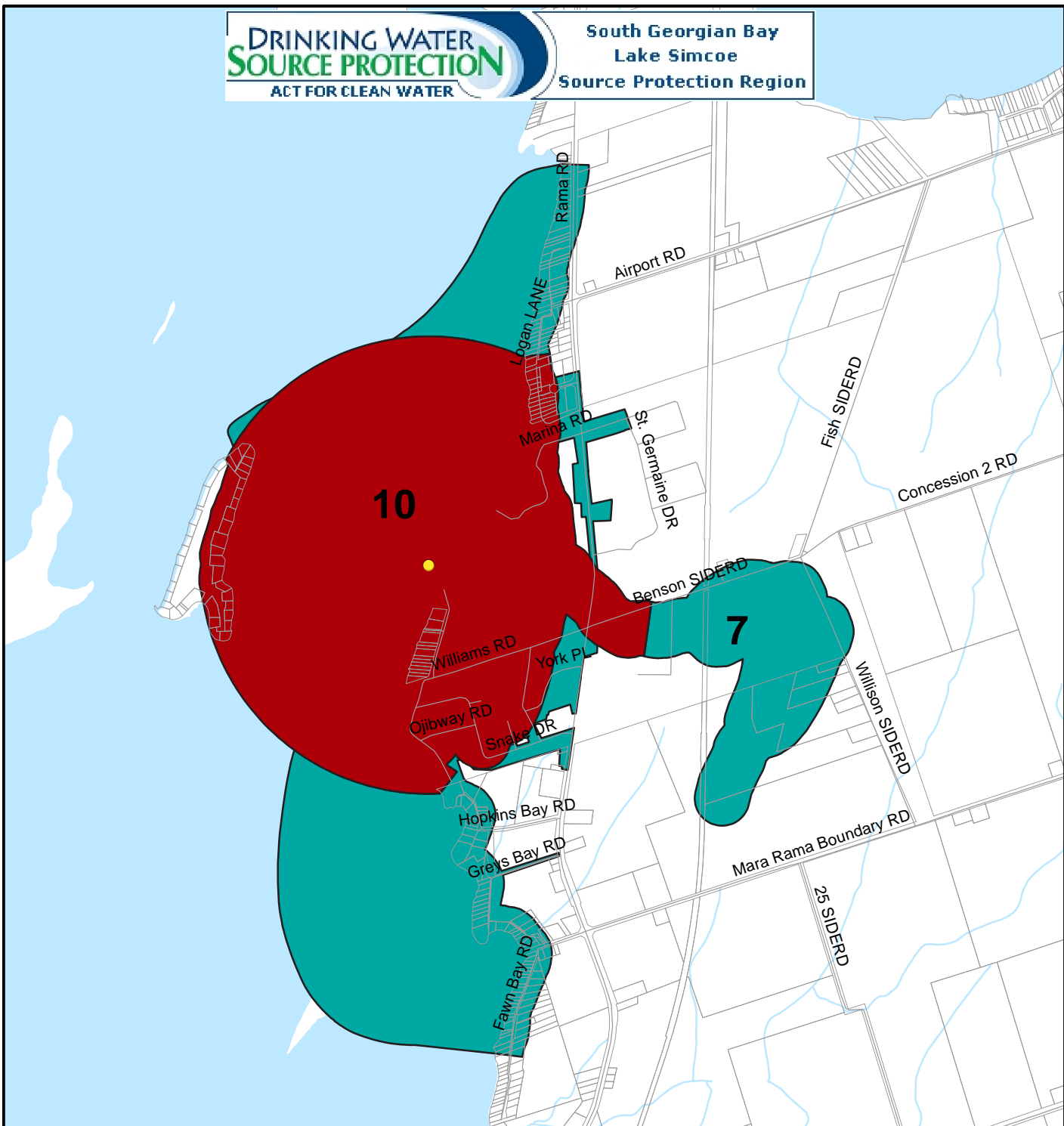


Scale: 1:100,000  
0 1 2km  
UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 11-1**



**Legend**

- IPZ 1 AND VULNERABILITY SCORE
- IPZ 2 AND VULNERABILITY SCORE
- SURFACE WATER INTAKE (TYPE D)



