# Chapter 13: Township of Tiny

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# 13 Township of Tiny

## 13.1 Introduction

This chapter contains information on the 19 drinking water systems in the Township of Tiny. Golder Associates Ltd has completed the work presented, which has also been reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group or the Source Protection Committee~~Golder Associates Ltd has completed the work presented, all of which was reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff, Township of Tiny staff, and members of the Source Protection Committee (SPC)~~.

The chapter 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), and the assignment of 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 responsible consultant reports and memos (found in Appendix MO and TI) for a more in depth description of the methods used, as well as the Glossary for any unfamiliar terms.

It should be noted that the threats enumerated may vary slightly from the tables in the Golder Associates Reports (Appendix TI). Minor adjustments to the threats enumeration have been made for municipal properties following submission of additional information by the municipality.

## 13.2 Drinking Water Systems

The Township of Tiny operates groundwater based water supplies in nineteen (19) communities and does not have a surface water intake. As shown in Table 13-1 and Figure 13-1 all of the groundwater supplies are within the South Georgian Bay-Lake Simcoe (SGBLS) Source

Protection Region (SPR). Table 13-1 also indicates the Source Protection Region and corresponding lead Source Protection Authority (SPA) for the municipal water supplies.

**Table 13-1: Municipal Groundwater Supplies in the Township of Tiny.**

| Local Municipality | Community Water Supply | Source Protection Region & Source Protection Authority (SPA) |
|---|---|---|
| Township of Tiny | Bluewater | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Cooks Lake | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Georgian Bay Estates | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Georgian Highlands | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Georgian Sands | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Lefaive | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Lafontaine | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Pennorth | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Perkinsfield | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Rayko | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Sand Castle | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Sawlog Bay | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Tee Pee Point | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Thunder Bay | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Tiny Cove | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Vanier Woods | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Whip-poor-will II | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Woodland Beach | SGBLS SPR & Severn Sound SPA |
| Township of Tiny | Wyevale | SGBLS SPR & Severn Sound SPA |

In addition, sections of the Midland (Town of Midland), Robert Street and Lepage WHPAs (Town of Penetanguishene) crosses municipal boundary into the Township of Tiny (Table 13-2). See

the Midland (Chapter 7) and Penetanguishene (Chapter 8) chapter for more information on these systems.

**Table 13-2: WHPA that cross into the Township of Tiny in the SGBLS SPR.**

| Local Municipality that WHPA extends into | Municipality where wellhead is located | Name of Water Supply | Source Protection Region & Source Protection Authority (SPA) | Location where entire Assessment can be obtained |
|---|---|---|---|---|
| Township of Tiny | Midland | Midland Well Supply | SGBLS SPR<br>&<br>Severn Sound SPA | This report (Chapter 7) |
| Township of Tiny | Town of Penetanguishene | Robert Street Well Supply | SGBLS SPR<br>&<br>Severn Sound SPA | This report (Chapter 8) |
| Township of Tiny | Town of Penetanguishene | Lepage Well Supply | SGBLS SPR<br>&<br>Severn Sound SPA | This report (Chapter 8) |

## 13.3 Bluewater Well Supply

The Bluewater Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of three wells (Wells 8-1, 18-1 and 18-2). Table 13-3 provides details on these wells.

**Table 13-3: Bluewater Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Bluewater | 8-1 | A3/A4 | 220005269 | 1148-7BRLXU (Mar 2018) | 360 | 90 |
| Bluewater | 18-1 | A3 | 220005269 | 1148-7BRLXU (Mar 2018) | 817 | 446 |
| Bluewater | 18-2 | A3 | 220005269 | 1148-7BRLXU (Mar 2018) | 817 | 0 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in the Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township.

Upper Confining Layer (UC) – This forms a discontinuous unit across the model area, mostly comprised of silty material. While the material is considerably finer than the underlying aquifer material, this unit is a poor confining layer and is typically unsaturated.

Aquifer Layer A1 – This forms a discontinuous unit across the model area, and frequently appears at surface where UC thins out. In some areas it has a direct hydraulic connection with A2.

Confining Layer C1 – This unit is prevalent over most of the modelled area. C1 occasionally reaches surface where A1 pinches out, particularly in the Tiny West model area.

Aquifer Layer A2 – This confined aquifer unit is found over most of the modelled area. It is a relatively thin aquifer, particularly near the shoreline of Georgian Bay. The majority of the Township's municipal wells are screened in this aquifer.

Confining Layer C2 – This unit is prevalent over most of the Tiny West modelled area, with the Woodland Beach area being an exception. In Tiny East, this unit thins considerably towards Severn Sound.

Aquifer Layer A3 – This forms a discontinuous unit across the model area. Its greatest thickness is found below the topographic high along the north-south centre of the Township. It is connected to A4 in the Woodland Beach area.

Confining Layer C3 – This unit is found over most of the Tiny West model area and is thickest in the Township centre. Similar to C2, this layer thins out towards Severn Sound in Tiny East.

Aquifer Layer A4 – This deep contact aquifer unit has limited extent and is only found in the Woodland Beach area and discrete areas of northwest Tiny. This aquifer unit is not found in Tiny East. It is assumed to be in direct hydraulic connection with the underlying weathered limestone aquifer.

Weathered Limestone Bedrock – A continuous layer of weathered limestone bedrock. In Tiny West, the thickness of this unit is a uniform 3 m; in Tiny East, the thickness is a uniform 12 m, based on observations in ~~MOE~~MECP well records.

### 13.3.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply. The Vulnerability Analysis considers the WHPA and the Groundwater Vulnerability, as well as the potential for the vulnerability to be increased by man-made (anthropogenic) structures, through Transport Pathways, by developing a "Vulnerability Score" within the WHPA. Conversion of Vulnerability categories (High, Medium and Low) to Vulnerability Scores (10, 8, 6, 4 and 2) results in a new map for each WHPA that expresses the relative degree to which a Threat could affect the drinking water supply. A higher value Vulnerability Score will always be assigned to the immediate vicinity of the well and to any areas that are shown to be vulnerable.

The Groundwater Vulnerability for the Bluewater water supply has been delineated following the process recommended in the Technical Rules. The areas that contribute groundwater to the wells were delineated as WHPA. The Groundwater Vulnerability Assessment was carried out as follows:

The Groundwater Vulnerability Assessment was carried out as follows:

- WHPA delineation for the Tiny Cove Estates and Wyevale Systems;
- Delineation of WHPA-E for the Georgian Bay Estates System;
- Assess Groundwater Vulnerability (AVI Method);
- Assign Vulnerability Score prior to modifiers (Transport Pathways);
- Consider modification to Vulnerability Score based on Transport Pathways;
- Assign final Vulnerability Score; and
- Determine level of uncertainty in Vulnerability Assessment

Details of the methods for the Vulnerability Analysis and details of the work performed to assess the Groundwater Vulnerability in Tiny are provided are provided in Golder, 2010c. Note that the methods used to assign vulnerability scores in the Golder report differ slightly than those within this Assessment Report. The Golder report includes a modification to vulnerability based on water quality. While Directors approval to use this alternate approach was requested under Technical Rule 15.1, approval was only given to increase vulnerability from low to medium, and not to increase vulnerability to high. As permission to only partially increase the vulnerability score was approved, it was recommended the not to increase vulnerability due to water quality. An explanation from MOE detailing the reason why the alternate method could not be used is provided in Appendix TI.

#### *13.3.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007).

An industry standard groundwater modelling software package, MODFLOW, was used to develop the capture zones for the majority of the wells in the Township of Tiny.

Since the time of the original assessment, new information has become available, primarily consisting of additional water well information system (WWIS) data (i.e., well records) and updated surveys of municipal well locations. It was recognized that this data may potentially warrant changes to the orientation, shape and location of the WHPAs developed earlier. This includes (i) updated surveys of the supply well locations (which indicated in some cases that they did not correspond with the previously modelled well coordinates and (ii) irregularities in the shape of some of the time-of-travel capture zones that make up the WHPAs.

Upon review of the updated locations, it was determined that the updated well coordinates were all within 40 m of the location used for the modelling conducted in the earlier studies. Recognizing the variability and relative accuracy associated with the data used to develop the

models (for example hydraulic conductivity and recharge) and other uncertainties associated with the modelling process (e.g., the hydrogeological "resolution" of the grids and the regional datasets would typically be 100 m to greater than 200 m), re-evaluation of the WHPAs determined based on the earlier modelling was not considered necessary. The previous results were applied, through shifted capture zones to reflect the new co-ordinate information. In addition, minor variances in capture zone polylines were corrected.

The Bluewater WHPAs are illustrated on Figure 13a-1. The WHPAs for the Bluewater well system extend to the east, away from Georgian Bay.

#### *13.3.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Bluewater WHPAs is shown in Figure 13a-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13a-2, High (<30) to Medium (30-80) Vulnerability is indicated in the western part of the Bluewater WHPA within WHPA-B through C and Medium to Low (>80) through WHPA-C to D.

#### *13.3.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). The presence of the Transport Pathways should be accounted for in the Vulnerability assessment and include:

- Private water wells, unused water wells and abandoned water wells;
- Construction of underground services;
- Subsurface excavations; and,
- Pits and quarries.

There were no adjustments made to the Vulnerability Scoring for the Bluewater system, with the exception of private wells.

Constructed Transport Pathways to an aquifer, for example water wells, can have a locally significant impact on the Vulnerability of an aquifer. The SSEA surveys were aimed at identifying and locating wells within the WHPAs and included a categorization of those wells which pose the highest risk to the aquifer. The wells were classified based on: (1) the physical condition of the well (i.e., Class A, B or C), based on height of the casing above grade and likely condition of the well cap; and (2) increasing risk (category 1, 2, and 3) based on the aquifer they were completed in. Wells with a risk rating of 3C were included as Transport Pathways as they are considered to have the highest risk as this comprises the wells completed to the municipal aquifer which have below standard well casing height. The high risk rating does not imply that these wells necessarily represent a Transport Pathway that is or could cause impact to the municipal aquifer. It implies that, based on the physical condition and depth of the well, there is an increased risk associated with these locations. These are the only wells (3C) that have been used to modify the Vulnerability Scoring, based on the rationale provided in Golder, 2010c. No 3C wells were identified in the Bluewater WHPA.

#### *13.3.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.3.1.5 Vulnerability Score*

The WHPA zones for the Bluewater Water Supply, as shown in Figure 13a-1, and the Groundwater Vulnerability, as shown in Figure 13a-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13a-3 illustrates the Vulnerability Scores for the Bluewater Water Supply. Figure 13a-3 will be used to assess Drinking Water Threats in Section 13.3.3.

#### *13.3.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c.

The independent peer review of WHPA delineation was undertaken by Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Bluewater WHPAs is High. The full results of the WHPA delineation Peer Review process, for

Bluewater is available in Appendix TI and discussed in Chapter 5 (Methods Overview). Based on the rationale provided for the Vulnerability Assessment (see below), Golder 2010c, characterized uncertainty of the WHPA delineation as Low. As this differs from that provided by the peer review, the most conservative, 'High' Uncertainty ranking will currently apply.

The uncertainty associated with the Vulnerability Assessment was evaluated using a qualitative process outlined in Golder, 2010c. The Uncertainty Assessment methodology considers the type, quantity and quality of available data, the methods used to determine the Vulnerability Assessment components, and the nature of the groundwater flow system.

Considering all of the available data, the uncertainty of the Vulnerability for the Bluewater Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.3.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

The Township of Tiny Drinking Water Issues evaluation was based on a review of water quality data from the NSGS (Golder 2005), annual drinking water quality reports and water quality digital data provided by the Township. Additionally, raw water quality samples were collected by Golder from the Township wells in March 2009 (Golder, 2010c) as part of the Issues Evaluation.

Water quality data for the municipal supply wells was assessed to identify parameters (including pathogens) for which there were indications of elevated concentrations. These parameters were further reviewed to determine if: (i) current or projected concentrations exceed the Ontario Drinking Water Quality Standards (ODWQS), (ii) if the parameter was considered to be anthropogenic or natural in origin, and (iii) if the parameter should be made a Drinking Water Issue. The projected concentrations were based on linear regression analysis for the available dataset. Where projected trends at 50 years indicated concentrations which were close to but not exceeding the ODWQS, the most recent data was evaluated to determine if there was indication of an increase in the trend or stabilization in the concentrations. If recent data indicated concentrations above the projected trend line, the parameter was included as a Drinking Water Issue.

***No Drinking Water Issues were identified for the Bluewater Well Supply.***

### 13.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Bluewater Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Bluewater Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for the Bluewater Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties included:

- MOE Look Up Tables (LUT) Database (2009);
- Municipal Property Assessment Corporation (MPAC) (2007) assessment information;
- Hazardous Waste Information Network (HWIN) (2009);
- MOE Records Database (2009);
- SSEA Land Use Mapping (November 2009);
- SSEA Livestock Survey (2001) and Biosolids (2007) database; and,
- SSEA Pre-Screening Report (2007).

Section 13.3.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Bluewater drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. The MOE Records database (2009) included a compilation of files from the MOE[1] District office for properties within approximately 500 m of a municipal well. The database included a number of records relating to Certificates of Approval, Records of Site Condition, miscellaneous reports, waste generator registration information, permits, applications and correspondence. The files in this list of potential Conditions were reviewed in greater detail to determine if there was sufficient evidence to confirm a Condition based on the Technical Rules criteria. The scoring of Condition Threats implemented by Golder uses the precautionary approach of assuming a Hazard Score of 10 since the Condition review methodology did not include detailed evaluation of all potential evidence/documentation that the contamination has not and will not move off-site. This type of information is typically not readily available for contaminated sites.

***No confirmed Conditions have been identified for the Bluewater water supply. No potential Conditions have been identified for consideration at this time.***

#### *13.3.3.3* 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~~

##### 13.3.3.3.1 Pathogen Parameters

The Technical Rules be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13a-4 ~~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 Bluewater Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

[1] Now, the MECP (The Ministry of the Environment, Conservation and Parks)

#### 13.3.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13a-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 Bluewater Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.3.3.3.3 DNAPL Chemical Parameters

Figure 13a-6 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Bluewater Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13a-6 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.3.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.3.3.2, no Conditions have been confirmed within the WHPAs for the Bluewater Water Supply.

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 ≥ 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 ≥ 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 ≥ 8 and < 10 and there is no evidence of off-site contamination.

Figure 13a-3 illustrates the Vulnerability Score map for the Bluewater Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

### *13.3.3.5 Enumerating Drinking Water Threats*

~~13.3.3.4.1~~13.3.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.3.2 and 13.3.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

A number of data sources were utilized as part of the Activity Threat Assessment. The data sources used to obtain Threat information for the GIS based algorithm developed for the project are described in Golder 2010c and summarized in section 13.3.3.1. In most cases, the detailed information required to document the MOE Circumstances was not readily available. The approach was designed to represent typical Activities occurring at different property types. The approach is considered conservative and, in many cases, likely results in a higher Threat ranking than may otherwise actually be present in many cases. The assumed Circumstances and MOE Hazard Scores are described in Golder, 2010c, and were based on MPAC property codes (and MOE LUT Activities – and now the MECP Threat Lookup Tool: https://threats.swpip.ca/). It is noted that the assessment has not involved field verification or site visits to validate information.

The Threat ranking algorithm was designed to perform the Threat rankings in an automated manner for properties within the WHPAs. The Threat ranking algorithm process begins with a yes/no question for each Prescribed Threat (e.g., Application of Agricultural Source Material (ASM) to Land, Application of Road Salt) to assess if the Activity is occurring on the property. If the answer was no, then no Threat was identified, and the algorithm did not calculate a Risk Score for that Threat. If the answer was yes, the algorithm proceeded to the Hazard Score related to the assumed Circumstance using the MOE LUT database.

The input data lead the algorithm to relevant reference IDs in the MOE Drinking Water Threats Tables that reflect the Circumstances identified on the property. A lookup table wasis used to link the selected Circumstance to an MOE Hazard Score which, when multiplied by the Vulnerability Score, provides the resultant Risk Score for the Threat in question. When multiple

chemical parameter Circumstances are present for a given Threat, Risk Scores are calculated for each parameter and the highest score is tabulated for the Threat. It is noted that the Vulnerability Score used to rank a property is based on the maximum Vulnerability Score intersected by the parcel for the WHPA being evaluated. Finally, if the calculated Risk Score for a Threat is greater than or equal to 80, the Threat is ranked as Significant.

Two unique 'polygon' Threats were assigned to each WHPA with a Vulnerability Score of 10 in accordance with the common methodology developed by SGBLS (SGBLS, 2010). For the Threat 'sewage system or sewage works – sanitary sewers and related pipes', one Threat was assigned to each WHPA to account for the potential Threat that could exist related to the sanitary network. One Threat was assigned to represent the entire network since detailed information regarding distribution and conveyance capacities was not readily available within some study areas. The second polygon Threat assigned was related to domestic fuel storage (i.e. Fuel Storage) which may be on a property as a primary source of heating fuel. One fuel storage Threat was assigned to each WHPA where there was a high probability that natural gas was not available in the area. Generally in urban areas, where natural gas was probable, the polygon Fuel Threat was not assigned.

Some Threats such as the Application of Agricultural Source Material to Land have Circumstances based on datasets that are on a scale larger than individual properties. These Circumstances included percent Managed Lands, Livestock Density and Impervious Surfaces. Therefore, additional calculations were required to determine these Circumstances for each WHPA. The percent Managed Lands and Livestock Density calculations were completed for this project using a methodology developed in consultation with the South Georgian Bay Lake Simcoe Source Protection Region and was based on the MOE Technical Bulletin for Managed Land and Livestock Density Calculations (MOE, September 2009). The percent Managed Land and the Livestock Density of an area is used as an estimation to represent the quantity of nutrients present as a result of nutrient generation, storage and land application within a WHPA. Managed Lands, Livestock Density and Impervious Surfaces are discussed in more detail below.

### ~~13.3.3.4.1.1~~13.3.3.5.1.1 *Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Bluewater WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.3.3.5.2). Figure 13a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Bluewater Water Supply. The Managed Land within the majority of the Bluewater WHPA is in the lowest threshold of 0 to 40%. Only a small portion of the WHPA for Wells 18-1 and 18-2 has 40 to 80%.

### ~~13.3.3.4.1.2~~13.3.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Bluewater WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.3.3.5.2). Figure 13a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Bluewater Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Bluewater WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.3.3.4.1.3~~13.3.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009December 2021)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E . 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~in the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Bluewater WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.3.3.5.2). The

Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Bluewater Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.3.3.4.2~~13.3.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-4 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPAs for the Bluewater Water Supply. There are no Threats related to Issues or Conditions identified in the Bluewater WHPAs.

A total of fourteen (14) activities that are considered to be Significant Drinking Water Threats were identified in association with fourteen (14) land parcels in the two WHPAs for the Bluewater Water Supply. Twelve (12) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. Two (2) threat activities and parcels (one for each WHPA) have been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-4: Number of Parcels with Significant Threat Activities for the Bluewater Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 12 |
| 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. | 0 |
| 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 |
| 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 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **14*** significant threats (on **14** properties) |

*11 verified existing Threats and 3 potential Threats that require further verification (2015)

## 13.4 Cooks Lake Well Supply

The Cooks Lake Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 12-1 and 12-2). Table 13-5 provides details on these wells.

**Table 13-5: Cook's Lake Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Cooks Lake | 12-1 | A2 | 220005278 | 91-P-3064 (Apr 2011) | 200 | 140 |
| Cooks Lake | 12-2 | A2 | 220005278 | 91-P-3064 (Apr 2011) | 200 | 0 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.4.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.4.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Cooks Lake WHPAs are illustrated on Figure 13b-1. The WHPAs for the Cook's Lake well system extend to the west, away from the Lake.

#### *13.4.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Cook's Lake WHPAs is shown in Figure 13b-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13b-2, Low (>80) Vulnerability is indicated through WHPA-B to D.

#### *13.4.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c. No Transport Pathways were identified in the Cooks Lake WHPA.

#### *13.4.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.4.1.5 Vulnerability Score*

The WHPA zones for the Cooks Lake Water Supply, as shown in Figure 13b-1, and the Groundwater Vulnerability, as shown in Figure 13b-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13b-3 illustrates the Vulnerability Scores for the Cooks Lake Water Supply. Figure 13b-3 will be used to assess Drinking Water Threats in Cooks Lake 13.4.3.

#### *13.4.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Cooks Lake WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Cook's Lake Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.4.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Cook's Lake Well Supply.***

### 13.4.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Cook's Lake Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Cooks Lake Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for the Cooks Lake Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in section 13.3.3.1 and Section 13.4.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Cooks Lake drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Cooks Lake water supply. No potential Conditions have been identified for consideration at this time.***

### *13.4.3.3* 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~~

#### 13.4.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13b-4 ~~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 Cooks Lake Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.4.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13b-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 Cooks Lake Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.4.3.3.3 DNAPL Chemical Parameters

Figure 13b-6 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Cooks Lake Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13b-6 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.4.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.4.3.2, no Conditions have been confirmed within the WHPA for the Cooks Lake Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Cooks Lake Water Supply (Figure 13b-3) can be used to determine where these locations occur.

### *13.4.3.5 Enumerating Drinking Water Threats*

#### ~~13.4.3.4.1~~13.4.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.4.2 and 13.4.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.4.3.4.1.1~~13.4.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Cooks Lake WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.4.3.5.2). Figure 13b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Cooks Lake Water Supply. The Managed Land within all of the Cooks Lake WHPA is in the lowest threshold of 0 to 40%.

### ~~13.4.3.4.1.2~~13.4.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Cooks Lake WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.4.3.5.2). Figure 13b-8illustrates the distribution of Livestock Density within the delineated WHPA zones for the Cooks Lake Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Cooks Lake WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.4.3.4.1.3~~13.4.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E . 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Cooks Lake WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were

used in the enumeration of Significant Drinking Water Threats (Section 13.4.3.5.2b). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Cooks Lake Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 1 to 8% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.4.3.4.2~~13.4.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-6 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Cooks Lake Water Supply. There are no Threats related to Issues or Conditions identified in the Cooks Lake WHPA.

A total of five (5) activities that are considered to be Significant Drinking Water Threats were identified in association with five (5) land parcels in the WHPA for the Cooks Lake Water Supply. Four (4) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-6: Number of Parcels with Significant Threat Activities for the Cooks Lake Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 4 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **5*** significant threats (on **5** properties) |

*3 verified existing Threat and 2 potential Threats that require further verification (2015)

## 13.5 Georgian Bay Estates Well Supply

The Georgian Bay Estates Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of three wells (Wells 19-1, 19-4 and 19-5). Table 13-7 provides details on these wells.

**Table 13-7: Georgian Bay Estates Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Georgian Bay Estates | 19-1 | BR | 220005287<br>91-P-3063 | (Apr 2011) | 426 | 219 |
| Georgian Bay Estates | 19-4 | A1/A2 | 220005287<br>91-P-3063 | (Apr 2011) | 327 | 167 |
| Georgian Bay Estates | 19-5 | A1/A2 | 220005287<br>91-P-3063 | (Apr 2011) | 196 | 101 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.5.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply. Methods used to assess the

Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.5.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1

The Georgian Bay Estates WHPAs are illustrated on Figure 13c-1. The WHPAs for the Georgian Bay Estates well system extend to the south, away from Georgian Bay.

#### *13.5.1.2 WHPA-E ~~/ WHPA-F~~*

The Technical Rules require that all wells that are identified as GUDI (groundwater under the direct influence of surface water) as determined in accordance with Subsection 2(2) of O.Reg. 170/03 (Drinking Water Systems) made under the *Safe Drinking Water Act, 2002* delineate an additional vulnerable area that is representative of its surface water Vulnerability, known as WHPA-E.

A GUDI evaluation was completed at Georgian Bay Estates Wells 19-4 and 19-5 in 2002 (DHL, 2002). The MOE required that a GUDI study be conducted for these wells on the basis of their proximity to surface water and because the wells are constructed in an unconfined aquifer. Well 19-1 was exempt from the GUDI study because it is completed in a confined bedrock aquifer. The GUDI study concluded that Wells 19-4 and 19-5 are: i) completed in an unconfined aquifer that appears to be in direct contact with Georgian Bay, ii) water quality was good with no history of microbial contamination; turbidity and particle counting data indicated the wells have effective natural filtration through the aquifer, and iii) the wells are likely under the direct influence of surface water but beyond a 50 day travel time. As such the wells were designated as GUDI supplies.

The WHPA-E is to be delineated in accordance with the rules that apply to the delineation of an Intake Protection Zone 2 (IPZ-2), which is generally a two-hour surface water time-of-travel. Additional assessment of these two well fields was completed to delineate the WHPA-E (Golder, 2009).

The Georgian Bay Estates wells have relatively small contributing catchment areas requiring that the development of the WHPA-E be primarily based on the confirmation of previous estimates of the catchment boundaries. To confirm the two hour time-of-travel extends to at least the catchment area boundary, the times of concentration for the catchment area was estimated using the Soil Conservation Service (SCS, now called the Natural Resources Conservation Service (NRCS)) curve number method.

Figure 13c-2 illustrates the WHPA-E for the Georgian Bay Estates wells. The time of concentration for the watershed draining the Georgian Bay Estates wellfield is less than two hours and therefore the WHPA-E boundary represents the watershed boundary in this area.

#### *13.5.1.3 Groundwater Vulnerability*

The Groundwater Vulnerability within the Georgian Bay Estates WHPAs is shown in Figure 13b-2 (wells 19-4 and 19-5) and Figure 13c-3 (well 19-1).

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13b-2, High to Medium Vulnerability is indicated in the northern part of the WHPA within WHPA-B through C and Medium to Low through WHPA-C to D for Wells 19-4 and 19-5. The Groundwater Vulnerability ranges from Medium to Low through WHPA-A to D for Well 19-1 (Figure 13c-3).

#### *13.5.1.4 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c. A sand and gravel operation was noted within the Georgian Bay Estates WHPAs. The depth of this operation was not considered sufficient to warrant an increase in the vulnerability. In addition, for the Georgian Bay Estates WHPA, the Vulnerability of the WHPA was already scored as high and therefore no additional increase was possible.

No Transport Pathways were identified in the Georgian Bay Estates WHPA.

#### *13.5.1.5 Vulnerability Score*

The WHPA zones for the Georgian Bay Estates Water Supply, as shown in Figure 13c-1, and the Groundwater Vulnerability, as shown in Figure 13b-2 and Figure 13c-3, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section

5.2.4). Figure 13c-4 illustrates the Vulnerability Scores for the Georgian Bay Estates Water Supply. Figure 13c-4 will be used to assess Drinking Water Threats in Section 13.5.3.

#### *13.5.1.6 Vulnerability Score for WHPA-E*

The Technical Rules: Assessment Report proposed amendments dated August 24, 2009 outline that the vulnerability score for a WHPA-E is determined based on the same principles as an Intake Protection Zone-2 which is defined based on Area Vulnerability ($V_a$) and Source Vulnerability ($V_s$) factors. Within the Golder, 2009 study Area Vulnerability and Source Vulnerability were developed using the following methodology.

The scores were calculated in accordance with the formula presented in Chapter 5 (Methods Overview), Section 5.3.2.

The Area Vulnerability factor for IPZ-2 must be greater than 7 and less than 9 based on the Vulnerability of the area where a lower factor corresponds to a lower Vulnerability. The percentage of the IPZ-2 area composed of land, land cover, soil type, permeability, slope and hydrological/hydrogeological conditions that contribute water to the area through Transport Pathways are required for consideration when selecting an Area Vulnerability factor.

The Source Vulnerability factor must be between 0.8 and 1 where a lower factor corresponds to a lower Vulnerability. The depth of the intake from the top of the water surface, distance of the intake from land and historical water quality concerns at the surface water intake are required for consideration when selecting a Source Vulnerability factor.

Table 13-8 summarizes the Area and Source Vulnerability Factors and overall Vulnerability Scores. A map of the WHPA-E Vulnerability Score is presented in Figure 13c-2. Justification of the score is provided in Golder, 2009.

**Table 13-8: Vulnerability Scoring for WHPA-E Catchment Areas.**

| Well Field | Area Vulnerability Factor | Source Vulnerability Factor | Vulnerability Score |
|---|---|---|---|
| Georgian Bay Estates | 7 | 0.8 | 5.6 |

#### *13.5.1.7 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Georgian Bay Estates WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Georgian Bay Estates Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.5.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Georgian Bay Estates Well Supply.***

### 13.5.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Georgian Bay Estates Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). A Drinking Water Threat is defined as “an activity, or condition that adversely affects or 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 Georgian Bay Estates Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Georgian Bay Estates Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in section 13.3.3.1 and Section 13.5.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Georgian Bay Estates drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Georgian Bay Estates water supply. No potential Conditions have been identified for consideration at this time.***

#### *13.5.3.3* 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~~

##### 13.5.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores~~The Key Table~~ on Figure 13c-5 ~~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 Georgian Bay Estates Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not

contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.5.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13c-6 ~~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 Georgian Bay Estates Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.5.3.3.3 DNAPL Chemical Parameters

Figure 13c-7 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Georgian Bay Estates Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13c-7 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.5.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.5.3.2, no Conditions have been confirmed within the WHPA for the Georgian Bay Estates Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Georgian Bay Estates Water Supply (Figure 13b-3 and Figure 13c-3) can be used to determine where these locations occur.

### *13.5.3.5 Enumerating Drinking Water Threats*

~~13.5.3.4.1~~13.5.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.5.2 and 13.5.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

### *~~13.5.3.4.1.1~~13.5.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Georgian Bay Estates WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.5.3.5.2). Figure 13b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Georgian Bay Estates Water Supply. The Managed Land within all of the Georgian Bay Estates WHPA is in the lowest threshold of 0 to 40%.

### *~~13.5.3.4.1.2~~13.5.3.5.1.2 Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Georgian Bay Estates WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.5.3.5.2). Figure 13b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Georgian Bay Estates Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Georgian Bay Estates WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.5.3.4.1.3~~13.5.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021)~~)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E . 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Georgian Bay Estates WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.5.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Georgian Bay Estates Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D, and greater than 4.5 for WHPA-E. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.5.3.4.2~~13.5.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-9 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Georgian Bay Estates Water Supply. There are no Threats related to Issues or Conditions identified in the Georgian Bay Estates WHPA.

A total of fourteen (14) activities that are considered to be Significant Drinking Water Threats were identified in association with fourteen (14) land parcels in the WHPA for the Georgian Bay Estates Water Supply. Thirteen (13) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One

(1) Threat and parcel has been included to represent the potential handling and storage of fuel for residential heating purposes within the area where the vulnerability score is 10.

**Table 13-9: Number of Parcels with Significant Threat Activities for the Georgian Bay Estates Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 13 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **14*** significant threats (on **14** properties) |

*13 verified existing Threats and 1 potential Threat that requires further verification (2015)

## 13.6 Georgian Highlands Well Supply

The Georgian Highlands Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of one well (Well 4-1). Table 13-10 provides details on the well.

**Table 13-10: Georgian Highlands Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Georgian Highlands | 4-1 | A1/A2 | 220005296 | 5437-8GHP8U* (April, 2021) | 962 | 179 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

* The, Georgian Highlands, Tiny Cove, and Sandcastle well systems are now operated under single Permit To Take Water # 5437-8GHP8U. This permit cancels and replaces the permits previously issued for these individual well supplies. All of the wells under this permit are now considered part of a single well system referred to as the Castle Cove Estates well supply.

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.6.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.6.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in section 13.3.1.1.

The Georgian Highlands WHPAs are illustrated on Figure 13d-1. The WHPAs for the Georgian Highlands well system extend to the east, away from Georgian Bay.

#### *13.6.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Georgian Highlands WHPAs is shown in Figure 13d-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously the regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13d-2, Low Vulnerability (>80) is indicated within WHPA-B to WHPA-D.

#### *13.6.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Georgian Highlands WHPA.

#### *13.6.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.6.1.5 Vulnerability Score*

The WHPA zones for the Georgian Highlands Water Supply, as shown in Figure 13d-1, and the Groundwater Vulnerability, as shown in Figure 13d-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13d-3 illustrates the Vulnerability Scores for the Georgian Highlands Water Supply. Figure 13d-3 will be used to assess Drinking Water Threats in Section 13.6.3.

#### *13.6.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Georgian Highlands WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Georgian Highlands Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.6.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c

***No Drinking Water Issues were identified for the Georgian Highlands Well Supply.***

### 13.6.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Georgian Highlands Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Georgian Highlands Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Georgian Highlands Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties included:

- MOE Look Up Tables (LUT) Database (2009);
- Municipal Property Assessment Corporation (MPAC) (2007) assessment information;
- Hazardous Waste Information Network (HWIN) (2009);
- MOE Records Database (2009);
- SSEA Land Use Mapping (November 2009);
- SSEA Livestock Survey (2001) and Biosolids (2007) database; and,
- SSEA Pre-Screening Report (2007).

The key data sources used to identify Threats on properties are identified in section 13.3.3.1 and Section 13.6.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Georgian Highlands drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Georgian Highlands water supply. No potential Conditions have been identified for consideration at this time.***

### *13.6.3.3* 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 tables 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~~

#### 13.6.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13d-4 ~~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 Georgian Highlands Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.6.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13d-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 Georgian Highlands Water Supply, Areas within the WHPA that

have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.6.3.3.3 DNAPL Chemical Parameters

Figure 13d-6 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Georgian Highlands Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13d-6 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.6.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.6.3.2, no Conditions have been confirmed within the WHPA for the Georgian Highlands Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Georgian Highlands Water Supply (Figure 13d-3) can be used to determine where these locations occur.

### *13.6.3.5 Enumerating Drinking Water Threats*

#### ~~13.6.3.4.1~~13.6.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.6.2 and 13.6.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

### ~~13.6.3.4.1.1~~13.6.3.5.1.1 *Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Georgian Highlands WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.6.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Georgian Highlands Water Supply. The Managed Land within the WHPA-A and -B of the Georgian Highlands WHPA is in the lowest threshold of 0 to 40%. WHPA-C to -D has 40 to 80%.

### ~~13.6.3.4.1.2~~13.6.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Georgian Highlands WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.6.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Georgian Highlands Water Supply. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Georgian Highlands WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.6.3.4.1.3~~13.6.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~-~~requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E . 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Georgian Highlands WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.6.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Georgian Highlands Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.6.3.4.2~~13.6.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-11 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Georgian Highlands Water Supply. There are no Threats related to Issues or Conditions identified in the Georgian Highlands WHPA.

A total of three (3) activities that are considered to be Significant Drinking Water Threats were identified in association with three (3) land parcels in the WHPA for the Georgian Highlands Water Supply. Two (2) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-11: Number of Parcels with Significant Threat Activities for the Georgian Highlands Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 2 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **3*** significant threats (on **3** properties) |

*2 verified existing Threats and 1 potential Threat that require further verification (2015)

## 13.7 Georgian Sands Well Supply

The Georgian Sands Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of four wells (Wells 1-1, 2-1, 2-2 and 14-1). Table 13-12 provides details on these wells.

**Table 13-12: Georgian Sands Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Georgian Sands | 1-1 | A1/A2 | 220005303 | 1533-9DMMTD* | 328 | 82 |
| Georgian Sands | 2-1 | A1/A2 | 220005303 | 1533-9DMMTD* | 982 | 246 |
| Georgian Sands | 2-2 | A1/A2 | 220005303 | 1533-9DMMTD* | 524 | 0 |
| Georgian Sands | 14-1 | A1/A2 | 220005303 | 1533-9DMMTD* | 1,310 | 603 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

* Both the Lafontaine (Section 13.8) and Georgian Sands well systems are now operated under PTTW # 1533-9DMMTD; this permit cancels and replaces both PTTW 2456-6FMKND (previously issued for the Lafontaine municipal wells) and PTTW 2277-8G3QWX (previously issued for the Georgian Sands well system).

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.7.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been

assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.7.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in section 13.3.1.1.

The Georgian Sands WHPAs are illustrated on Figure 13e-1. The WHPAs for the Georgian Sands well system extends to the northeast, away from Georgian Bay.

#### *13.7.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Georgian Sands WHPAs is shown in Figure 13e-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13e-2, Low (>80) to High (<30) Vulnerability is indicated through WHPA-B to D.

#### *13.7.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

One Transport Pathway was identified in the Georgian Sands WHPA. The Vulnerability at the well location was increased one level within a 30 m buffer of the well.

The location of Transport Pathways and the resulting increase to Vulnerability Scores are presented in Figure 13e-3.

#### *13.7.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.7.1.5 Vulnerability Score*

The WHPA zones for the Georgian Sands Water Supply, as shown in Figure 13e-1, the Groundwater Vulnerability, as shown in Figure 13e-2, and increases due to Transport Pathways (Section 13.7.1.3) were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13e-3 illustrates the Vulnerability Scores for the Georgian Sands Water Supply. Figure 13e-3 will be used to assess Drinking Water Threats in Section 13.7.3.

#### *13.7.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Georgian Sands WHPAs delineation is High. Considering all of the available data, the uncertainty of the for the Georgian Sands Water Supply Vulnerability is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.7.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in section 13.3.2 and in more detail with Golder 2010c.

***Nitrate was identified as a Drinking Water Issue for the Georgian Sands Well Supply.***

The projected trend of nitrate concentrations at Georgian sands Wells 2-1, 2-2 and 14-1 are illustrated in Golder, 2010c (Appendix TI). The linear regression trend for Wells 2-1 and 2-2 shows a future exceedance of the Ontario Drinking Water Quality Standards (ODWQS) 10mg/L limit for nitrate. At Well 14-1 the linear trend indicates exceedances within the 50 year timeframe. But, more recent data suggests a steeper trend in concentrations indicating exceedance within approximately 10 years. As such, nitrate has been identified as a Drinking Water Issue at these wells. Well 1-1 within this system also shows generally low nitrate concentrations and no obvious trending is observed for this well. However, given the close proximity to the other wells, similar aquifer conditions, shored capture zones, and erring on the side of caution. This WHPA has also been identified as having a nitrate Drinking Water Issue.

The nitrate Issue for this system likely results from point (i.e. septic systems) and non-point (i.e. agricultural inputs) sources although no detailed investigation of source identification was completed as part of this project. There are multiple potential sources throughout the WHPA for both the point and no-point sources and therefore the delineation of the Wellhead Protection Area-Issues Contributing Area (WHPA-ICA) is complicated. It is determined that the effort required to effectively delineate and quantify the contributing areas is not reasonable. Instead efforts should be directed towards overall Source Water Protection Plans which target reductions in nitrate inputs. As such it is considered that the entire WHPA for these wells should be part of the WHPA-ICA (Figure 13e-4).

It is important to note that the Township of Tiny is currently undertaking a Class Environmental Assessment (Class EA) for the Georgian Sands water systems. The Class EA is considering options including replacement of these wells with alternative sources or blending of existing water with new alternative sources.

When a Drinking Water Issues is identified, the Technical Rules require the following to be prepared:

- A List of prescribed drinking water threats activities that may lead to the Issue is to be prepared (See section 13.7.3.1). No additional local circumstances were identified by the SPC that may be lead to the Drinking Water Issue.
- Conditions that may contribute to the Issue were investigated, and none were identified (Section 13.7.3.2).
- A list of the threat activities, land uses and circumstances that could contribute to the Drinking Water Issue has been prepared and a Map has been prepared to illustrate the Issues Contributing Area where these activities are or would a Significant, drinking water threat (Section 13.7.3.4).

- All current activities, land uses and circumstances that could contribute to the Drinking Water Issue within the Issues Contributing Area have been identified and included in the table of enumerated significant threats (Section 13.7.3.5.2).

### 13.7.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Georgian Sands Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Georgian Sands Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Georgian Sands Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.7.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Georgian Sands drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Georgian Sands water supply. No potential Conditions have been identified for consideration at this time.***

### *13.7.3.3* 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 tables 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~~

#### 13.7.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13e-5 ~~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 Georgian Sands Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.7.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13e-6 ~~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 Georgian Sands Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.7.3.3.3 DNAPL Chemical Parameters

Figure 13e-7 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Georgian Sands Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13e-7 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

#### 13.7.3.3.4 Nitrate Drinking Water Issue

Nitrate was identified as a Drinking Water Issue. As per the Technical Rules, land use activities that can release parameters that are identified as a Drinking Water Issue within the identified Issues Contributing Area are to be considered as Significant Drinking Water Threats. Appendix TI provides a list of the land uses that can potentially release Nitrate to the environment within the identified Issues Contributing Area (Figure 13e-4).

Figure 13e-4 illustrates the Issues Contributing Area where activities and circumstances listed in Appendix TI are considered to be a Significant Drinking Water Threat for the Georgian Sands Well Supply.

### *13.7.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.7.3.2, no Conditions have been confirmed within the WHPA for the Georgian Sands Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Georgian Sands Water Supply (Figure 13e-4) can be used to determine where these locations occur.

## 13.7.3.5 Enumerating Drinking Water Threats

### ~~13.7.3.4.1~~13.7.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.7.2 and 13.7.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### ~~13.7.3.4.1.1~~13.7.3.5.1.1 *Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Georgian Sands WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.7.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Georgian Sands Water Supply. The Managed Land within the Georgian Sands WHPA varies. In WHPA-A for well 14-1 and WHPA-A and B for Wells 2-1, 2-2 and 1-1 the managed lands is the lowest threshold of 0 to 40%. WHPA-B and C for Well 14-1 and WHPA-C for Wells 2-1, 2-2 and 1-1 have 40 to 80%. WHPA-D for all wells is within the highest threshold of greater than 80%.

#### ~~13.7.3.4.1.2~~13.7.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is

expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Threat in the Table of Drinking Water Threats~~.

The Livestock Density was determined for the Georgian Sands WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.7.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Georgian Sands Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Georgian Sands WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

#### ~~*13.7.3.4.1.3*~~*13.7.3.5.1.3 Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E~~-~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Georgian Sands WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.7.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Georgian Sands Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

#### ~~13.7.3.4.2~~13.7.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-13 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Georgian Sands Water Supply. There are no Threats related to Conditions identified in the Georgian Sands WHPA.

A total of 373 activities that are considered to be Significant Drinking Water Threats were identified in association with 249 land parcels in the WHPA for the Georgian Sands Water Supply. The large number of Significant Threats is related to the identification of a Nitrate Drinking Water Issue and therefore all Activities related to Nitrate were automatically increased to a Significant Threat regardless of the Vulnerability Score.

The Significant Threats are related to the application of agricultural source material to land (5), application of commercial fertilizer to land (142), handling and storage of fuel (6), handling and storage of non-agricultural source material (1) and the use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm animal yard (1). 218 parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems.

**Table 13-13: Number of Parcels with Significant Threat Activities for the Georgian Sands Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 218 |
| 3. | The application of agricultural source material to land. | 5 |
| 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. | 1 |
| 8. | The application of commercial fertilizer to land. | 142 |
| 9. | The handling and storage of commercial fertilizer to land. | 0 |
| 10. | The application of pesticide to land. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 6 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **372*** significant threats (on **249** properties) |

*248 verified existing Threats and 125 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

## 13.8 Lafontaine Well Supply

The Lafontaine Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 23-1 and 23-4). Table 13-14 provides details on these wells.

**Table 13-14: Lafontaine Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Lafontaine | 23-1 | A2 | 220006277 | 1533-9DMMTD* | 357 | 157 |
| Lafontaine | 23-4 | A2 | 220006277 | 1533-9DMMTD* | 357 | 0 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

* Both the Lafontaine and Georgian Sands (Section 13.7) well systems are now operated under PTTW # 1533-9DMMTD; this permit cancels and replaces both PTTW 2456-6FMKND (previously issued for the Lafontaine municipal wells) and PTTW 2277-8G3QWX (previously issued for the Georgian Sands well system).

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.8.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.8.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Lafontaine WHPAs are illustrated on Figure 13f-1. The WHPAs for the Lafontaine well system extend to the northeast, away from the more densely populated areas of the community.

#### *13.8.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Lafontaine WHPAs is shown in Figure 13d-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13d-2, High (<30) to Medium (30-80) Vulnerability is indicated in the western part of the WHPA within WHPA-B and Medium to Low (>80) through WHPA-C to D.

#### *13.8.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Lafontaine WHPA.

#### *13.8.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.8.1.5 Vulnerability Score*

The WHPA zones for the Lafontaine Water Supply, as shown in Figure 13f-1, the Groundwater Vulnerability, as shown in Figure 13d-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13f-2 illustrates the Vulnerability Scores for the Lafontaine Water Supply. Figure 13f-2 will be used to assess Drinking Water Threats in Section 13.8.3.

#### *13.8.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Lafontaine WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Lafontaine Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.8.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***Nitrate was identified as a Drinking Water Issue for the Lafontaine Well Supply.***

Projected trends of nitrate concentrations for Lafontaine Wells 23-1 and 23-4 are illustrated in Golder, 2010c (Appendix TI). The linear regression trend for the wells shows a future exceedance of the Ontario Drinking Water Quality Standards (ODWQS) 10mg/L limit for nitrate within the 50 year projected window. Recent data suggest a steepening of the nitrate concentration trend with exceedance projected within approximately 10 years. As such, nitrate has been identified as a Drinking Water Issue for these wells.

Similar to Georgian Sands (Section 13.7), the nitrate Issue for this system likely results from point (i.e. septic systems) and non-point (i.e. agricultural inputs) sources although no detailed investigation of source identification was completed as part of this project. There are multiple potential sources throughout the WHPA for both the point and no-point sources and therefore the delineation of the Wellhead Protection Area-Issues Contributing Area (WHPA-ICA) is complicated. It is determined that the effort required to effectively delineate and quantify the contributing areas is not reasonable. Instead efforts should be directed towards overall Source Water Protection Plans which target reductions in nitrate inputs. As such it is considered that the entire WHPA for these wells should be part of the WHPA-ICA (Figure 13f-3).

It is important to note that the Township of Tiny is currently undertaking a Class Environmental Assessment (Class EA) for the Lafontaine water system. The Class EA is considering options including replacement of these wells with alternative sources or blending of existing water with new alternative sources.

When a Drinking Water Issues is identified, the Technical Rules require the following to be prepared:

- A List of prescribed drinking water threats activities that may lead to the Issue is to be prepared (See section 13.8.3.1). No additional local circumstances were identified by the SPC that may be lead to the Drinking Water Issue.
- Conditions that may contribute to the Issue were investigated, and none were identified (Section 13.8.3.2)
- A list of the threat activities, land uses and circumstances that could contribute to the Drinking Water Issue has been prepared and a Map has been prepared to illustrate the Issues Contributing Area where these activities are or would a Significant, drinking water threat (Section 13.8.3.3.4).
- All current activities, land uses and circumstances that could contribute to the Drinking Water Issue within the Issues Contributing Area have been identified and included in the table of enumerated significant threats (Section 13.8.3.5.2)

### 13.8.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Lafontaine Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Lafontaine Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Lafontaine Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.8.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Lafontaine drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Lafontaine water supply. No potential Conditions have been identified for consideration at this time.***

#### *13.8.3.3 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~~

13.8.3.3.1

13.8.3.3.2 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13f-4 ~~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 Lafontaine Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

### 13.8.3.3.3 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13f-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 Lafontaine Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

### 13.8.3.3.4 DNAPL Chemical Parameters

Figure 13f-6 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Lafontaine Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13f-6 ~~can be used to can be used to~~ identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### 13.8.3.3.5 Nitrate Drinking Water Issue

Nitrate was identified as a Drinking Water Issue. As per the Technical Rules, land use activities that can release parameters that are identified as a Drinking Water Issue within the identified Issues Contributing Area are to be considered as Significant Drinking Water Threats. Appendix

TI provides a list of the land uses that can potentially release Nitrate to the environment within the identified Issues Contributing Area (Figure 13f-3).

Figure 13f-3 illustrates the Issues Contributing Area where activities and circumstances listed in Appendix TI are considered to be a Significant Drinking Water Threat for the Lafontaine Well Supply.

### *13.8.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.8.3.2, no Conditions have been confirmed within the WHPA for the Lafontaine Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Lafontaine Water Supply (Figure 13f-2) can be used to determine where these locations occur.

### *13.8.3.5 Enumerating Drinking Water Threats*

~~13.8.3.4.1~~13.8.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.8.2 and 13.8.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.8.3.4.1.1~~13.8.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken

into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Lafontaine WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.8.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Lafontaine Water Supply. The Managed Land within the all of the Lafontaine WHPA is in the high threshold of greater than 80%.

### ~~13.8.3.4.1.2~~13.8.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Lafontaine WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.8.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Lafontaine Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Lafontaine WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.8.3.4.1.3~~13.8.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E . 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~ ~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Lafontaine WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.8.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Lafontaine Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.8.3.4.2~~13.8.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-15 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Lafontaine Water Supply. There are no Threats related to Conditions identified in the Lafontaine WHPA.

A total of forty-eight (48) activities that are considered to be Significant Drinking Water Threats were identified in association with twenty-nine (29) land parcels in the WHPA for the Lafontaine Water Supply. The large number of Significant Threats is related to the identification of a Nitrate Drinking Water Issue and therefore all Activities related to Nitrate were automatically increased to a Significant Threat regardless of the Vulnerability Score.

The Significant Threats are related to the application of agricultural source material to land (2), storage of agricultural source material (1), application of commercial fertilizer to land (15), handling and storage of commercial fertilizer (1), handling and storage of fuel (3), handling and storage of DNAPLs (1), and handling and storage of organic solvents (1). Twenty-four (24) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems.

**Table 13-15: Number of Parcels with Significant Threat Activities for the Lafontaine Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 1~~0~~ |
| 2. | The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage. | 24 |
| 3. | The application of agricultural source material to land. | 2 |
| 4. | The storage of agricultural source material to land. | 1 |
| 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. | 15 |
| 9. | The handling and storage of commercial fertilizer to land. | 1 |
| 10. | The application of pesticide to land. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 3 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 1 |
| 17. | The handling and storage of an organic solvent. | 1 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **4~~98~~*** significant threats (on **30** properties) |

*31 verified existing Threats and 17 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

## 13.9 Lefaive Well Supply

The Lefaive Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 3-2 and 3-3). Table 13-16 provides details on these wells.

**Table 13-16: Lefaive Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Lefaive | 3-2 | A2 | 220005321<br>92-P-3047 | (Aug 2012) | 308 | 47 |
| Lefaive | 3-3 | A2 | 220005321<br>92-P-3047 | (Aug 2012) | 308 | 104 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.9.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.9.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Lefaive WHPAs are illustrated on Figure 13g-1. The WHPAs for the Lefaive well system extend to the northeast, away from Georgian Bay.

#### *13.9.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Lefaive WHPAs is shown in Figure 13d-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13d-2, Medium (30-80) to Low (>80) Vulnerability is indicated within WHPA-B through D.

#### *13.9.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

One Transport Pathway was identified in the Lefaive WHPA. The Vulnerability at the well location was increased one level within a 30 m buffer of the well.

The location of Transport Pathway and the resulting increase to Vulnerability Scores is presented in Figure 13g-2.

#### *13.9.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.9.1.5 Vulnerability Score*

The WHPA zones for the Lefaive Water Supply, as shown in Figure 13g-1, the Groundwater Vulnerability, as shown in Figure 13d-2, and increases due to Transport Pathways (Section 13.9.1.3) were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13g-2 illustrates the Vulnerability Scores for the Lefaive Water Supply. Figure 13g-2 will be used to assess Drinking Water Threats in Section13.9.3.

#### *13.9.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Lefaive WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Lefaive Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.9.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Lefaive Well Supply.***

### 13.9.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Lefaive Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Lefaive Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Lefaive Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.9.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Lefaive drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Lefaive water supply. No potential Conditions have been identified for consideration at this time.***

### *13.9.3.3* 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~~

#### 13.9.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores~~The Key Table~~ on Figure 13g-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 Lefaive Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.9.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13g-4 ~~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 Lefaive Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.9.3.3.3 DNAPL Chemical Parameters

Figure 13g-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Lefaive Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13g-5 ~~can be used to can~~

~~be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.9.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.9.3.2, no Conditions have been confirmed within the WHPA for the Lefaive Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Lefaive Water Supply (Figure 13g-2) can be used to determine where these locations occur.

### *13.9.3.5 Enumerating Drinking Water Threats*

~~13.9.3.4.1~~13.9.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.9.2 and 13.9.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.9.3.4.1.1~~13.9.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Lefaive WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.9.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Lefaive Water Supply. The Managed Land within the part of the Lefaive WHPA is in the lowest threshold of 0 to 40%. The other portion of the WHPAs has 40 to 80%.

#### ~~13.9.3.4.1.2~~13.9.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Lefaive WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.9.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Lefaive Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Lefaive WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

#### ~~13.9.3.4.1.3~~13.9.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E~~-~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Lefaive WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.9.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Lefaive Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.9.3.4.2~~13.9.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-17 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Lefaive Water Supply. There are no Threats related to Issues or Conditions identified in the Lefaive WHPA.

A total of twenty-seven (27) activities that are considered to be Significant Drinking Water Threats were identified in association with twenty-seven (27) land parcels in the WHPA for the Lefaive Water Supply. Twenty-five (25) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) parcel was identified for potential handling and storage of DNAPLs. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-17: Number of Parcels with Significant Threat Activities for the Lefaive Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 25 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 1 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **27*** significant threats (on **27** properties) |

*25 verified existing Threat and 2 potential Threats that require further verification (2015)

## 13.10 Pennorth Well Supply

The Pennorth Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 7-1 and 7-2). Table 13-18 provides details on these wells.

**Table 13-18: Pennorth Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Pennorth | 7-1 | A2 | 220005358<br>2406-7ULLEG | (Apr 2011) | 61.4 | 50 |
| Pennorth | 7-2 | A2 | 220005358<br>2406-7ULLEG | (Apr 2011) | 61.4 | 0 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.10.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.10.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Pennorth WHPAs are illustrated on Figure 13h-1.The WHPAs for the Pennorth well system curve from north to northeast, away from Georgian Bay.

#### *13.10.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Pennorth WHPAs is shown in Figure 13d-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13d-2, Medium (30-80) to Low (>80) Vulnerability is indicated within WHPA-B through D.

#### *13.10.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Pennorth WHPA.

#### *13.10.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.10.1.5 Vulnerability Score*

The WHPA zones for the Pennorth Water Supply, as shown in Figure 13h-1, and the Groundwater Vulnerability, as shown in Figure 13d-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13h-2 illustrates the Vulnerability Scores for the Pennorth Water Supply. Figure 13h-2 will be used to assess Drinking Water Threats in Section13.10.3.

#### *13.10.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Pennorth WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Pennorth Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.10.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Pennorth Well Supply.***

### 13.10.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Pennorth Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Pennorth Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Pennorth Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.3.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Pennorth drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Pennorth water supply. No potential Conditions have been identified for consideration at this time.***

#### *13.10.3.3 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~~

##### 13.10.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13h-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 Pennorth Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

##### 13.10.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13h-4 ~~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 Pennorth Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

##### 13.10.3.3.3 DNAPL Chemical Parameters

Figure 13h-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Pennorth Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13h-5 ~~can be used~~

~~to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.10.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.10.3.2, no Conditions have been confirmed within the WHPA for the Pennorth Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Pennorth Water Supply (Figure 13h-2) can be used to determine where these locations occur.

### *13.10.3.5 Enumerating Drinking Water Threats*

#### ~~13.10.3.4.1~~13.10.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.10.2 and 13.10.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.10.3.4.1.1~~13.10.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Pennorth WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.10.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Pennorth Water Supply. The Managed Land within the majority of the Pennorth WHPA is in the medium threshold of 40 to 80%. Only a small portion of the WHPA for Wells 7-1 and 7-2 has greater than 80%.

### ~~*13.10.3.4.1.2*~~*13.10.3.5.1.2 Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Pennorth WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.10.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Pennorth Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Pennorth WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~*13.10.3.4.1.3*~~*13.10.3.5.1.3 Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E~~.~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~the Table of Drinking Water Threats.

The proportion of Impervious Surfaces within the Pennorth WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.10.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Pennorth Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.10.3.4.2~~13.10.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-19 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Pennorth Water Supply. There are no Threats related to Issues or Conditions identified in the Pennorth WHPA.

A total of nine (9) activities that are considered to be Significant Drinking Water Threats were identified in association with nine (9) land parcels in the WHPA for the Pennorth Water Supply. Eight (8) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-19: Number of Parcels with Significant Threat Activities for the Pennorth Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 1~~0~~ |
| 2. | The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage. | 8 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | 9* significant threats (on **9** properties) |

*8 verified existing Threats and 1 potential Threat that requires further verification (2015)

## 13.11 Perkinsfield Well Supply

The Perkinsfield Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of four wells (Wells 22-1, 26-4, 26-5 and 11-2). Table 13-20 provides details on these wells.

**Table 13-20: Perkinsfield Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Perkinsfield | 22-1 | A2 | 220005544<br>5616-7VZHHC | (Aug 2019) | 353 | 245 |
| Perkinsfield | 26-4 | A2/A3 | 220005544<br>5616-7VZHHC | (Aug 2019) | 360 | 250 |
| Perkinsfield | 26-5 | A2/A3 | 220005544<br>5616-7VZHHC | (Aug 2019) | 933 | 648 |
| Perkinsfield | 11-2 | A2 | 220005544<br>5616-7VZHHC | (Aug 2019) | 196 | 136 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.11.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been

assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.11.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

An industry standard groundwater modelling software package, MODFLOW, was used to develop the capture zones for the wells in the Township of Tiny with the exception of Perkinsfield Wells 26-4 and 26-5. These wells, screened in aquifer A2 to A3, appear to be located slightly east of a regional groundwater divide which runs roughly through the centre of the Township. Given their close proximity to the groundwater divide, it was assumed that groundwater flow to these wells is predominately radial; as such, the calculated fixed radius method was used to delineate their capture zones.

The Perkinsfield WHPAs are illustrated on Figure 13i-1. The WHPAs for the Wells 22-1 and 11-2 extend to the east while the WHPAs for Wells 26-4 and 26-5 are circular shaped, extending out in all directions.

#### *13.11.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Perkinsfield WHPAs is shown in Figure 13d-2 and Figure 13i-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

The exception is Wells 26-4 and 26-5. These wells are outside of the numerical model domain with the WHPAs delineated with the calculated fixed radius method. Therefore calculation of the AVI scores with the model layers was not possible. The ISI calculated in the NSGS showed Low Vulnerability to the aquifer above which the wells are screened with the exception of a few small areas of Medium (30-80) and High (<30) (Figure 13i-2).

Medium to Low Vulnerability is indicated within WHPA-B through D for Wells 11-2 and 22-1 (Figure 13d-2).

#### *13.11.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Perkinsfield WHPA.

#### *13.11.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.11.1.5 Vulnerability Score*

The WHPA zones for the Perkinsfield Water Supply, as shown in Figure 13i-1, and the Groundwater Vulnerability, as shown in Figure 13d-2 and Figure 13i-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13i-3 illustrates the Vulnerability Scores for the Perkinsfield Water Supply. Figure 13i-3 will be used to assess Drinking Water Threats in Section 13.11.3.

#### *13.11.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Perkinsfield WHPAs delineation is High. Considering all of the available data, the uncertainty of the for the Perkinsfield Water Supply Vulnerability is

considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.11.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Perkinsfield Well Supply.***

### 13.11.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Perkinsfield Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Perkinsfield Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Perkinsfield Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.11.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Perkinsfield drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Perkinsfield water supply. No potential Conditions have been identified for consideration at this time.***

### *13.11.3.3* 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~~

#### 13.11.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13i-4 ~~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 Perkinsfield Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.11.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13i-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 Perkinsfield Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.11.3.3.3 DNAPL Chemical Parameters

Figure 13i-6 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Perkinsfield Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13i-6 ~~can be used to can be used to~~ identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.11.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.11.3.2, no Conditions have been confirmed within the WHPA for the Perkinsfield Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Perkinsfield Water Supply (Figure 13i-3) can be used to determine where these locations occur.

### *13.11.3.5 Enumerating Drinking Water Threats*

#### ~~13.11.3.4.1~~13.11.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.11.2 and 13.11.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities.

Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

### ~~13.11.3.4.1.1~~13.11.3.5.1.1 *Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Perkinsfield WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.11.3.5.2). Figure 13a-7 and Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Perkinsfield Water Supply. The Managed Land within all of the Perkinsfield WHPAs for Wells 26-4 and 26-5 is in the lowest threshold of 0 to 40%. For Wells 11-2 and 22-1 small portions are 0 to 40%, while the rest is 40 to 80%.

### ~~13.11.3.4.1.2~~13.11.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Perkinsfield WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.11.3.5.2). Figure 13a-8 and Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Perkinsfield Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Perkinsfield WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.11.3.4.1.3~~13.11.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021)~~)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E~~-~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Perkinsfield WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.11.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13a-9 and Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Perkinsfield Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits for Wells 11-2 and 22-1 and 1 to 8% for Wells 26-4 and 26-5.~~

### ~~13.11.3.4.2~~13.11.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-21 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPAs for the Perkinsfield Water Supply. There are no Threats related to Issues or Conditions identified in the Perkinsfield WHPAs.

A total of twenty-two (22) activities that are considered to be Significant Drinking Water Threats were identified in association with twenty-two (22) land parcels in the WHPAs for the Perkinsfield Water Supply. Seventeen (17) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. Other identified Significant Threats are related to the application of pesticides to land (2) and the handling and storage of fuel (3).

**Table 13-21: Number of Parcels with Significant Threat Activities for the Perkinsfield Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 17 |
| 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. | 2 |
| 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 |
| 15. | The handling and storage of fuel. | 3 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **22*** significant threats (on **22** properties) |

*17 verified existing Threats and 5 potential Threats that require further verification (2015)

## 13.12 Rayko Well Supply

The Rayko Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 6-2 and 6-3). Table 13-22 provides details on these wells.

**Table 13-22: Rayko Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Rayko | 6-2 | A3 | 220005367 | 02-P-1372 (Feb 2013) | 65 | 73 |
| Rayko | 6-3 | A3 | 220005367 | 02-P-1372 (Feb 2013) | 130 | 0 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.12.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.12.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Rayko WHPAs are illustrated on Figure 13j-1. The WHPAs for the Rayko well system extend to the east, away from Georgian Bay.

#### *13.12.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Rayko WHPAs is shown in Figure 13j-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13j-2, Low Vulnerability (>80) is indicated in WHPA-B through D.

#### *13.12.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Rayko WHPA.

#### *13.12.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.12.1.5 Vulnerability Score*

The WHPA zones for the Rayko Water Supply, as shown in Figure 13j-1, and the Groundwater Vulnerability, as shown in Figure 13j-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13j-3 illustrates the Vulnerability Scores for the Rayko Water Supply. Figure 13j-3 will be used to assess Drinking Water Threats in Section 13.12.3.

#### *13.12.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Rayko WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Rayko Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.12.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Rayko Well Supply.***

### 13.12.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Rayko Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Rayko Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Rayko Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.12.3 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Rayko drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Rayko water supply. No potential Conditions have been identified for consideration at this time.***

### *13.12.3.3* 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~~

#### 13.12.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13j-4 ~~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 Rayko Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.12.3.3.2 Chemical Parameters

The Technical Rules be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13j-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 Rayko Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.12.3.3.3 DNAPL Chemical Parameters

Figure 13j-6 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Rayko Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13j-6 ~~can be used to can be~~

~~used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.12.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.12.3.2, no Conditions have been confirmed within the WHPA for the Rayko Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Rayko Water Supply (Figure 13j-3) can be used to determine where these locations occur.

### *13.12.3.5 Enumerating Drinking Water Threats*

#### ~~13.12.3.4.1~~13.12.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.12.2 and 13.12.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.12.3.4.1.1~~13.12.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Rayko WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.12.3.5.2). Figure 13a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Rayko Water Supply. The Managed Land within the all of the Rayko WHPA is in the lowest threshold of 0 to 40%.

### ~~*13.12.3.4.1.2*~~*13.12.3.5.1.2 Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Rayko WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.12.3.5.2). Figure 13a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Rayko Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Rayko WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~*13.12.3.4.1.3*~~*13.12.3.5.1.3 Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E~~-~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~the Table of Drinking Water Threats~~.

The proportion of Impervious surfaces within the Rayko WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1

(Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.12.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Rayko Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.12.3.4.2~~13.12.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-23 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Rayko Water Supply. There are no Threats related to Issues or Conditions identified in the Rayko WHPA.

A total of eleven (11) activities that are considered to be Significant Drinking Water Threats were identified in association with eleven (11) land parcels in the WHPA for the Rayko Water Supply. Ten (10) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-23: Number of Parcels with Significant Threat Activities for the Rayko Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 10 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **11*** significant threats (on **11** properties) |

*10 verified existing Threats and 1 potential Threat that requires further verification (2015)

## 13.13 Sandcastle Well Supply

The Sandcastle Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 13-1 and 13-2). Table 13-24 provides details on these wells.

**Table 13-24: Sandcastle Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Sandcastle | 13-1 | A2 | 220005376 | 5437-8GHP8U* (April, 2021) | 491 | 123 |
| Sandcastle | 13-2 | A2 | 220005376 | 5437-8GHP8U* (April, 2021) | 491 | 0 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

* The, Sandcaslte, Tiny Cove, and Georgian Highlands well systems are now operated under single Permit To Take Water # 5437-8GHP8U. This permit cancels and replaces the permits previously issued for these individual well supplies. All of the wells under this permit are now considered part of a single well system referred to as the Castle Cove Estates well supply.

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.13.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.13.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Sandcastle WHPAs are illustrated on Figure 13k-1. The WHPAs for the Sandcastle well system extend to the northeast, away from Georgian Bay.

#### *13.13.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Sandcastle WHPAs is shown in Figure 13d-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13d-2, Medium (30-80) to Low (>80) Vulnerability is indicated within WHPA-B through D.

#### *13.13.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Sandcastle WHPA.

#### *13.13.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.13.1.5 Vulnerability Score*

The WHPA zones for the Sandcastle Water Supply, as shown in Figure 13k-1, and the Groundwater Vulnerability, as shown in Figure 13d-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13k-2 illustrates the Vulnerability Scores for the Sandcastle Water Supply. Figure 13k-2 will be used to assess Drinking Water Threats in Section 13.13.3.

#### *13.13.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Sandcastle WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Sandcastle Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25-year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.13.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c

***No Drinking Water Issues were identified for the Sandcastle Well Supply.***

### 13.13.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Sandcastle Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Sandcastle Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Sandcastle Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.13.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Sandcastle drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Sandcastle water supply. No potential Conditions have been identified for consideration at this time.***

### *13.13.3.3* 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~~

#### 13.13.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13k-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 Sandcastle Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.13.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13k-4 ~~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 Sandcastle Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.13.3.3.3 DNAPL Chemical Parameters

Figure 13k-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Sandcastle Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13k-5 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.13.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.13.3.2, no Conditions have been confirmed within the WHPA for the Sandcastle Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Sandcastle Water Supply (Figure 13k-2) can be used to determine where these locations occur.

### *13.13.3.5 Enumerating Drinking Water Threats*

#### ~~13.13.3.4.1~~13.13.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.13.2 and 13.13.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.13.3.4.1.1~~13.13.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Sandcastle WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.13.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Sandcastle Water Supply. The Managed Land within WHPA-A and B of the Sandcastle system is in the lowest threshold of 0 to 40%. WHPA-C to D has 40 to 80%.

### ~~13.13.3.4.1.2~~13.13.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules ~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Sandcastle WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.13.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Sandcastle Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Sandcastle WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.13.3.4.1.3~~13.13.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E . 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Sandcastle WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within

the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.13.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Sandcastle Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.13.3.4.2~~13.13.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-25 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Sandcastle Water Supply. There are no Threats related to Issues or Conditions identified in the Sandcastle WHPA.

A total of five (5) activities that are considered to be Significant Drinking Water Threats were identified in association with five (5) land parcels in the WHPA for the Sandcastle Water Supply. Four (4) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-25: Number of Parcels with Significant Threat Activities for the Sandcastle Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 4 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **5*** significant threats (on **5** properties) |

*4 verified existing Threats and 1 potential Threat that requires further verification (2015)

## 13.14 Sawlog Well Supply

The Sawlog Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 6-2 and 16-3). Table 13-26 provides details on these wells.

**Table 13-26: Sawlog Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Sawlog | 16-2 | BR | 220006259 | 6013-7SFQZN (May 2019) | 196 | 49 |
| Sawlog | 16-3 | BR | 220006259 | 6013-7SFQZN (May 2019) | 251 | 53 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.14.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.14.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Sawlog WHPAs are illustrated on Figure 13l-1. The WHPAs for the Sawlog well system extend to the south, away from Georgian Bay.

#### *13.14.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Sawlog WHPAs is shown in Figure 13b-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13b-2, Medium (30-80) to Low (>80) Vulnerability is indicated within WHPA-B through D.

#### *13.14.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Sawlog WHPA.

#### *13.14.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.14.1.5 Vulnerability Score*

The WHPA zones for the Sawlog Water Supply, as shown in Figure 13l-1, and the Groundwater Vulnerability, as shown in Figure 13b-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13l-2 illustrates the Vulnerability Scores for the Sawlog Water Supply. Figure 13l-2 will be used to assess Drinking Water Threats in Section 13.14.3.

#### *13.14.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Sawlog WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Sawlog Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.14.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Sawlog Well Supply.***

### 13.14.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Sawlog Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Sawlog Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Sawlog Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.14.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Sawlog drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Sawlog water supply. No potential Conditions have been identified for consideration at this time.***

### *13.14.3.3* 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~~

#### 13.14.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13l-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 Sawlog Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.14.3.3.2 Chemical Parameters

The MECP table of drinking water threats can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13l-4 ~~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 Sawlog Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.14.3.3.3 DNAPL Chemical Parameters

Figure 13l-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Sawlog Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13l-5 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.14.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.14.3.2, no Conditions have been confirmed within the WHPA for the Sawlog Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Sawlog Water Supply (Figure 13l-2) can be used to determine where these locations occur.

### *13.14.3.5 Enumerating Drinking Water Threats*

#### ~~13.14.3.4.1~~13.14.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.14.2 and 13.14.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.14.3.4.1.1~~13.14.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Sawlog WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.14.3.5.2). Figure 13b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Sawlog Water Supply. The Managed Land within all of the Sawlog WHPA is in the lowest threshold of 0 to 40%.

### ~~13.14.3.4.1.2~~13.14.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Sawlog WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.14.3.5.2). Figure 13b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Sawlog Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Sawlog WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.14.3.4.1.3~~13.14.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009December 2021)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E . 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Sawlog WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.14.3.5.2). The

Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Sawlog Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 1 to 8% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.14.3.4.2~~13.14.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-27 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Sawlog Water Supply. There are no Threats related to Issues or Conditions identified in the Sawlog WHPA.

A total of six (6) activities that are considered to be Significant Drinking Water Threats were identified in association with six (6) land parcels in the WHPA for the Sawlog Water Supply. Five (5) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-27: Number of Parcels with Significant Threat Activities for the Sawlog Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 5 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **6*** significant threats (on **6** properties) |

*5 verified existing Threats and 1 potential Threat that requires further verification (2015)

## 13.15 Tee Pee Point Well Supply

The Tee Pee Point Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 9-1 and 9-2). Table 13-28 provides details on these wells.

**Table 13-28: Tee Pee Point Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Tee Pee Point | 9-1 | BR | 220005394 | 0883-76WPAH (Sept 2017) | 178* | 140 |
| Tee Pee Point | 9-2 | BR | 220005394 | 0883-76WPAH (Sept 2017) | 178* | 0 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

*combined

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.15.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1and provided in detail in Golder, 2010c.

#### *13.15.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Tee Pee Point WHPAs are illustrated on Figure 13m-1. The WHPAs for the Tee Pee Point well system extend to the west, away from Georgian Bay.

#### *13.15.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Tee Pee Point WHPA is shown in Figure 13b-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13b-2, Low (>80) to High (<30) Vulnerability is indicated within WHPA-B through D.

#### *13.15.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

There is a sand and gravel operation noted in the Township, within the Tee Pee Point WHPAs. The depth of this operation was not considered sufficient to warrant an increase in the Vulnerability. No Transport Pathways were identified in the Tee Pee Point WHPA.

#### *13.15.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.15.1.5 Vulnerability Score*

The WHPA zones for the Tee Pee Point Water Supply, as shown in Figure 13m-1, and the Groundwater Vulnerability, as shown in Figure 13b-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13m-2 illustrates the Vulnerability Scores for the Tee Pee Point Water Supply. Figure 13m-2 will be used to assess Drinking Water Threats in Section 13.15.3.

#### *13.15.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Tee Pee Point WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Tee Pee Point Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25-year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.15.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Tee Pee Point Well Supply.***

### 13.15.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Tee Pee Point Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Tee Pee Point Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Tee Pee Point Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.15.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Tee Pee Point drinking water system.

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

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

The initial compilation of Conditions was based on the MOEMECP Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Tee Pee Point water supply. No potential Conditions have been identified for consideration at this time.***

#### *13.15.3.3 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~~

##### 13.15.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13m-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 Tee Pee Point Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

##### 13.15.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13m-4 ~~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 Tee Pee Point Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

##### 13.15.3.3.3 DNAPL Chemical Parameters

Figure 13m-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Tee Pee Point Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13m-5 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.15.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.15.3.2, no Conditions have been confirmed within the WHPA for the Tee Pee Point Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Tee Pee Point Water Supply (Figure 13m-2) can be used to determine where these locations occur.

### *13.15.3.5 Enumerating Drinking Water Threats*

#### ~~13.15.3.4.1~~13.15.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.15.2 and 13.15.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.15.3.4.1.1~~13.15.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Tee Pee Point WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.15.3.5.2). Figure 13b-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Tee Pee Point Water Supply. The Managed Land within all of the Tee Pee Point WHPA is in the lowest threshold of 0 to 40%.

### ~~*13.15.3.4.1.2*~~*13.15.3.5.1.2 Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Tee Pee Point WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.15.3.5.2). Figure 13b-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Tee Pee Point Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Tee Pee Point WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~*13.15.3.4.1.3*~~*13.15.3.5.1.3 Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E~~-~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Tee Pee Point WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were

used in the enumeration of Significant Drinking Water Threats (Section 13.15.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13b-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Tee Pee Point Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.15.3.4.2~~13.15.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-29 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Tee Pee Point Water Supply. There are no Threats related to Issues or Conditions identified in the Tee Pee Point WHPA.

A total of twenty-three (23) activities that are considered to be Significant Drinking Water Threats were identified in association with twenty-three (23) land parcels in the WHPA for the Tee Pee Point Water Supply. Twenty-one (21) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) parcel is identified as having a potential Threat related to the handling and storage of DNAPLs. One (1) Threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-29: Number of Parcels with Significant Threat Activities for the Tee Pee Point Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 21 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 1 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **23*** significant threats (on **23** properties) |

*21 verified existing Threats and 2 potential Threats that require further verification (2015)

## 13.16 Thunder Bay Well Supply

The Thunder Bay Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 20-1 and 20-2). Table 13-30 provides details on these wells.

**Table 13-30: Thunder Bay Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Thunder Bay | 20-1 | A2 | 220006268 | 0024-62TPFM (June 2014) | 203* | 52 |
| Thunder Bay | 20-2 | A2 | 220006268 | 0024-62TPFM (June 2014) | 203* | 0 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

*combined

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.16.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.16.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Thunder Bay WHPAs are illustrated on Figure 13n-1.The WHPAs for the Thunder Bay well system extend to the south, away from Georgian Bay.

#### *13.16.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Thunder Bay WHPAs is shown in Figure 13d-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13d-2, Low to Medium Vulnerability is indicated within WHPA-B through D.

#### *13.16.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Thunder Bay WHPA.

#### *13.16.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.16.1.5 Vulnerability Score*

The WHPA zones for the Thunder Bay Water Supply, as shown in Figure 13n-1, and the Groundwater Vulnerability, as shown in Figure 13d-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13n-2 illustrates the Vulnerability Scores for the Thunder Bay Water Supply. Figure 13n-2 will be used to assess Drinking Water Threats in Section 13.16.3.

#### *13.16.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Cooks Lake WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Thunder Bay Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.16.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c

***No Drinking Water Issues were identified for the Thunder Bay Well Supply.***

### 13.16.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Thundery Bay Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Thunder Bay Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Thunder Bay Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.16.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Thunder Bay drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Thunder Bay water supply. No potential Conditions have been identified for consideration at this time.***

### *13.16.3.3* 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 tables 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~~

#### 13.16.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13n-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 Thunder Bay Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.16.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13n-4 ~~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 Thunder Bay Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.16.3.3.3 DNAPL Chemical Parameters

Figure 13n-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Thunder Bay Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13n-5 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.16.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.16.3.2, no Conditions have been confirmed within the WHPA for the Thunder Bay Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Thunder Bay Water Supply (Figure 13n-2) can be used to determine where these locations occur.

### *13.16.3.5 Enumerating Drinking Water Threats*

#### ~~13.16.3.4.1~~13.16.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.16.2 and 13.16.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.16.3.4.1.1~~13.16.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Thunder Bay WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.16.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Thunder Bay Water Supply. The Managed Land within the majority of the Thunder Bay WHPA is in the lowest threshold of 0 to 40%. Only a small portion of the WHPA has 40 to 80%.

### ~~13.16.3.4.1.2~~13.16.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Thunder Bay WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.16.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Thunder Bay Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Thunder Bay WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.16.3.4.1.3~~13.16.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and –E-. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Thunder Bay WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within

the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.16.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Thunder Bay Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 1 to 8% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.16.3.4.2~~13.16.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-31 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Thunder Bay Water Supply. There are no Threats related to Issues or Conditions identified in the Thunder Bay WHPA.

A total of nine (9) activities that are considered to be Significant Drinking Water Threats were identified in association with nine (9) land parcels in the WHPA for the Thunder Bay Water Supply. Eight (8) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-31: Number of Parcels with Significant Threat Activities for the Thunder Bay Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 8 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **9*** significant threats (on **9** properties) |

*8 verified existing Threats and 1 potential Threat that requires further verification (2015)

]

## 13.17 Tiny Cove Estates Well Supply

The Tiny Cove Estates Well Supply is one of nineteen systems that the Township of Tiny obtains water from and is located in the northwest part of the Township, along the shores of Georgian Bay. The system is comprised of one pump house with two wells (Wells 30-2 and 30-1). Table 13-32 provides details on these wells.

**Table 13-32: Tiny Cove Estates Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Tiny Cove Estates | 30-2 | A2 | See (*). | 5437-8GHP8U** (April, 2021) | 150 | 0 |
| Tiny Cove Estates | 30-1 | A2 | See (*). | 5437-8GHP8U** (April, 2021) | 150 | 71 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

* Tiny Cove Estates is a planned system that has not been issued a DWIS Number.

** The Tiny Cove, Sandcastle, and Georgian Highlands well systems are now operated under single Permit To Take Water # 5437-8GHP8U. This permit cancels and replaces the permits previously issued for these individual well supplies. All of the wells under this permit are now considered part of a single well system referred to as the Castle Cove Estates well supply.

The Tiny Cover Estates wells were originally constructed and tested in 1996 for a proposed residential development. A Ministry of the Environment (MOE) Permit to Take Water (PTTW) Number 96-P-1066 was issued for the operation of the two wells. The wells have not been in operation since the PTTW was issued. A review of the water demand for the subdivision, under full development build-out, has been provided by Richardson Foster Limited as: 71.3 $m^3$/day (Average Day Demand) and 213.83 $m^3$/day (Maximum Day Demand).

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.17.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.17.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007).

Since the time of the original assessment of the WHPAs, new information was made available which may have impacted the shape and extent of the WHPAs. As such, adjustments have been made to the WHPAs where appropriate.

Modeling undertaken to delineate WHPA during the original 2007 study was completed with the previous existing PTTW rates of 62 $m^3$/day. As the proposed water taking for the site was increased to 71.3 $m^3$/day the WHPA was remodeled. The updated WHPA modelling was completed with the existing 3D numerical (MODLFOW) Tiny West Groundwater Model. No changes to the model domain, with the exception of pumping rates, were completed for this assessment.

The original WHPA modelling incorporated uncertainty measures to cover sources of uncertainty in the capture zone estimates stemming from the reliability of the model input data and the simplicity of the aquifer representation. To incorporate this uncertainty in the delineation of the capture zones, practical adjustments were made to the theoretical prediction of the groundwater model. These adjustments included the application of two "shape factors", which result in an increase in the size of the theoretical capture zones predicted by the model.

The resulting WHPA, with the increased water taking, remains unchanged from the originally modeled WHPA for this system. This is reflective of the nominal increase in pumping rates from the wells and the incorporation of the uncertainty factors implemented in the original modeling. The WHPAs are illustrated in Figure 13o-1.

#### *13.17.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Tiny Cove Estates WHPAs is shown in Figure 13d-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13d-2, Low Vulnerability (>80) is indicated WHPA-B through D.

#### *13.17.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Tiny Cove Estates WHPA.

#### *13.17.1.4 WHPA-E~~ / WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.17.1.5 Vulnerability Score*

The WHPA zones for the Tiny Cove Estates Water Supply, as shown in Figure 13o-1, and the Groundwater Vulnerability, as shown in Figure 13d-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13o-2 illustrates the Vulnerability Scores for the Tiny Cove Estates Water Supply. Figure 13o-2 will be used to assess Drinking Water Threats in Section 13.17.3.

#### *13.17.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In

situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Tiny Cove Estates WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Tiny Cove Estates Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.17.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Tiny Cove Estates Well Supply.***

### 13.17.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Tiny Cove Estates Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Tiny Cove Estates Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Tiny Cove Estates Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.17.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Tiny Cove Estates drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Tiny Cove Estates water supply. No potential Conditions have been identified for consideration at this time.***

#### *13.17.3.3 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 table of drinking water 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~~

13.17.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13o-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 Tiny Cove Estates Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.17.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13o-4 ~~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 Tiny Cove Estates Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.17.3.3.3 DNAPL Chemical Parameters

Figure 13o-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Tiny Cove Estates Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13o-5 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.17.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.17.3.2, no Conditions have been confirmed within the WHPA for the Tiny Cove Estates Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Tiny Cove Estates Water Supply (Figure 13o-2) can be used to determine where these locations occur.

## 13.17.3.5 Enumerating Drinking Water Threats

### ~~13.17.3.4.1~~13.17.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.17.2 and 13.17.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.17.3.4.1.1~~13.17.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Tiny Cove Estates WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.17.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Tiny Cove Estates Water Supply. The Managed Land within the majority of the Tiny Cove Estates WHPA is in the lowest threshold of 0 to 40%. Only a small portion of the WHPA has 40 to 80%.

#### *~~13.17.3.4.1.2~~13.17.3.5.1.2 Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated

in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Tiny Cove Estates WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.17.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Tiny Cove Estates Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Tiny Cove Estates WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~*13.17.3.4.1.3*~~*13.17.3.5.1.3 Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~-~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and ~~–~~E~~-~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Tiny Cove Estates WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.17.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Tiny Cove Estates Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.17.3.4.2~~13.17.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-33 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Tiny Cove Estates Lake Water Supply. There are no Threats related to Issues or Conditions identified in the Tiny Cove Estates WHPA.

A total of six (6) activities that are considered to be Significant Drinking Water Threats were identified in association with six (6) land parcels in the WHPA for the Tiny Cove Estates Water Supply. Five (5) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-33: Number of Parcels with Significant Threat Activities for the Tiny Cove Estates Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 5 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **6*** significant threats (on **6** properties) |

*4 verified existing Threats and 2 potential Threats that require further verification (2015)

## 13.18 Vanier Woods Well Supply

The Vanier Woods Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 15-1 and 15-2). Table 13-34 provides details on these wells.

**Table 13-34: Vanier Woods Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Vanier Woods | 15-1 | A2 | 220005401 | 92-P-3088 (Aug 2012) | 360 | 144 |
| Vanier Woods | 15-2 | A2 | 220005401 | 92-P-3088 (Aug 2012) | 360 | 0 |

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.18.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.18.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Vanier Woods WHPAs are illustrated on Figure 13p-1. The WHPAs for the Vanier Woods well system extend to the north, away from Georgian Bay.

#### *13.18.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Vanier Woods WHPAs is shown in Figure 13d-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13d-2, Low to High Vulnerability is indicated within WHPA-B through D.

#### *13.18.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Vanier Woods WHPA.

#### *13.18.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.18.1.5 Vulnerability Score*

The WHPA zones for the Vanier Woods Water Supply, as shown in Figure 13p-1, and the Groundwater Vulnerability, as shown in Figure 13d-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13p-2 illustrates the Vulnerability Scores for the Vanier Woods Water Supply. Figure 13p-2 will be used to assess Drinking Water Threats in Section 13.18.3.

#### *13.18.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Vanier Woods WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Vanier Woods Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.18.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Vanier Woods Well Supply.***

### 13.18.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Vanier Woods Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Vanier Woods Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Vanier Woods Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.18.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Vanier Woods drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Vanier Woods water supply. No potential Conditions have been identified for consideration at this time.***

### ***13.18.3.3*** 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~~

#### 13.18.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13p-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 Vanier Woods Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.18.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13p-4 ~~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 Vanier Woods Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.18.3.3.3 DNAPL Chemical Parameters

Figure 13p-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Vanier Woods Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13p-5 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.18.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.18.3.2, no Conditions have been confirmed within the WHPA for the Vanier Woods Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Vanier Woods Water Supply (Figure 13p-2) can be used to determine where these locations occur.

### *13.18.3.5 Enumerating Drinking Water Threats*

~~13.18.3.4.1~~13.18.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.18.2 and 13.18.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.18.3.4.1.1~~13.18.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Vanier Woods WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.18.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Vanier Woods Water Supply. The Managed Land within the WHPA-A and B of the Vanier Woods system is in the lowest threshold of 0 to 40%, while WHPA-C to D has greater than 80%.

### ~~13.18.3.4.1.2~~13.18.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Vanier Woods WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.18.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Vanier Woods Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Vanier Woods WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.18.3.4.1.3~~13.18.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E~~–E~~. 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~~Part XII of the Technical Rules ~~(December 2021)~~.

The proportion of Impervious Surfaces within the Vanier Woods WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within

the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.18.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Vanier Woods Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.18.3.4.2~~13.18.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-35 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Vanier Woods Water Supply. There are no Threats related to Issues or Conditions identified in the Vanier Woods WHPA.

A total of fifteen (15) activities that are considered to be Significant Drinking Water Threats were identified in association with fifteen (15) land parcels in the WHPA for the Vanier Woods Water Supply. Fourteen (14) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-35: Number of Parcels with Significant Threat Activities for the Vanier Woods Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 14 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **15*** significant threats (on **15** properties) |

*14 verified existing Threats and 1 potential Threat that requires further verification (2015)

## 13.19 Whip-Poor-Will Well Supply

The Whip-Poor-Will Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 21-1 and 21-2). Table 13-36 provides details on these wells.

**Table 13-36: Whip-Poor-Will Municipal Wells**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Whip-Poor-Will | 21-1 | A2/A3 | 220007481 | 3610-7SNNSM (May 2019) | 532* | 5 |
| Whip-Poor-Will | 21-2 | A2/A3 | 220007481 | 3610-7SNNSM (May 2019) | 532* | 96 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

*combined

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.19.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.19.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

Since the time of the original assessment of the WHPAs, new information was made available which may have impacted the shape and extent of the WHPAs. As such, adjustments have been made to the WHPAs where appropriate. For the Whip-Poor-Will system, Wells 21-1 and 21-2 are located 9m apart; however the original modeling had the wells located at a greater separation distance and within separate model grid cells. It was determined that a shift of capture zone alone was not appropriate and therefore the location of the Whip-Poor-Will wells was updated and the WHPAs delineated (Figure 13q-1) based on new locations.

#### *13.19.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Whip-Poor-Will WHPAs is shown in Figure 13q-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13q-2, Low (>80) to Medium (30-80) Vulnerability is indicated within WHPA-B through D.

#### *13.19.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Whip-Poor-Will WHPA.

#### *13.19.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.19.1.5 Vulnerability Score*

The WHPA zones for the Whip-Poor-Will Water Supply, as shown in Figure 13q-1, and the Groundwater Vulnerability, as shown in Figure 13q-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13q-3 illustrates the Vulnerability Scores for the Whip-Poor-Will Water Supply. Figure 13q-3 will be used to assess Drinking Water Threats in Section 13.19.3.

#### *13.19.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Whip-Poor-Will WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Whip-Poor-Will Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.19.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Whip-Poor-Will Well Supply.***

### 13.19.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Whip-Poor-Will Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Whip-Poor-Will Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Whip-Poor-Will Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.19.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Whip-Poor-Will drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A

summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Whip-Poor-Will water supply. No potential Conditions have been identified for consideration at this time.***

### *13.19.3.3* 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~~

#### 13.19.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13q-4 ~~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 Whip-Poor-Will Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.19.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13q-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 Whip-Poor-Will Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.19.3.3.3 DNAPL Chemical Parameters

Figure 13q-6 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Whip-Poor-Will Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can

be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13q-6 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.19.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.19.3.2, no Conditions have been confirmed within the WHPA for the Whip-Poor-Will Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Whip-Poor-Will Water Supply (Figure 13q-3) can be used to determine where these locations occur.

### *13.19.3.5 Enumerating Drinking Water Threats*

#### ~~13.19.3.4.1~~13.19.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.19.2 and 13.19.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.19.3.4.1.1~~13.19.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Whip-Poor-Will WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.19.3.5.2). Figure 13d-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Whip-Poor-Will Water Supply. The Managed Land within all of the Whip-Poor-Will WHPA is in the lowest threshold of 0 to 40%.

### ~~13.19.3.4.1.2~~13.19.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Whip-Poor-Will WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.19.3.5.2). Figure 13d-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Whip-Poor-Will Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Whip-Poor-Will WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.19.3.4.1.3~~13.19.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E~~ –E~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Whip-Poor-Will WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.19.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13d-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Whip-Poor-Will Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.19.3.4.2~~13.19.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-37 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Whip-Poor-Will Water Supply. There are no Threats related to Issues or Conditions identified in the Whip-Poor-Will WHPA.

A total of ten (10) activities that are considered to be Significant Drinking Water Threats were identified in association with ten (10) land parcels in the WHPA for the Whip-Poor-Will Water Supply. Nine (9) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-37: Number of Parcels with Significant Threat Activities for the Whip-Poor-Will Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 9 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **10*** significant threats (on **10** properties) |

*9 verified existing Threats and 1 potential Threat that requires further verification (2015)

## 13.20 Woodland Beach Well Supply

The Woodland Beach Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of two wells (Wells 25-1 and 25-2). Table 13-38 provides details on these wells.

**Table 13-38: Woodland Beach Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Woodland Beach | 25-1 | A4 | 260002330 | 92-P-3061 (July 2012) | 171 | 31 |
| Woodland Beach | 25-2 | A4 | 260002330 | 92-P-3061 (July 2012) | 171 | 31 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.20.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.20.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

The Woodland Beach WHPAs are illustrated on Figure 13r-1. The WHPAs for the Woodland Beach well system extend to the east, away from Georgian Bay.

#### *13.20.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Woodland Beach WHPAs is shown in Figure 13a-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13a-2, Low Vulnerability (>80) is indicated within WHPA-B through D.

#### *13.20.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c.

No Transport Pathways were identified in the Woodland Beach WHPA.

#### *13.20.1.4 WHPA-E ~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.20.1.5 Vulnerability Score*

The WHPA zones for the Woodland Beach Water Supply, as shown in Figure 13r-1, and the Groundwater Vulnerability, as shown in Figure 13a-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13r-2 illustrates the Vulnerability Scores for the Woodland Beach Water Supply. Figure 13r-2 will be used to assess Drinking Water Threats in Section 13.20.3.

#### *13.20.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Woodland Beach WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Woodland Beach Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.20.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Woodland Beach Well Supply.***

### 13.20.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Woodland Beach Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Woodland Beach Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Woodland Beach Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.20.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Woodland Beach drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A

summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Woodland Beach water supply. No potential Conditions have been identified for consideration at this time.***

### *13.20.3.3* 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~~

#### 13.20.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13r-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 Woodland Beach Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.20.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13r-4 ~~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 Woodland Beach Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.20.3.3.3 DNAPL Chemical Parameters

Figure 13r-5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Woodland Beach Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores~~The Key Table~~ on Figure 13r-5 ~~can be~~

~~used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.20.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.20.3.2, no Conditions have been confirmed within the WHPA for the Woodland Beach Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Woodland Beach Water Supply (Figure 13r-2) can be used to determine where these locations occur.

### *13.20.3.5 Enumerating Drinking Water Threats*

#### ~~13.20.3.4.1~~13.20.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.20.2 and 13.20.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

#### *~~13.20.3.4.1.1~~13.20.3.5.1.1 Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Woodland Beach WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.20.3.5.2). Figure 13a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Woodland Beach Water Supply. The Managed Land within all of the Woodland Beach WHPA is in the lowest threshold of 0 to 40%.

### ~~13.20.3.4.1.2~~13.20.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Woodland Beach WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.20.3.5.2). Figure 13a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Woodland Beach Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Woodland Beach WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.20.3.4.1.3~~13.20.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021) ~~requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E~~ –E~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Woodland Beach WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.20.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Woodland Beach Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.20.3.4.2~~13.20.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-39 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Woodland Beach Water Supply. There are no Threats related to Issues or Conditions identified in the Woodland Beach WHPA.