**INTAKE PROTECTION ZONES AND VULNERABILITY SCORES - RAMA FIRST NATION**

DATE: MAY 2011

SCALE: 1:25000

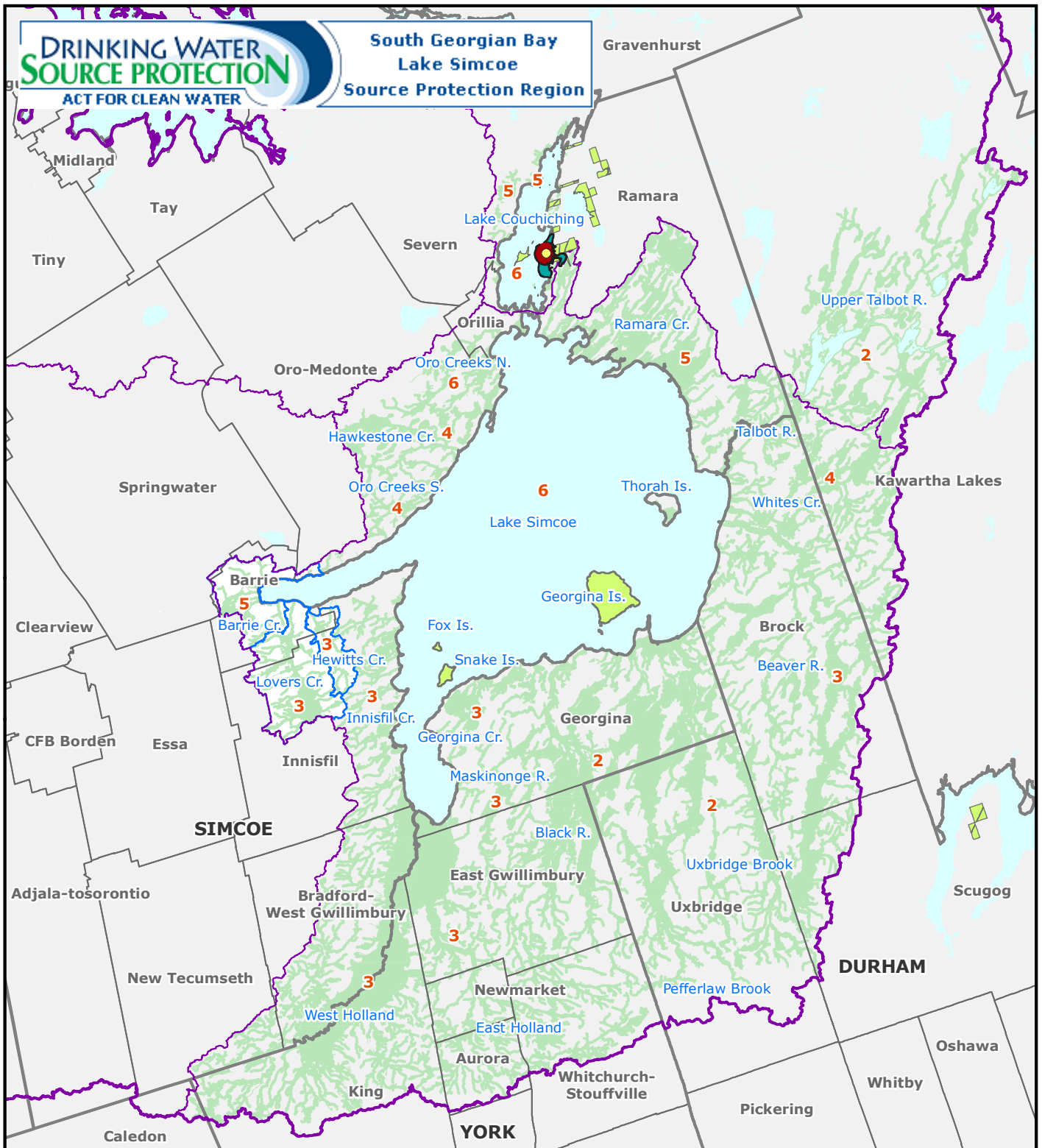
PROJECT: 0-071948.08

FILE. NO.:0-07194808F19.1-1

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



FIGURE  
**11a-1**



- Surface Water Intake
- IPZ-1
- IPZ-2
- IPZ-3 and Vulnerability Score
- First Nation Lands
- SWP Watershed Region
- SWP Watershed Area
- Subwatershed Boundary

**Intake Protection Zone 3 and  
Vulnerability Scores  
Chippewas of Rama First Nation**

Created by: LSRCA  
Date: 2011-05-11

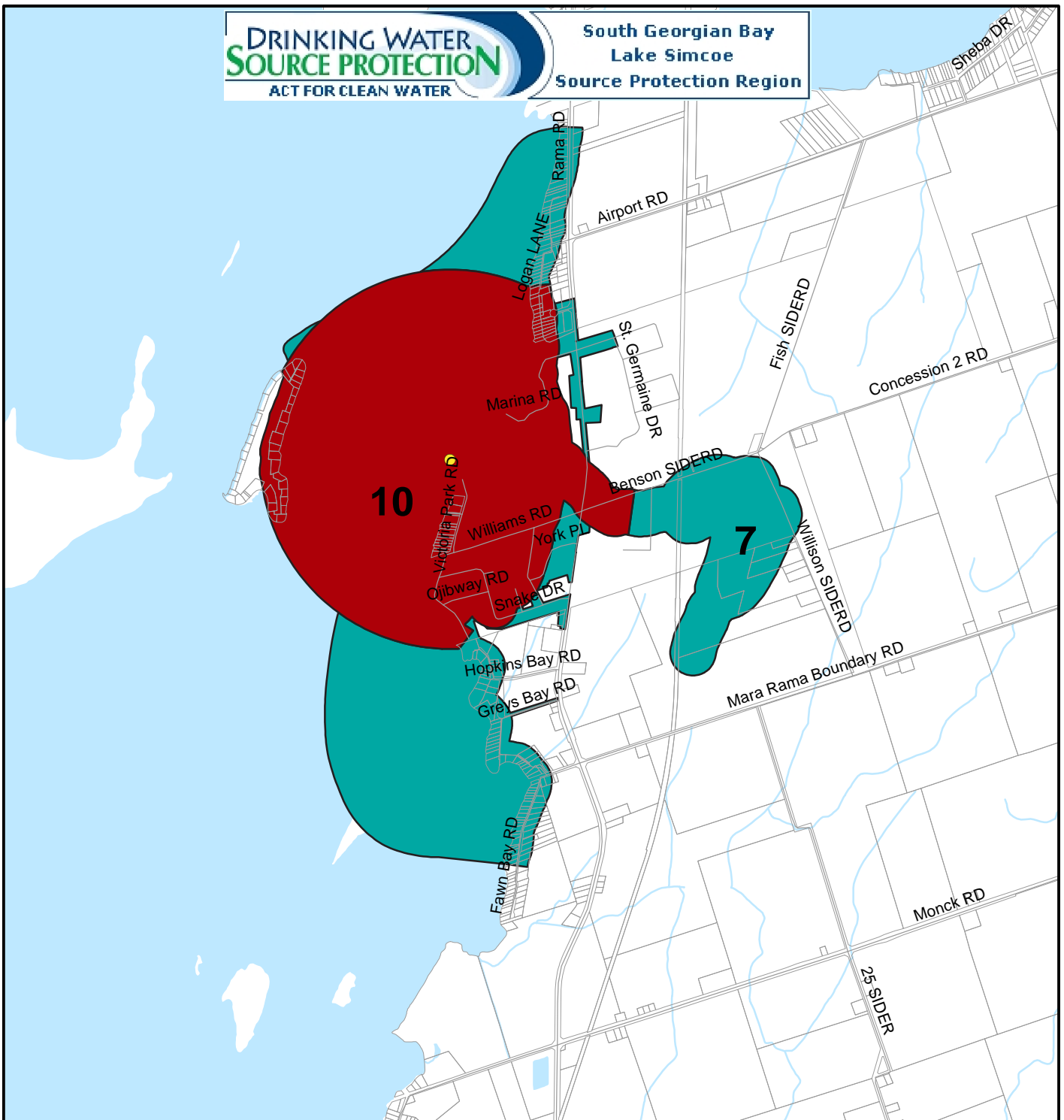


Scale: 1:500,000 0 2 4 6 8 10km  
UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 11a-2**



**Legend**

- 10 IPZ 1 AND VULNERABILITY SCORE
- 7 IPZ 2 AND VULNERABILITY SCORE
- SURFACE WATER INTAKE (TYPE D)