A total of twelve (12) activities that are considered to be Significant Drinking Water Threats were identified in association with twelve (12) land parcels in the WHPA for the Woodland Beach Water Supply. Eleven (11) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) threat activity and parcel has been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-39: Number of Parcels with Significant Threat Activities for the Woodland Beach Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 11 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 1 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 0 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **12*** significant threats (on **12** properties) |

*9 verified existing Threats and 3 potential Threats that require further verification (2015)

## 13.21 Wyevale Well Supply

The Wyevale Well Supply is one of nineteen systems that the Township of Tiny obtains water from and consists of five wells (Wells 17-1, 17-2, 17-3, 29-1 and 29-2). Table 13-40 provides details on these wells.

**Table 13-40: Wyevale Municipal Wells.**

| Municipal System | Well Name | Aquifer | DWIS # | PTTW # (expiry date) | PTTW Max ($m^3$/day) | Model Pumping Rate ($m^3$/day) |
|---|---|---|---|---|---|---|
| Wyevale | 17-1 | A3 | 220005410 | 3278-6JSJ6V (Dec 2015) | 259 | 82 |
| Wyevale | 17-2 | A3 | 220005410 | 3278-6JSJ6V (Dec 2015) | 527 | 168 |
| Wyevale | 17-3 | A3 | 220005410 | 3278-6JSJ6V (Dec 2015) | 259 | 82 |
| Wyevale | 29-1 | A2 | 220005410 | 3278-6JSJ6V (Dec 2015) | 655 | 208 |
| Wyevale | 29-2 | A2 | 220005410 | 3278-6JSJ6V (Dec 2015) | 982 | 312 |

Note: PTTW – Permit to Take Water, DWIS – Drinking Water Information System Number

Formatted Table

The hydrogeology and groundwater resources of the Town were described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005). A summary of the hydrogeologic characterization is provided herein for reference.

Five principle aquifer zones have been identified in Township as follows: a surficial semi-confined aquifer (A1); an intermediate confined aquifer (A2); a deep aquifer (A3); a deeper "contact" aquifer (A4); and a fractured limestone bedrock aquifer (A4 and the bedrock aquifer are considered hydraulically connected and may be grouped as one aquifer).

Detailed numerical groundwater flow modeling was completed in 2007 for the Township municipal wells (Golder, 2007). This updated the capture zones delineated in the NSGS. Based on the earlier groundwater study work a conceptual Hydrostratigraphy was developed. Based on this conceptualization a number of hydrostratigraphic layers were developed which generally characterize the hydrogeologic setting in the Township. For a description of these layers, see Section 13.3.

### 13.21.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, which current (or future) Threats at the surface present the greatest risk to contaminate the water supply.

Methods used to assess the Groundwater Vulnerability in Tiny are summarized in Section 13.3.1 and provided in detail in Golder, 2010c.

#### *13.21.1.1 Wellhead Protection Area (WHPA) Delineation*

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Township. To enhance, and improve upon, the WHPAs delineated, 3-dimensional numerical MODFLOW groundwater models were developed for the Township. This work included the construction of two models, 'Tiny West' and 'Tiny East'. A detailed description of the model construction and calibration can be found in the report: *Township of Tiny Numerical Groundwater Modelling and Updated Wellhead Protection Areas* (Golder, 2007). A brief summary of the methods used to delineate WHPA can be found in Section 13.3.1.1.

WHPAs for the Wyevale system were delineated as part of earlier modeling studies (Golder 2005, 2007). Since the completion of the most recent modeling in 2007, two new supply wells (29-1 and 29-2) have been added to the Wyevale system. As such, updated WHPAs for the Wyevale system were delineated. In order to update the WHPAs, anew (local scale) groundwater model for the Wyevale area was developed (Wyevale model) and used to simulate the time-of-travel capture zones. The Wyevale model was 'cut out' of the existing Tiny West groundwater model and subsequently refined to accommodate the new wells. Details of the modeling are provided in Golder, 2008a.

The Wyevale WHPAs are illustrated on Figure 13s-1. The WHPAs for the Wyevale well system extends west before curving to both north and south.

#### *13.21.1.2 Groundwater Vulnerability*

The Groundwater Vulnerability within the Wyevale WHPAs is shown in Figure 13a-2.

The regional scale intrinsic susceptibility index (ISI) Vulnerability was previously completed for the Township in the North Simcoe Groundwater Study (Golder, 2005). As the municipal aquifers in the Town may be located below the first aquifer in some areas as defined in this method, the resulting ISI Vulnerability may not accurately reflect the Vulnerability of the municipal supply aquifers, which in some cases are overlain by low permeability materials.

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the

Vulnerability. The layers from the calibrated numerical model developed for the Township were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 13a-2, Low Vulnerability (>80) is indicated within WHPA-B through D.

#### *13.21.1.3 Transport Pathway Increase*

The Technical Rules allow for increasing the aquifer vulnerability based on Transport Pathways that are anthropogenic in origin (i.e. man-made structures). A summary of the steps taken to identify Transport Pathways is presented in Section 13.3.1.3 and discussed in detail within Golder 2010c

No Transport Pathways were identified in the Wyevale WHPA.

#### *13.21.1.4 WHPA-E~~/ WHPA-F~~*

None of the wells in this study have been identified as Groundwater Under the Influence of surface water (GUDI), therefore delineation of a WHPA-E was not required. ~~Since a WHPA-E was not required for any of the wells, the delineation of a WHPA-F was also not required.~~

#### *13.21.1.5 Vulnerability Score*

The WHPA zones for the Wyevale Water Supply, as shown in Figure 13s-1, and the Groundwater Vulnerability, as shown in Figure 13a-2, were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 13s-2 illustrates the Vulnerability Scores for the Wyevale Water Supply. Figure 13s-2 will be used to assess Drinking Water Threats in Section 13.21.3.

#### *13.21.1.6 Uncertainty Rating*

The Technical Rules require that an Uncertainty Rating, characterized as High or Low, be assigned for completed Vulnerability and WHPA assessments. Uncertainty assessment for WHPA delineation was undertaken by both Golder 2010c and independent peer review. In situations where different uncertainty estimates are provided (i.e. Low and High), the most conservative (High uncertainty) has been applied. Uncertainty of the Vulnerability Assessment was only undertaken by Golder 2010c. A summary of the approach used to assign WHPA delineation and Vulnerability Uncertainty is provided in Section 13.3.1.7 and in more detail with Golder 2010c and Table 1 in Appendix MO.

The Uncertainty Rating assigned for the Wyevale WHPAs delineation is High. Considering all of the available data, the uncertainty of the Vulnerability for the Wyevale Water Supply is considered Low close to the municipal wells and increases at the outer reaches of the 25 year capture area. Overall the Vulnerability Uncertainty is characterized as Low.

### 13.21.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) 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.

A summary of the approach used to identify any Issues is provided in Section 13.3.2 and in more detail with Golder 2010c.

***No Drinking Water Issues were identified for the Wyevale Well Supply.***

### 13.21.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Wyevale Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010c (Appendix TI). 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 Wyevale Water Supply 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.

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

The list of Prescribed Drinking Water Threats considered in the assessment for Wyevale Drinking Water Supply is provided in Chapter 5, section 5.5.1.

The key data sources used to identify Threats on properties are identified in Section 13.3.3.1 and Section 13.21.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Wyevale drinking water system.

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

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

The initial compilation of Conditions was based on the MOE Records Database and the MOE Brownfields Database (2009) and supplemented by information provided by the City. A summary of the approach used to identify any Conditions is provided in Section 13.3.3.2 and in more detail with Golder 2010c.

***No confirmed Conditions have been identified for the Wyevale water supply. No potential Conditions have been identified for consideration at this time.***

### *13.21.3.3* 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~~

#### 13.21.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13s-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 Wyevale Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.21.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13s-4 ~~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 Wyevale Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances

(high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

#### 13.21.3.3.3 DNAPL Chemical Parameters

Figure 13s- 5 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Wyevale Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 13s- 5 ~~can be used to can be used~~ to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats.

### *13.21.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 13.21.3.2, no Conditions have been confirmed within the WHPA for the Wyevale Water Supply.

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.

Section 13.3.3.4 summarizes the situations where a Condition is or would be a Significant, Moderate or Low threat to municipal drinking waters. Once the situations dictating the threat level are know, the Vulnerability Score map for the Wyevale Water Supply (Figure 13s-2) can be used to determine where these locations occur.

### *13.21.3.5 Enumerating Drinking Water Threats*

#### ~~13.21.3.4.1~~13.21.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 13.21.2 and 13.21.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. For a general summary on the methods, see Section 13.3.3.5.1. Detailed methodology can be found in Golder, 2010c. Additional refinement of the Significant Drinking Water Threats Enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

### ~~13.21.3.4.1.1~~13.21.3.5.1.1 *Managed Lands*

Managed Land is land to which nutrients (Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM)) are applied. It includes crop land, fallow land, pasture land, golf courses, sports fields and residential lawns. Managed Lands is broken into two subsets; agricultural managed lands and non-agricultural managed lands. Agricultural managed lands include areas of crop land, fallow and pasture land that may receive nutrients. Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

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 WHPA-A, -B, -C, -D, and –E . 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 Technical Rules~~Table of Drinking Water Threats~~.

Managed Lands were identified and the Managed Lands proportions were determined for the Wyevale WHPA as outlined in Golder, 2010c.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.21.3.5.2). Figure 13a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Wyevale Water Supply. The Managed Land within the majority of the Wyevale WHPA is in the medium threshold of 40 to 80%. WHPA-B to C for Wells 29-1 and 29-2 has 0 to 40%.

### ~~13.21.3.4.1.2~~13.21.3.5.1.2 *Livestock Density*

Livestock Density is calculated to provide a measure of the potential for generating, storing and land applying ASM as a source of nutrients within a defined area. The livestock density is expressed as Nutrient Units per Acre. It is determined by dividing the Nutrient Units generated in each area by the number of acres of agricultural managed land in the area where agricultural source material is applied.

Technical Rule 16(10) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and –E. 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 Technical Rules~~Table of Drinking Water Threats~~.

The Livestock Density was determined for the Wyevale WHPA as outlined in Golder, 2010c. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.21.3.5.2). Figure 13a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Wyevale Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. The livestock density calculations result in <0.5 NU/acres within all of the Wyevale WHPAs where densities were calculated (i.e. greater than a Vulnerability of 6).

### ~~13.21.3.4.1.3~~13.21.3.5.1.3 *Impervious Surfaces*

Technical Rule 16(11) ~~(August 2009~~December 2021)~~ ~~requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and ~~-E~~ E~~. 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 ~~Part XII of~~ the Technical Rules ~~(December 2021)~~the Table of Drinking Water Threats~~.

The proportion of Impervious Surfaces within the Wyevale WHPA was determined in accordance with the methodology in Golder, 2010c. Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 13.21.3.5.2). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 13a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Wyevale Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. ~~It is noted that an impervious area of 8 to 80% has been assigned within all lands contained within the WHPA limits.~~

### ~~13.21.3.4.2~~13.21.3.5.2 Enumerating Significant Drinking Water Threats – Results

Table 13-41 documents the refined enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the two WHPAs for the Wyevale Water Supply. There are no Threats related to Issues or Conditions identified in the Wyevale WHPAs.

A total of thirty-four (34) activities that are considered to be Significant Drinking Water Threats were identified in association with thirty-four (34) land parcels in the WHPAs for the Wyevale Water Supply. Thirty-one (31) parcels are identified as having Significant Threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) parcel was identified to have a potential Threat related to the handling and storage of DNAPLs. Two (2) (one for each WHPA) threat activities and parcels have been included to represent the potential for subsurface storage of fuel for home heating purposes within the area where the Vulnerability Score is 10.

**Table 13-41: Number of Parcels with Significant Threat Activities for the Wyevale Water Supply.**

| Threat Number | Threat | Significant threat counts 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. | 31 |
| 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. | 0 |
| 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 |
| 15. | The handling and storage of fuel. | 2 |
| 16. | The handling and storage of dense non-aqueous phase liquid. | 1 |
| 17. | The handling and storage of an organic solvent. | 0 |

| Threat Number | Threat | Significant threat counts Number of threats |
|---|---|---|
| 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 |
| 22. | The establishment and operation of a liquid hydrocarbon pipeline | 0 |
| - | **Totals:** | **34*** significant threats (on **34** properties) |

*31 verified existing Threats and 3 potential Threats that require further verification (2015)




- Municipal Supply Well in Township of Tiny
- WHPA-A (100m)
- WHPA-B (2 years time of travel)
- WHPA-C (5 years time of travel)
- WHPA-C1 (10 years time of travel)
- WHPA-D (25 years time of travel)
- SWP Watershed Region
- Upper Tier Municipality
- Lower Tier Municipality

# Drinking Water System Vulnerable Areas in Township of Tiny

Created by: LSRCA
Date: 2011-03-29

Scale: 1:200,000
0 2 4km
UTM Zone 17N, NAD83

Severn Sound Environmental Association

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.

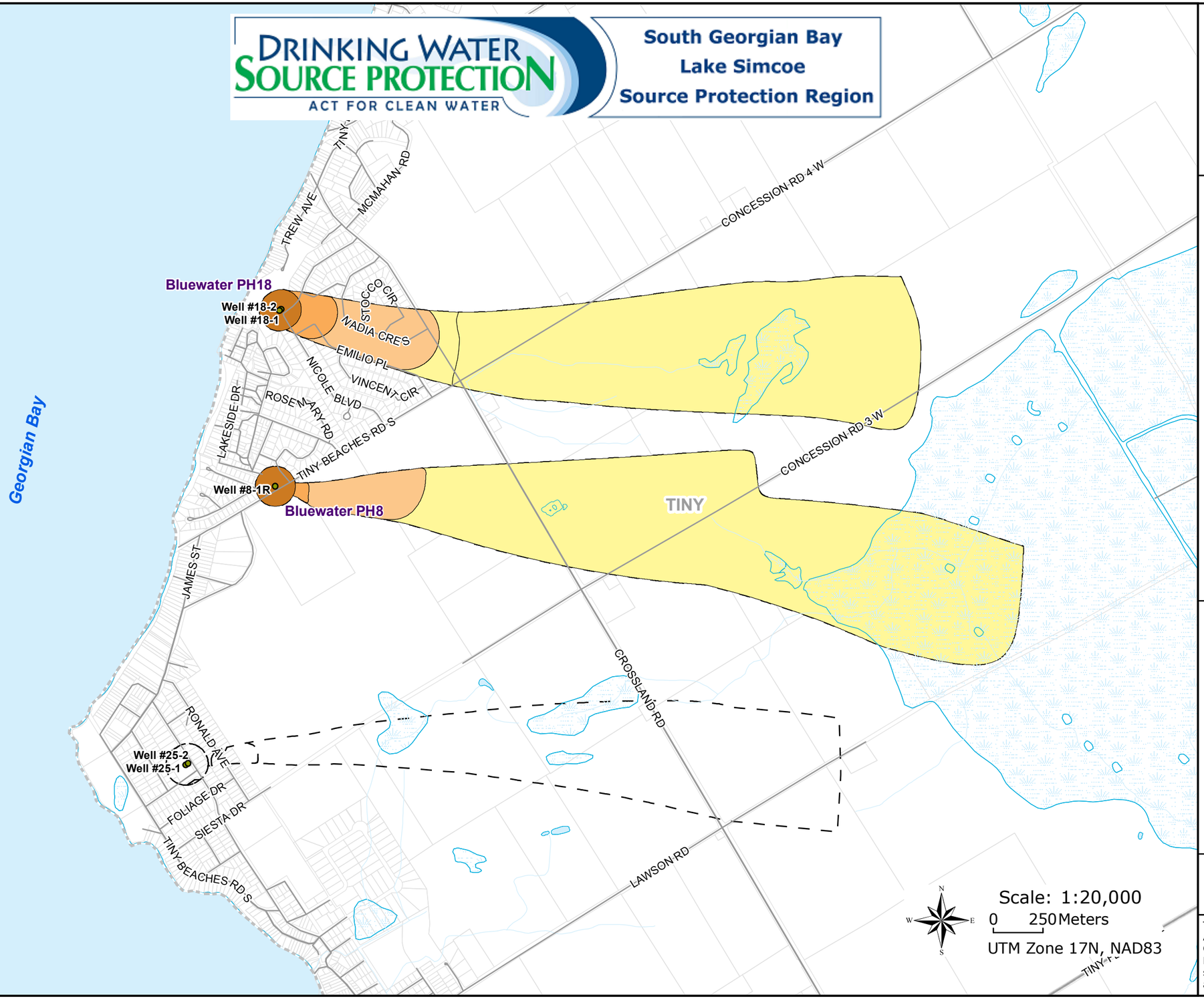
Ontario

**Figure 13-1**

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Bluewater Beach
# Well 8-1, 18-1, and 18-2
# Wellhead Protection Area




Municipal Wells
Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary

**WHPA TOT**

WHPA-A (100 m radius)
WHPA-B (2 yr TOT)
WHPA-C (5 yr TOT)
WHPA-D (25 yr TOT)
Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
BW-1-Wellhead Protection Area Bluewater Beach.mxd
Date: 2009-12-14

Ontario

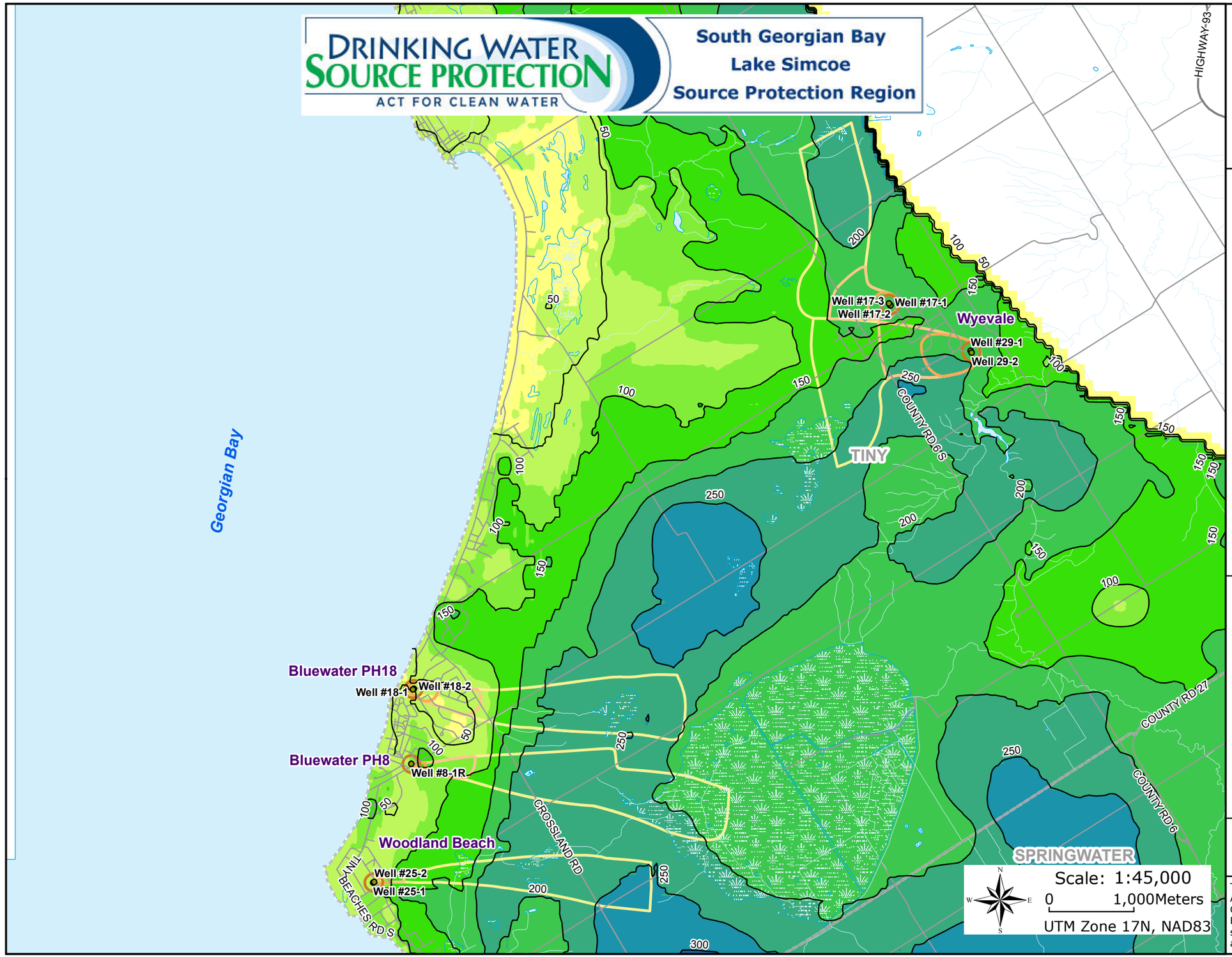
**13a-1**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Model Calculated AVI
# To Top of Model Layer 5
# (Aquifer A2 Southwest)




Municipal Well
Contour (50 AVI)

**Model Calculated Aquifer Vulnerability Index**

- 0 - 30
- 31 - 80
- 81 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 300
- 301 - 350
- 351 - 400
- 401 - 450

WHPA TOT

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)

- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Figure illustrates only AVI score for WHPAs corresponding to this model layer

Scale: 1:45,000
0 1,000Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: Fig_A-5_Topof5Southwest.mxd
Date: 2009-12-23

Ontario

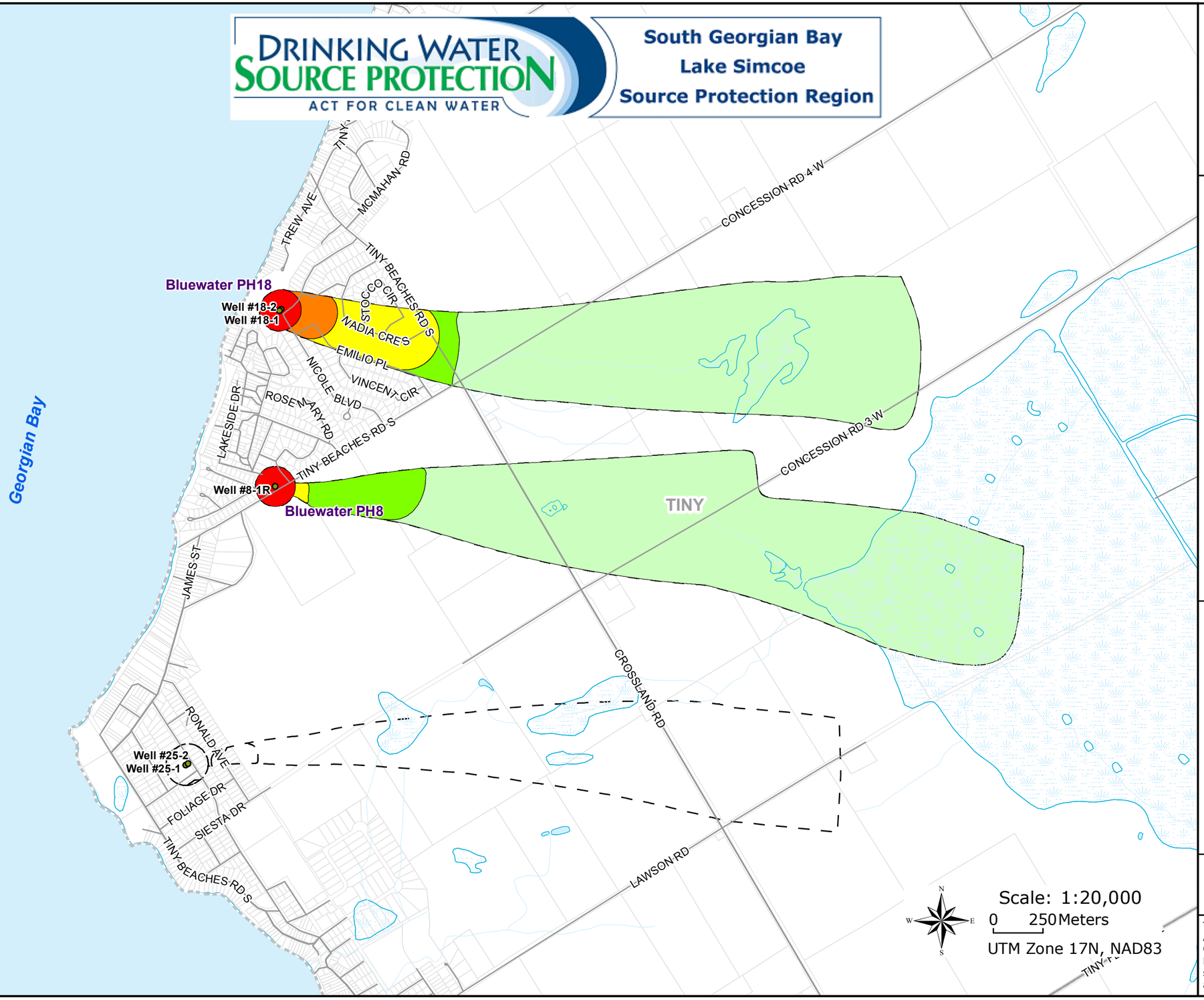
**13a-2**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Bluewater Beach
# Well 8-1, 18-1, and 18-2
# Final Vulnerability Scoring




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
BW-2-Final Vulnerability Scoring Bluewater Beach.mxd
Date: 2009-12-14

Ontario

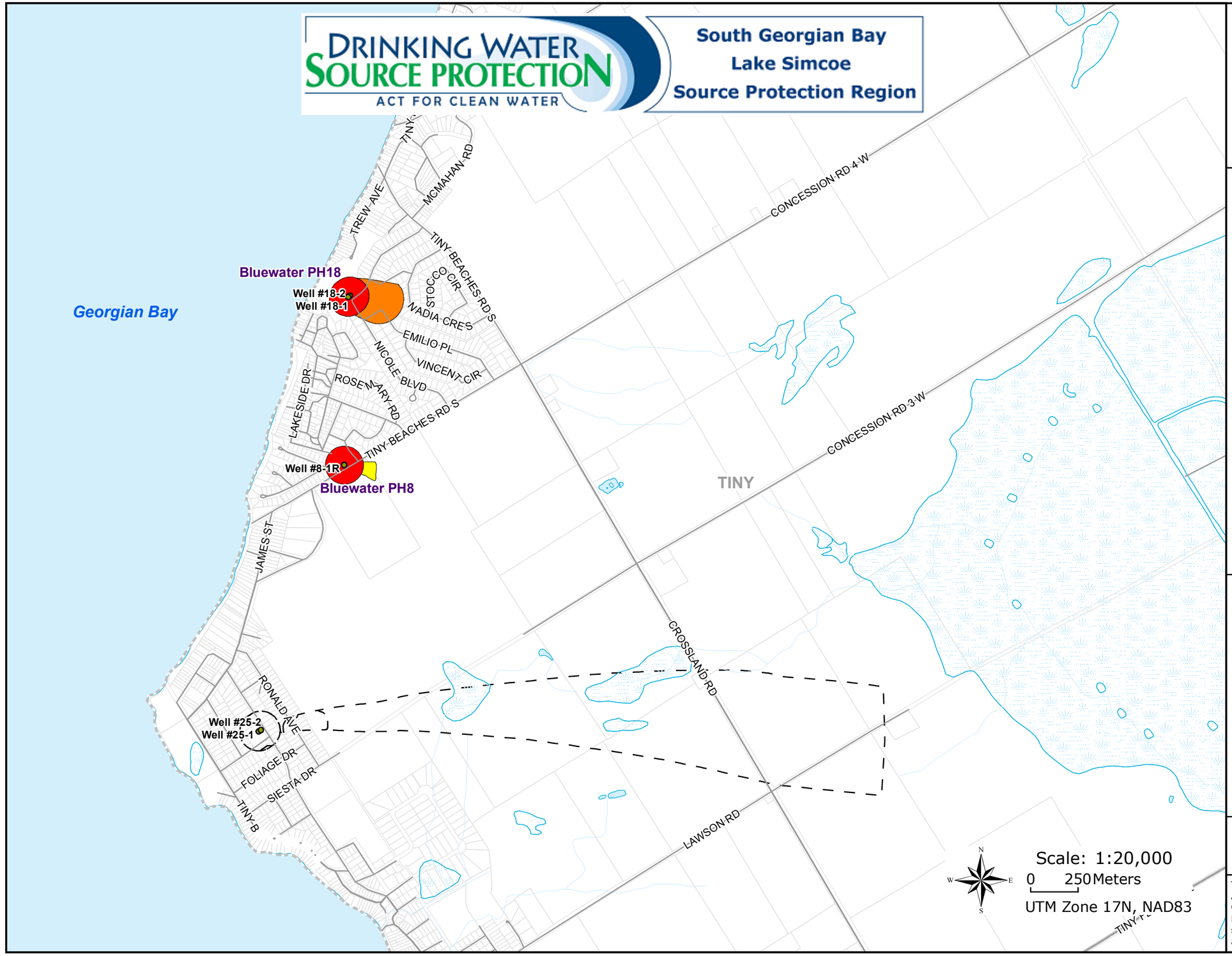
**13a-3**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Bluewater Beach Well 8-1, 18-1, and 18-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
BW-4-Pathogen Threat Bluewater Beach.mxd
Date: 2010-05-18

Ontario

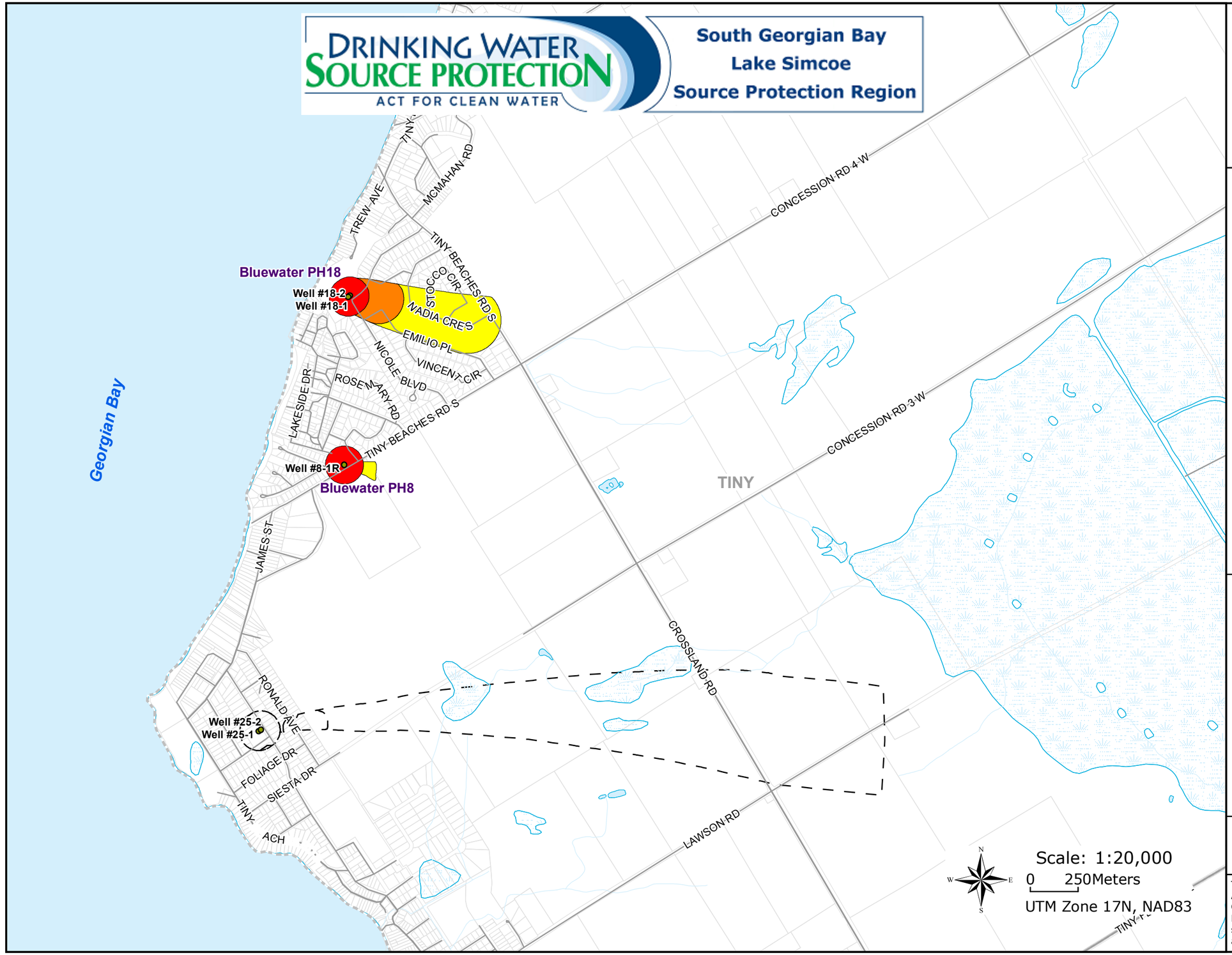
**13a-4**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Bluewater Beach Well 8-1, 18-1, and 18-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
BW-3-Chemical Threat Bluewater Beach.mxd
Date: 2009-12-14

Ontario

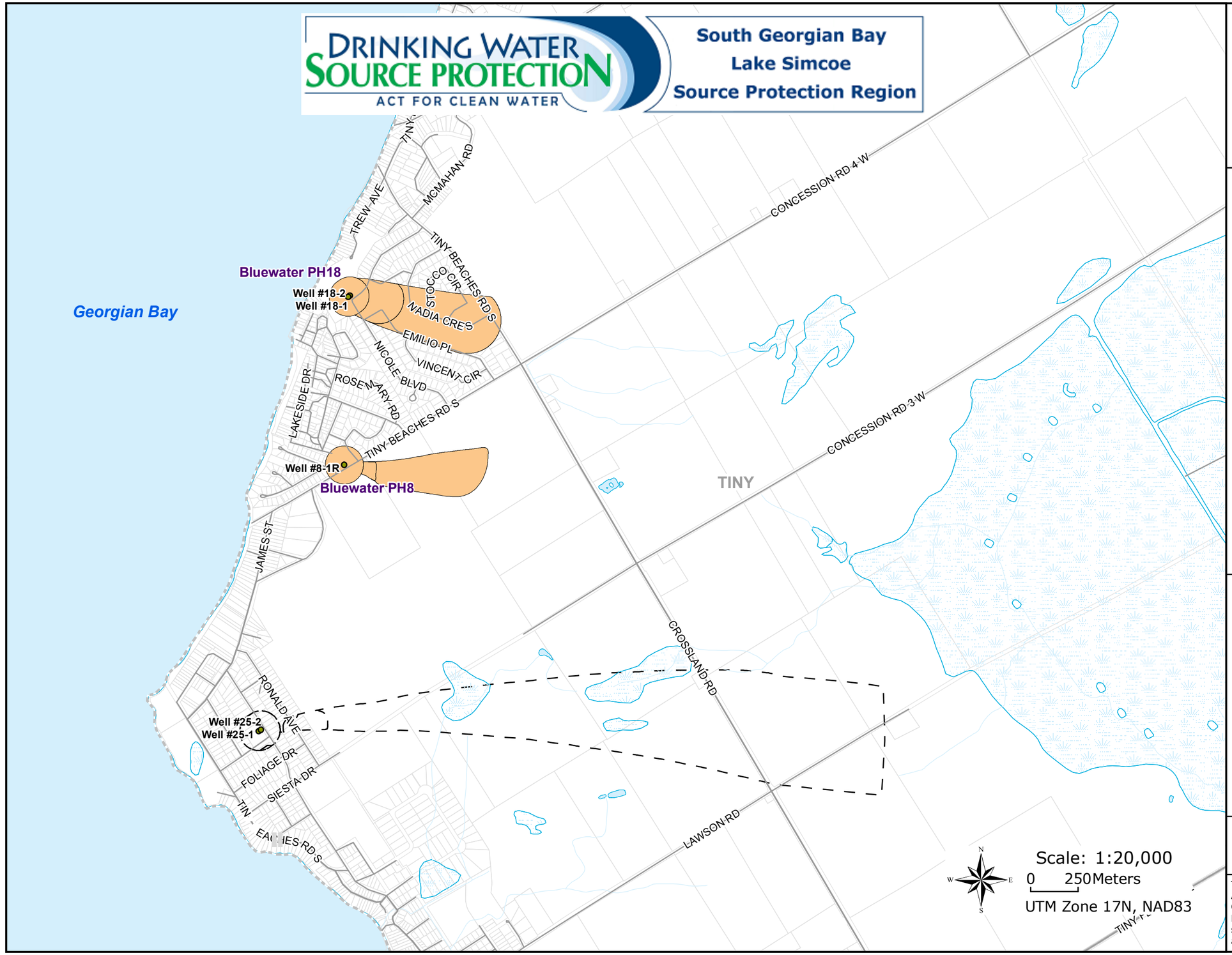
**13a-5**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Bluewater Beach Well 8-1, 18-1, and 18-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




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Project #: 07-1170-0014
File Number:
BW-5-DNAPL Threat Bluewater Beach.mxd
Date: 2010-05-18

Ontario

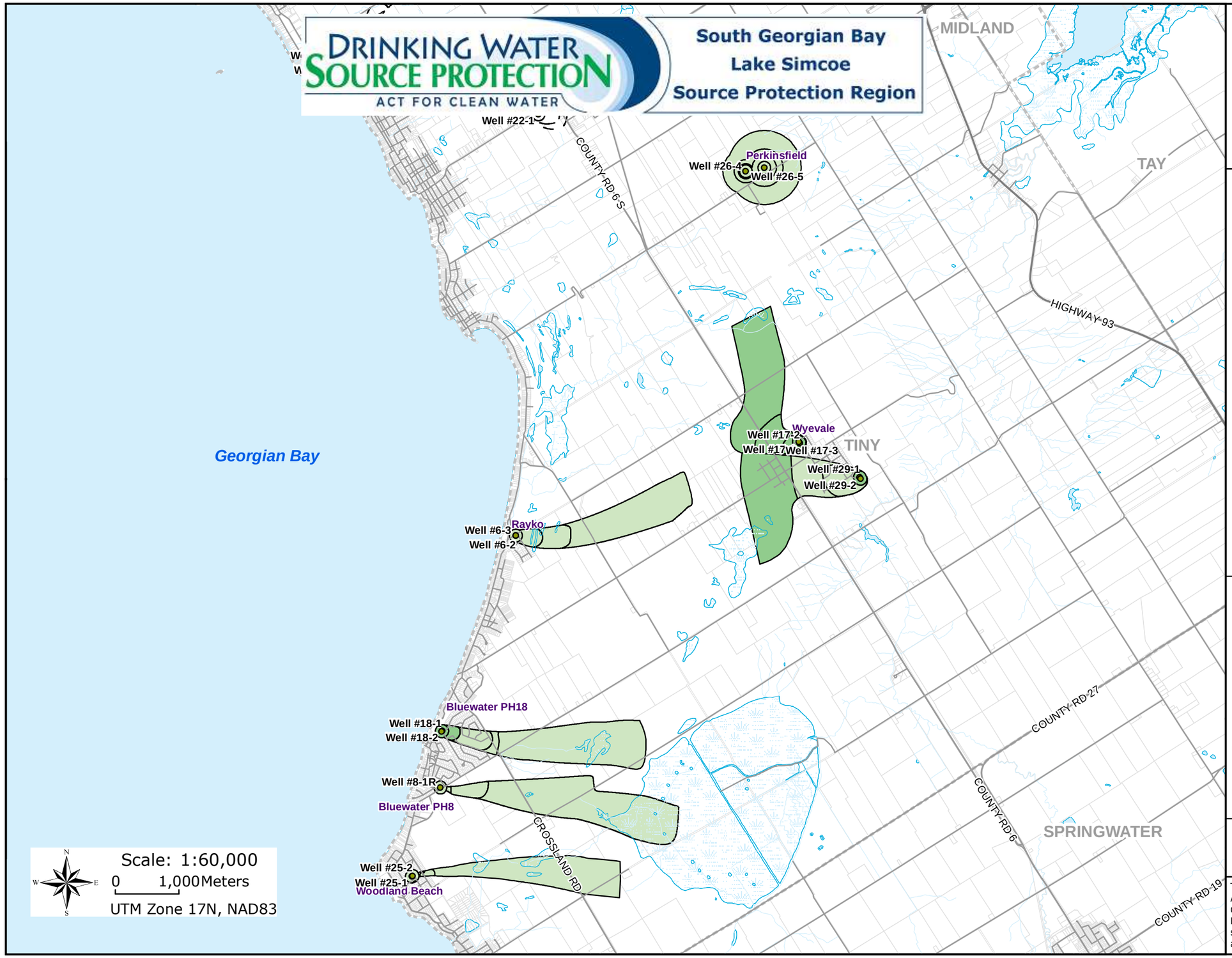
**13a-6**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Wellhead Protection Areas
# Managed Land
# (South)




Municipal Wells

**Managed Land (Percentage)**

- < 40
- 40-80
- >80

Principal Highway
Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:60,000
0 1,000 Meters
UTM Zone 17N, NAD83

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
C-4b-Impervious S.mxd
Date: 2009-12-14

Ontario

**13a-7**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Wellhead Protection Areas
# Livestock Density
# (South)

Georgian Bay

Well #22-1

COUNTY RD 6 S

Well #26-4
Perkinsfield
Well #26-5

TAY

HIGHWAY-93

TINY

Well #17-2
Wyevale
Well #17
Well #17-3

Well #29-1
Well #29-2

Well #6-3
Rayko
Well #6-2

Well #18-1
Well #18-2
Bluewater-PH18

Well #8-1R
Bluewater PH8

GROSSLAND RD

Well #25-2
Well #25-1
Woodland Beach

COUNTY RD 27

COUNTY RD 6

SPRINGWATER

COUNTY RD 19

- Municipal Wells
- <0.5 NU/Acre
- WHPA Boundary
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

N W E S

Scale: 1:60,000
0 1,000Meters
UTM Zone 17N, NAD83

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Barrie, Ontario

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Project #: 07-1170-0014
File Number:
C-5b-Livestock Density S.mxd
Date: 2009-12-14

Ontario

**13a-8**

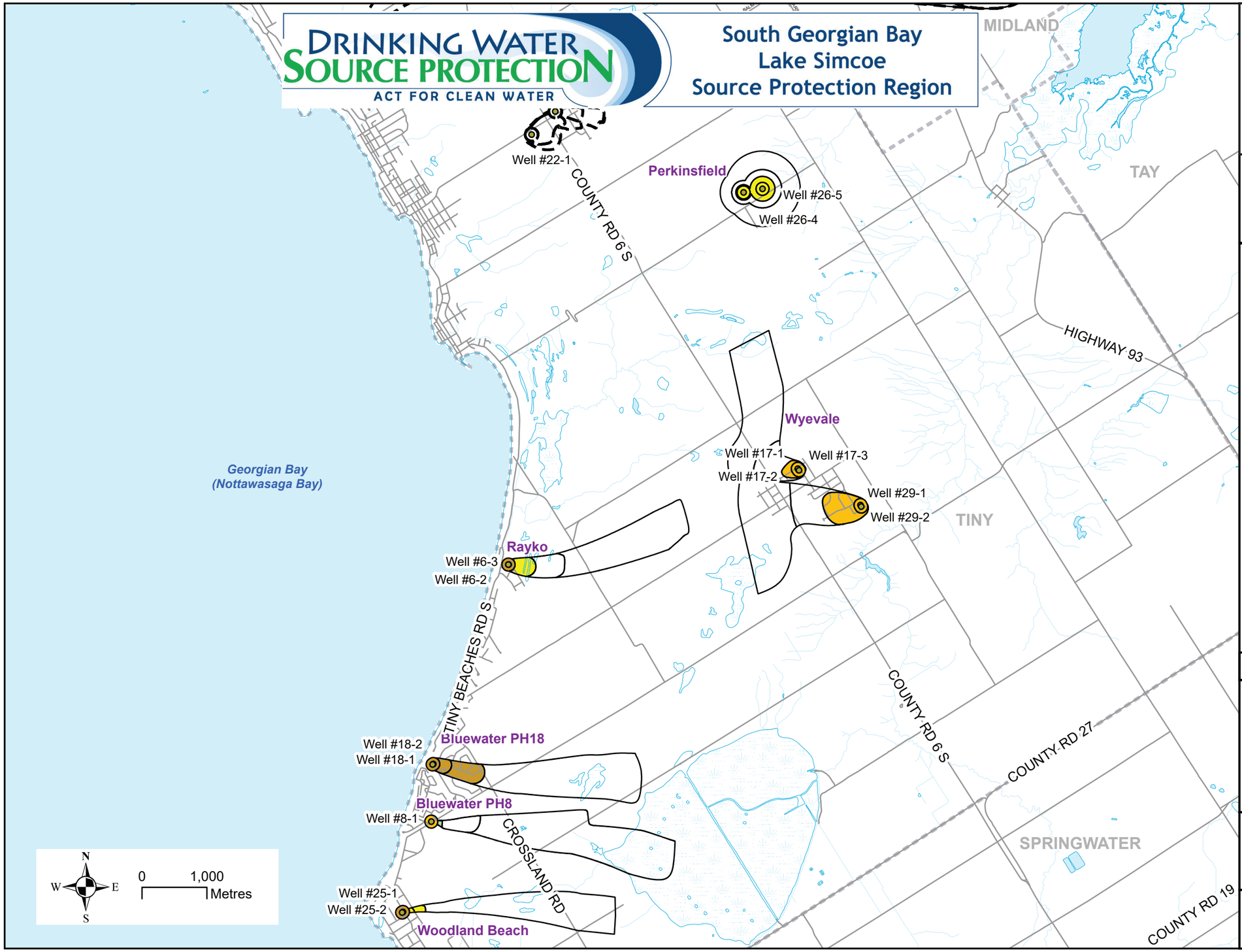
This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data,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

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# TOWNSHIP OF TINY
# WELLHEAD PROTECTION AREAS
# IMPERVIOUS SURFACES
# (SOUTH)

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region




## LEGEND

- Municipal Wells

**IMPERVIOUS SURFACE**

- < 1%
- = 1% - < 6%
- = 6% - < 8%
- = 8% - < 30%
- => 30%
- WHPA Boundary
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary
- Adjacent Well Field WHPA

The Impervious Surfaces are illustrated for WHPA A-D where the vulnerability score is > 6.

Severn Sound Environmental Association

DATE: AUGUST 2025

SCALE: 1:60,000

Ontario

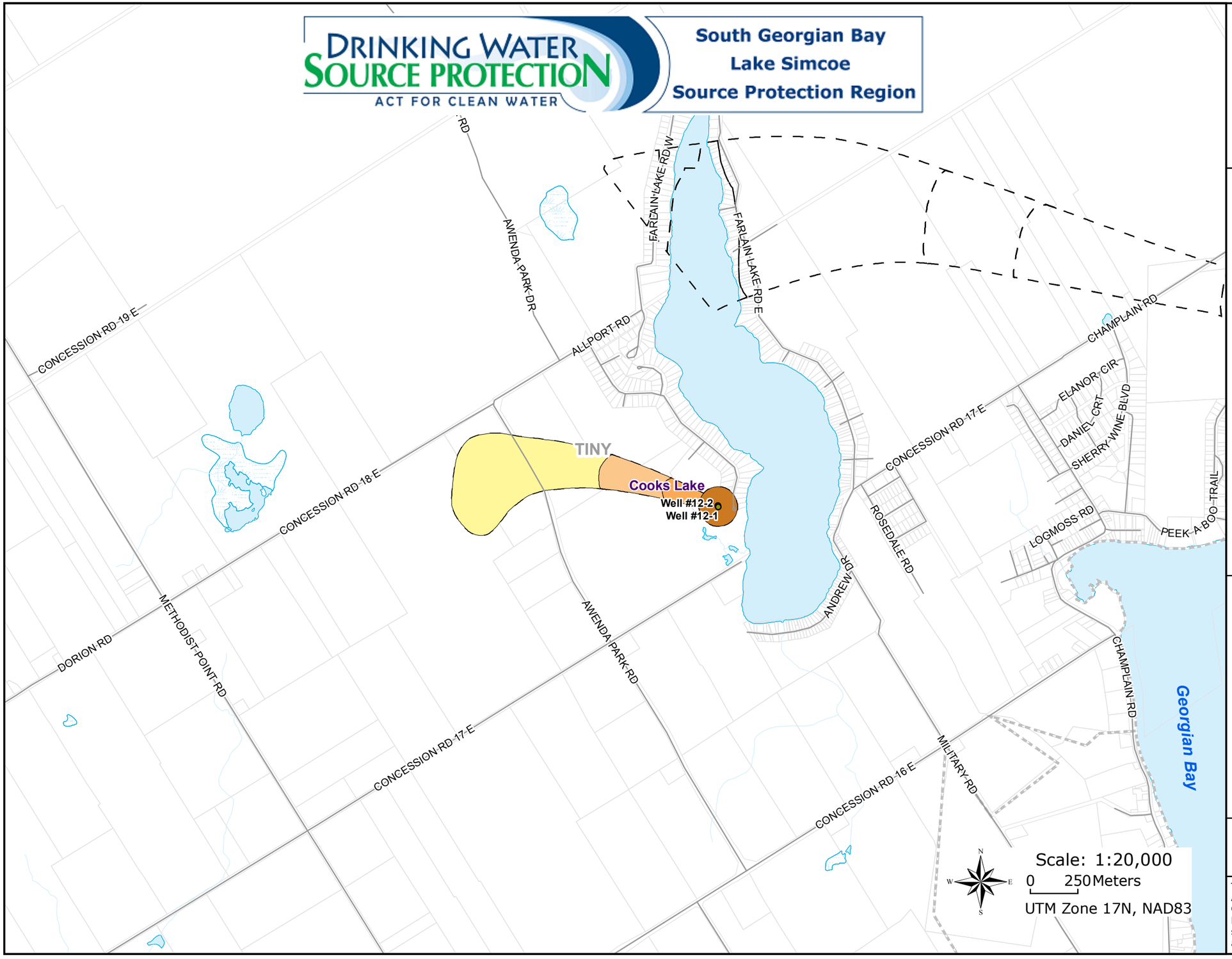
FIGURE
**13a-9**

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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Cooks Lake
# Well 12-1 and 12-2
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
CL-1-Wellhead Protection Area Cooks Lake.mxd
Date: 2009-12-14

Ontario

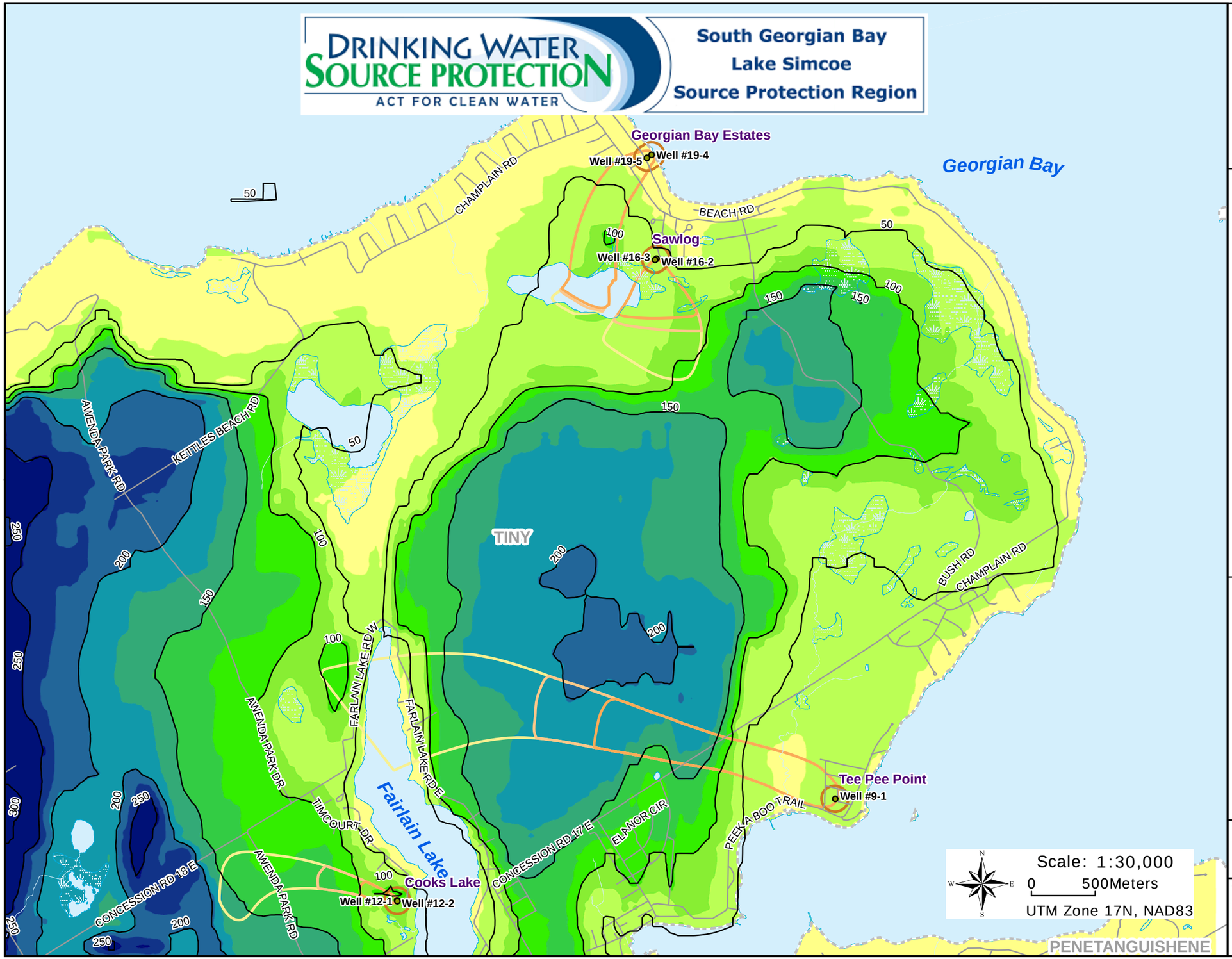
**13b-1**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Towhnship of Tiny
# Model Calculated AVI
# To Top of Model Layer 5
# (Aquifer A2 Northeast)




- Municipal Well
- Contour (50 AVI)

**Model Calculated Aquifer Vulnerability Index**

- 0 - 30
- 31 - 80
- 81 - 100
- 101 - 125
- 126 - 150
- 151 - 175
- 176 - 200
- 201 - 225
- 226 - 250
- 251 - 275

WHPA TOT

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Figure illustrates only AVI score for WHPAs corresponding to this model layer

Scale: 1:30,000
0 500Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: Topof5NorthEast.mxd
Date: 2009-12-10

Ontario

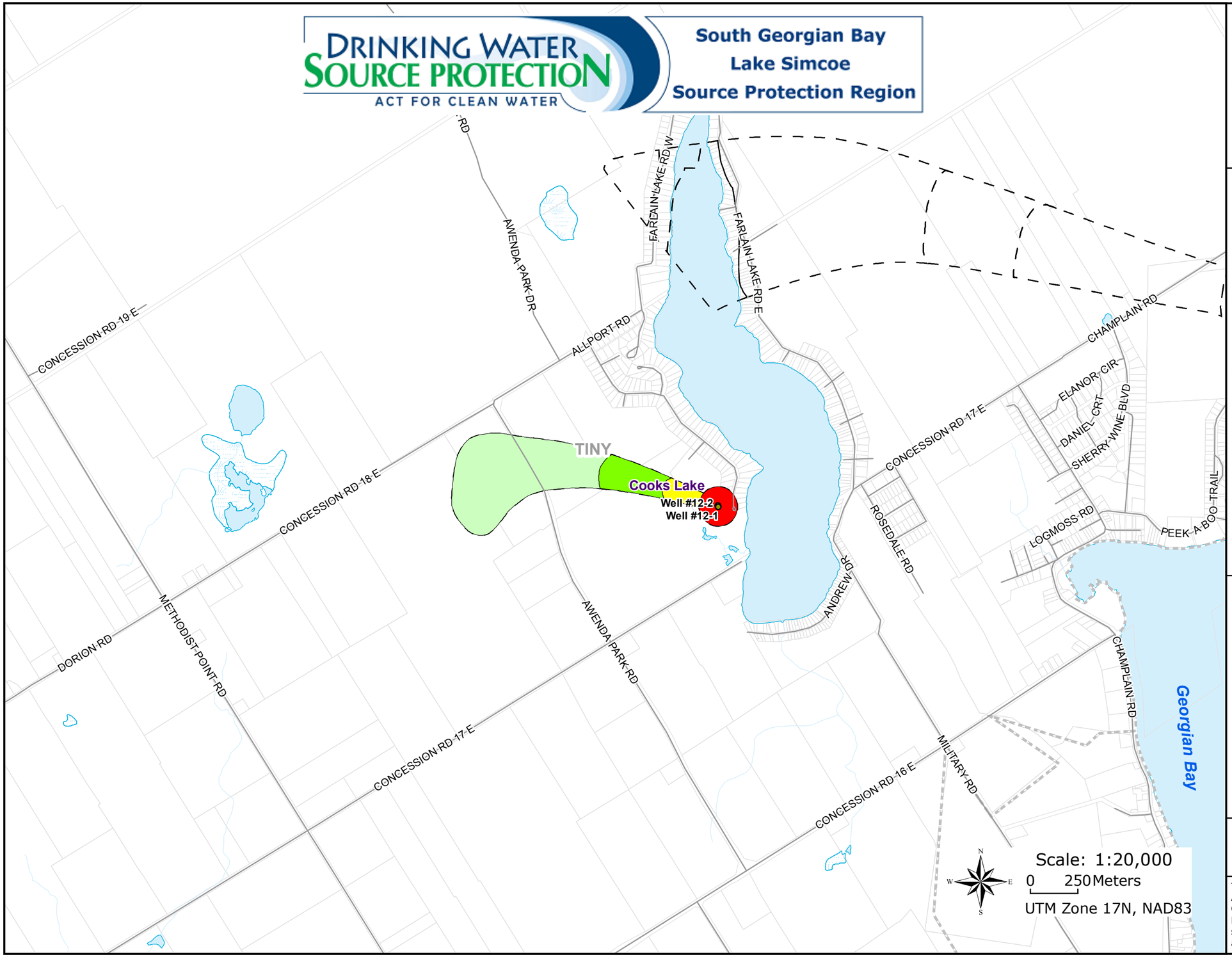
**13b-2**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Cooks Lake
# Well 12-1 and 12-2
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
CL-2-Final Vulnerability Scoring Cooks Lake.mxd
Date: 2009-12-14

Ontario

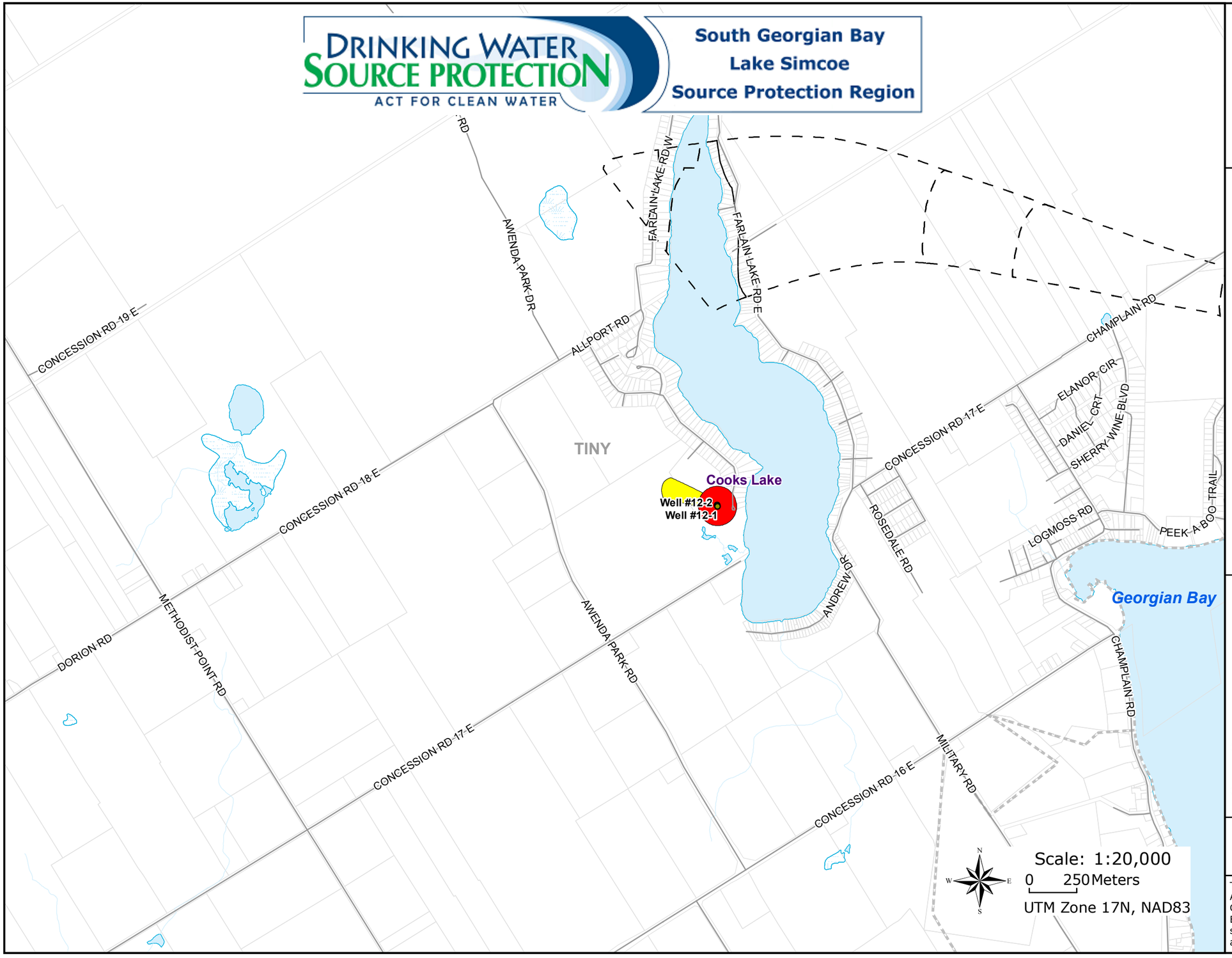
**13b-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Cooks Lake
# Well 12-1 and 12-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
CL-4-Pathogen Threat Cooks Lake.mxd
Date: 2010-05-18

Ontario

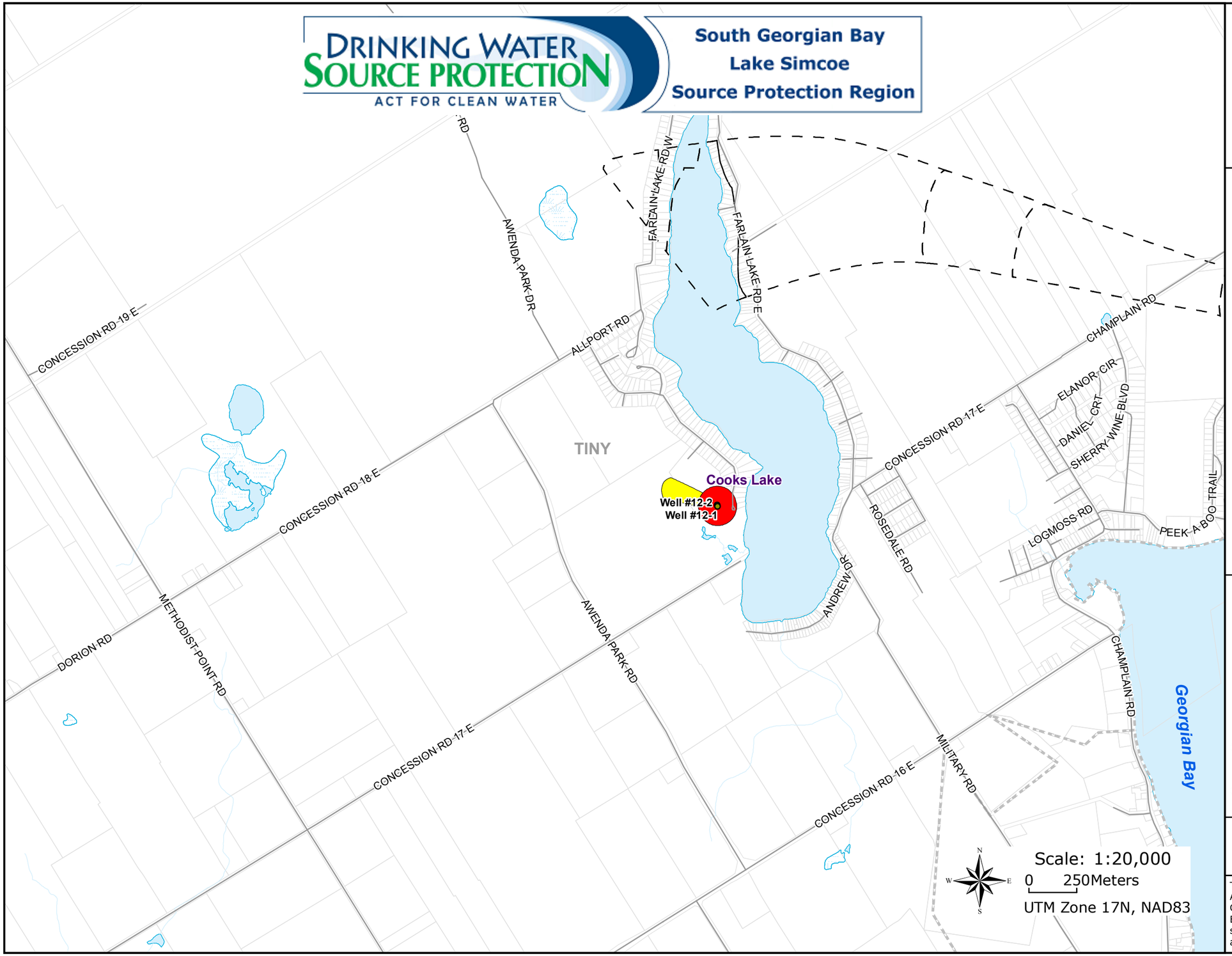
**13b-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Cooks Lake
# Well 12-1 and 12-2
# Areas That are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
CL-3-Chemical Threat Cooks Lake.mxd
Date: 2009-12-14

Ontario

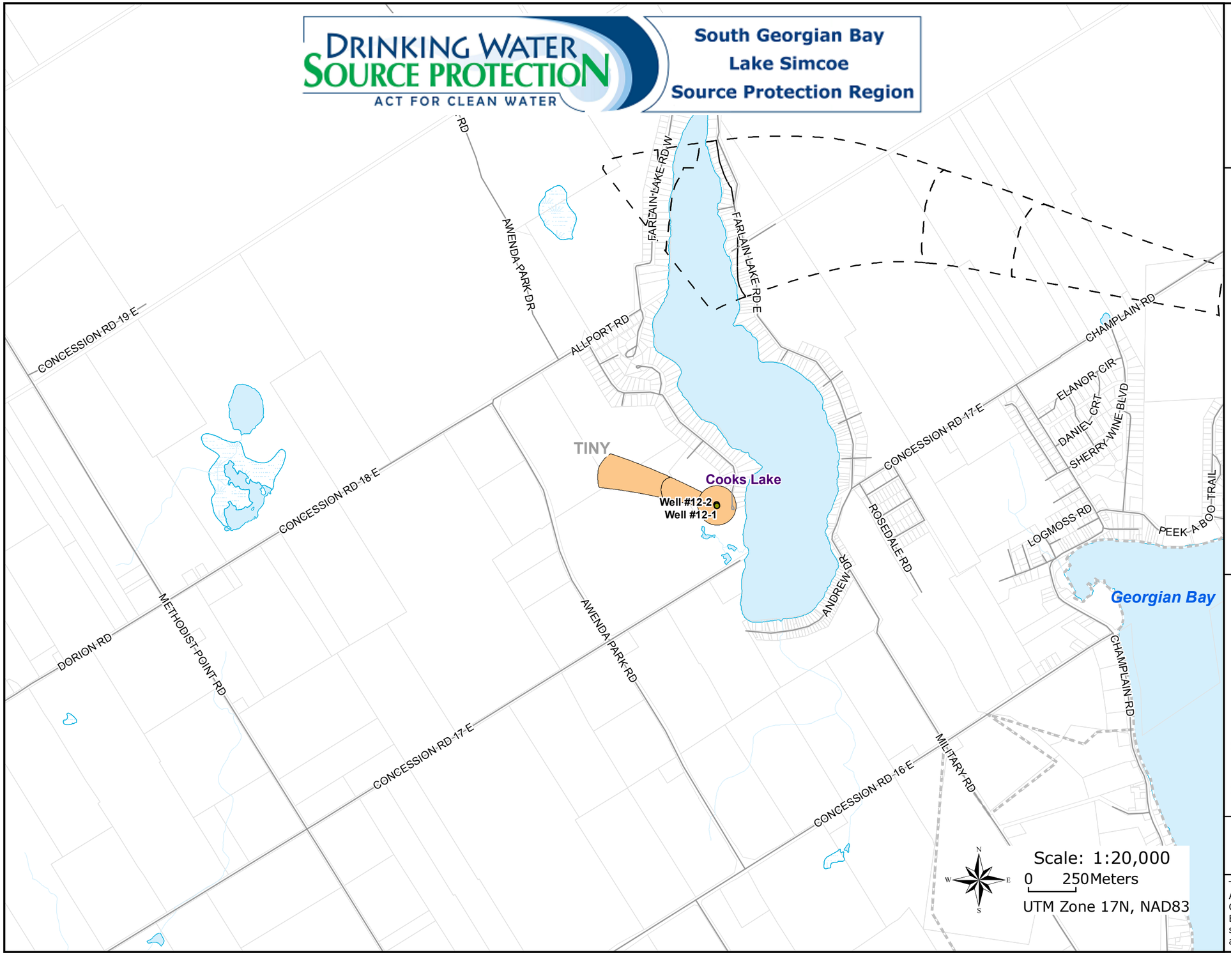
**13b-5**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Cooks Lake
# Well 12-1 and 12-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
CL-5-DNAPL Threat Cooks Lake.mxd
Date: 2010-05-18

Ontario

**13b-6**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Georgian Bay

GEORGIAN BAY

Well #19-4
Well #19-1
Well #19-5
Georgian Bay Estates
Sawlog
Well #16-2
Well #16-3
TINY
Well #9-2
Well #9-1
Tee Pee Point
Well #12-2
Well #12-1
Cooks Lake
PENETANGUISHENE
FULLER AVE

N
W
E
S

Scale: 1:45,000
0 1,000 Meters
UTM Zone 17N, NAD83

# Township of Tiny Wellhead Protection Areas Managed Land (Northeast)

- Municipal Wells

**Managed Land (Percentage)**

- < 40
- 40-80
- >80
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
C-4-Impervious NE.mxd
Date: 2009-12-14

Ontario

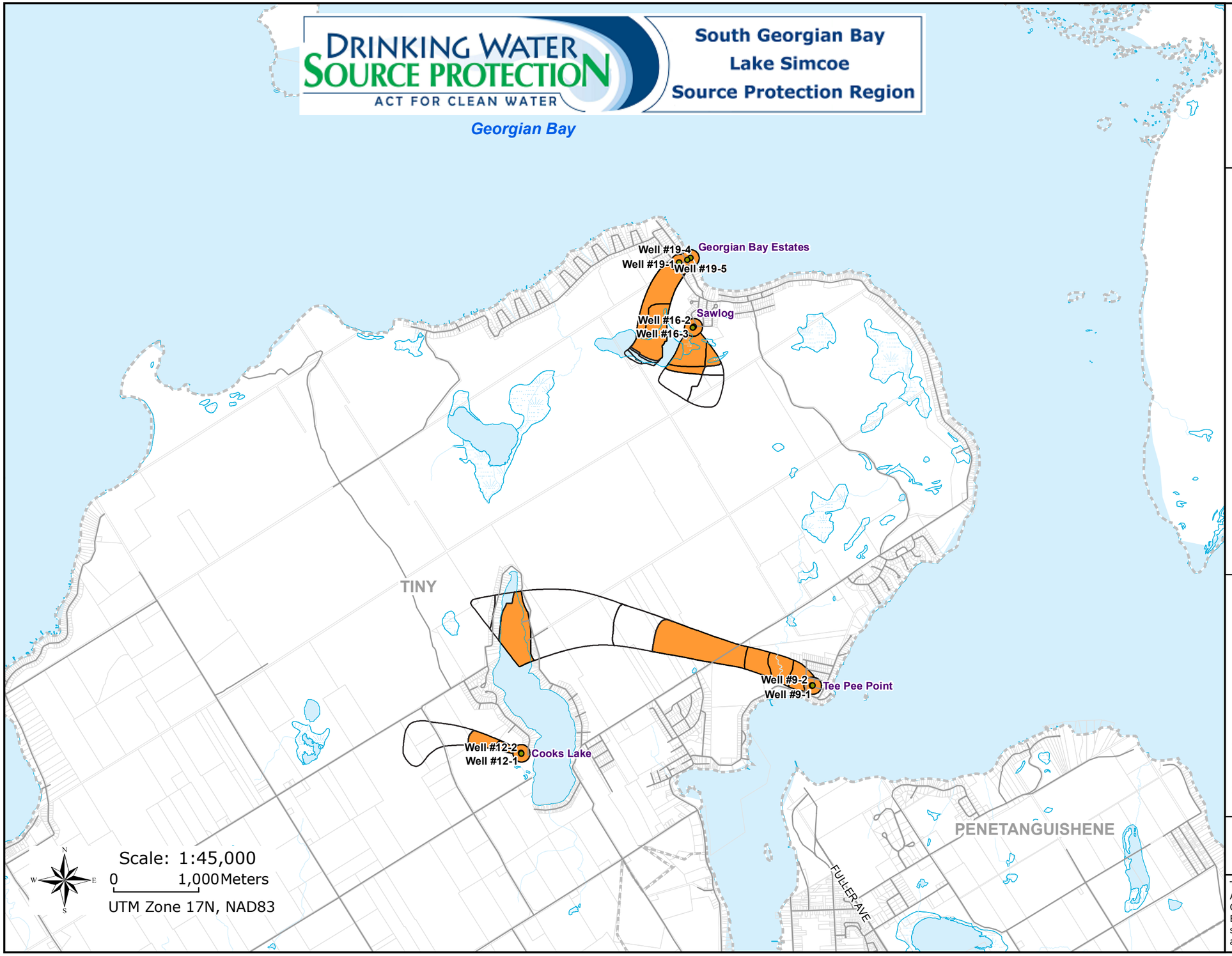
**13b-7**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Wellhead Protection Areas Livestock Density (Northeast)




- Municipal Wells
- <0.5 NU/Acre
- WHPA Boundary
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
C-5-Livestock Density NE.mxd
Date: 2009-12-14

Ontario

**13b-8**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

Georgian Bay

GEORGIAN BAY TWP.

Well #19-4
Well #19-1
Georgian Bay Estates
Well #19-5
Sawlog
Well #16-2
Well #16-3

TINY

CHAMPLAIN RD

Farlain Lake

Well #9-2
Well #9-1
Tee Pee Point

Well #12-2
Well #12-1
Cook's Lake

PENETANGUISHENE

N
W E
S

0 1,000 Metres

# TOWNSHIP OF TINY WELLHEAD PROTECTION AREAS IMPERVIOUS SURFACES (NORTHEAST)

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

**LEGEND**

- Municipal Wells

**IMPERVIOUS SURFACE**

- < 1%
- = 1% - < 6%
- = 6% - < 8%
- = 8% - < 30%
- => 30%
- WHPA Boundary
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary
- Adjacent Well Field WHPA

The Impervious Surfaces are illustrated for WHPA A-D where the vulnerability score is > 6.

Severn Sound Environmental Association

DATE: AUGUST 2025

SCALE: 1:45,000

Ontario

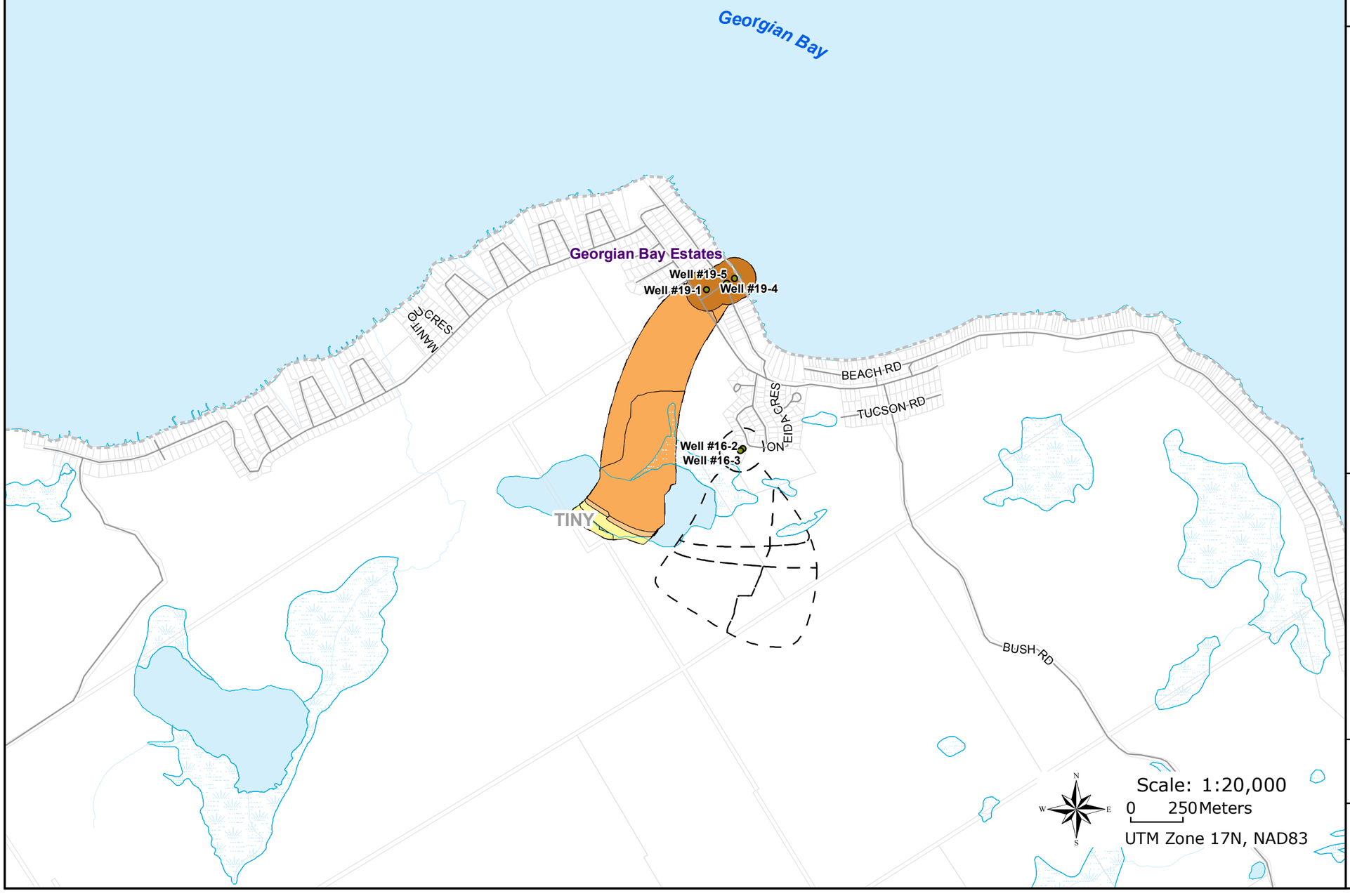
FIGURE
**13b-9**

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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Bay Estates
# Well 19-1, 19-4, and 19-5
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GB-1-Wellhead Protection Area Georgian Bay Estates.mxd
Date: 2009-12-14

Ontario

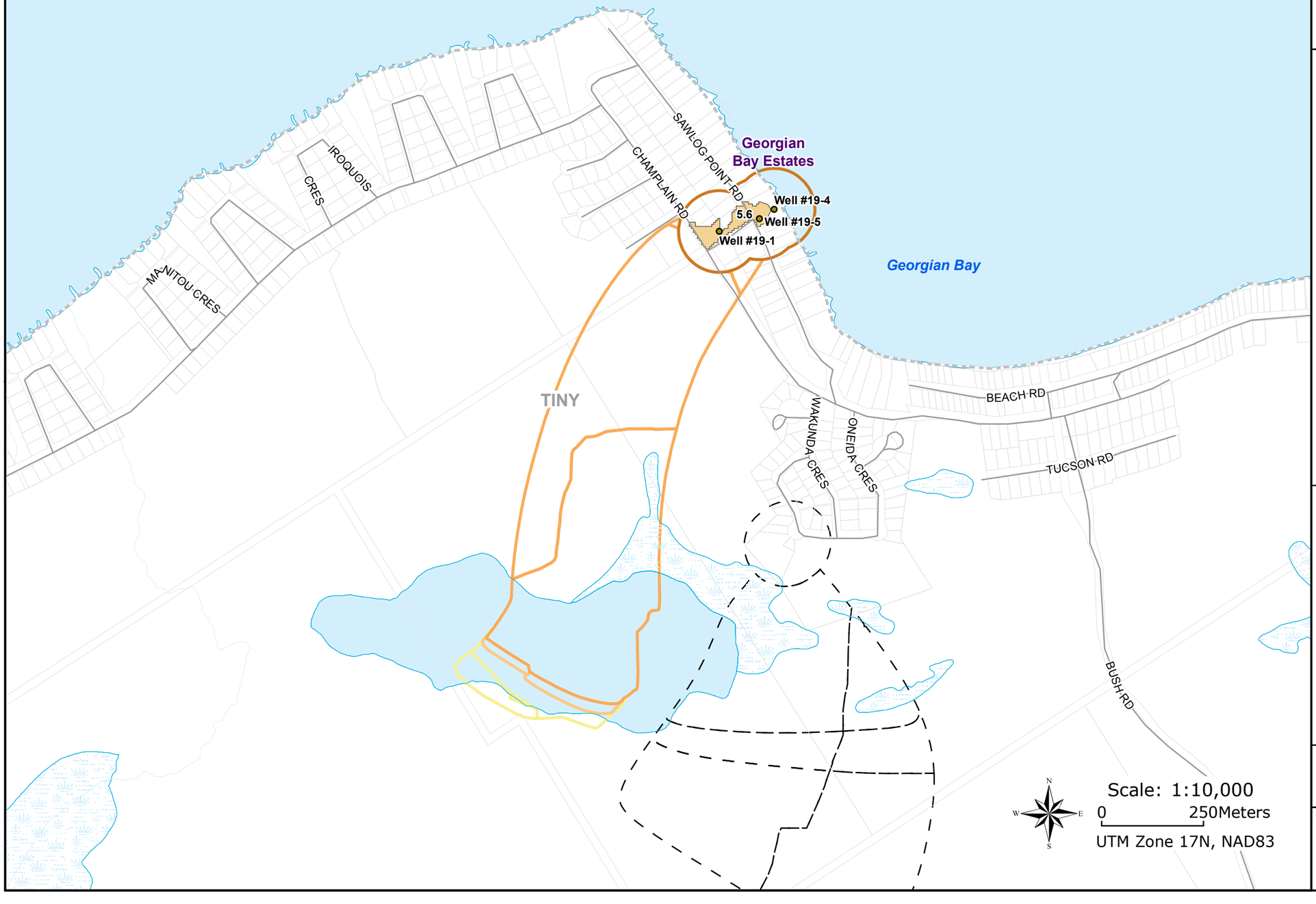
**13c-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Tiny Township
# Georgian Bay Estates
# Well 19-4 and 19-5
# WHPA-E Vulnerability Scoring




**5.6** WHPA-E Vulnerability Score
Municipal Well

**WHPA TOT**
WHPA-A (100 m radius)
WHPA-B (2 yr TOT)
WHPA-C (5 yr TOT)
WHPA-D (25 yr TOT)
WHPA-E
Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
Fig_GB-2_GeorgianBayEstates_WHPA_E.mxd
Date: 2009-12-23

Ontario

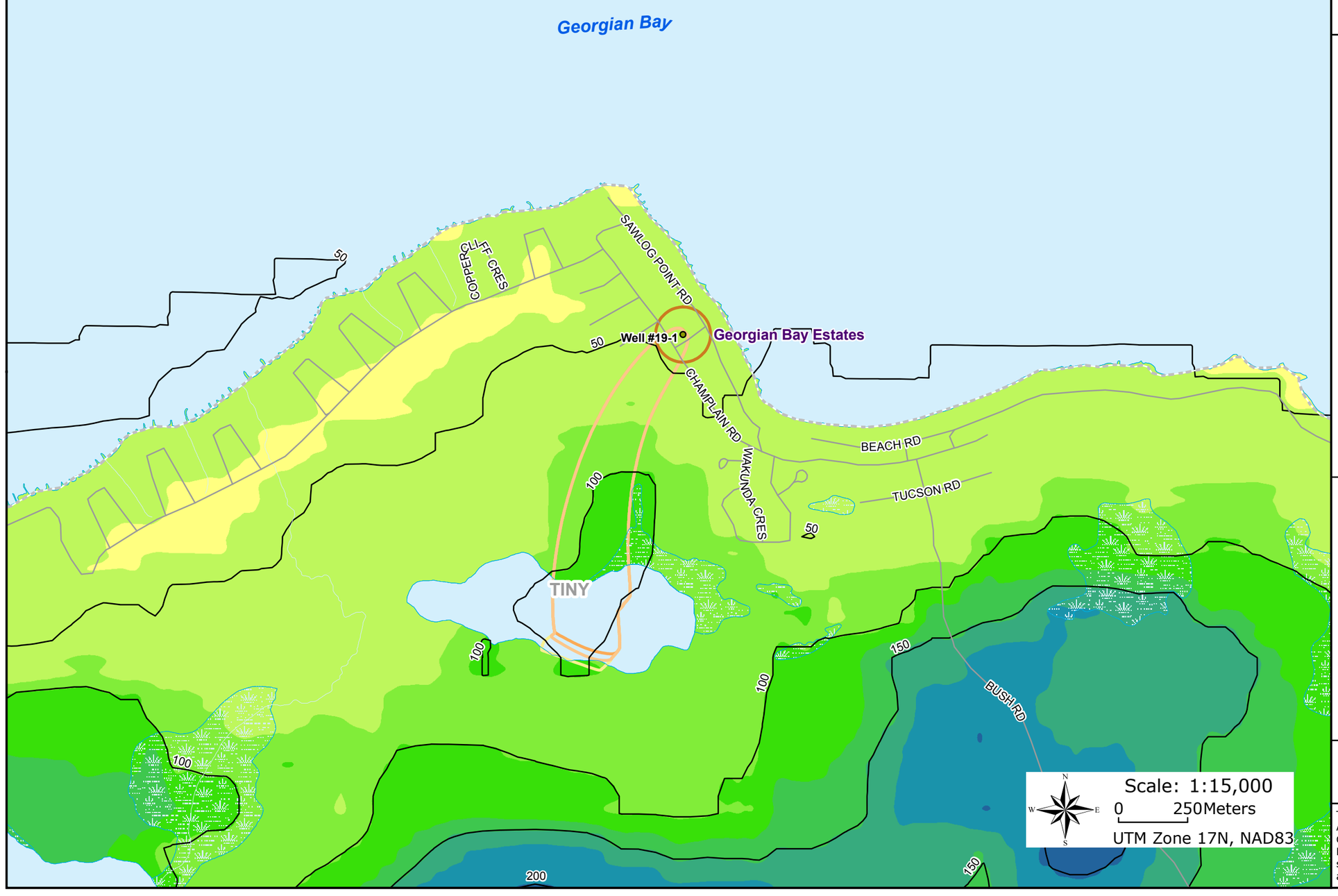
**13c-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Model Calculated AVI
# To Top of Model Layer 10
# (Aquifer BR Northeast)




- Municipal Well
- Contour (50 AVI)

**Model Calculated Aquifer Vulnerability Index**

- 0 - 30
- 31 - 80
- 81 - 100
- 101 - 125
- 126 - 150
- 151 - 175
- 176 - 200
- 201 - 225
- 226 - 250
- 251 - 275

WHPA TOT

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Figure illustrates only AVI score for WHPAs corresponding to this model layer

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: Fig_A-2_TopofBRNorthEast.mxd
Date: 2009-12-23

Ontario

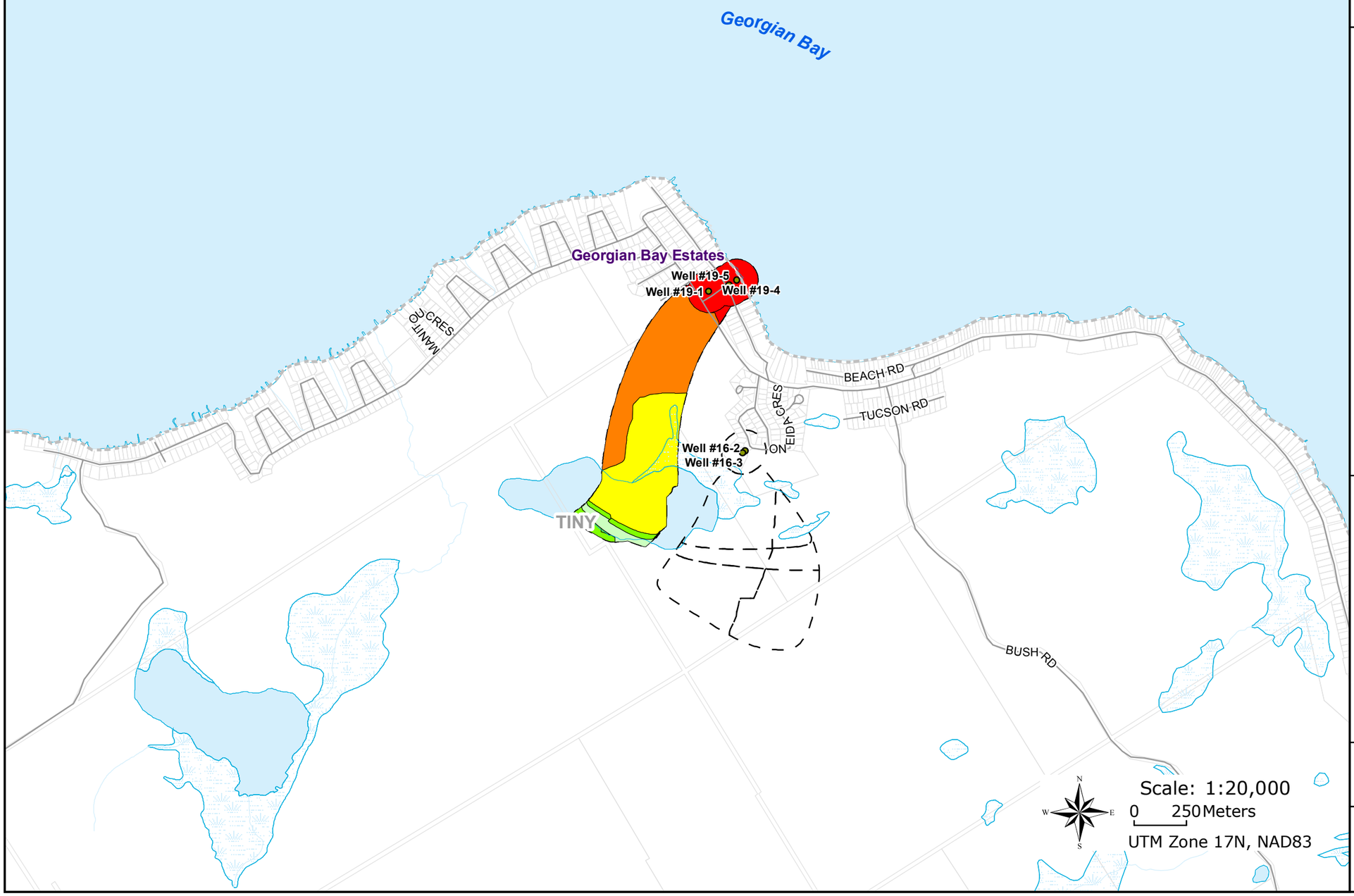
**13c-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Bay Estates
# Well 19-1, 19-4, and 19-5
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GB-2-Final Vulnerability Scoring Georgian Bay Estates.mxd
Date: 2009-12-14