300 150 0 300 Metres

**AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - RAMA FIRST NATION**

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

DATE: MAY 2011

SCALE: 1:30000

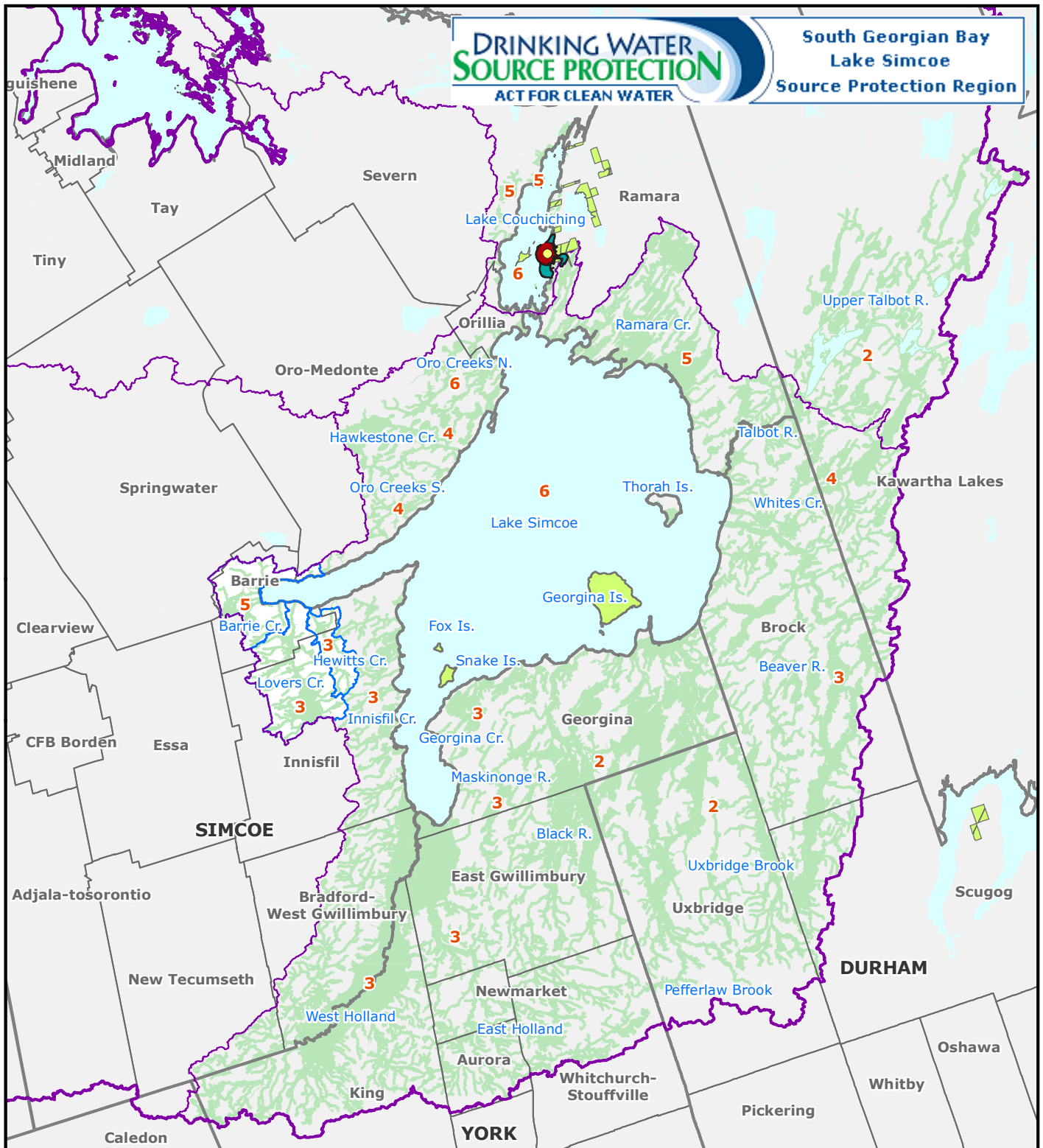
PROJECT: 0-071948.08

FILE. NO.:0-07194808F19.1-2

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FIGURE  
**11a-3**



- Surface Water Intake
- IPZ-1
- IPZ-2
- IPZ-3 and Vulnerability Score
- First Nation Lands
- SWP Watershed Region
- SWP Watershed Area
- Subwatershed Boundary

**Areas Where Pathogens Are Or Would Be Significant, Moderate, Or Low Threats  
Chippewas of Rama First Nation**

Created by: LSRCA  
Date: 2011-05-11

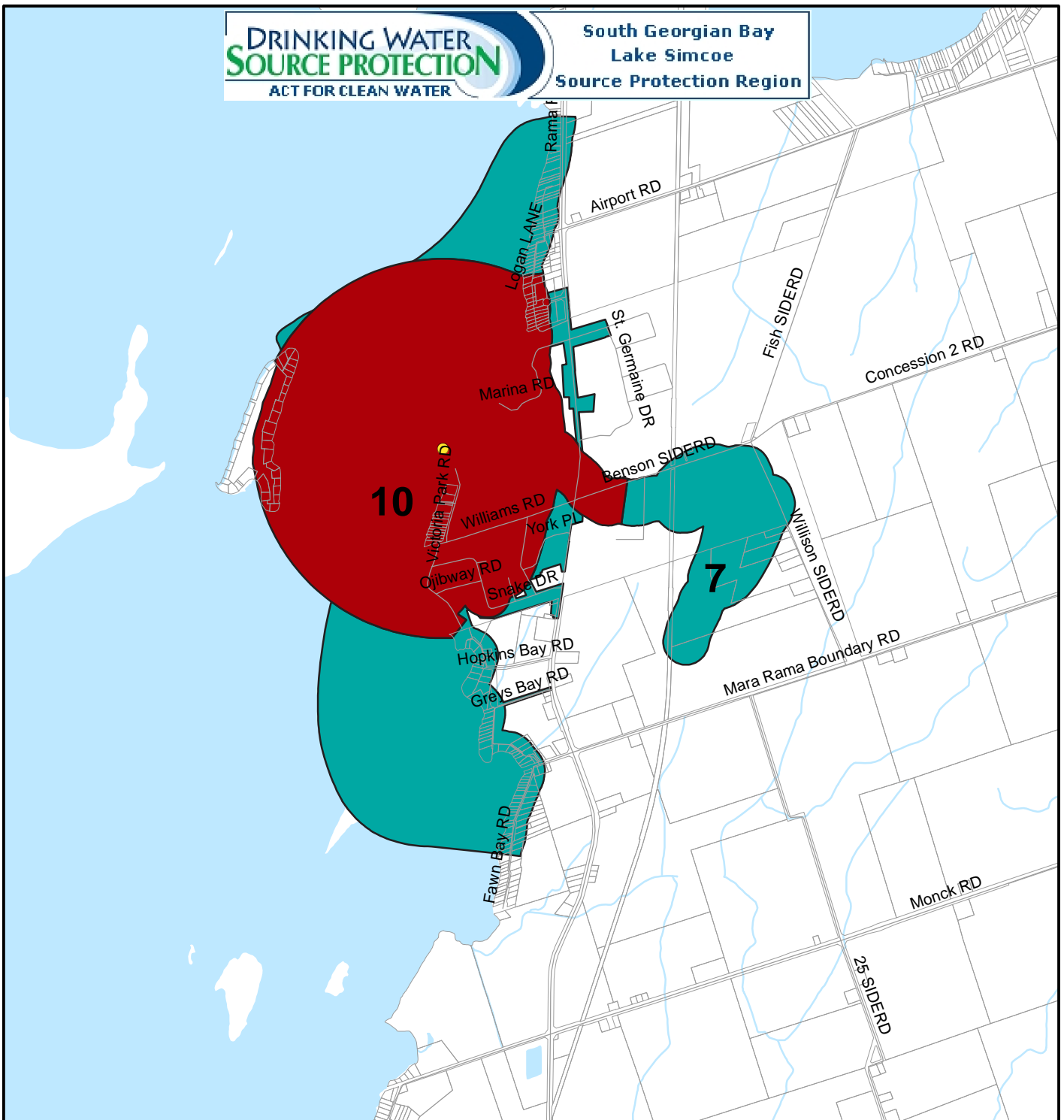


Scale: 1:500,000 0 2 4 6 8 10km  
UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 11a-4**



**Legend**

- 10 IPZ 1 AND VULNERABILITY SCORE
- 7 IPZ 2 AND VULNERABILITY SCORE
- SURFACE WATER INTAKE (TYPE D)



300 150 0 300 Metres

**AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - RAMA FIRST NATION**

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water Threats. The table shows the number of circumstances and references the table designation in the Provincial Tables of Circumstances for each threat category.

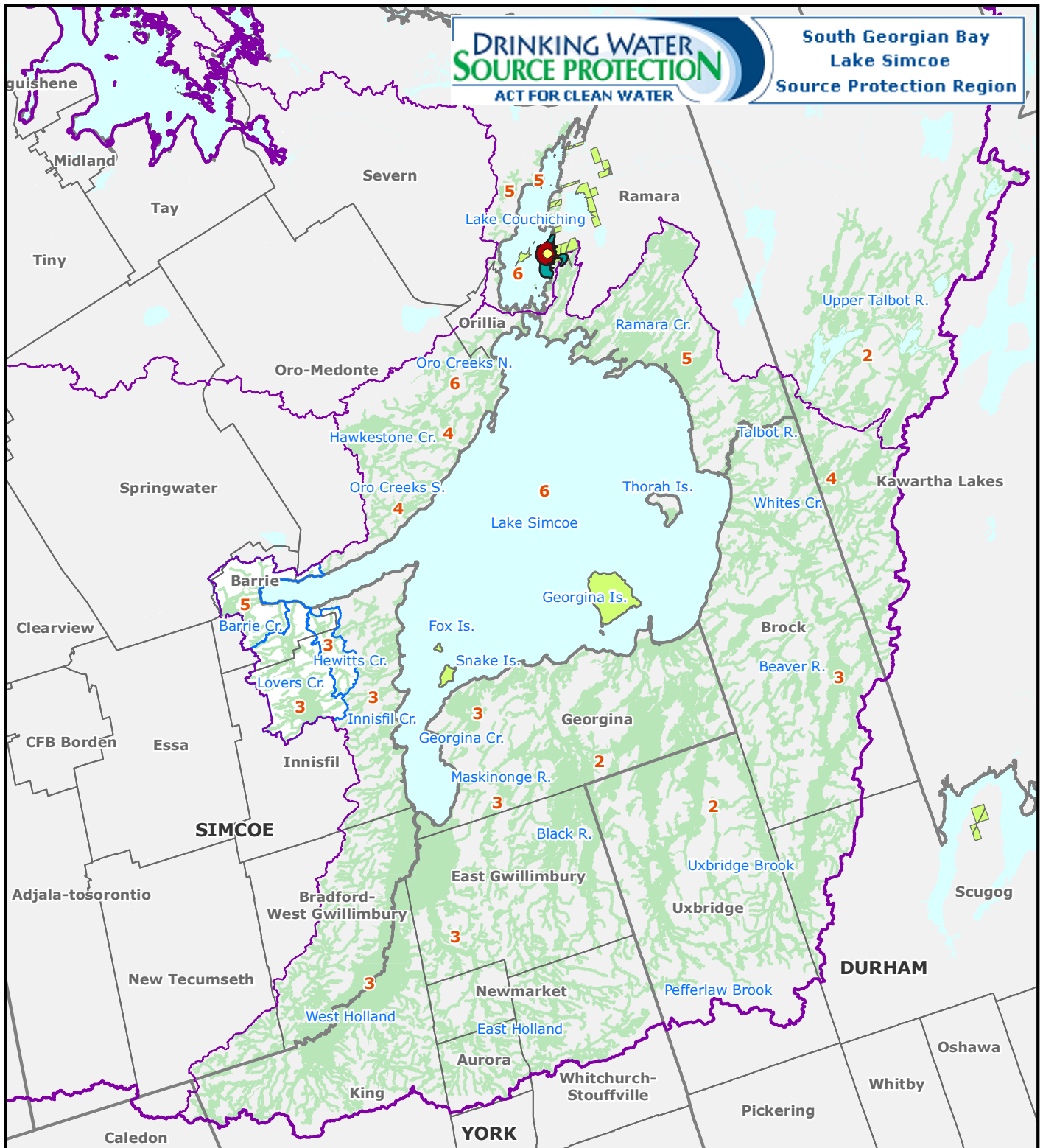
DATE: MAY 2011

SCALE: 1:30000

PROJECT: 0-071948.08

FILE. NO.:0-07194808F19.1-3

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



- Surface Water Intake
- IPZ-1
- IPZ-2
- IPZ-3 and Vulnerability Score
- First Nation Lands
- SWP Watershed Region
- SWP Watershed Area
- Subwatershed Boundary