Ontario

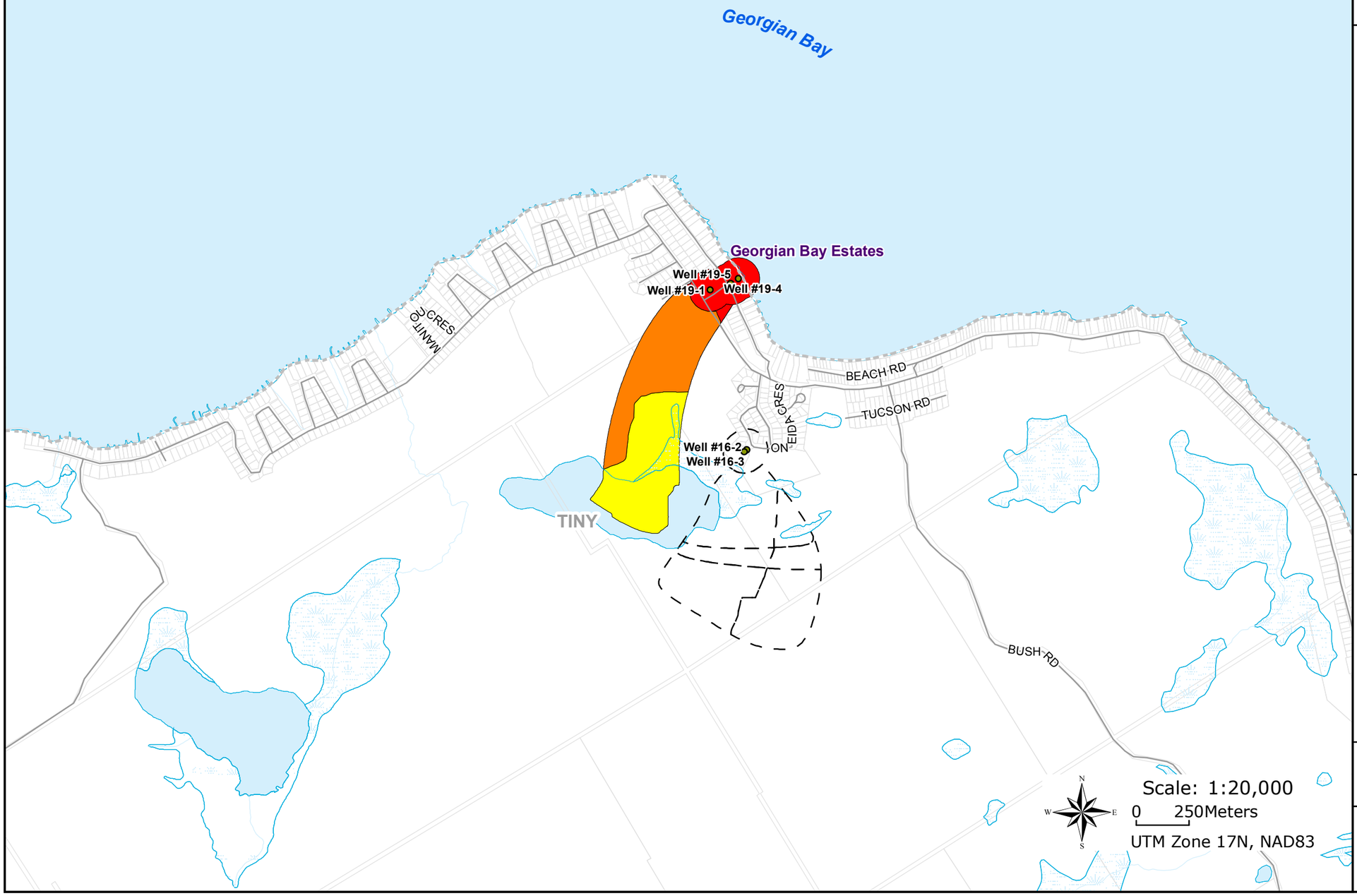
**13c-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Bay Estates
# Well 19-1, 19-4, and 19-5
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250Meters
UTM Zone 17N, NAD83

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GB-3-Chemical Threat Georgian Bay Estates.mxd
Date: 2009-12-14

Ontario

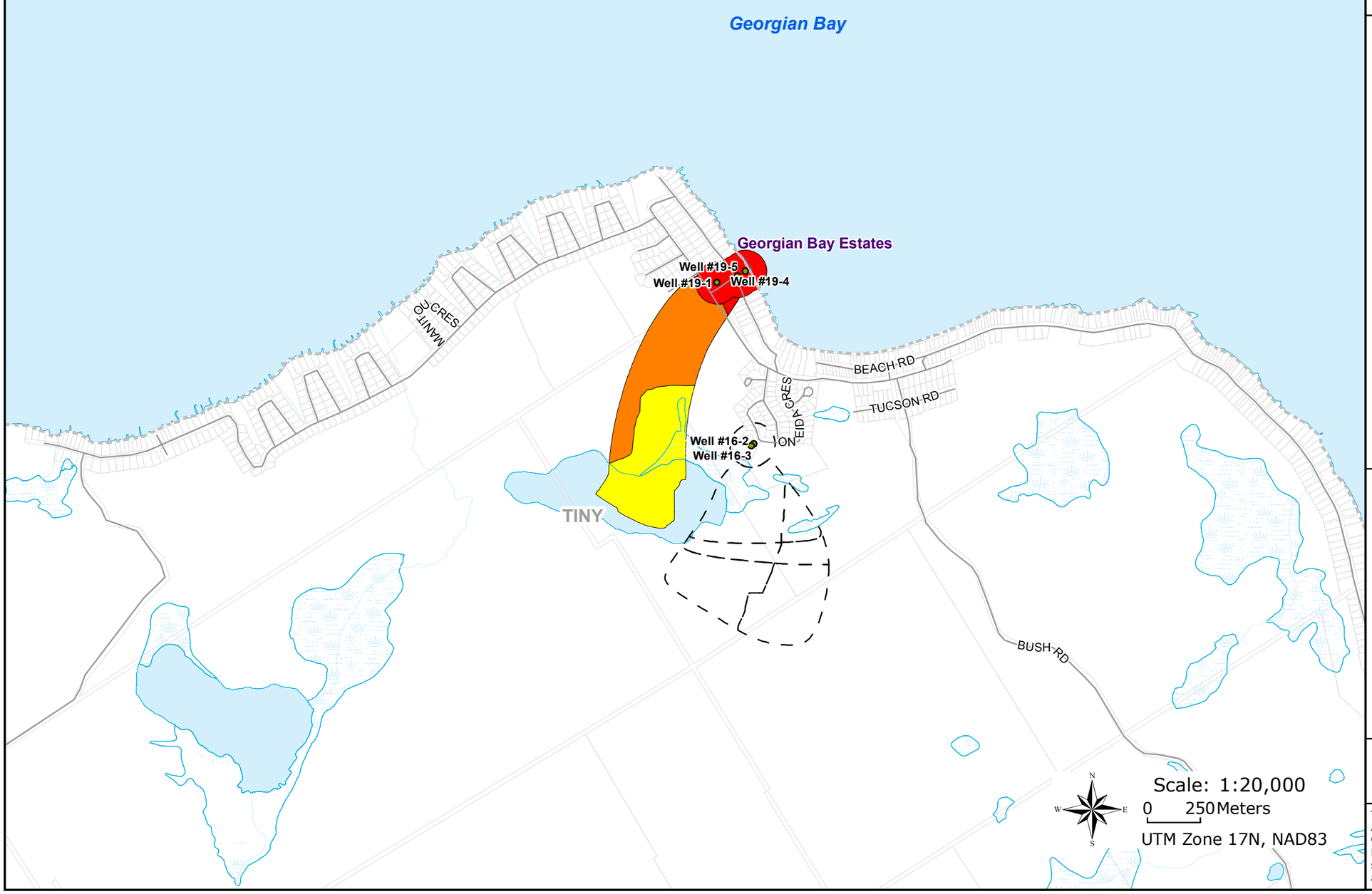
**13c-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Georgian Bay Estates Well 19-1, 19-4, and 19-5 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GB-4-Pathogen Threat Georgian Bay Estates.mxd
Date: 2010-05-18

Ontario

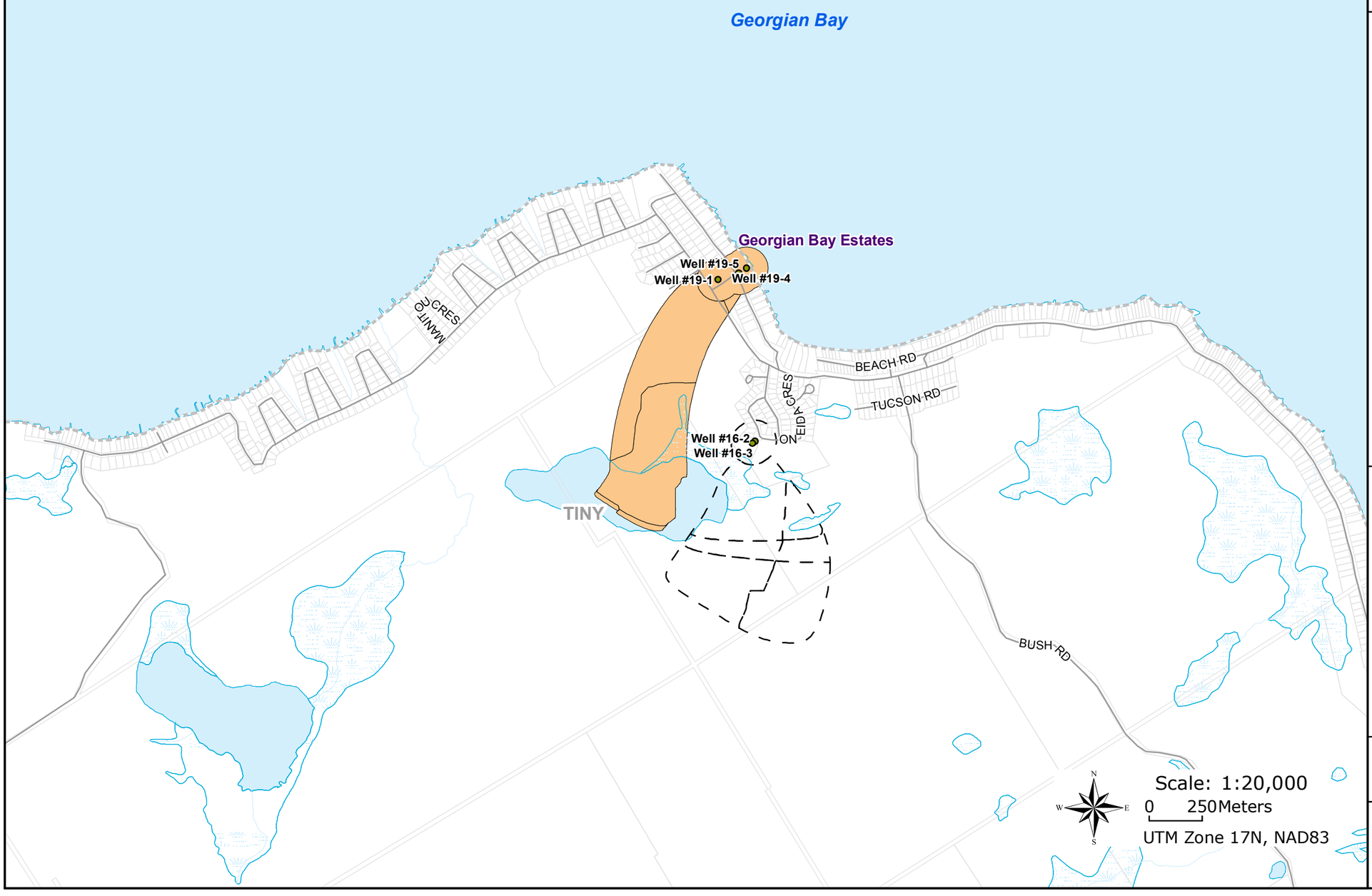
**13c-6**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Bay Estates
# Well 19-1, 19-4, and 19-5
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GB-5-DNAPL Threat Georgian Bay Estates.mxd
Date: 2010-05-18

Ontario

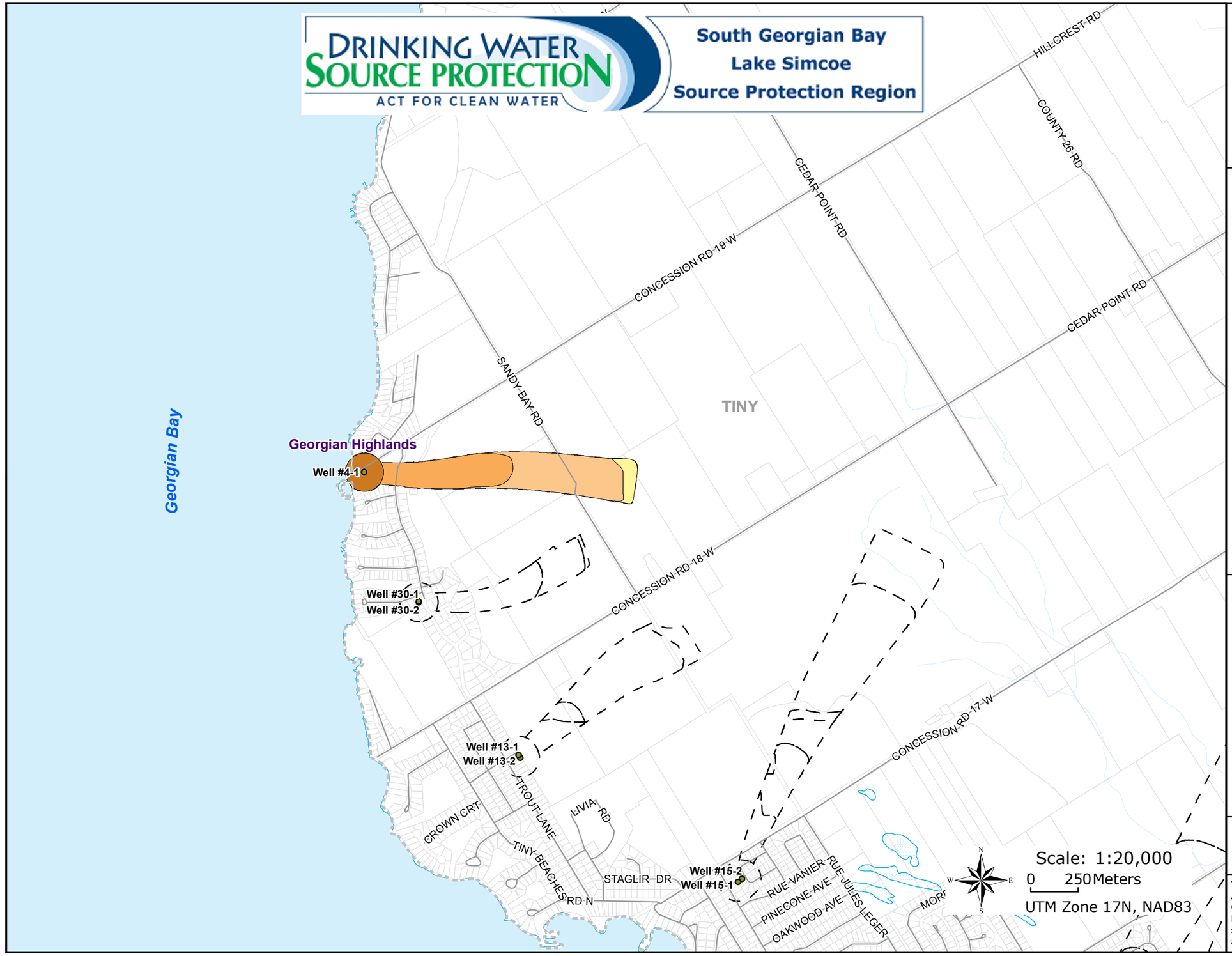
**13c-7**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Highlands
# Well 4-1
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GH-1-Wellhead Protection Area Georgian Highlands.mxd
Date: 2009-12-14

Ontario

**13d-1**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Model Calculated AVI
# To Top of Model Layer 5
# (Aquifer A2 Northwest)

Georgian Bay
Georgian Highlands
Well #4-1
Well #30-2
Tiny Well #30-1
Cove Estates
Well #13-2
Well #13-1
Sandcastle
Well #15-2
Well #15-1
Vanier Woods
Well #20-1
Well #20-2
Thunder Bay
TINY
Well #23-1
Well #23-4
Lafontaine
Well #7-1
Well #7-2
Pennorth
Well #3-2
Well #3-3
Lefaive
Perkinsfield
Well #11-2
Well #22-1
LAFONTAINE RD E
LAFONTAINE RD W
COUNTY RD 6
OVERHEAD BRIDGE RD
BALM BEACH RD E

Municipal Well
Contour (50 AVI)

**Model Calculated Aquifer Vulnerability Index**
- 0 - 30
- 31 - 80
- 81 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 300
- 301 - 350
- 351 - 400
- 401 - 450

WHPA TOT
- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)

- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Figure illustrates only AVI score for WHPAs corresponding to this model layer

Scale: 1:50,000
0 1,000Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
Fig_A-4_Topof5Northwest.mxd
Date: 2009-12-23

Ontario

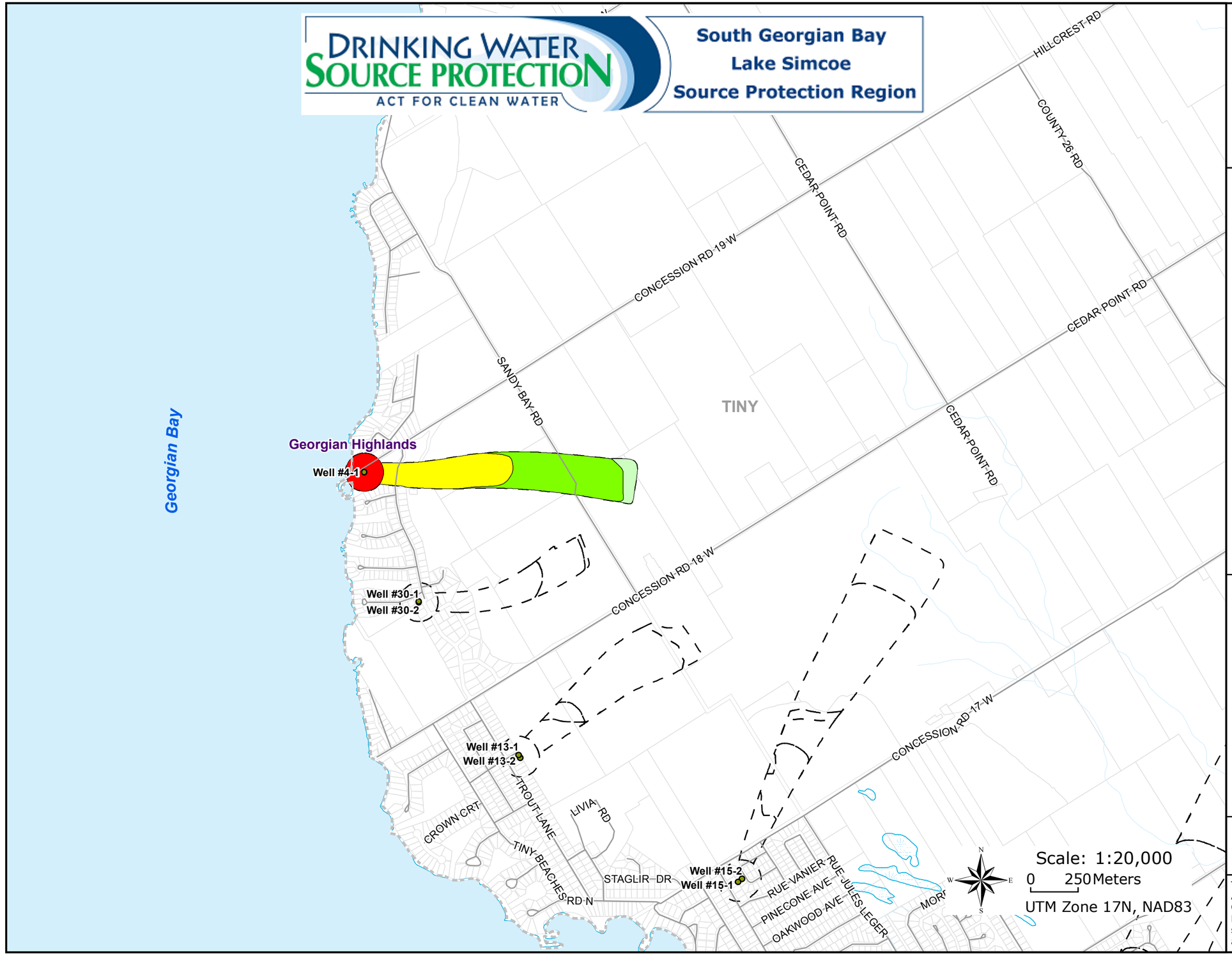
**13d-2**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Highlands
# Well 4-1
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GH-2-Final Vulnerability Scoring Georgian Highlands.mxd
Date: 2009-12-14

Ontario

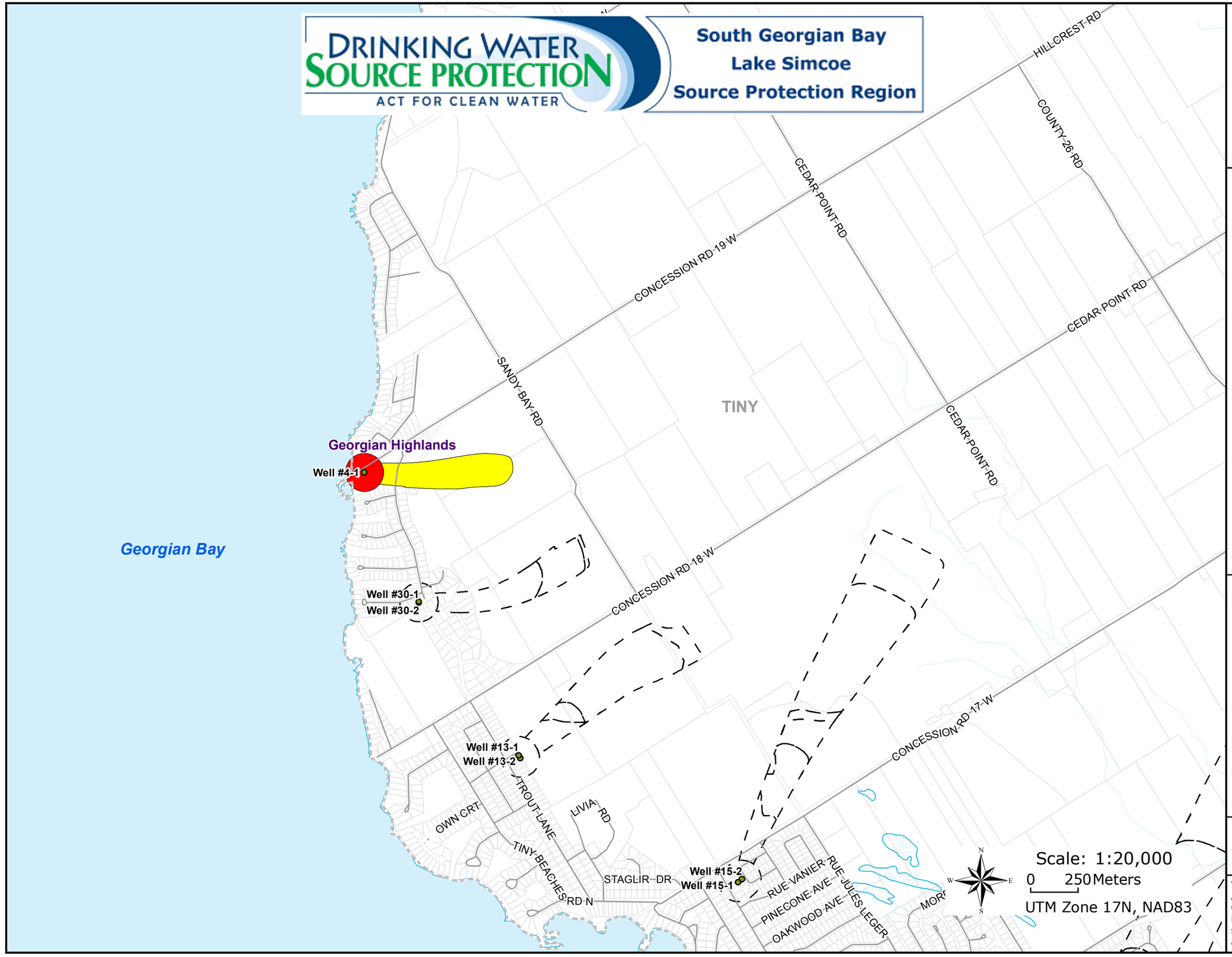
**13d-3**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Georgian Highlands Well 4-1 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GH-4-Pathogen Threat Georgian Highlands.mxd
Date: 2010-05-18

Ontario

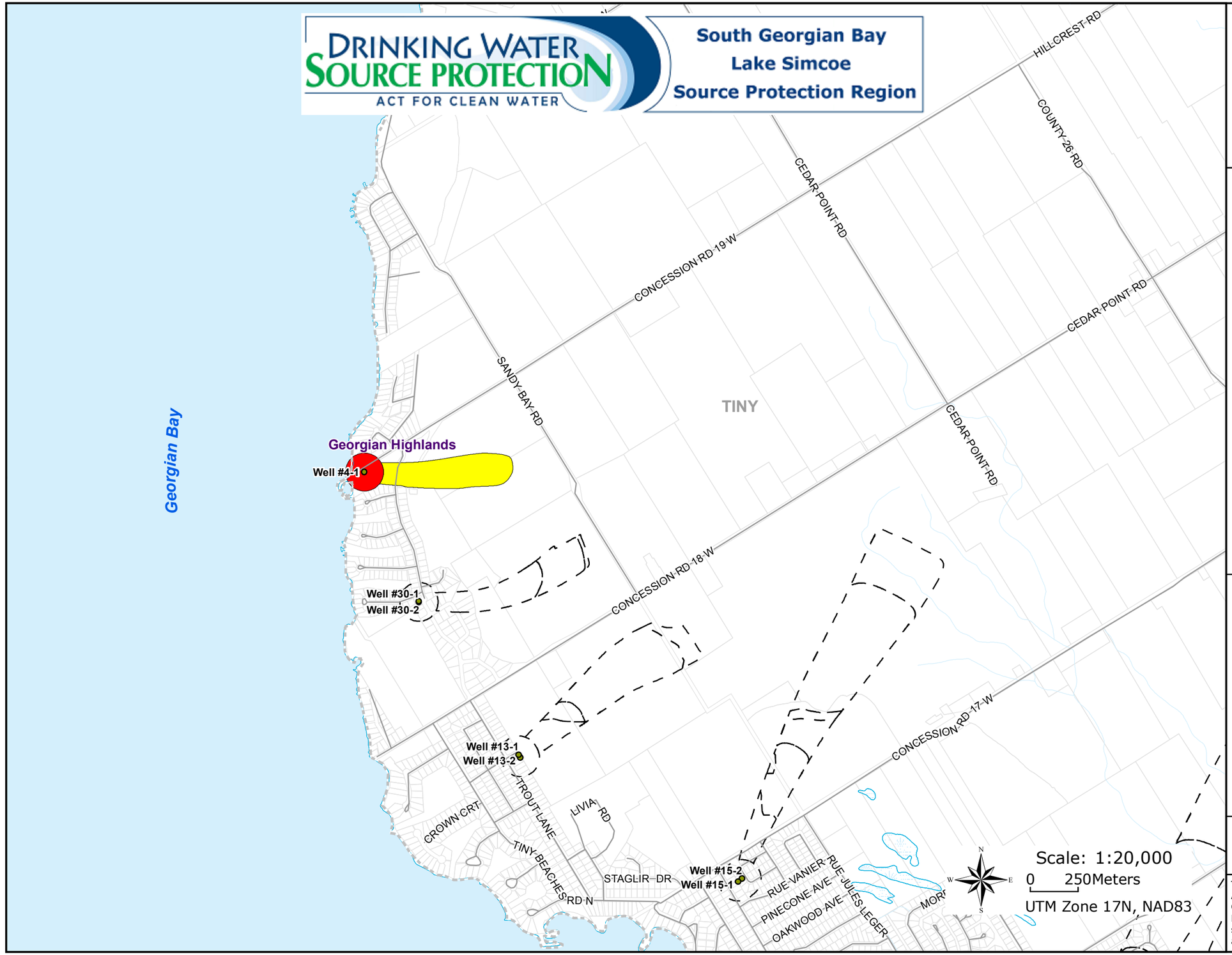
**13d-4**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Georgian Highlands Well 4-1 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GH-3-Chemical Threat Georgian Highlands.mxd
Date: 2009-12-14

Ontario

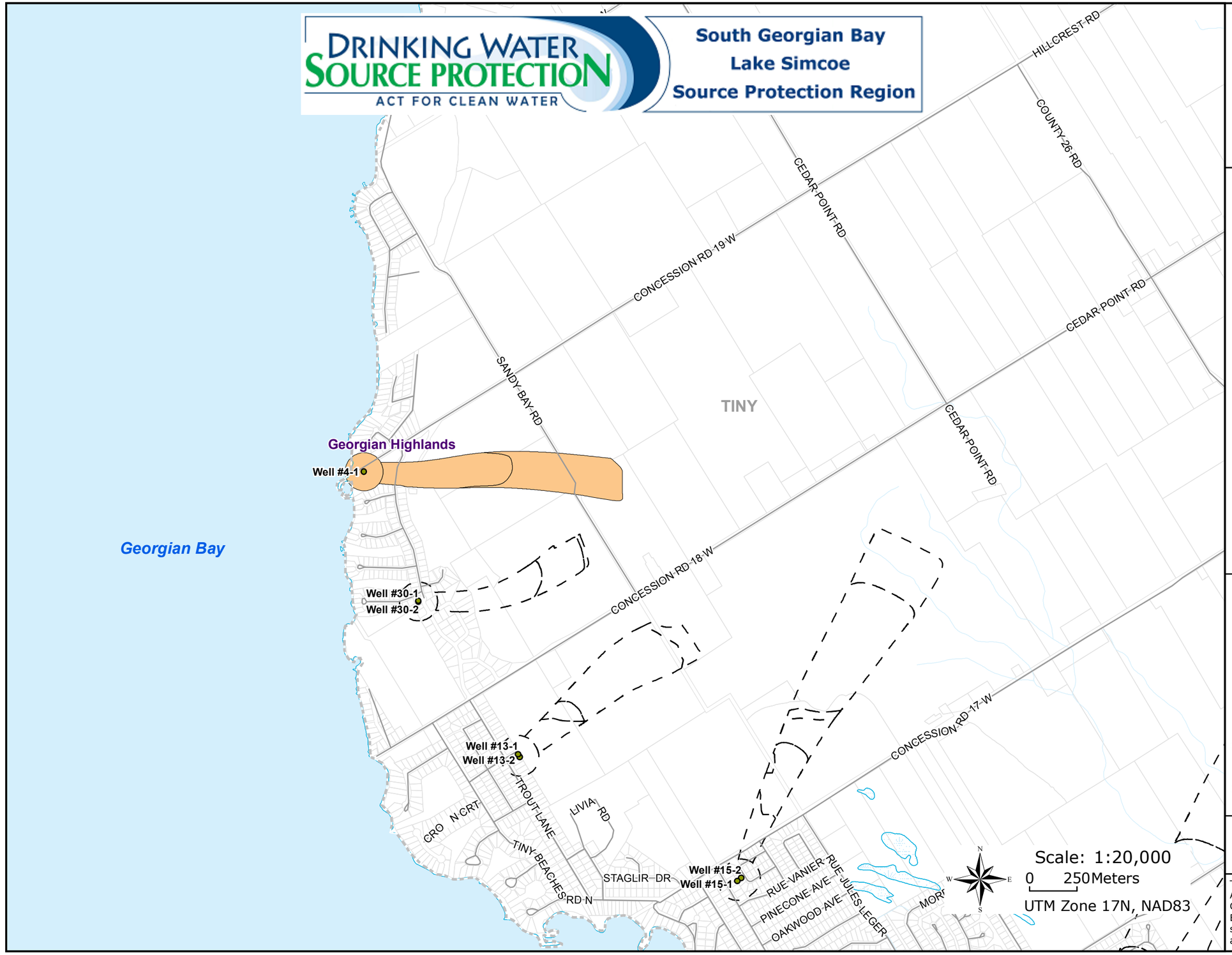
**13d-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Georgian Highlands Well 4-1 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

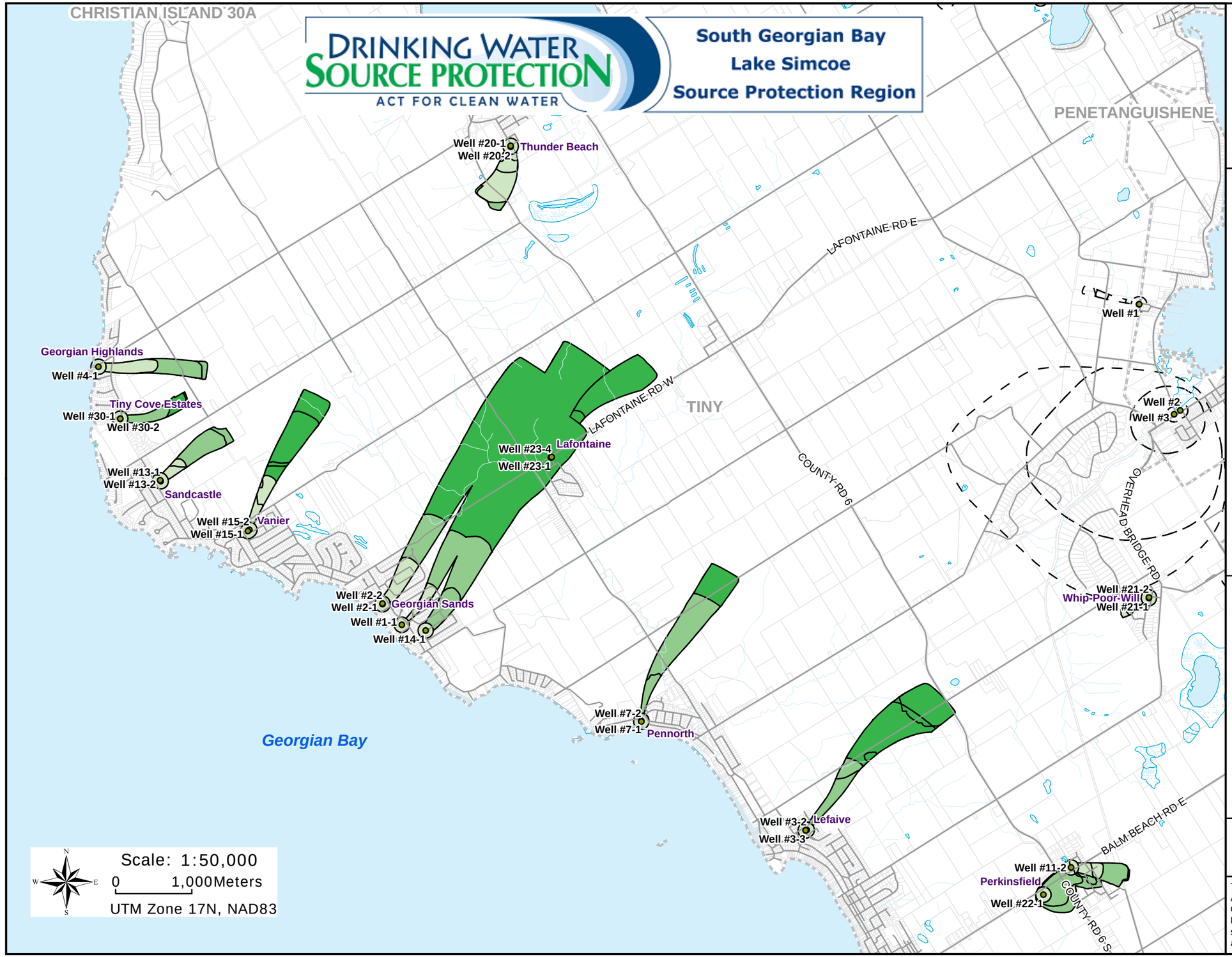
Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
GH-5-DNAPL Threat Georgian Highlands.mxd
Date: 2010-05-18

Ontario

**13d-6**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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# Township of Tiny Wellhead Protection Areas Managed Land (Northwest)

- Municipal Wells

**Managed Land (Percentage)**

- < 40
- 40-80
- >80
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
C-4a-Impervious NW.mxd
Date: 2009-12-14

Ontario

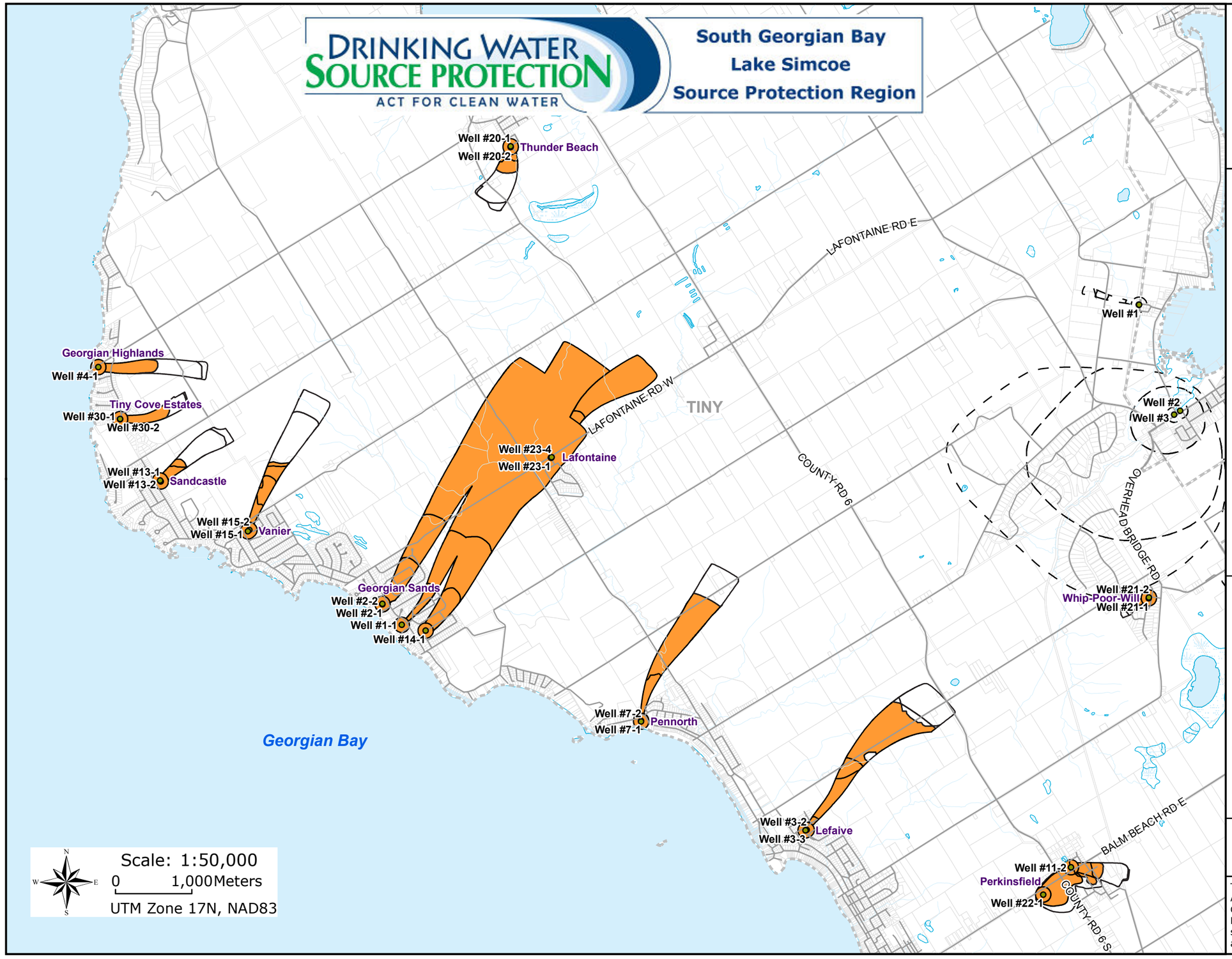
**13d-7**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Wellhead Protection Areas
# Livestock Density
# (Northwest)




- Municipal Wells
- <0.5 NU/Acre
- WHPA Boundary
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Scale: 1:50,000
0 1,000 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
C-5a-Livestock Density NW.mxd
Date: 2009-12-14

Ontario

**13d-8**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

CHRISTIAN ISLAND 30A

Thunder Bay
Well #20-2
Well #20-1

Georgian Highlands
Well #4-1

Tiny Cove Estates
Well #30-2
Well #30-1

Sandcastle
Well #13-1
Well #13-2

Vanier
Well #15-2
Well #15-1

Lafontaine - Georgian Sands
Well #2-1
Well #2-2
Well #1-1
Well #14-1

Well #23-1
Well #23-4

Pennorth
Well #7-2
Well #7-1

Lefaive
Well #3-3
Well #3-2

Perkinsfield
Well #22-1
Well #11-2

Whip-Poor-Will
Well #21-1
Well #21-2

Well 12-2

Well 3
Well 2

Well #26-4

Georgian Sands

TINY

LAFONTAINE RD E
LAFONTAINE RD W
COUNTY RD 6
COUNTY RD 6 S
ROBERT ST
BALM BEACH RD E

N
W E
S
0 1,000
Metres

# TOWNSHIP OF TINY WELLHEAD PROTECTION AREAS IMPERVIOUS SURFACES (NORTHWEST)

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

## LEGEND

- Municipal Wells

**IMPERVIOUS SURFACE**

- < 1%
- = 1% - < 6%
- = 6% - < 8%
- = 8% - < 30%
- => 30%
- WHPA Boundary
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary
- Adjacent Well Field WHPA

The Impervious Surfaces are illustrated for WHPA A-D where the vulnerability score is > 6.

Severn Sound Environmental Association

DATE: AUGUST 2025

SCALE: 1:55,000

Ontario

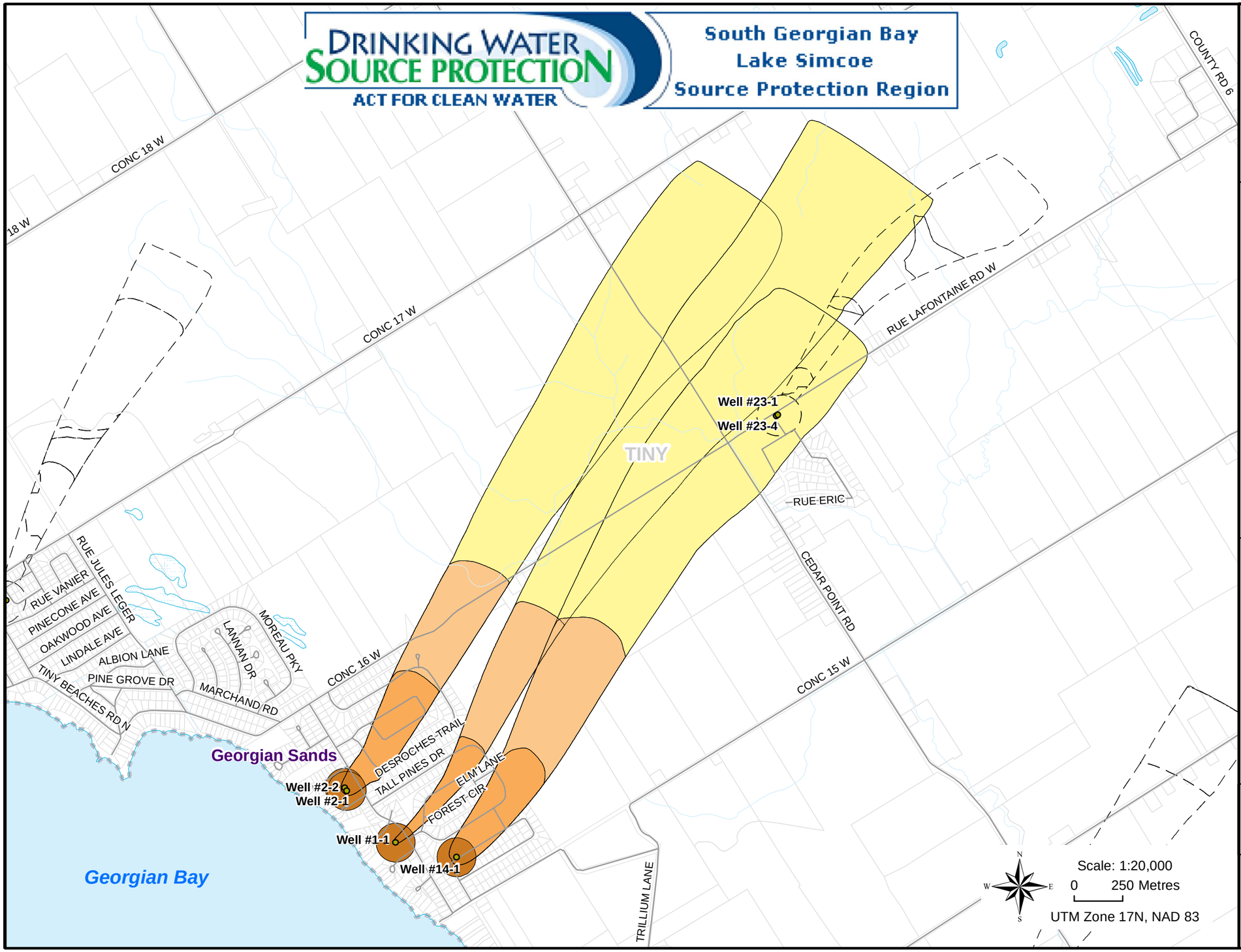
FIGURE
**13d-9**

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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Sands
# Well 1-1, 2-1, 2-2 and 14-1
# Wellhead Protection Area




- Municipal Wells
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2yr TOT)
- WHPA-C (5yr TOT)
- WHPA-D (25yr TOT)
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Metres
UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
GS-1-Wellhead Protection Area Georgian Sands.mxd
Date: 2011-07-27

Ontario

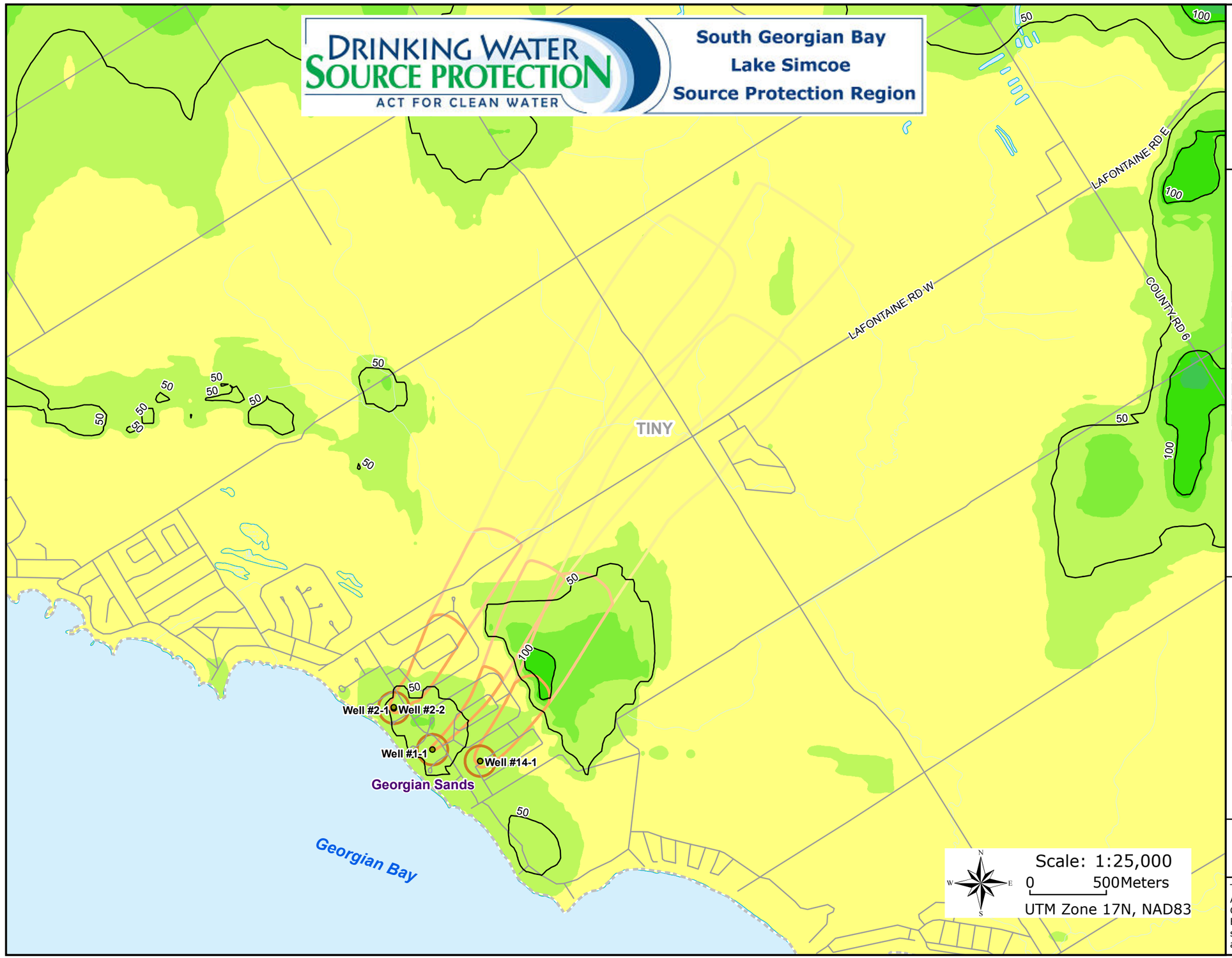
**13e-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Model Calculated AVI
# To Top of Model Layer 4
# (Aquifer A2 Northwest)




- Municipal Well
- Contour (50 AVI)

**Model Calculated Aquifer Vulnerability Index**

- 0 - 30
- 31 - 80
- 81 - 100
- 101 - 120
- 121 - 140
- 141 - 160
- 161 - 180
- 181 - 200
- 201 - 220
- 221 - 240

WHPA TOT

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Principal Highway
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Figure illustrates only AVI score for WHPAs corresponding to this model layer

Scale: 1:25,000
0 500Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: Fig_A-3_Topof4NorthWest.mxd
Date: 2009-12-23

Ontario

**13e-2**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Sands
# Well 1-1, 2-1, 2-2 and 14-1
# Final Vulnerability Scoring

CONC 18 W
18 W
CONC 17 W
COUNTY RD 6
RUE LAFONTAINE RD W
RUE ERIC
CEDAR POINT RD
CONC 16 W
CONC 15 W
TRILLIUM LANE
RUE JULES LEGER
RUE VANIER
PINECONE AVE
OAKWOOD AVE
LINDALE AVE
ALBION LANE
PINE GROVE DR
TINY BEACHES RD N
LANNAN DR
MOREAU PKY
MARCHAND RD
DESROCHES TRAIL
TALL PINES DR
ELM LANE
FOREST CIR

TINY
Georgian Sands
Georgian Bay

Well #23-1
Well #23-4
5704429
Well #2-2
Well #2-1
Well #1-1
Well #14-1

N
W
E
S

Scale: 1:20,000
0 250 Metres
UTM Zone 17N, NAD 83

- Municipal Wells
- 5705838 3C Well Pathway

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
GS-2-Final Vulnerability Scoring Georgian Sands.mxd
Date: 2011-07-27

Ontario

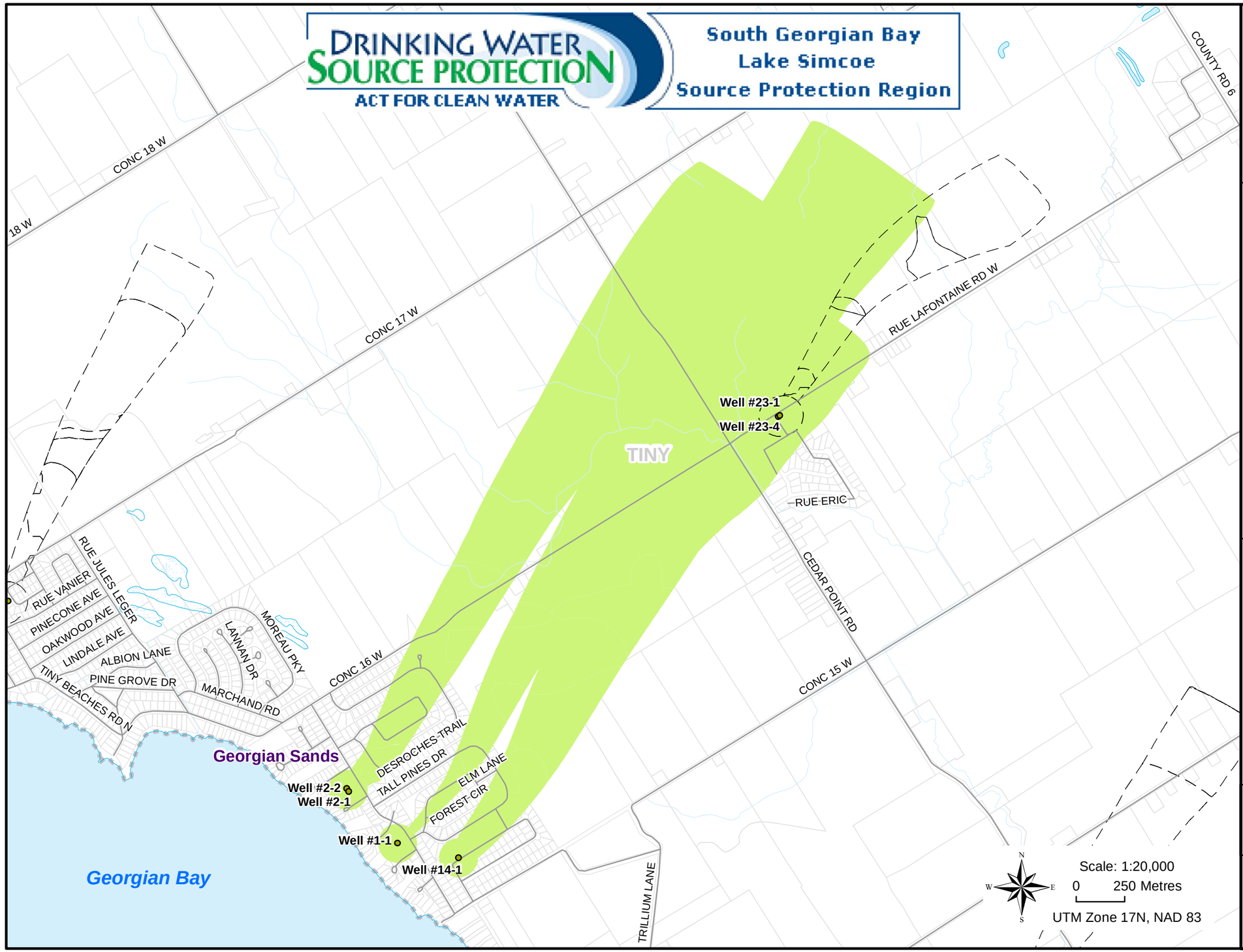
**13e-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Sands
# Drinking Water Issues
# Contributing Area




- Municipal Wells
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA
- Issue Contributing Area
  Wells 1-1, 2-1, 2-2 & 14-1 Nitrate

N
W E
S

Scale: 1:20,000
0 250 Metres

UTM Zone 17N, NAD 83

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Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
GS-8-Contributing Area.mxd
Date: 2011-07-28

Ontario

**13e-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Sands
# Well 1-1, 2-1, 2-2 and 14-1
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen

Well #23-1
Well #23-4
Well #15-2
Well #15-1
Well #2-2
Well #2-1
Well #1-1
Well #14-1
Well #7-2
Well #7-1

TINY
Georgian Sands
Georgian Bay

RUE LAFONTAINE RD
RUE ERIC
CEDAR POINT RD
CONC 15 W
CONC 16 W
CONC 14 W
TROUT LANE
STAGLIR DR
RUE VANIER
RUE JULES LEGER
PINECONE AVE
OAKWOOD AVE
LINDALE AVE
ALBION LANE
PINE GROVE DR
TINY BEACHES RD N
MARCHAND RD
LANNAN DR
MOREAU PKY
DESROCHES TRAIL
TALL PINES DR
ELM LANE
FOREST CIR
TRILLIUM LANE

Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6

Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

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Barrie, Ontario

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Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
GS-4-Pathogen Threat Georgian Sands.mxd
Date: 2011-07-27

Ontario

**13e-5**

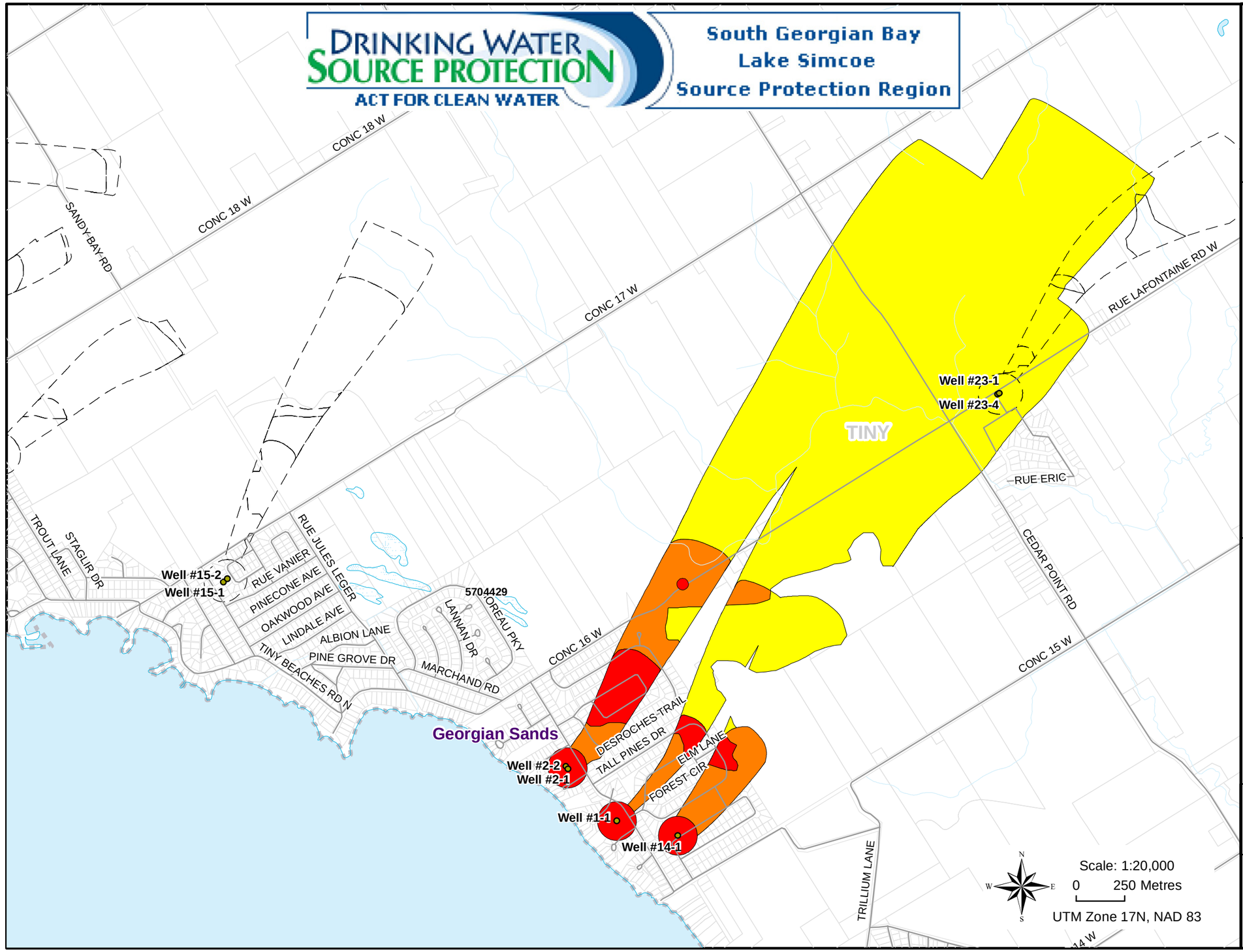
Scale: 1:20,000
0 250 Metres
UTM Zone 17N, NAD 83

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Sands
# Well 1-1, 2-1, 2-2 and 14-1
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




## Vulnerability Score

- Municipal Wells
- 10
- 8
- 6
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
GS-3-Chemical Threat Georgian Sands.mxd
Date: 2011-07-27

Ontario

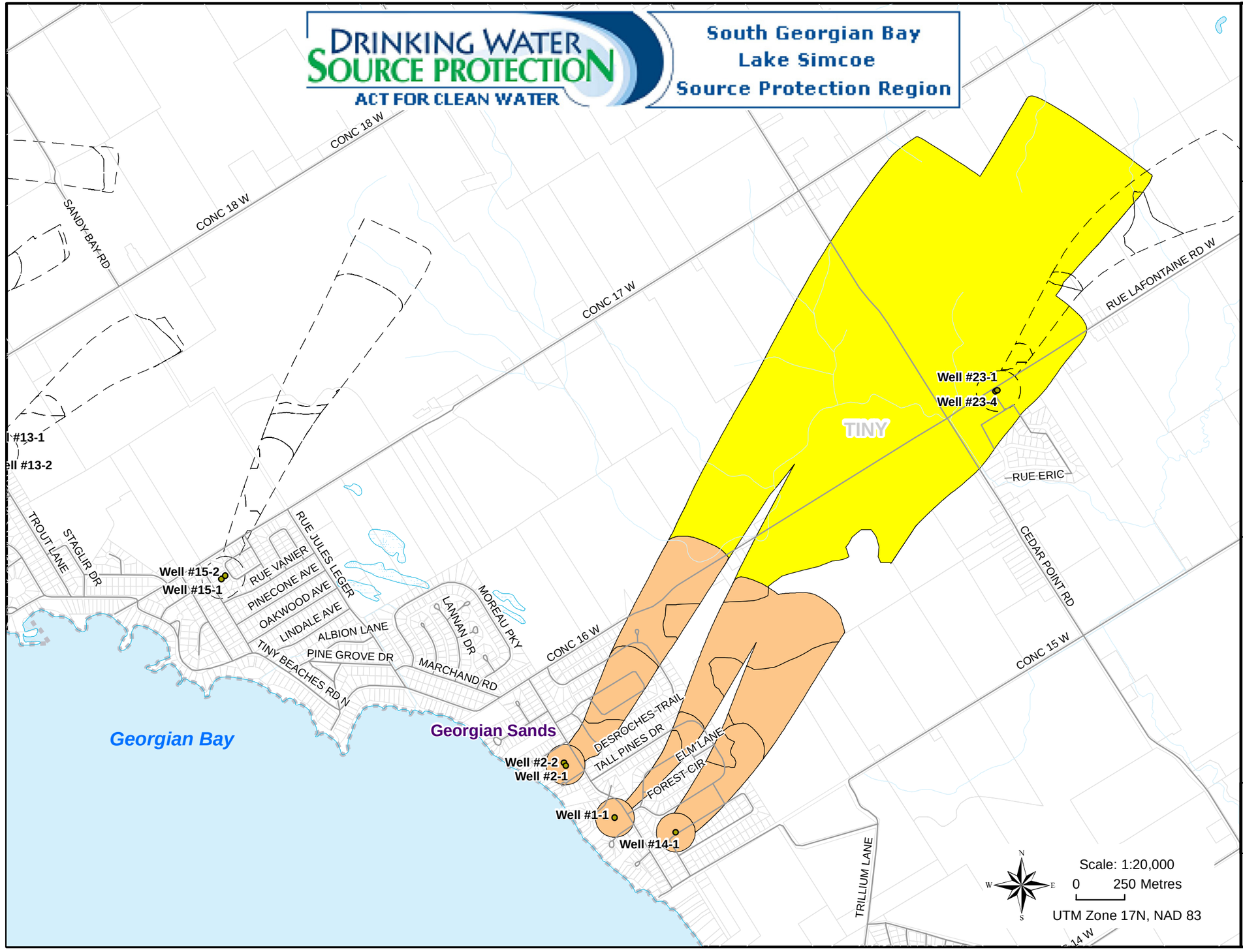
**13e-6**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Georgian Sands
# Well 1-1, 2-1, 2-2 and 14-1
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPAs**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

N W E S

Scale: 1:20,000
0 250 Metres
UTM Zone 17N, NAD 83

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Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
GS-5-DNAPL Threat Georgian Sands.mxd
Date: 2011-07-27

Ontario

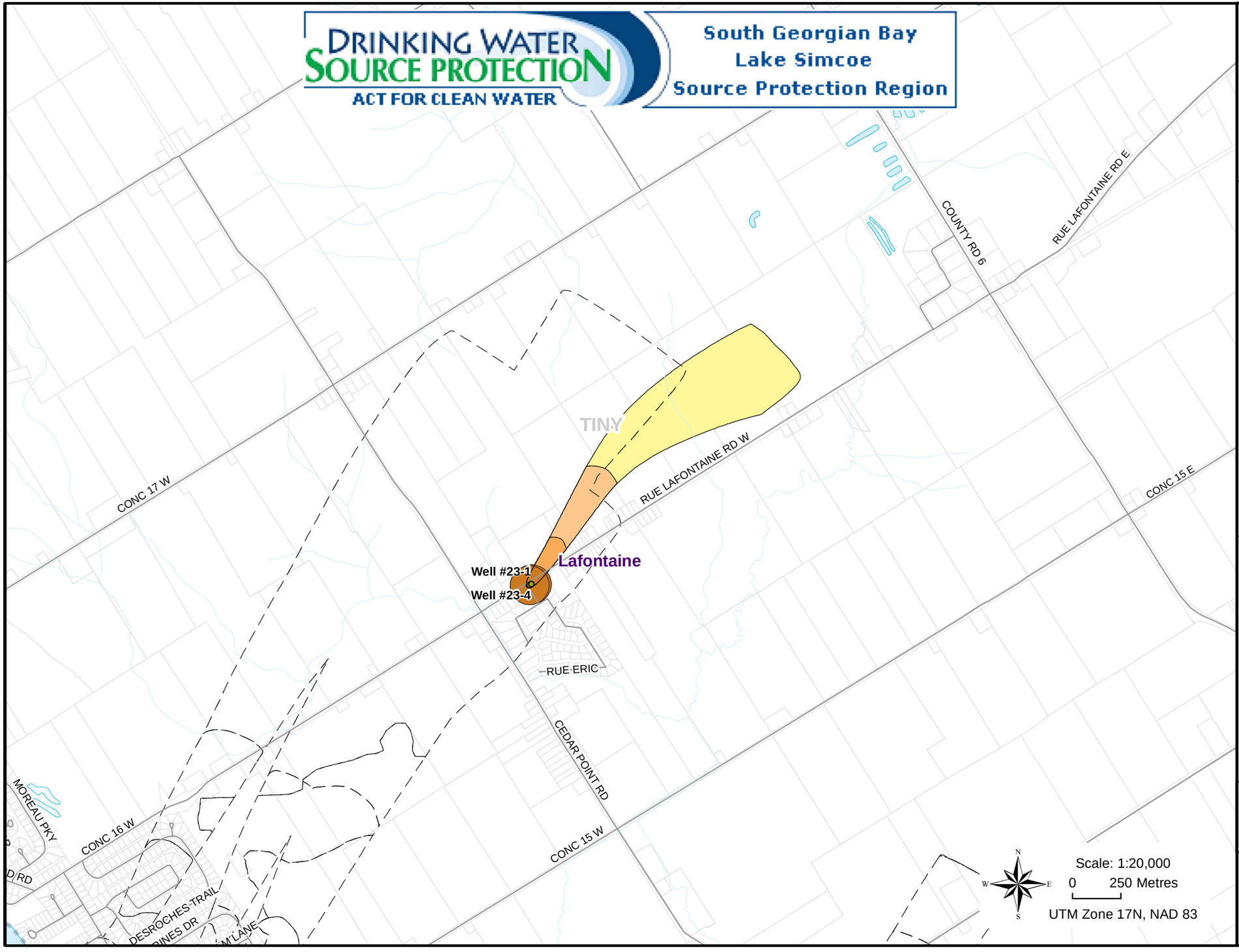
**13e-7**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Lafontaine
# Well 23-1 and 23-4,
# Wellhead Protection Area




- Municipal Wells
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2yr TOT)
- WHPA-C (5yr TOT)
- WHPA-D (25yr TOT)
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Metres
UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
LA-1-Wellhead Protection Area Lafontaine.mxd
Date: 2011-08-03

Ontario

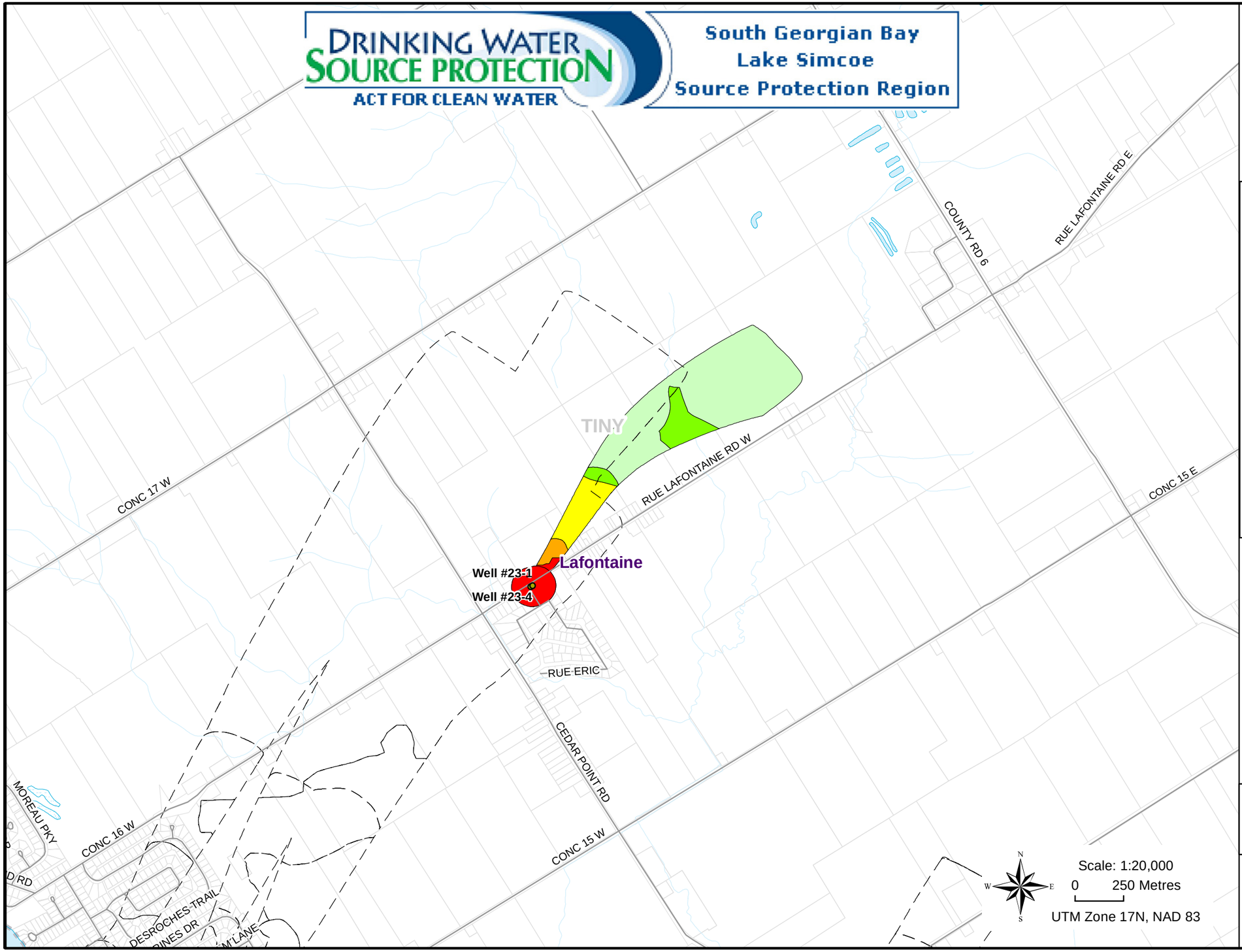
**13f-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Lafontaine
# Well 23-1 and 23-4,
# Final Vulnerability Scoring




- Municipal Wells
- 5705838 3C Well Pathway

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

N W E S

Scale: 1:20,000
0 250 Metres
UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
LA-2-Final Vulnerability Scoring Lafontaine.mxd
Date: 2011-08-03

Ontario

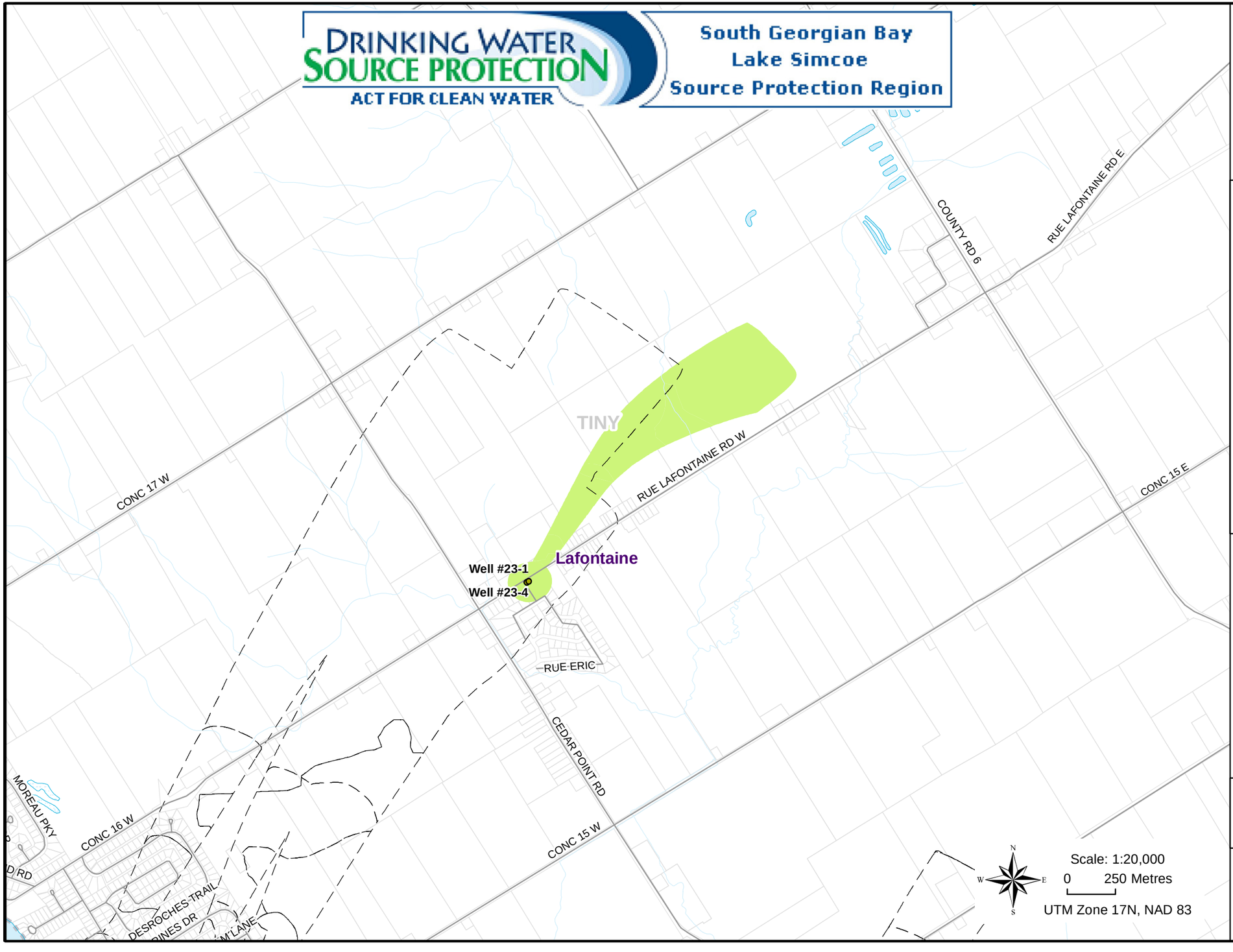
**13f-2**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Lafontaine
# Well 23-1 and 23-4, Contributing Areas




- Municipal Wells
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA
- Issue Contributing Area Wells 23-1 and 23-4 Nitrate

Scale: 1:20,000
0 250 Metres
UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
LA-7-Contributing Areas.mxd
Date: 2011-08-03

Ontario

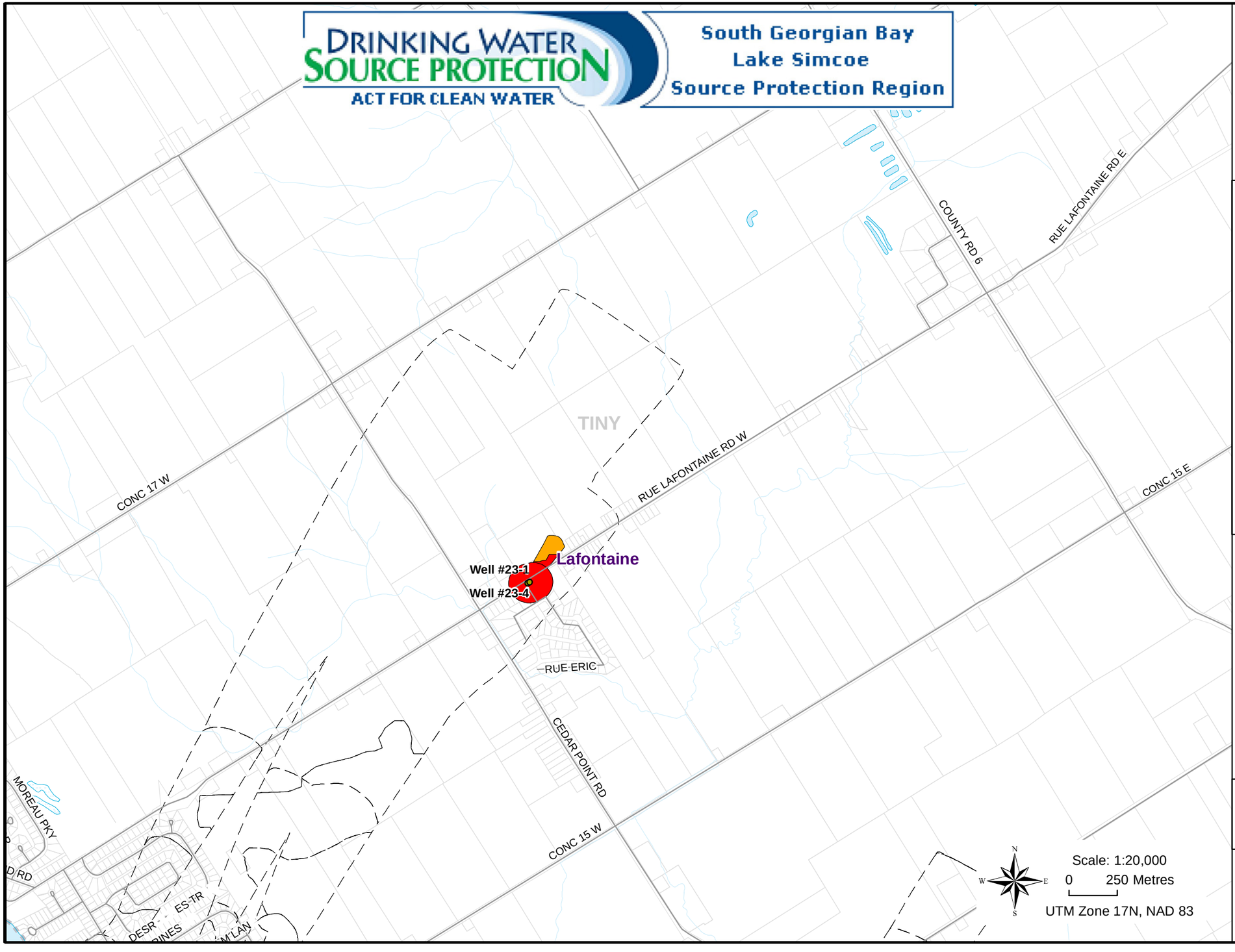
**13f-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Lafontaine Well 23-1 and 23-4, Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

N W E S

Scale: 1:20,000
0 250 Metres

UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
LA-4-Pathogen Threat Lafontaine.mxd
Date: 2011-08-03

Ontario

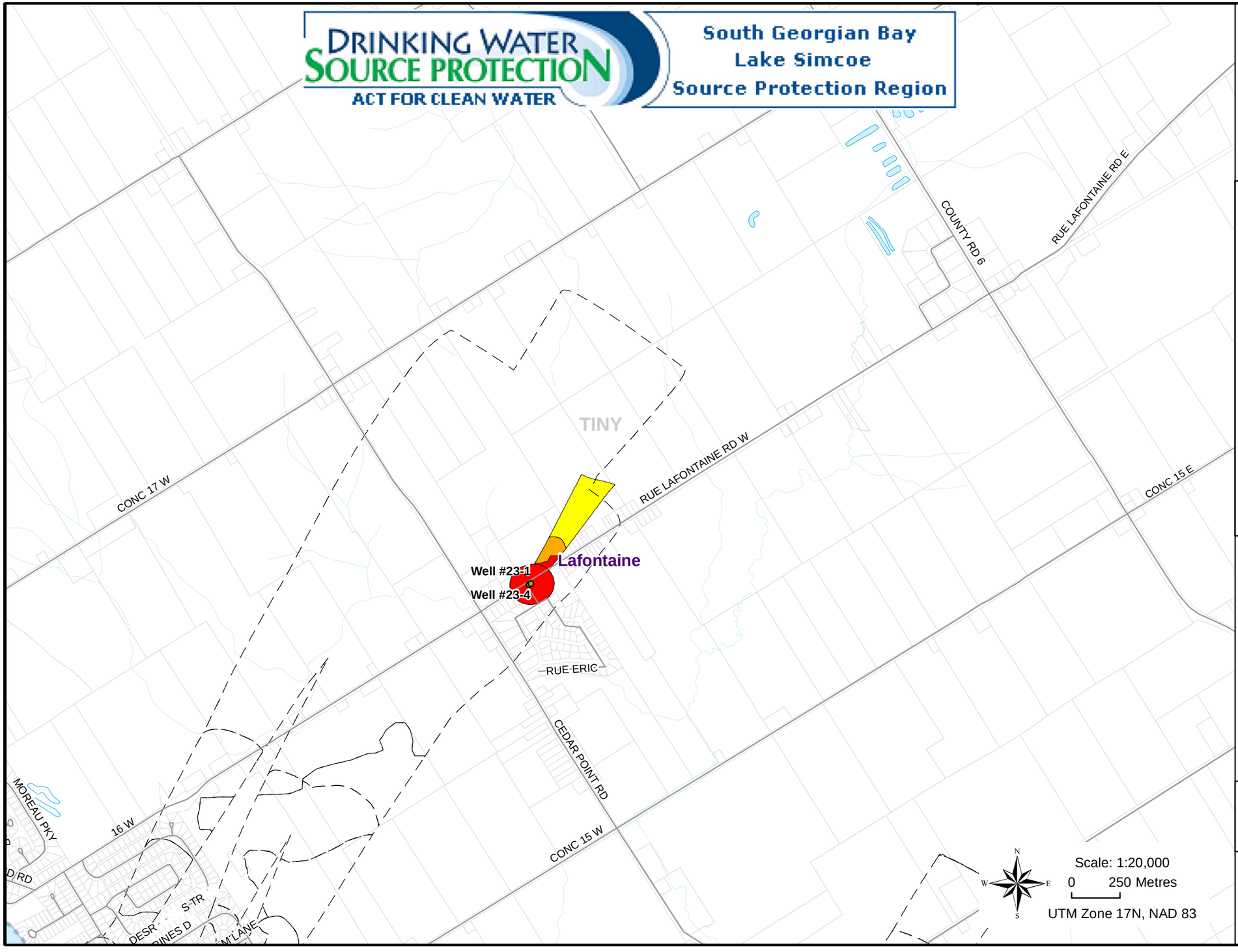
**13f-4**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Lafontaine Well 23-1 and 23-4, Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6

Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Metres
UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
LA-3-Chemical Threat Lafontaine.mxd
Date: 2011-08-03

Ontario

**13f-5**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Lafontaine Well 23-1 and 23-4, Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs

TINY

Lafontaine

Well #23-1

Well #23-4

CONC 17 W

RUE LAFONTAINE RD W

RUE LAFONTAINE RD E

COUNTY RD 6

CONC 15 E

RUE ERIC

CEDAR POINT RD

CONC 15 W

MOREAU PKY

6 W

D RD

TRAIL

DESROC

INES DR

M'LANE

- Municipal Wells

**WHPAs**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

N
W E
S

Scale: 1:20,000
0 250 Metres

UTM Zone 17N, NAD 83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Amendments by: Severn Sound Environmental Association
Project #: 07-1170-0014
File Number:
LA-5-DNAPL Threat Lafontaine.mxd
Date: 2011-08-03

Ontario

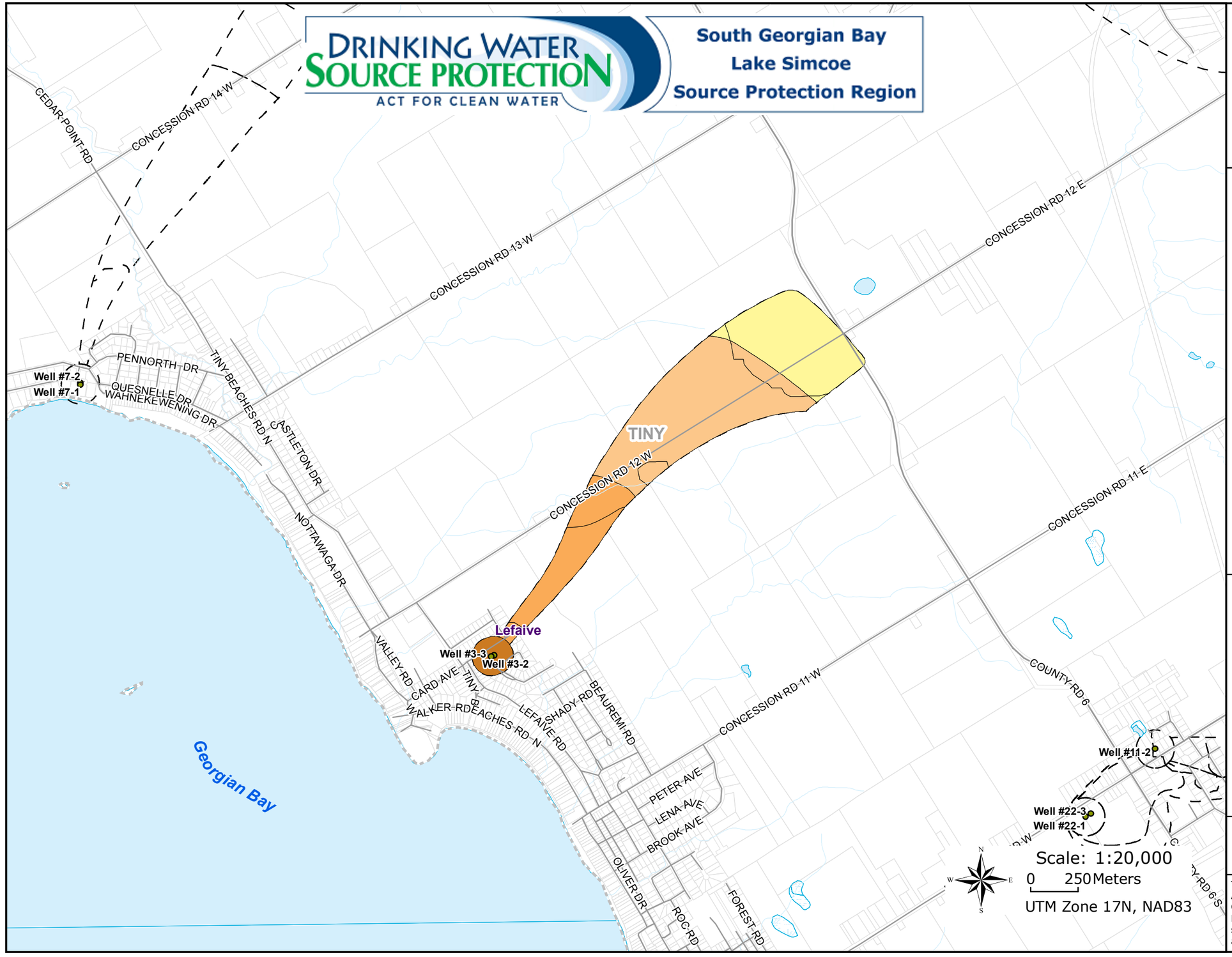
**13f-6**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# LeFaive
# Wells 3-2 and 3-3
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
LE-1-Wellhead Protection Area LeFaive.mxd
Date: 2009-12-14

Ontario

**13g-1**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# LeFaive
# Wells 3-2 and 3-3
# Final Vulnerability Scoring

CEDAR POINT RD
CONCESSION RD 14 W
CONCESSION RD 13 W
CONCESSION RD 12 E
CONCESSION RD 12 W
CONCESSION RD 11 E
CONCESSION RD 11 W
COUNTY RD 6
PENNORTH DR
QUESNEL E DR
WAHNEKEWENING DR
TINY BEACHES RD N
CASTLETON DR
NOTTAWAGA DR
VALLEY RD
CARD AVE
WALKER RD
SHADY RD
BEAUREMI RD
PETER AVE
LENA AVE
BROOK AVE
OLIVER DR
ROC RD
FOREST RD
TINY

Well #7-2
Well #7-1
5705600
Lefaive
Well #3-3
Well #3-2
Well #11-2
Well #22-1

Georgian Bay

Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
LE-2-Final Vulnerability Scoring LeFaive.mxd
Date: 2009-12-14

Ontario

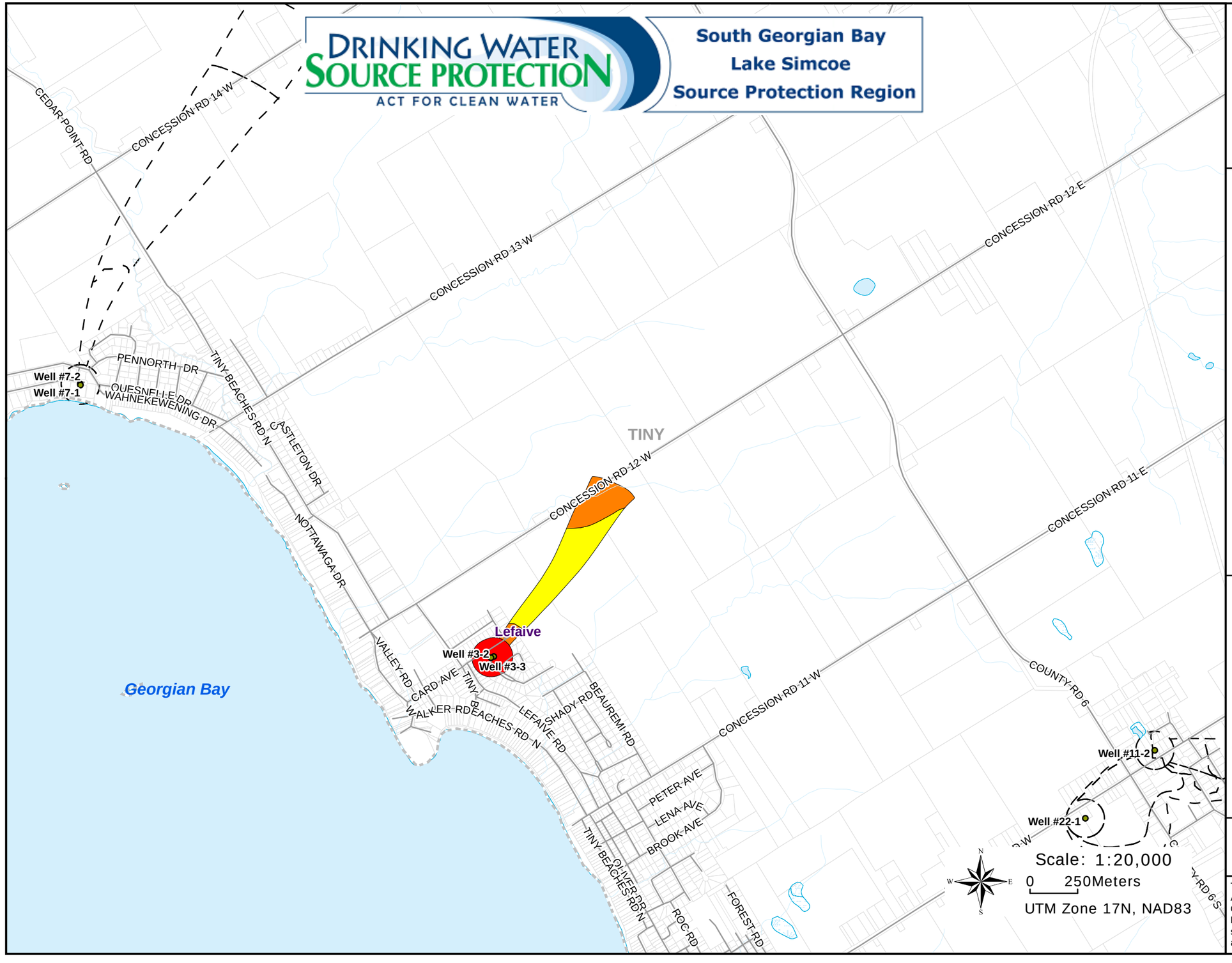
**13g-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# LeFaive
# Wells 3-2 and 3-3
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
LE-4-Pathogen Threat LeFaive.mxd
Date: 2010-05-18