**Areas Where Chemicals Are Or Would Be Significant, Moderate, Or Low Threats  
Chippewas of Rama First Nation**

Created by: LSRCA  
Date: 2011-05-11

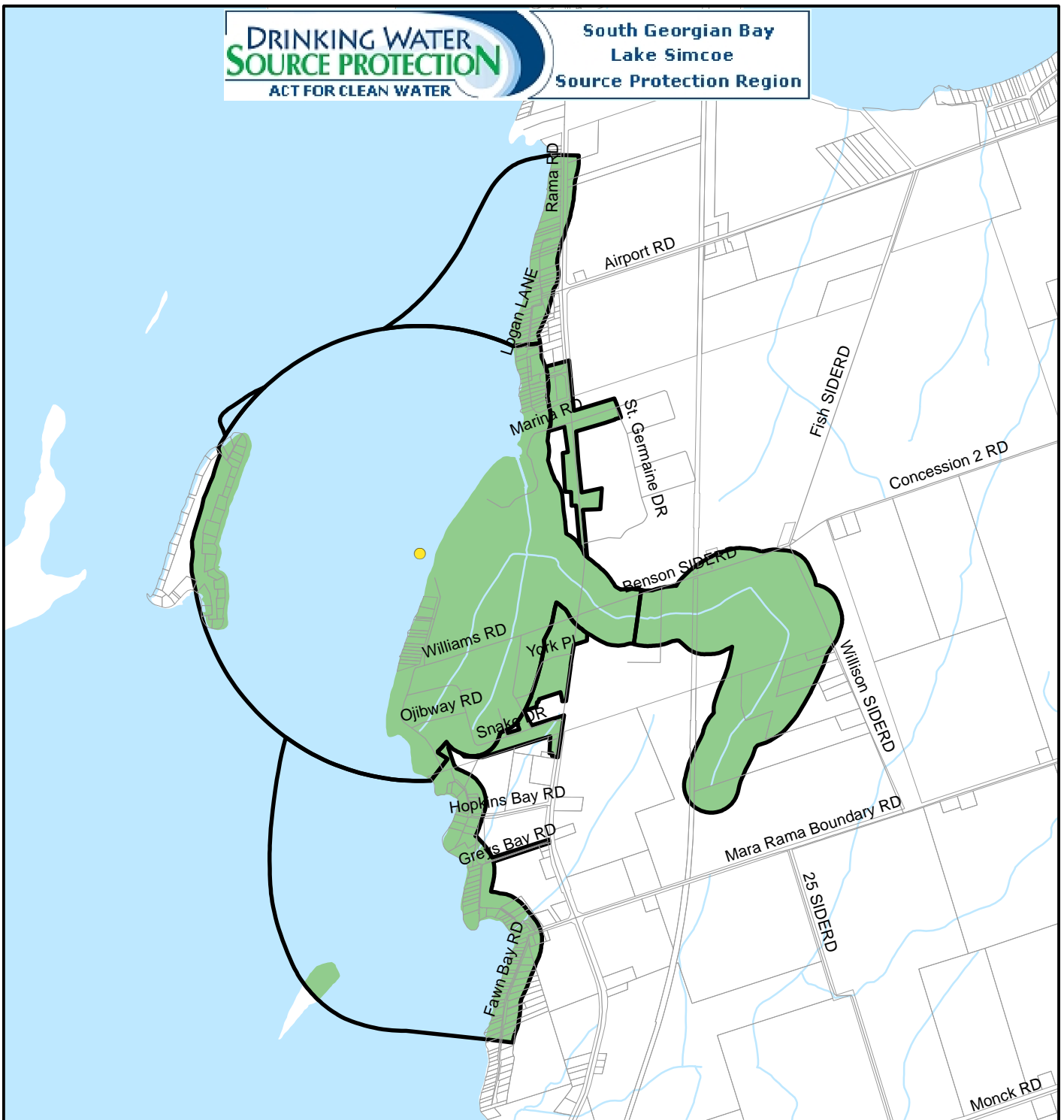


Scale: 1:500,000 0 2 4 6 8 10km  
UTM Zone 17N, NAD83

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**Figure 11a-6**



**Legend**

- MANAGED LANDS (<40%)
- MANAGED LANDS (40-80%)
- MANAGED LANDS (>80%)
- SURFACE WATER INTAKE (TYPE D)



250 125 0 250 Metres

**MANAGED LANDS -  
RAMA FIRST NATION**

The Managed Land proportion is illustrated for the parts of IPZ 1 and 2 where the vulnerability score is greater than 4.1.