Ontario

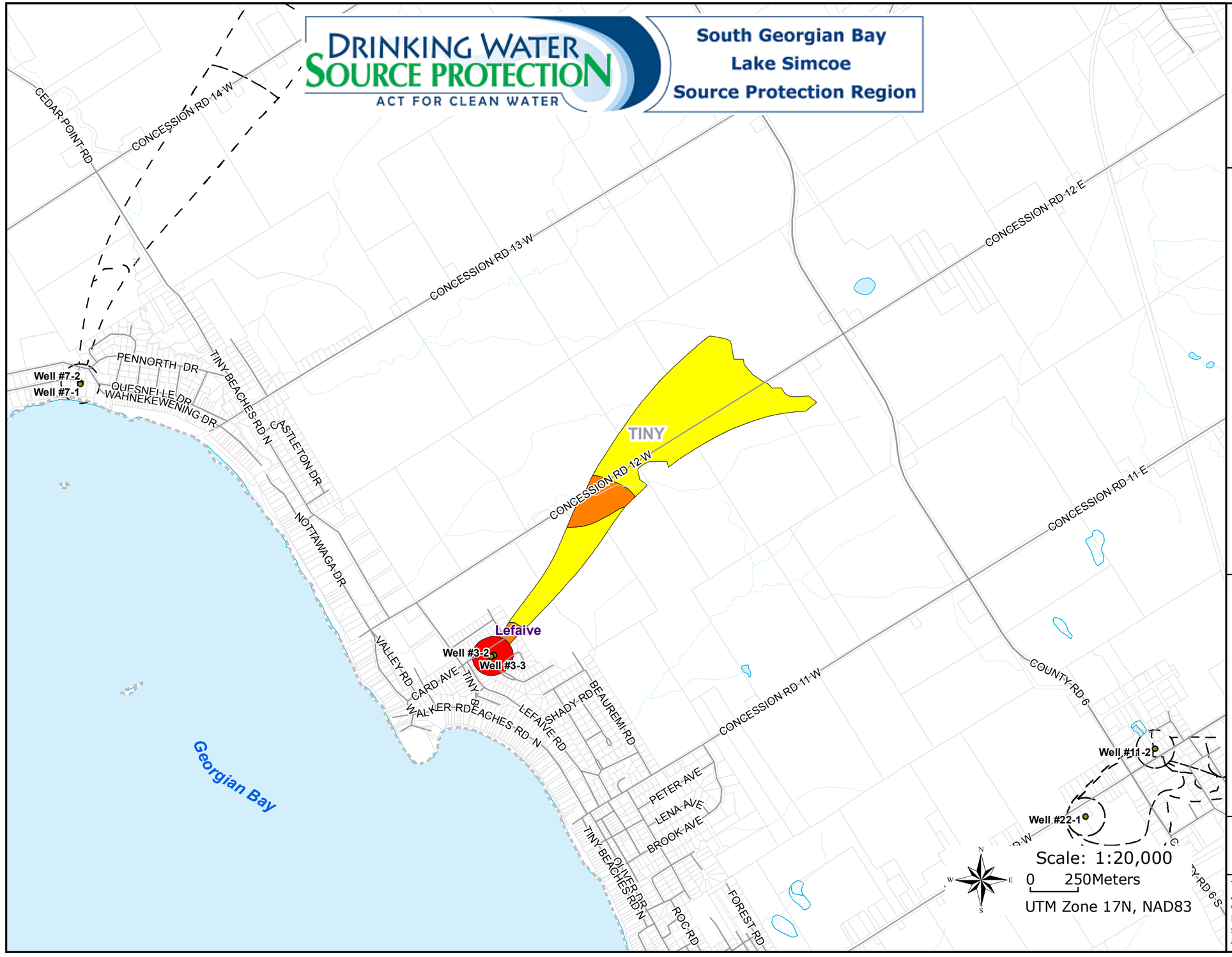
**13g-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# LeFaive
# Wells 3-2 and 3-3
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
LE-3-Chemical Threat LeFaive.mxd
Date: 2009-12-14

Ontario

**13g-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny LeFaive Wells 3-2 and 3-3 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs

CEDAR POINT RD
CONCESSION RD 14 W
CONCESSION RD 13 W
CONCESSION RD 12 E
CONCESSION RD 12 W
CONCESSION RD 11 E
CONCESSION RD 11 W
COUNTY RD 6
PENNORTH DR
QUESNELLE DR
WAHNEKEWENING DR
TINY BEACHES RD N
CASTLETON DR
NOTTAWAGA DR
VALLEY RD
CARD AVE
WALKER RD
LEFAIVE RD
SHADY RD
BEAUREMI RD
PETER AVE
LENA AVE
BROOK AVE
OLIVER DR
ROC RD
FOREST RD

Well #7-2
Well #7-1
Well #3-2
Well #3-3
Well #11-2
Well #22-1

TINY
Lefaive

Georgian Bay

Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
LE-5-DNAPL Threat LeFaive.mxd
Date: 2010-05-18

Ontario

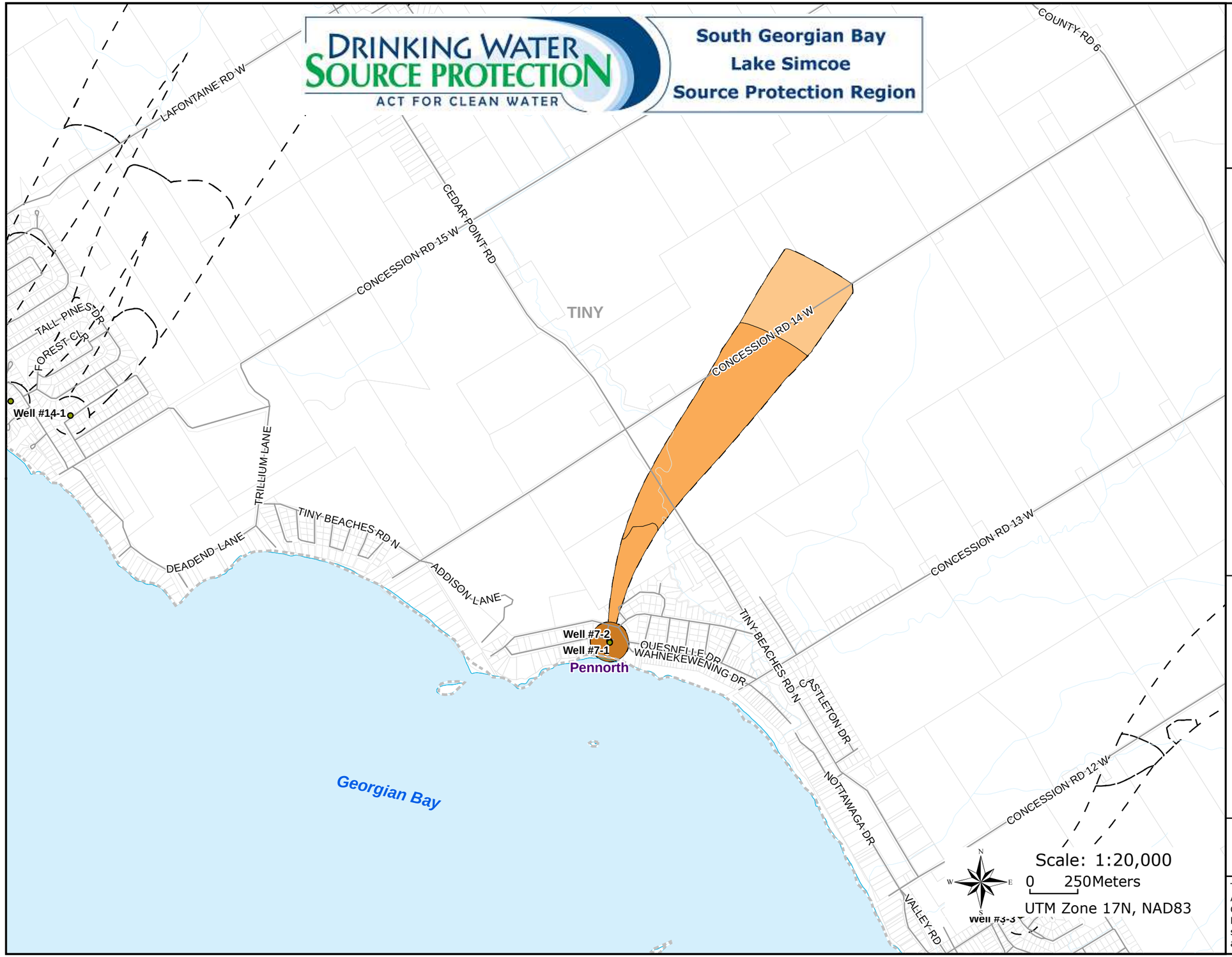
**13g-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Pennorth
# Well 7-1 and 7-2
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PN-1-Wellhead Protection Area Pennorth.mxd
Date: 2009-12-14

Ontario

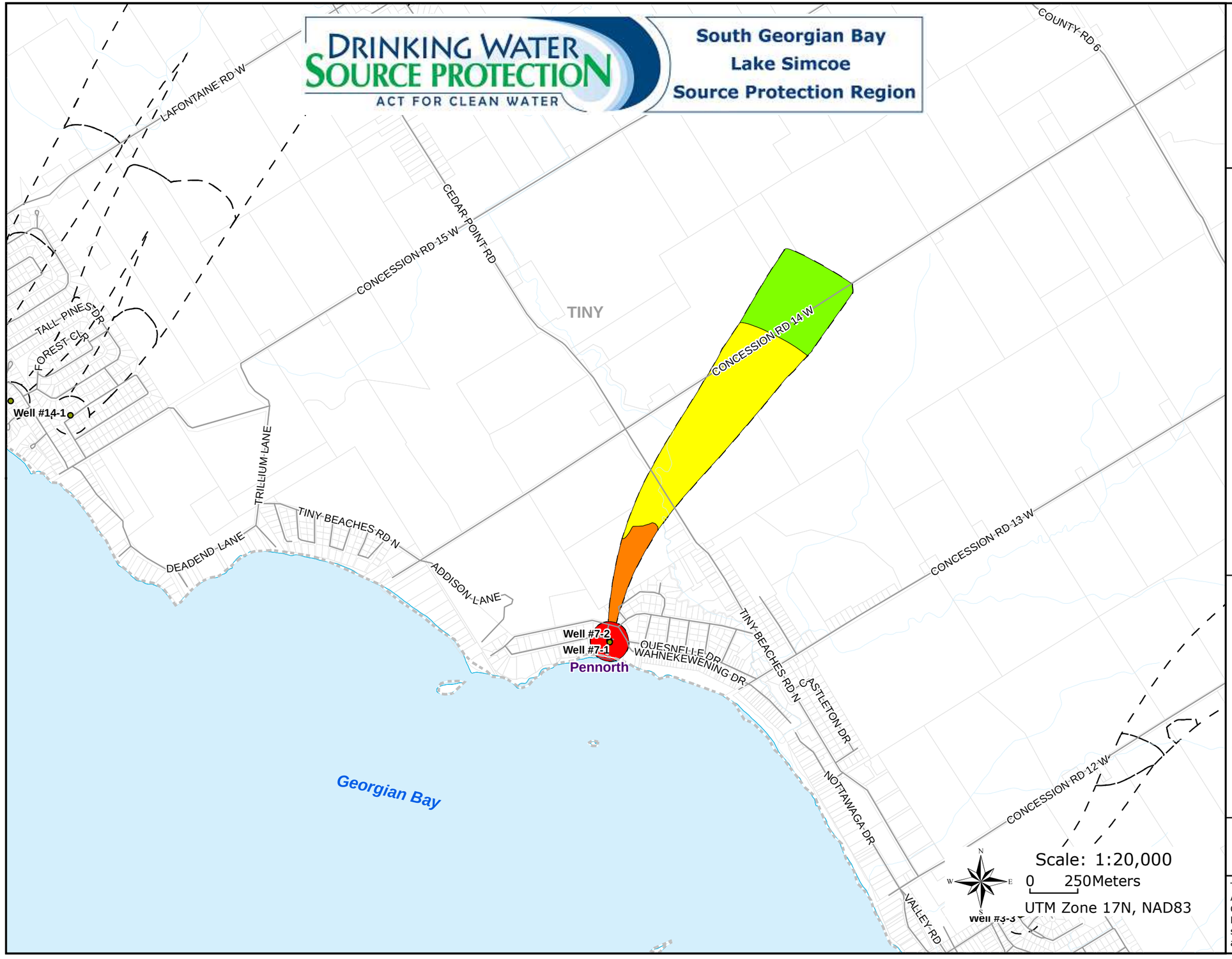
**13h-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Pennorth
# Well 7-1 and 7-2
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PN-2-Final Vulnerability Scoring Pennorth.mxd
Date: 2009-12-14

Ontario

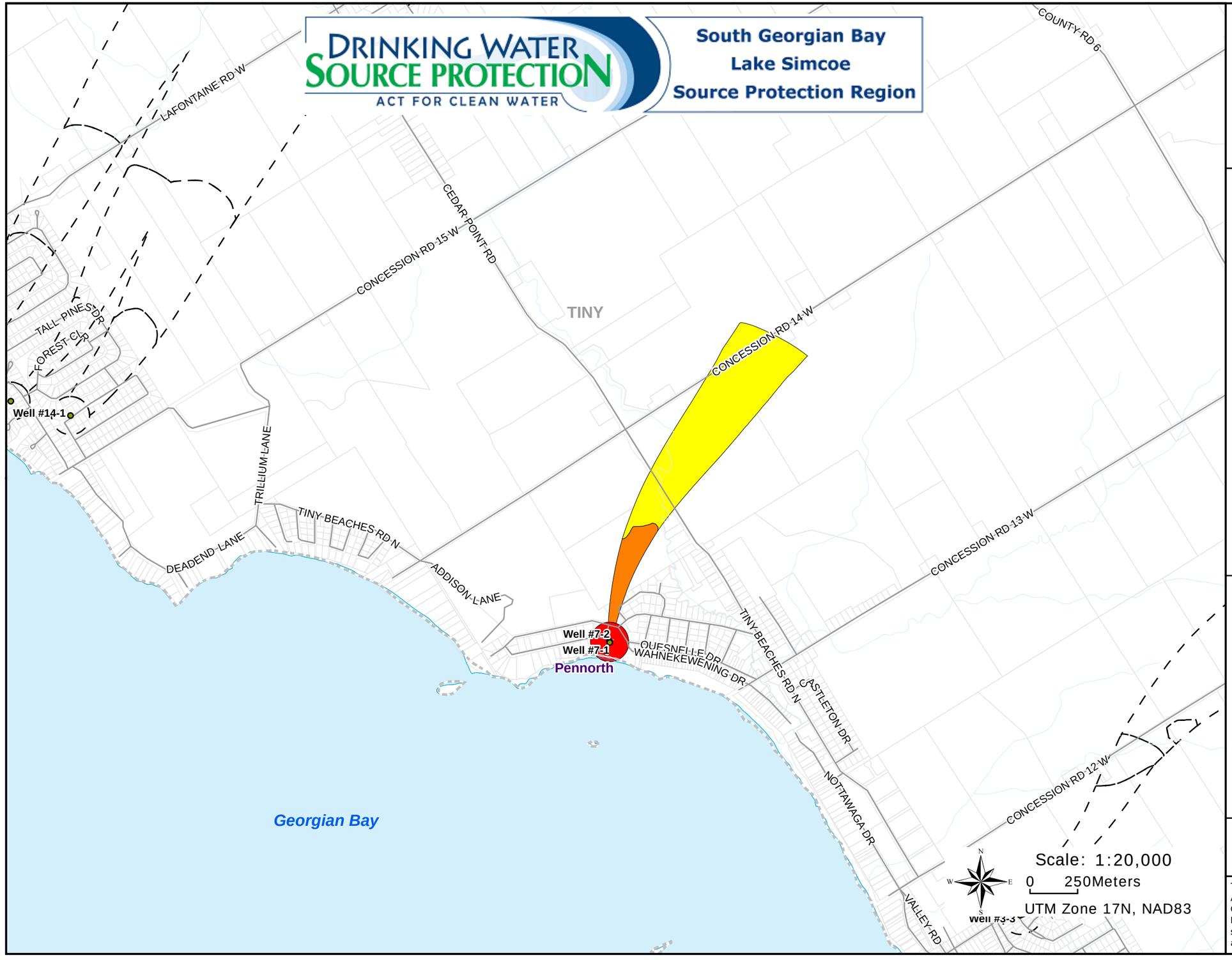
**13h-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Pennorth Well 7-1 and 7-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PN-4-Pathogen Threat Pennorth.mxd
Date: 2010-05-18

Ontario

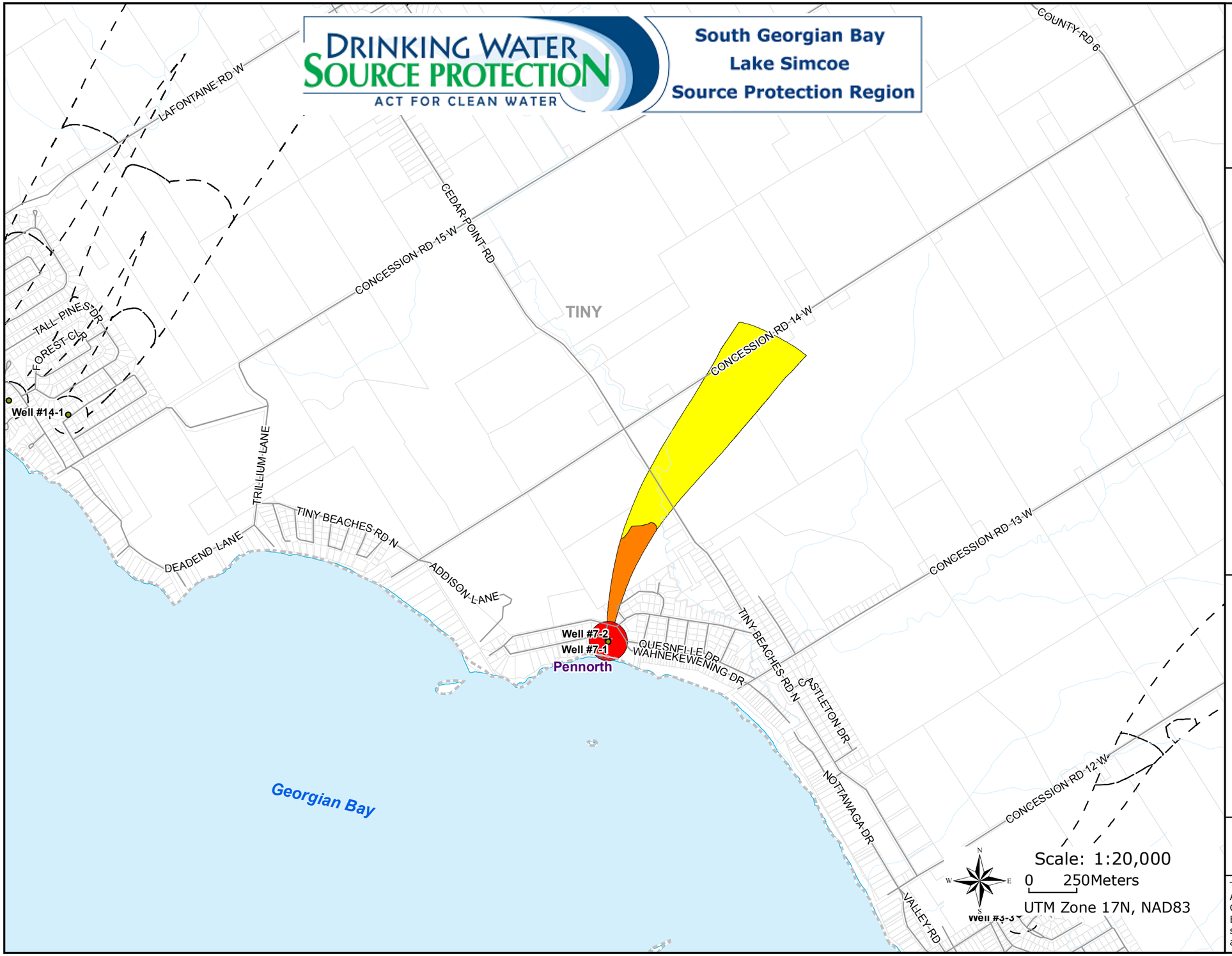
**13h-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Pennorth Well 7-1 and 7-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PN-3-Chemical Threat Pennorth.mxd
Date: 2009-12-14

Ontario

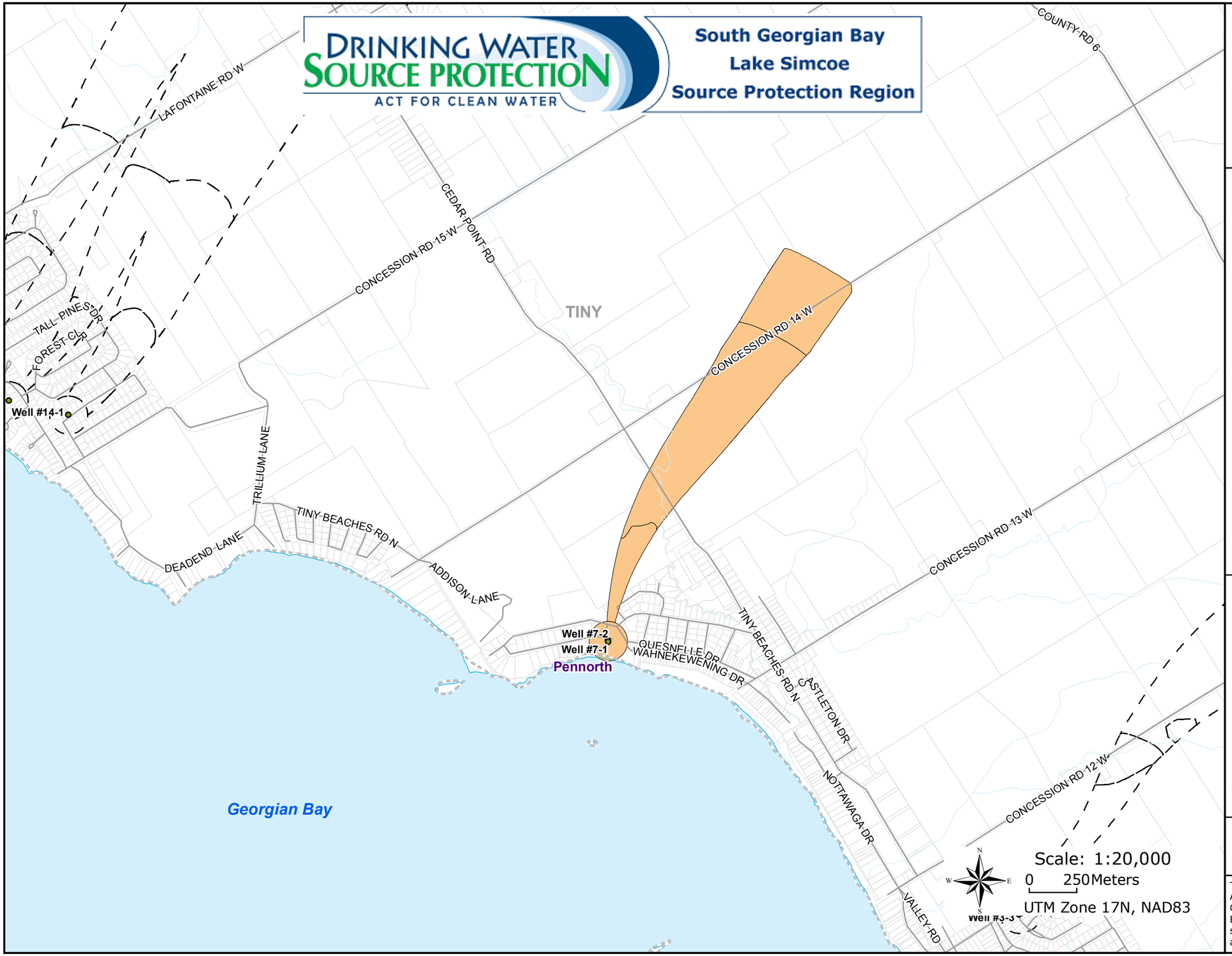
**13h-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Pennorth Well 7-1 and 7-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PN-5-DNAPL Threat Pennorth.mxd
Date: 2010-05-18

Ontario

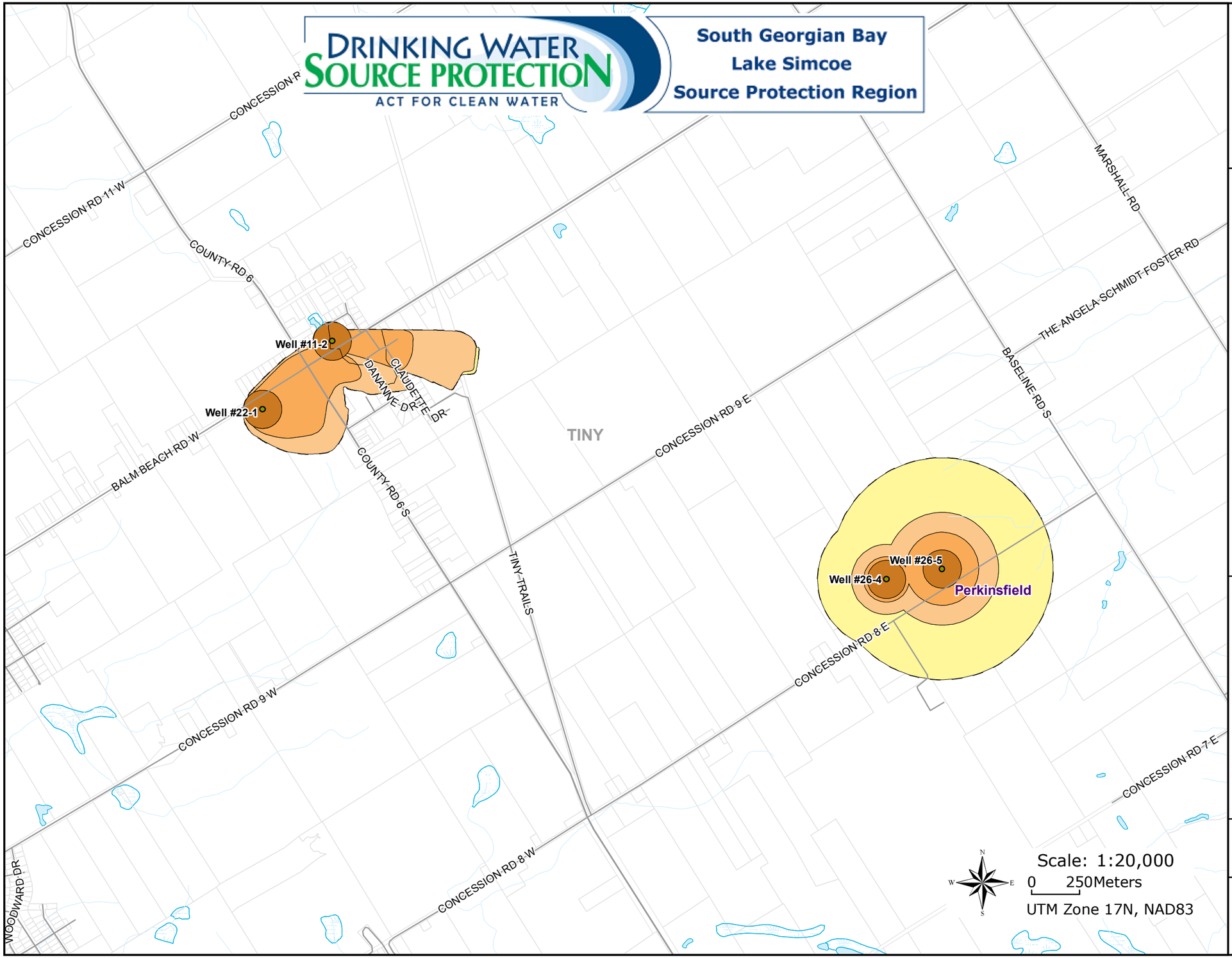
**13h-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Perkinsfield Well 11-2, 22-1, 26-4, and 26-5 Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PK-1-Wellhead Protection Area Perkinsfield.mxd
Date: 2009-12-14

Ontario

**13i-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Intrinsic Susceptibility Index
# Perkinsfield
# Well 26-4 and 26-5

CONCESSION RD 11 E
COUNTY RD 6
BALM BEACH RD W
CLAUDETTE DR
CONCESSION RD 9 E
COUNTY RD 6 S
TINY TRAILS
CONCESSION RD 9 W
TINY BEACHES RD S
TINY
MIDLAND
HERITAGE DR
BREBEUF RD
THE ANGELA SCHMIDT FOSTER RD
PRESTON RD
MARSHALL RD
HIGHWAY 93
ELLERYS SIDE RD
BASELINE RD S
DOWNERS RD
CONCESSION RD 8 E
CONCESSION RD 7 E
CONCESSION RD 6 E
Perkinsfield
Well #26-4
Well #26-5

Municipal Well
Principal Highway
Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Municipal Boundary

WHPA TOT
WHPA-A (100 m radius)
WHPA-B (2 yr TOT)
WHPA-C (5 yr TOT)
WHPA-D (25 yr TOT)

ISI
High Vulnerability (ISI <30)
Medium Vulnerability (ISI 30 - 80)
Low Vulnerability (ISI >80)

N
W
E
S

Scale: 1:25,000
0 250Meters
UTM Zone 17N, NAD83

Notes:
Figure illustrates only ISI score for WHPAs that fall outside AVI model domain.

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: PerkinsfieldISI.mxd
Date: 2009-12-10

Ontario

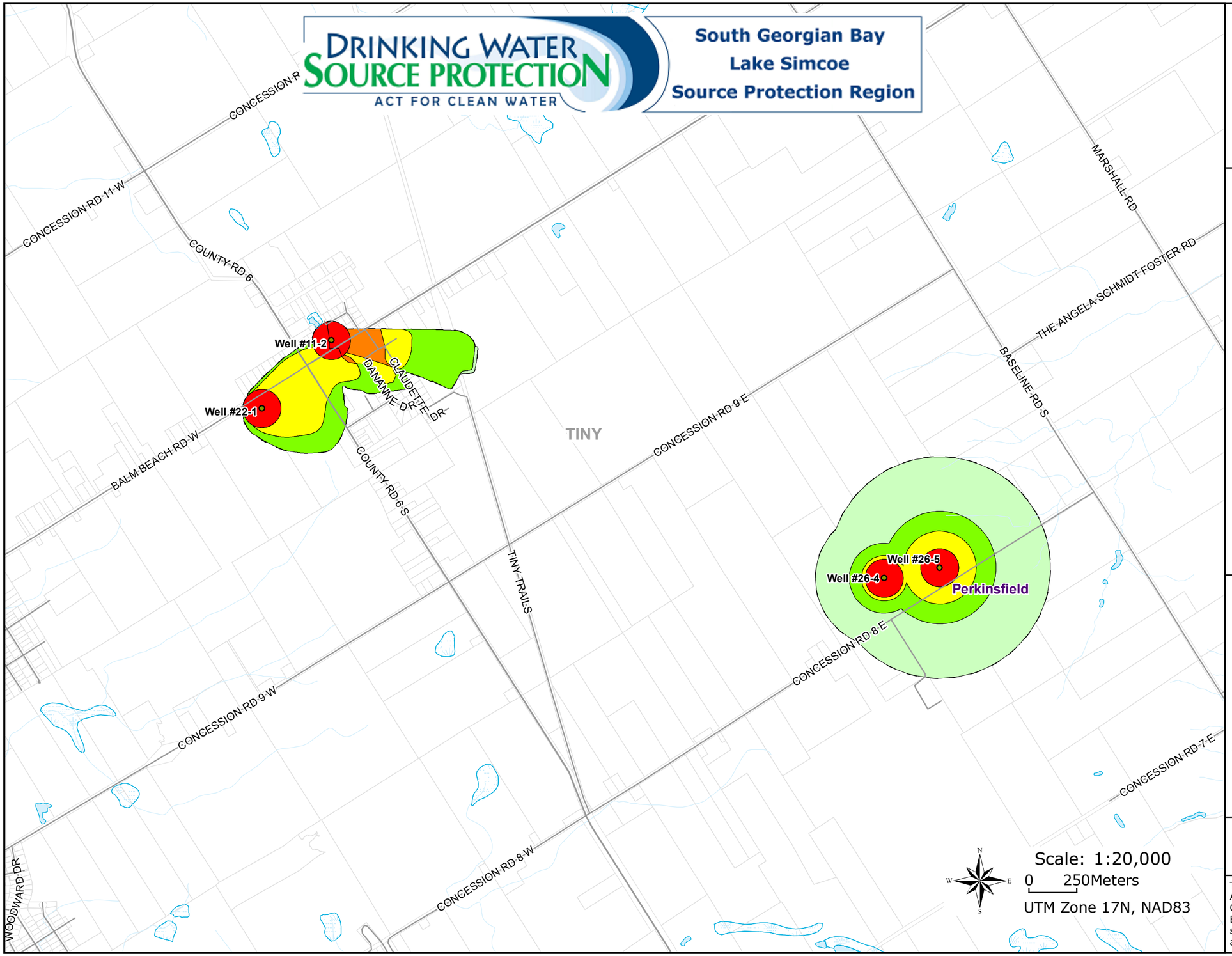
**13i-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Perkinsfield
# Well 11-2, 22-1, 26-4, and 26-5
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PK-2-Final Vulnerability Scoring Perkinsfield.mxd
Date: 2009-12-14

Ontario

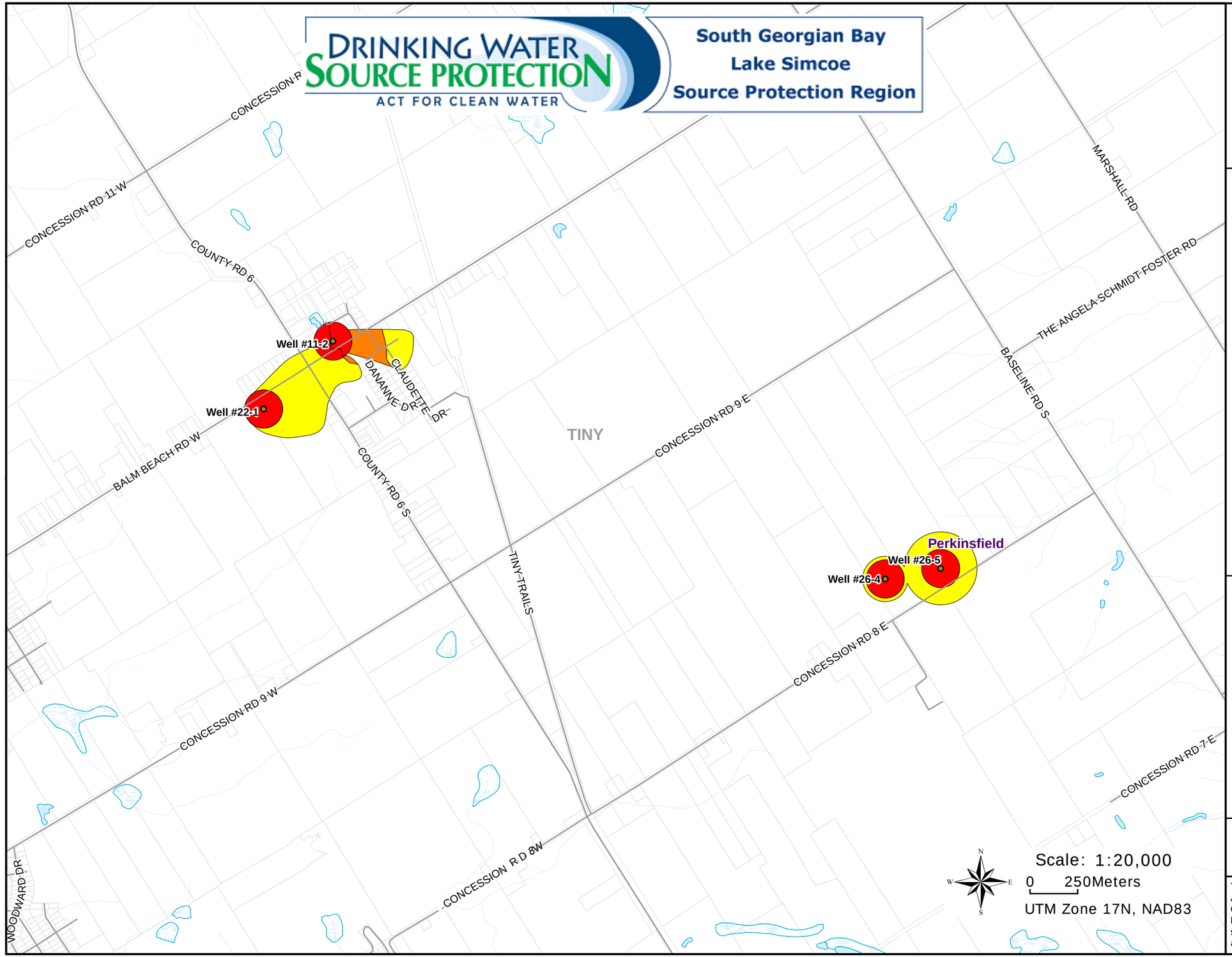
**13i-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Perkinsfield Well 11-2, 22-1, 26-4, and 26-5 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PK-4-Pathogen Threat Perkinsfield.mxd
Date: 2010-05-18

Ontario

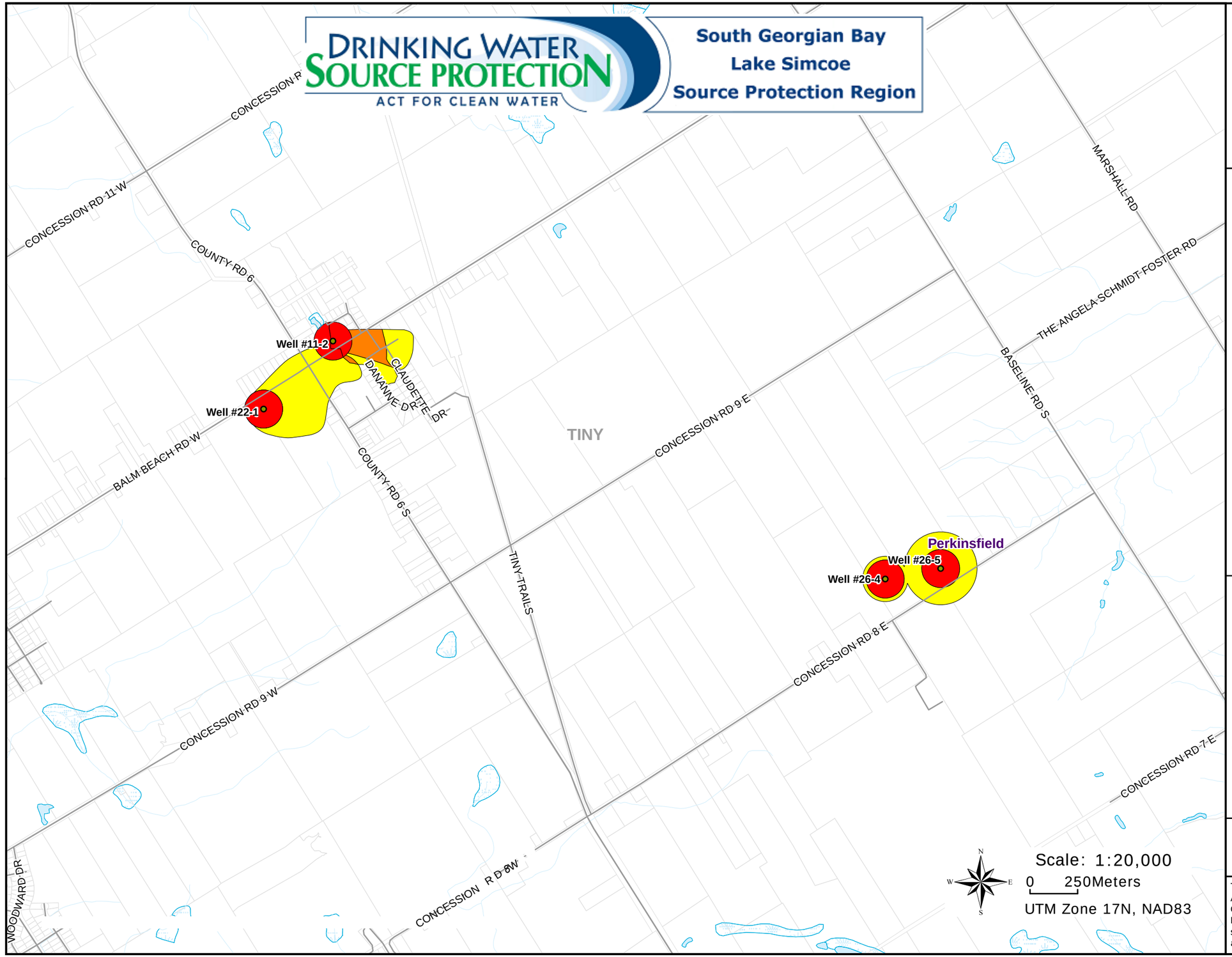
**13i-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Perkinsfield Well 11-2, 22-1, 26-4, and 26-5 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PK-3-Chemical Threat Perkinsfield.mxd
Date: 2009-12-14

Ontario

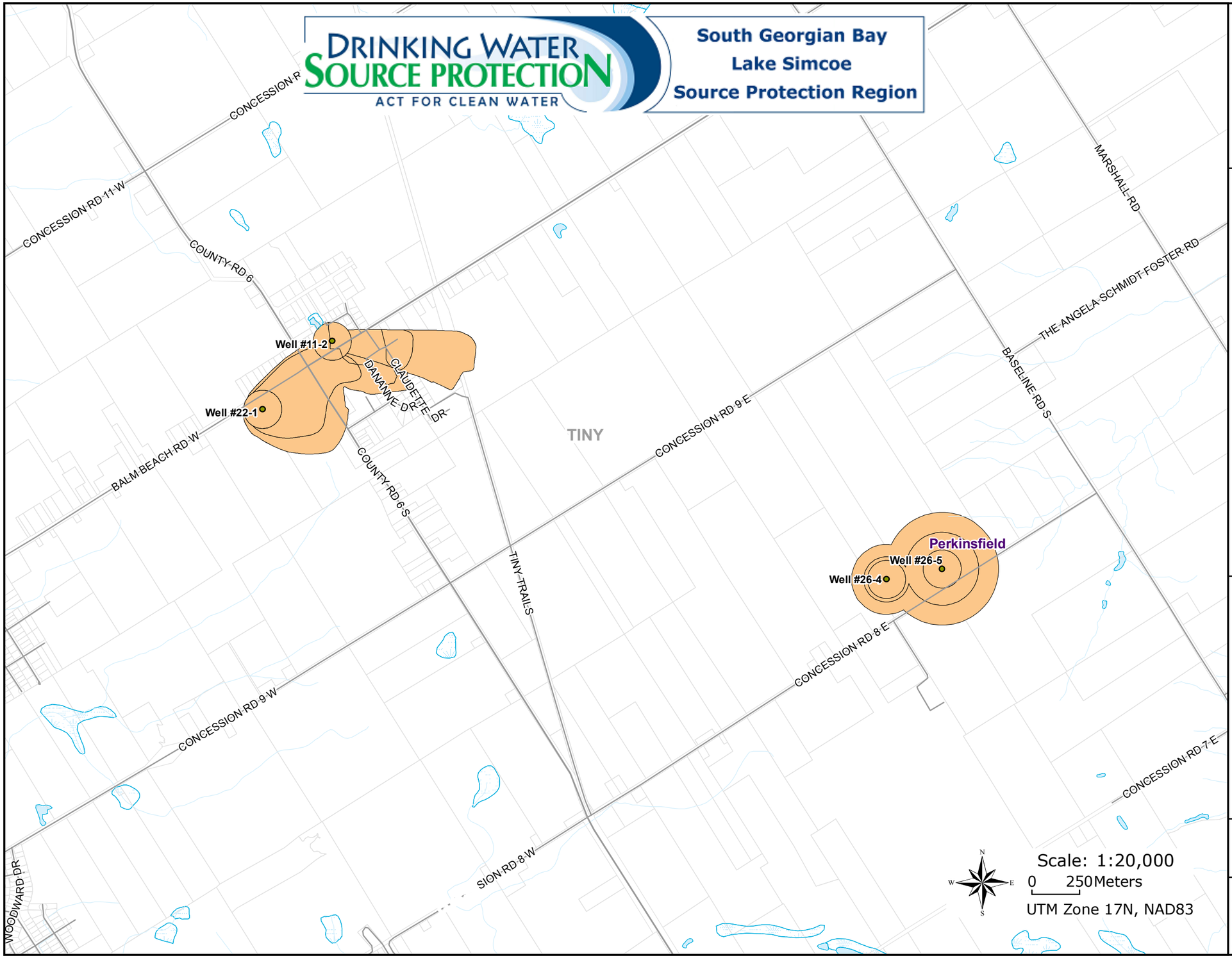
**13i-5**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Perkinsfield Well 11-2, 22-1, 26-4, and 26-5 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
PK-5-DNAPL Threat Perkinsfield.mxd
Date: 2010-05-18