DATE: MAY 2011

SCALE: 1:25000

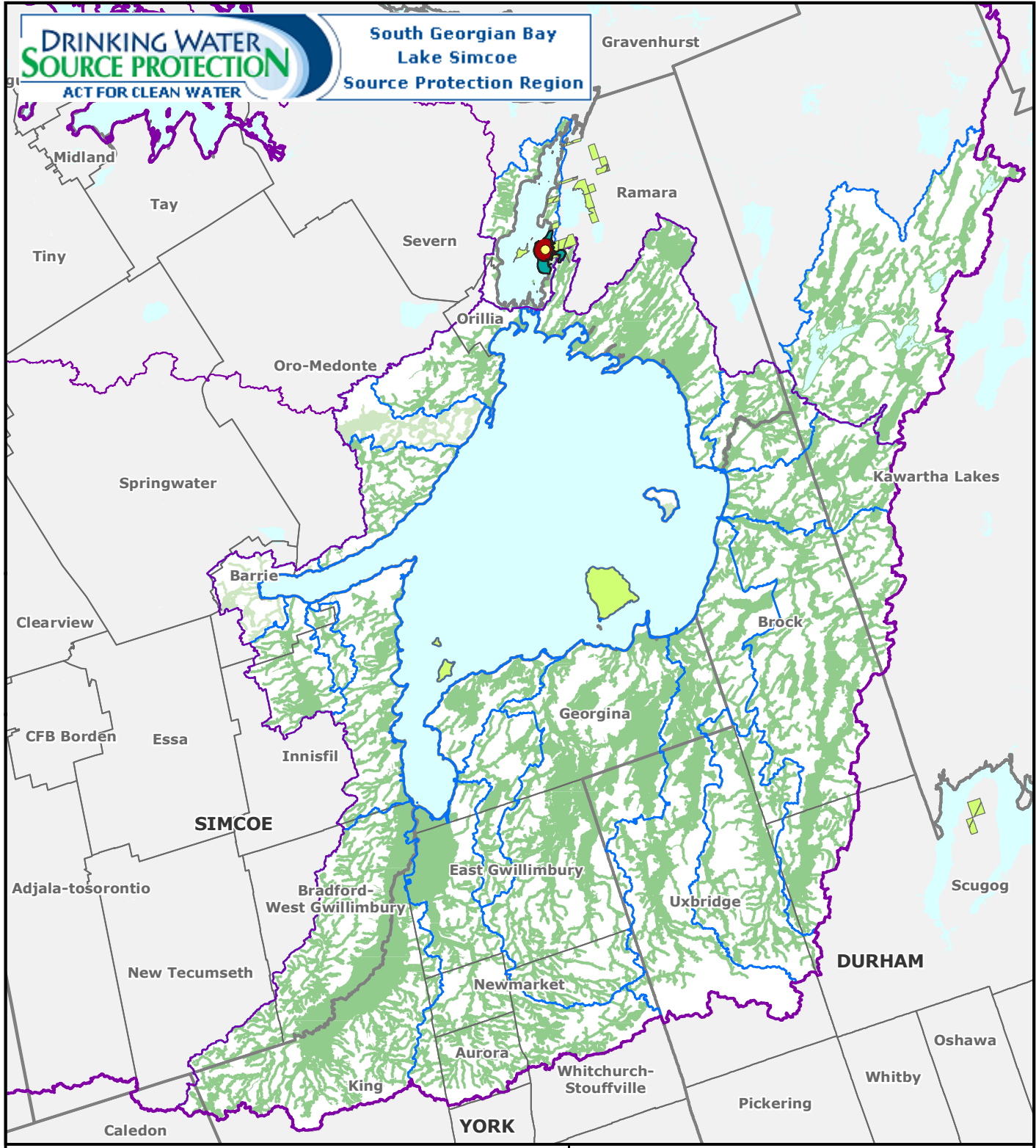
PROJECT: 0-071948.08

FILE. NO.: 0-07194808F19.1-4

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.

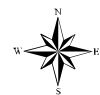


**FIGURE  
11a-7**



**Managed Lands  
Chippewas of Rama First Nation**

Created by: LSRCA  
Date: 2011-05-12

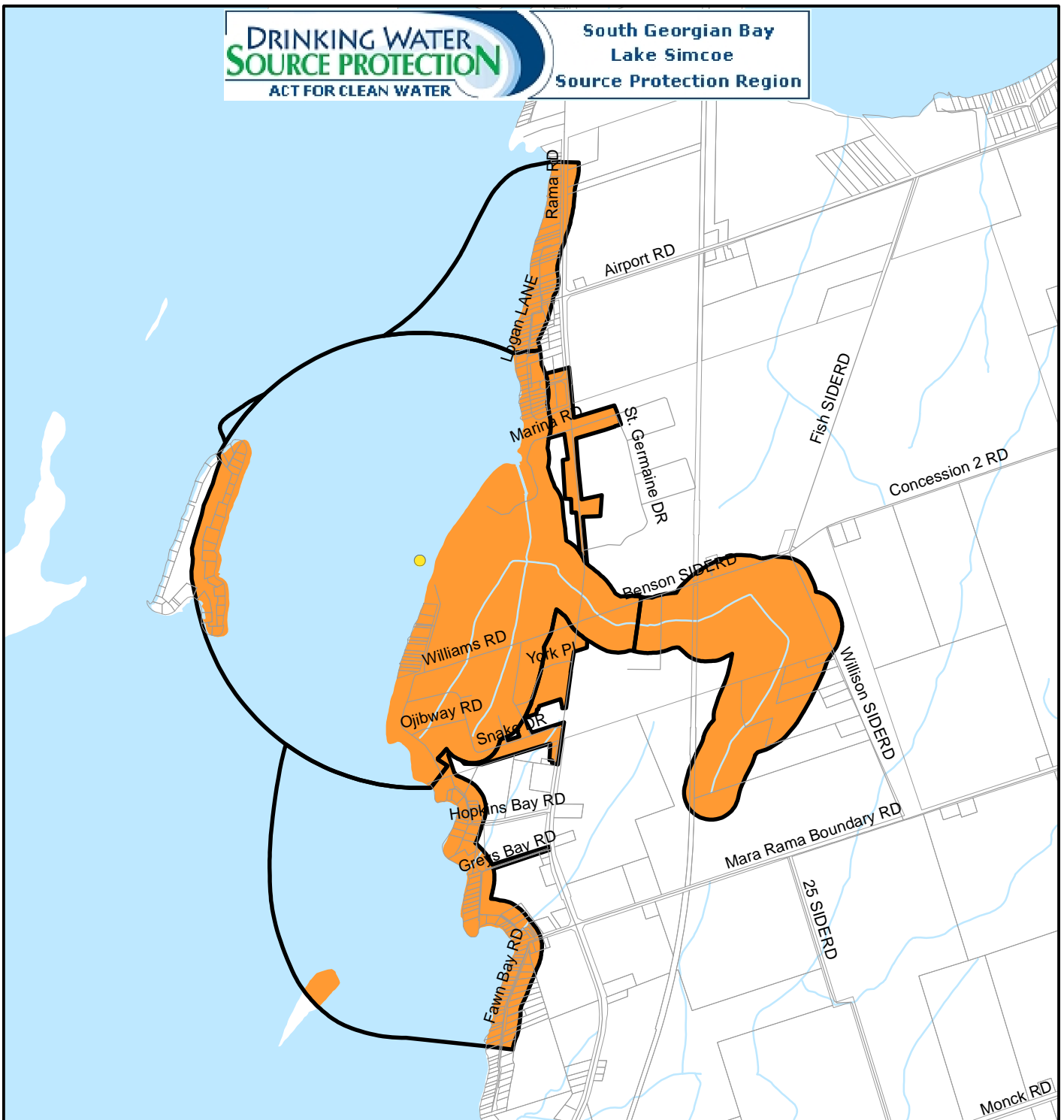


Scale: 1:500,000 0 2 4 6 8 10km  
UTM Zone 17N, NAD83

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**Figure 11a-8**



**Legend**

- LIVESTOCK DENSITY (<math><0.5</math> NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (0.5-1.0 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (>1.0 NUTRIENT UNITS/ACRE)
- SURFACE WATER INTAKE (TYPE D)

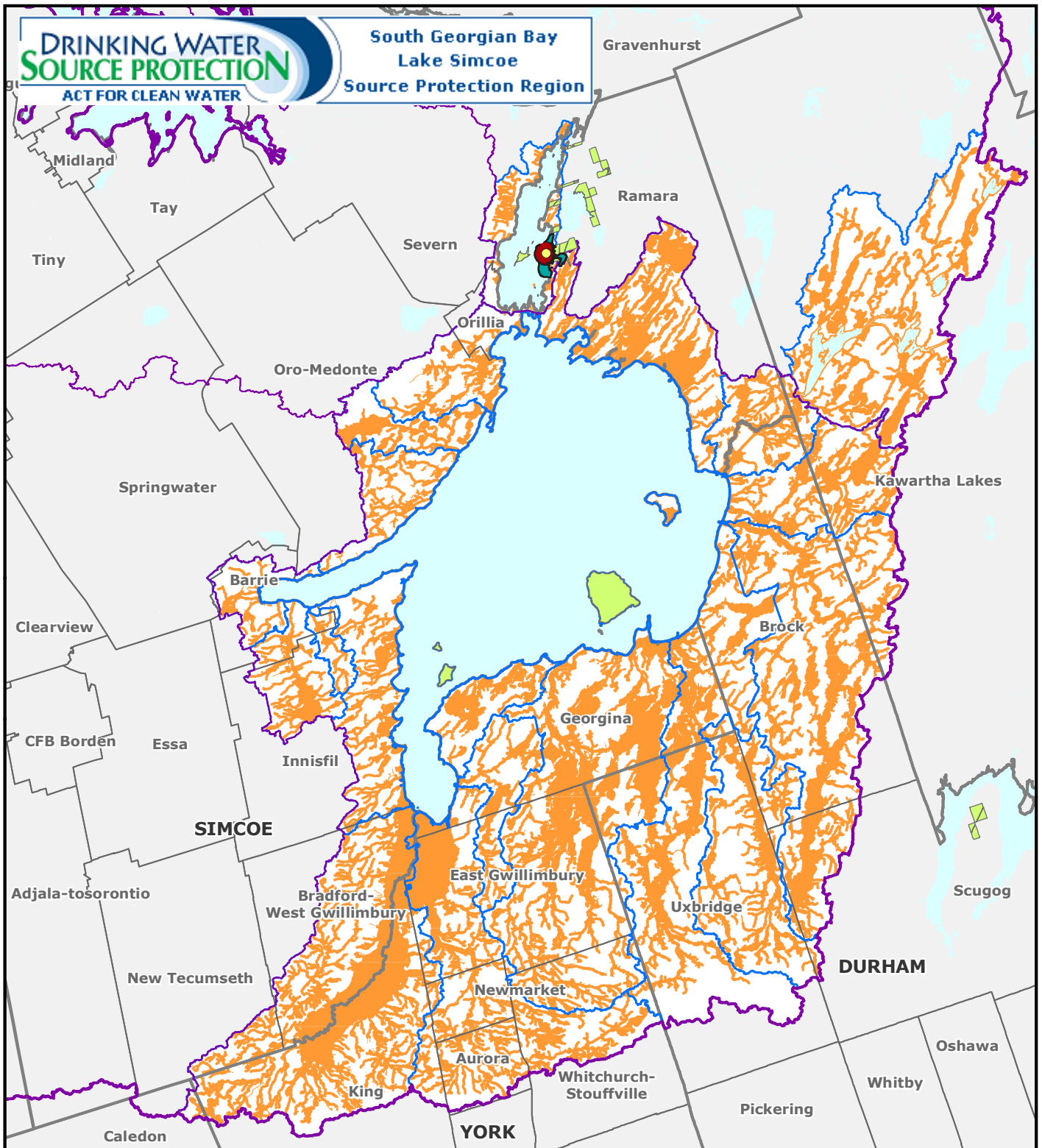
250 125 0 250 Metres

## LIVESTOCK DENSITY - RAMA FIRST NATION

The Livestock Density proportion is illustrated for the parts of IPZ 1 and 2 where the vulnerability score is greater than 4.1.

|                      |                              |
|----------------------|------------------------------|
| DATE: MAY 2011       | SCALE: 1:25000               |
| PROJECT: 0-071948.08 | FILE. NO.: 0-07194808F19.1-5 |

This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



Livestock Density (nutrient units per acre)

< 0.5

0.5 - 1.0

> 1.0

Surface Water Intake (Type D)

IPZ-1

IPZ-2

First Nation Lands

**Livestock Density  
Chippewas of Rama First Nation**

Created by: LSRCA  
Date: 2011-05-12



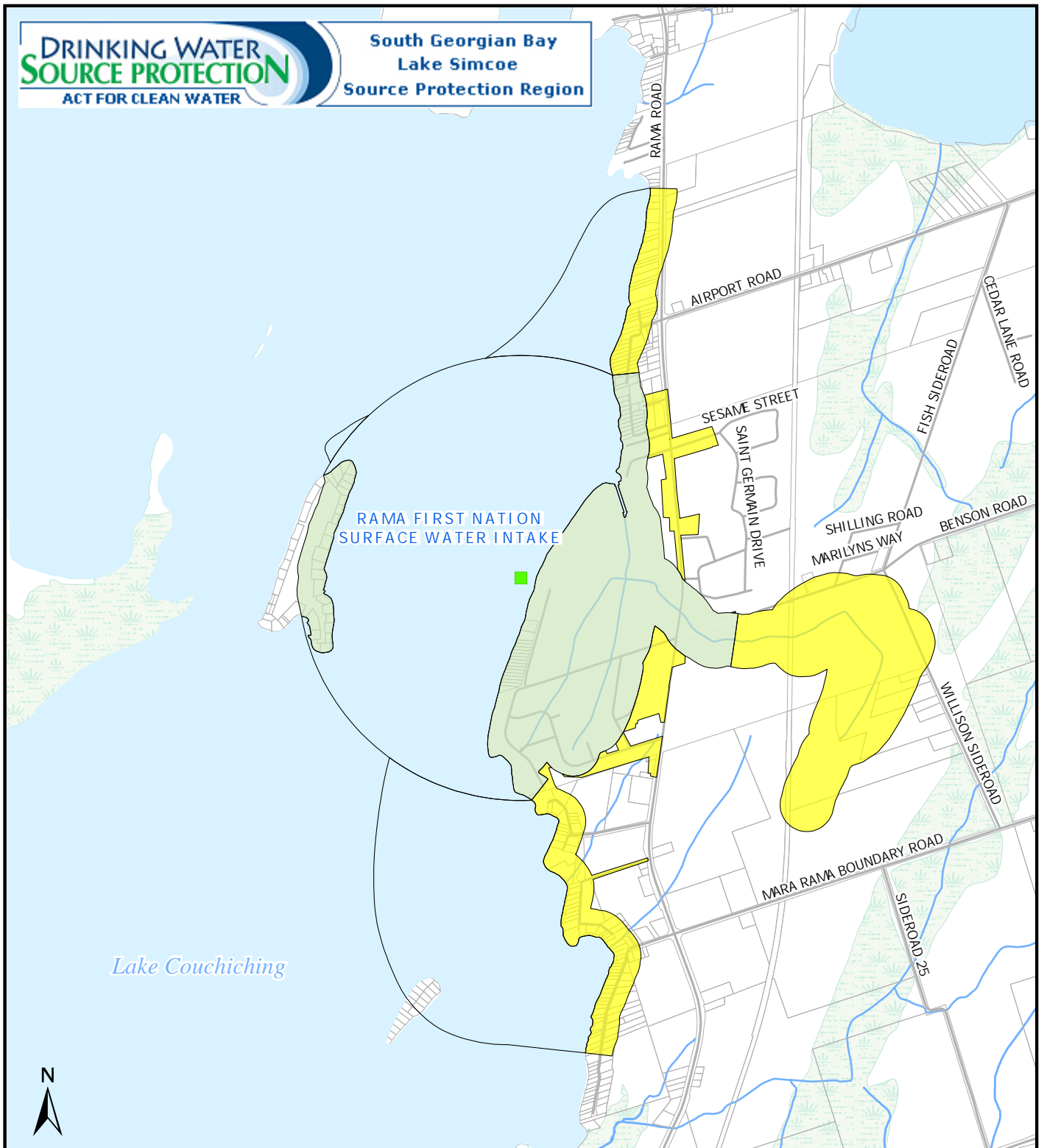
Scale: 1:500,000 0 2 4 6 8 10km

UTM Zone 17N, NAD83

This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



**Figure 11a-10**



- Surface Water Intake
- Impervious Surfaces in IPZ 1 & 2
- < 1%
- = 1 - < 6%
- = 6 - < 8%
- = 8 - < 30%
- > 30%

**Impervious Surfaces - Rama First Nation Intake Protection Zone 1 & 2**

Created by: LSRCA, 2025-08-05

Scale 1: 25,000

0 0.2 0.4 0.8 km

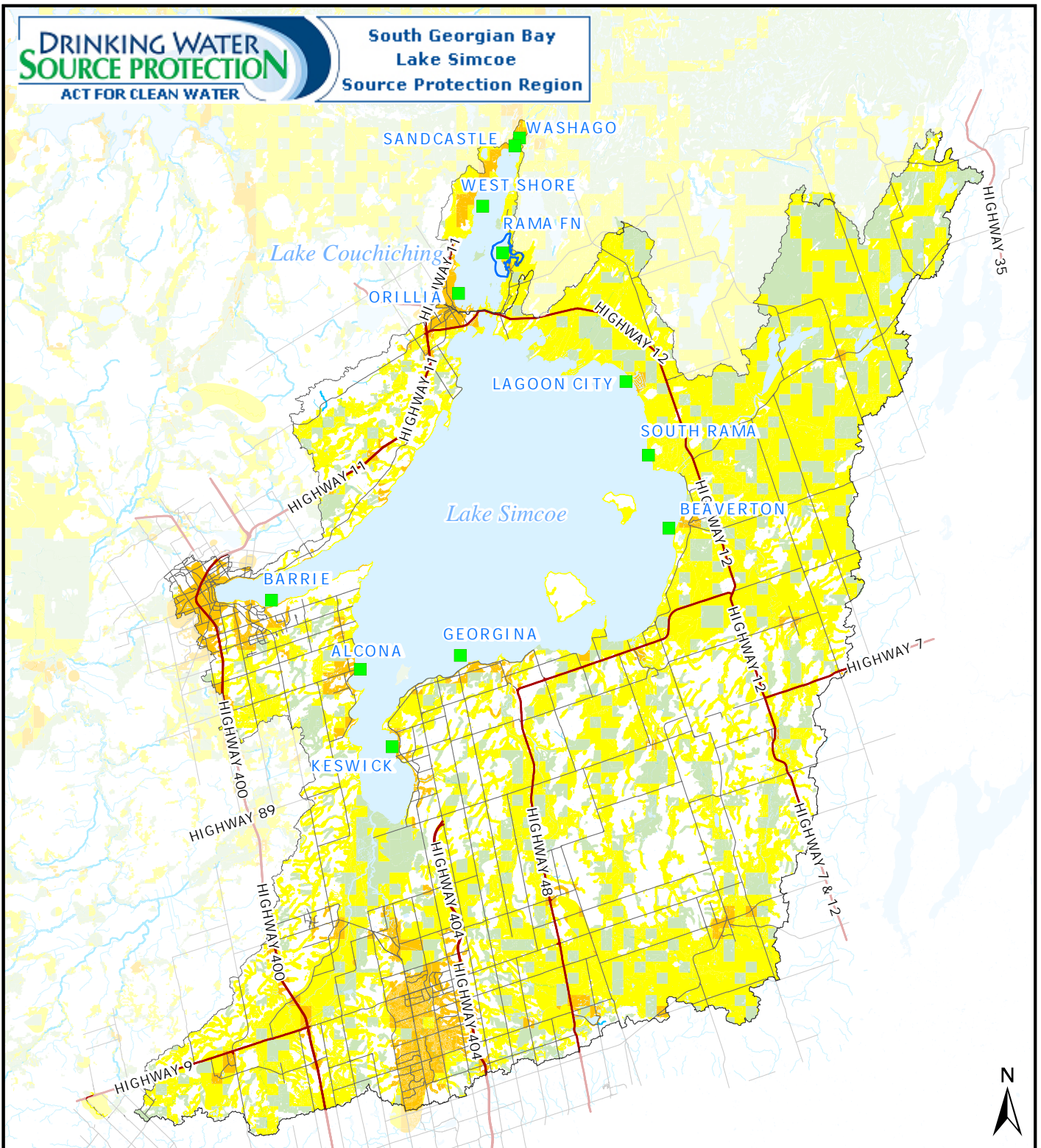
UTM Zone 17N, NAD83



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Figure 11a-11



- Surface Water Intake
- Impervious Surfaces in IPZ 3
  - < 1%
  - = 1 - < 6%
  - = 6 - < 8%
  - = 8 - < 30%
  - > 30%

**Impervious Surfaces - Chippewas of Rama First Nation  
Intake Protection Zone 3**

Created by: LSRCA, 2025-08-05

Scale 1: 500,000

0 5 10 15 20km

UTM Zone 17N, NAD83



This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



Figure 11a-12