Ontario

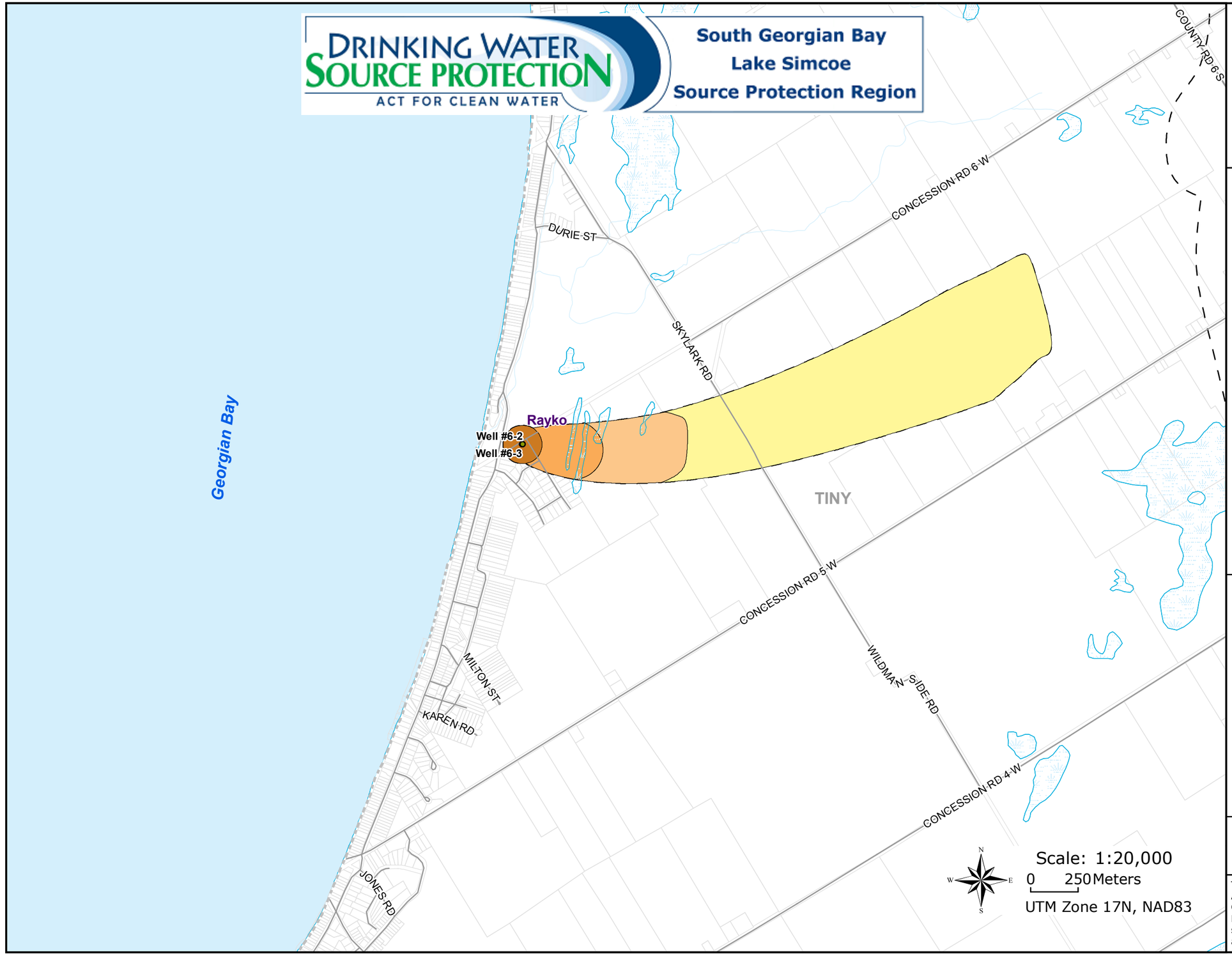
**13i-6**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Rayko
# Well 6-2 and 6-3
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

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Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
RK-1-Wellhead Protection Area Rayko.mxd
Date: 2009-12-14

Ontario

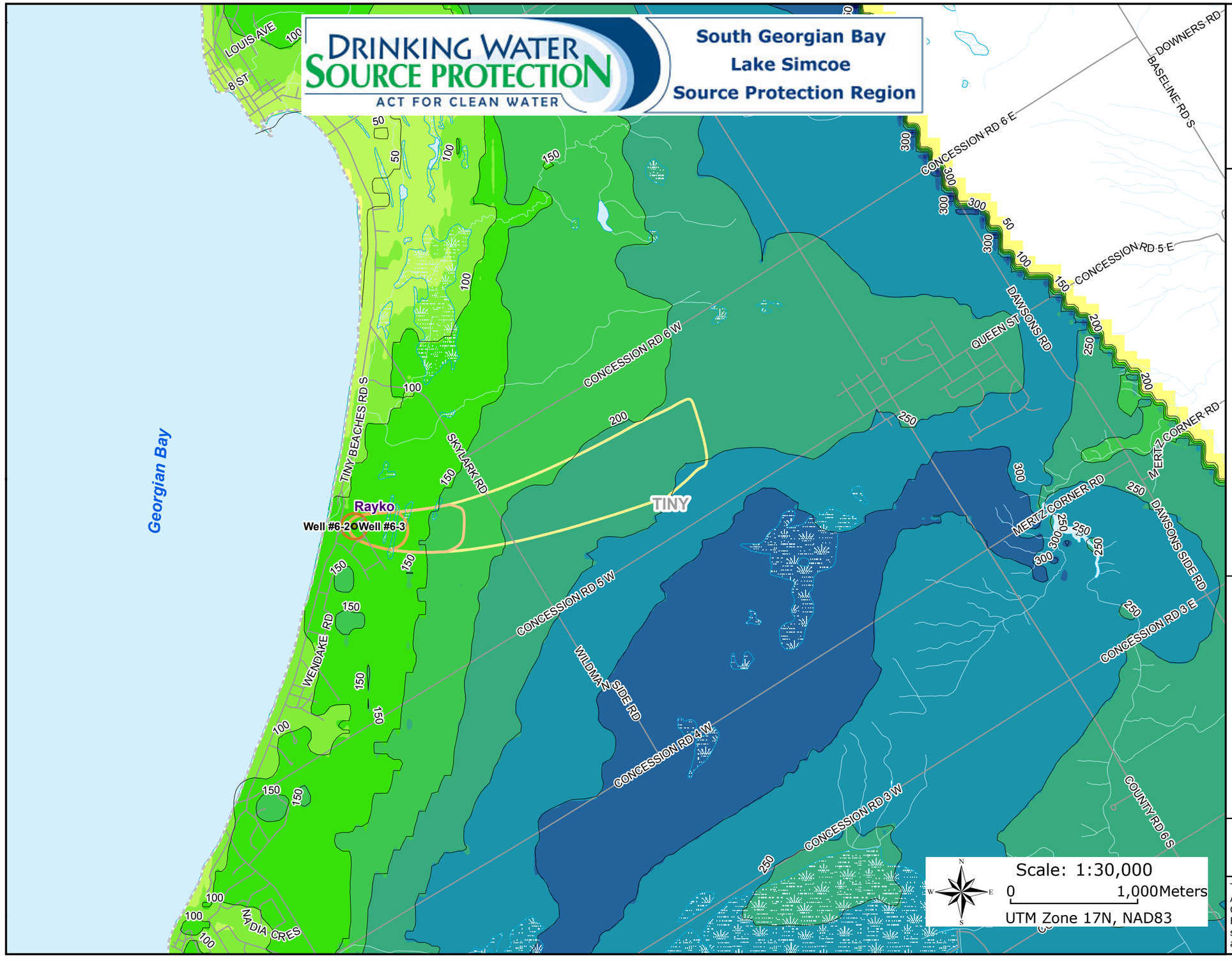
**13j-1**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Model Calculated AVI
# To Top of Model Layer 7
# (Aquifer A3 Southwest)




Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Figure illustrates only AVI score for
WHPAs corresponding to this model layer

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Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number: Fig_A-6_Topof7SouthWest
Date: 2009-12-23

Ontario

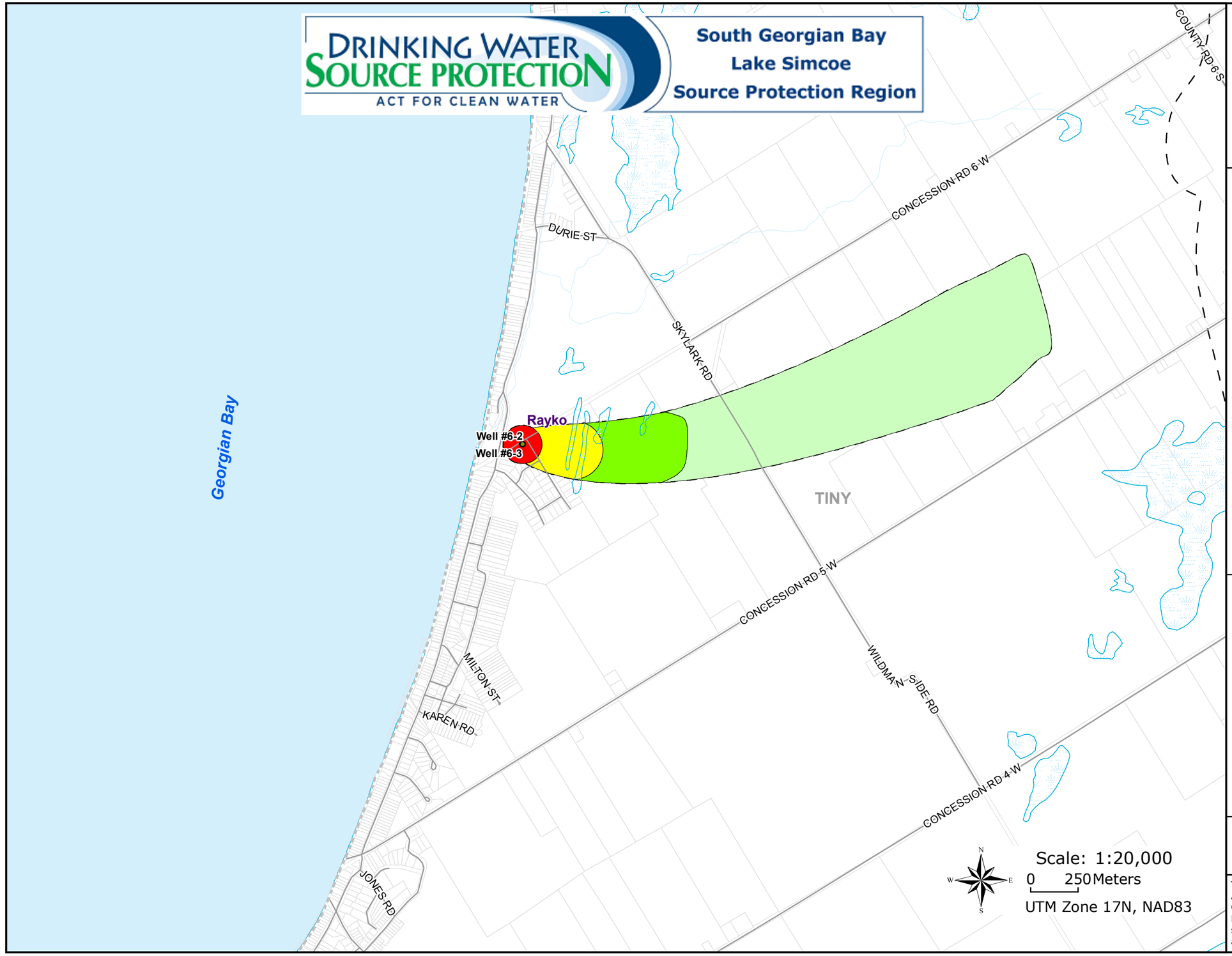
**13j-2**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Rayko
# Well 6-2 and 6-3
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
RK-2-Final Vulnerability Scoring Rayko.mxd
Date: 2009-12-14

Ontario

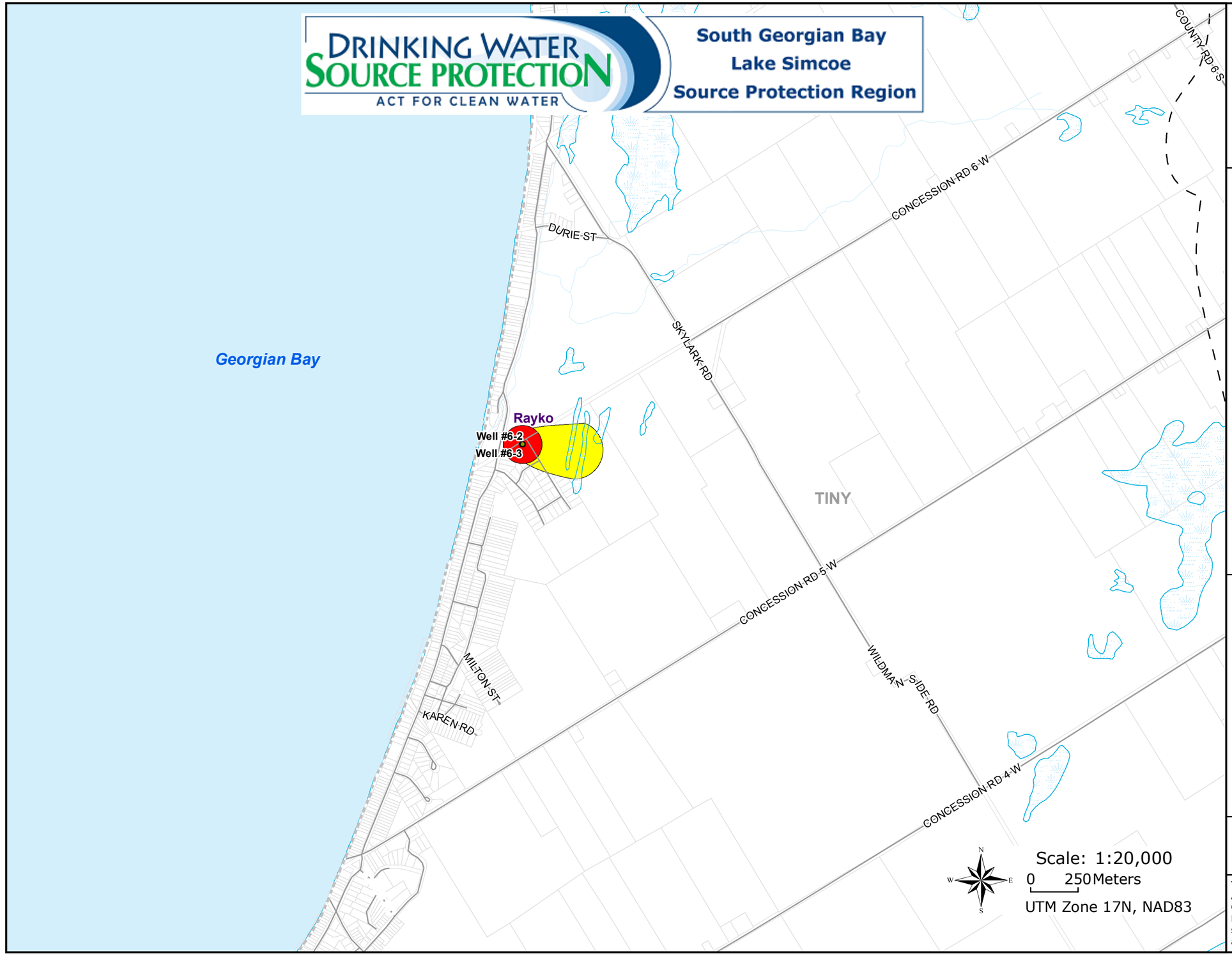
**13j-3**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Rayko
# Well 6-2 and 6-3
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
RK-4-Pathogen Threat Rayko.mxd
Date: 2010-05-18

Ontario

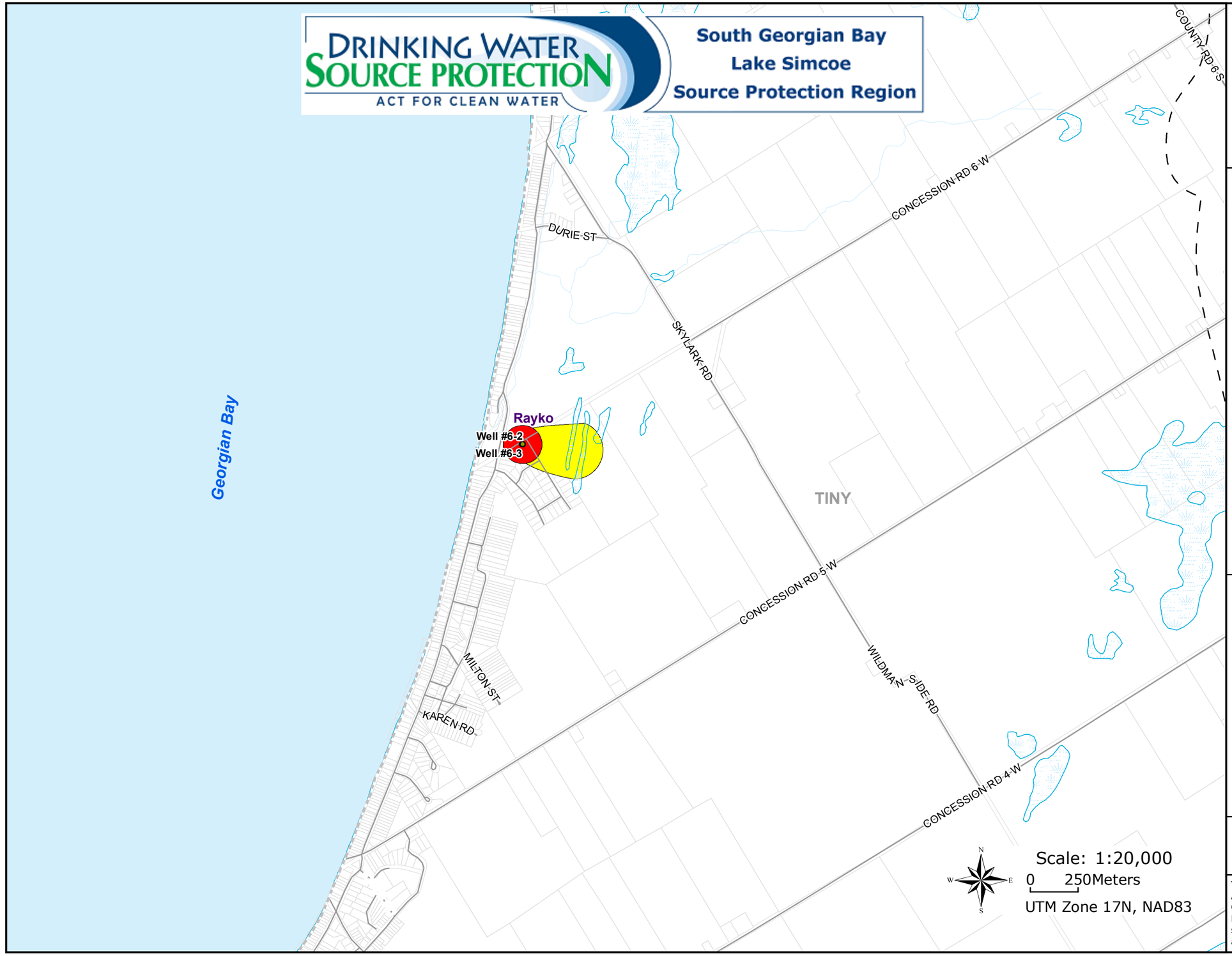
**13j-4**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Rayko
# Well 6-2 and 6-3
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
RK-3-Chemical Threat Rayko.mxd
Date: 2009-12-14

Ontario

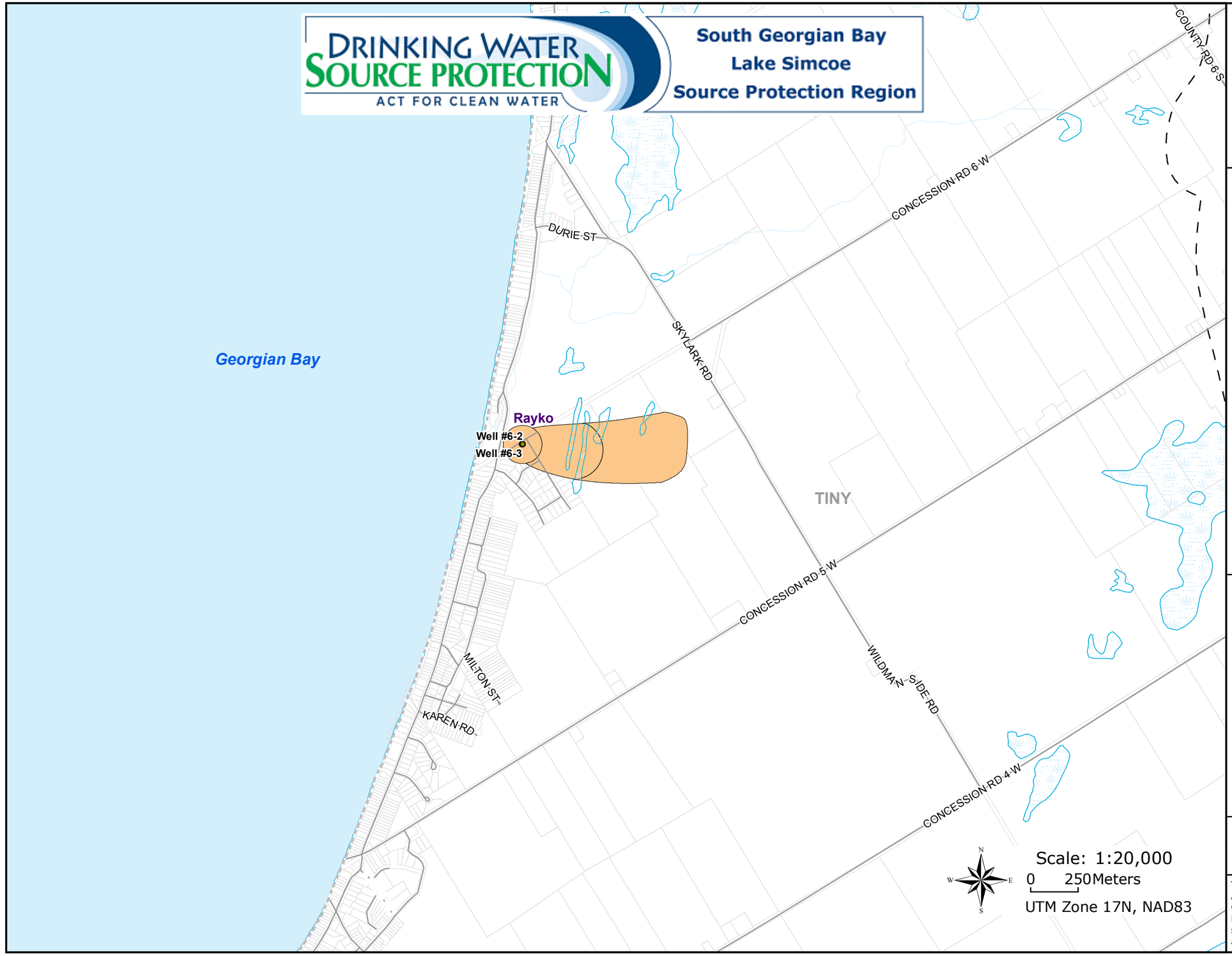
**13j-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Rayko
# Well 6-2 and 6-3
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
RK-5-DNAPL Threat Rayko.mxd
Date: 2010-05-18

Ontario

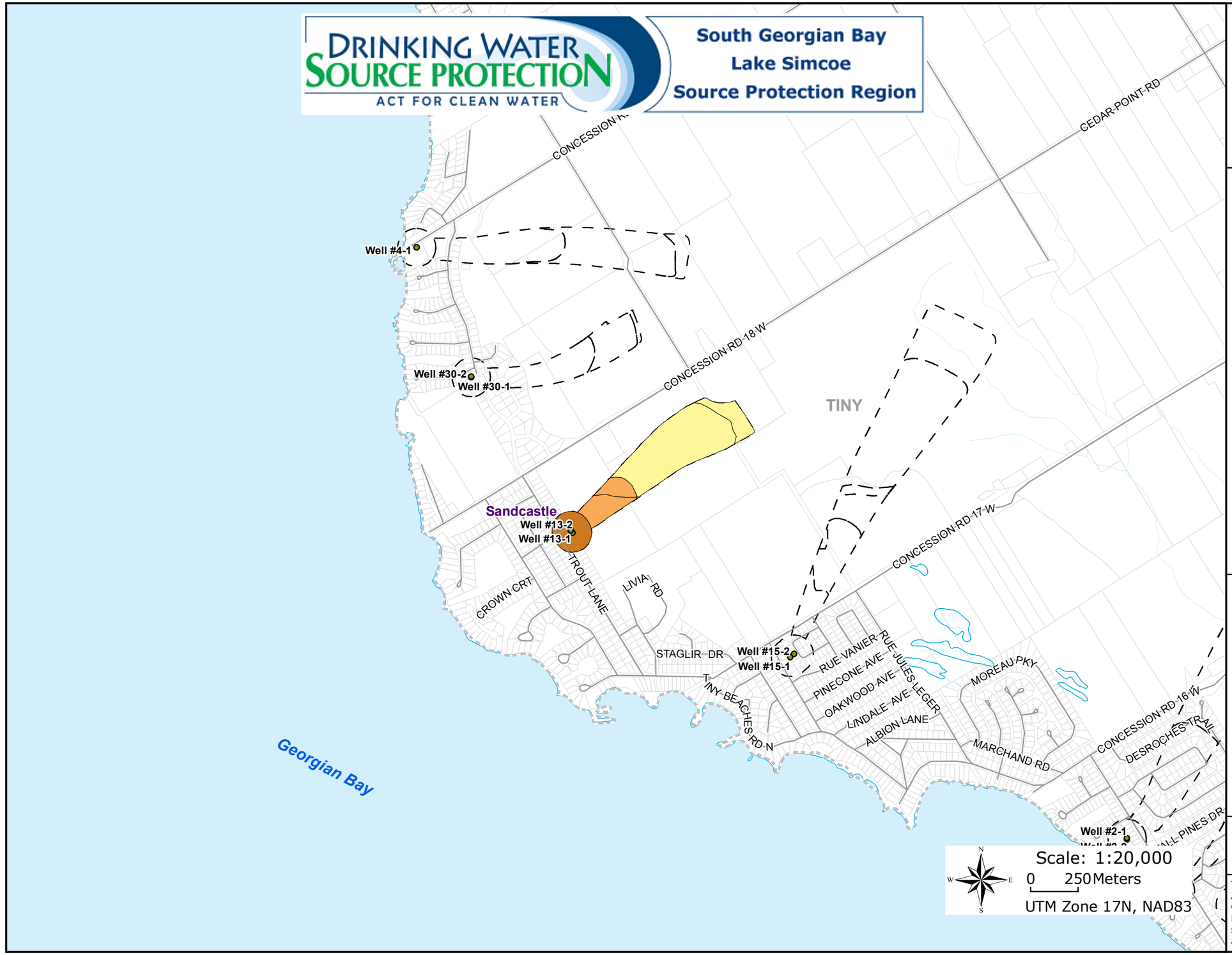
**13j-6**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Sandcastle
# Well 13-1 and 13-2
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SC-1-Wellhead Protection Area Sandcastle.mxd
Date: 2009-12-14

Ontario

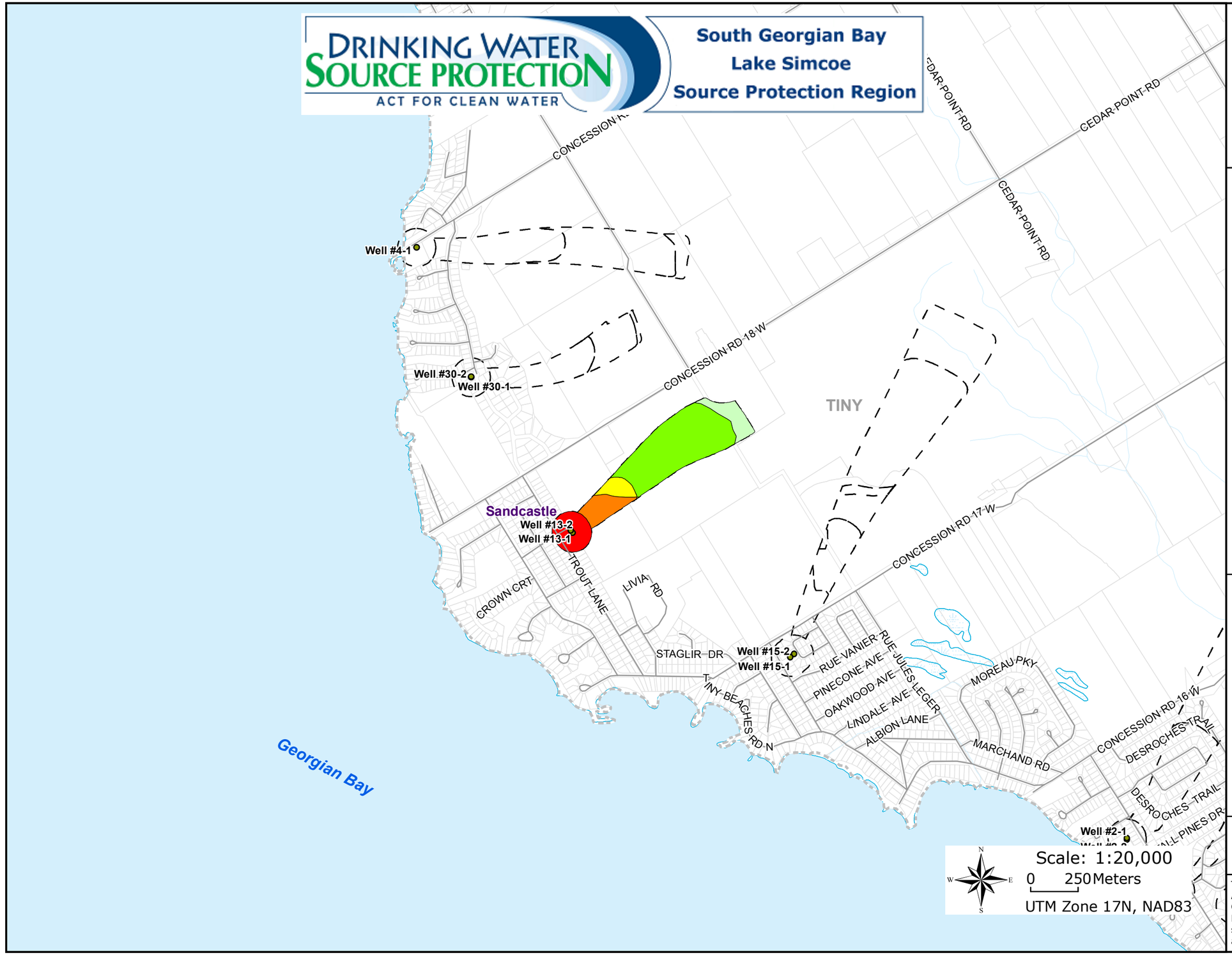
**13k-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Sandcastle
# Well 13-1 and 13-2
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SC-2-Final Vulnerability Scoring Sandcastle.mxd
Date: 2009-12-14

Ontario

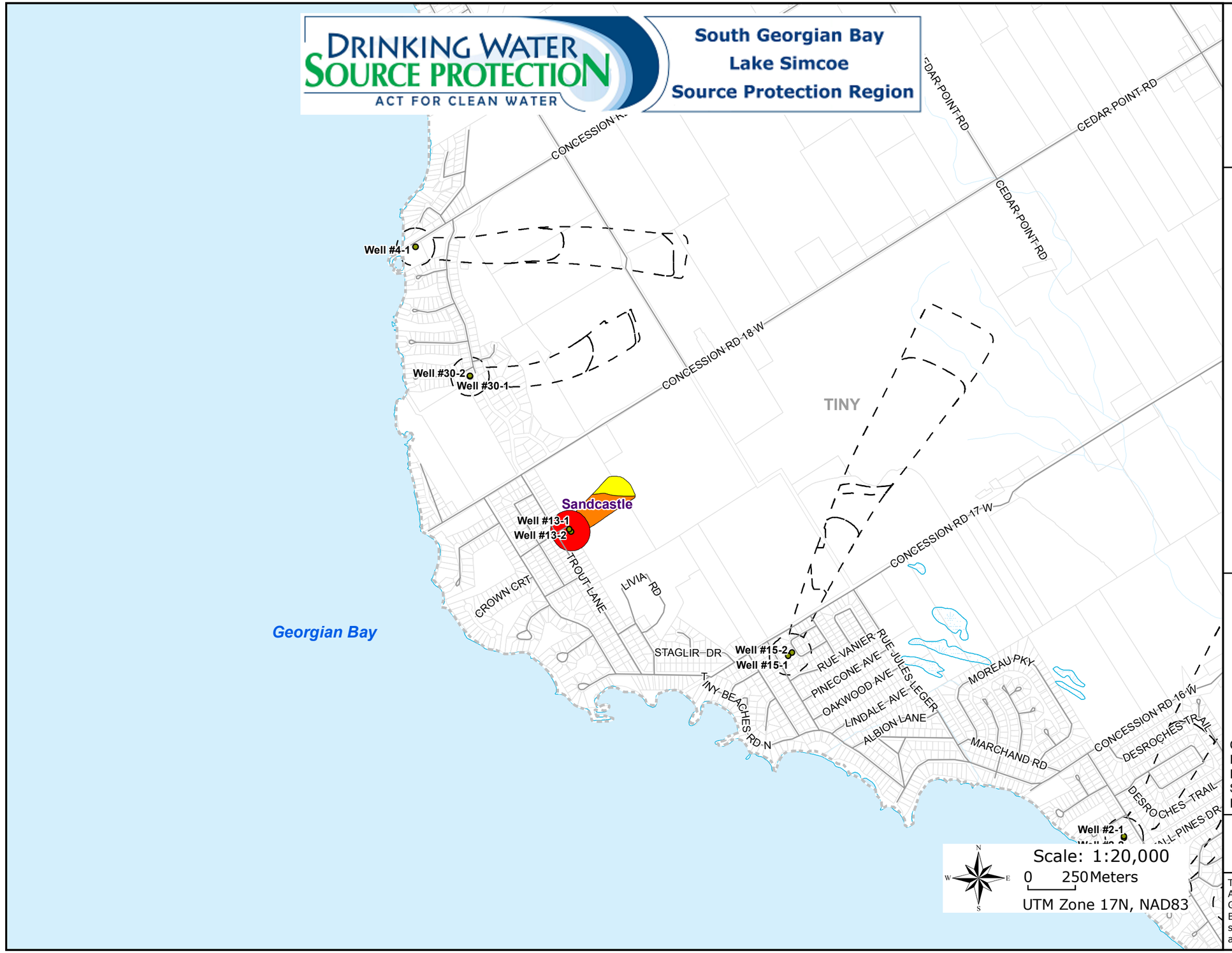
**13k-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Sandcastle Well 13-1 and 13-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SC-4-Pathogen Threat Sandcastle.mxd
Date: 2010-05-18

Ontario

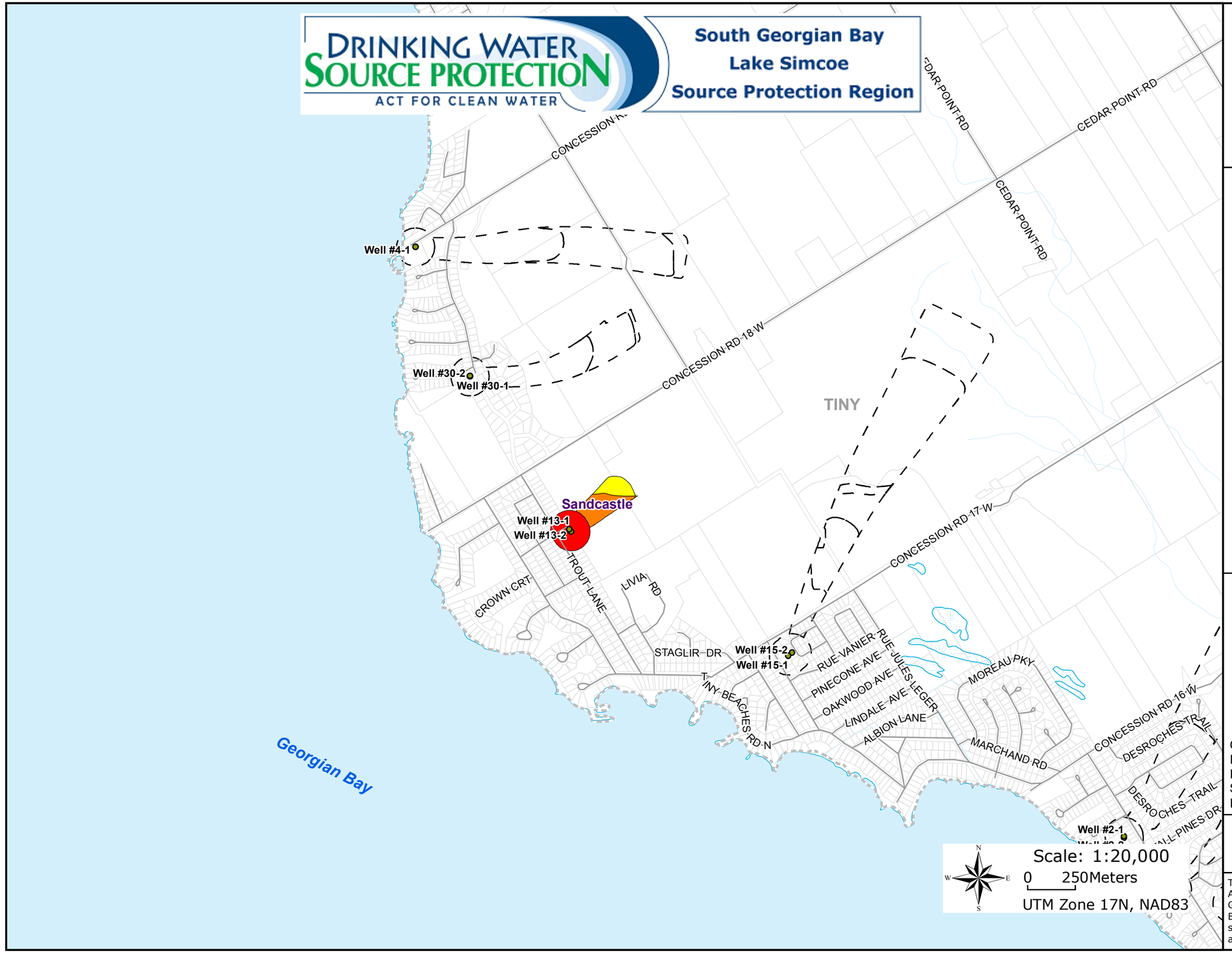
**13k-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Sandcastle Well 13-1 and 13-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SC-3-Chemical Threat Sandcastle.mxd
Date: 2009-12-14

Ontario

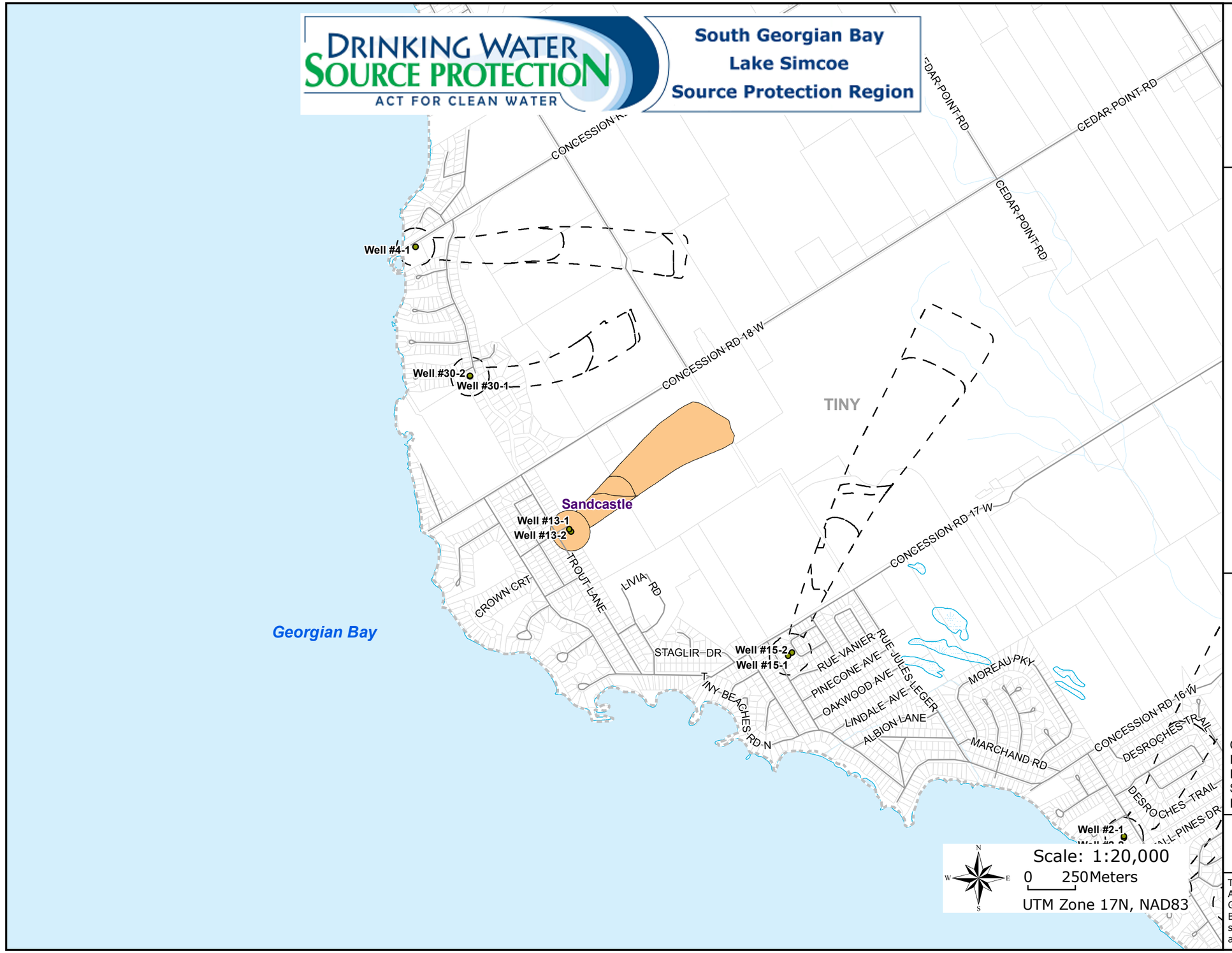
**13k-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Sandcastle Well 13-1 and 13-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SC-5-DNAPL Threat Sandcastle.mxd
Date: 2010-05-18

Ontario

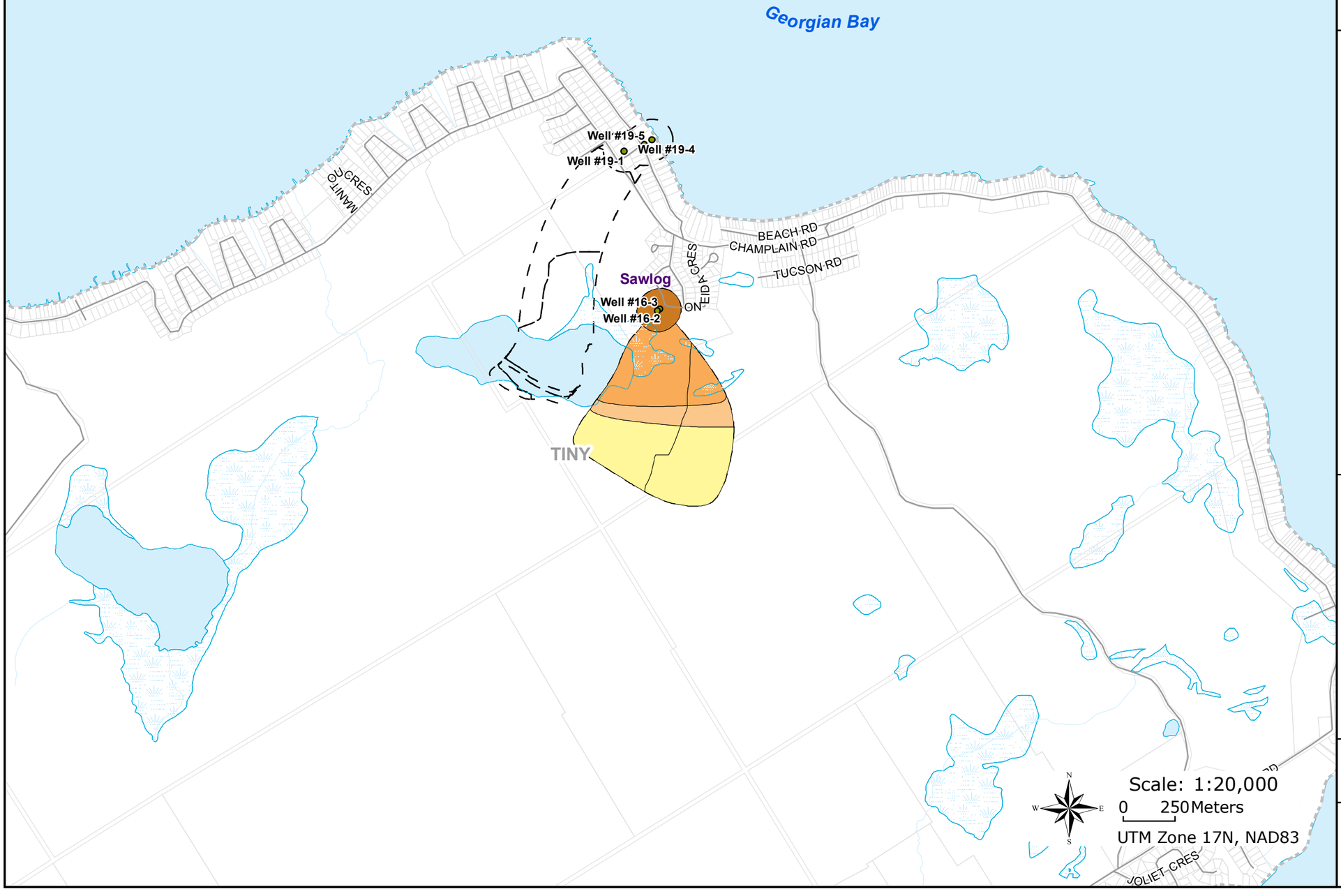
**13k-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Sawlog Bay
# Well 16-2 and 16-3
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SB-1-Wellhead Protection Area Sawlog Bay.mxd
Date: 2009-12-14

Ontario

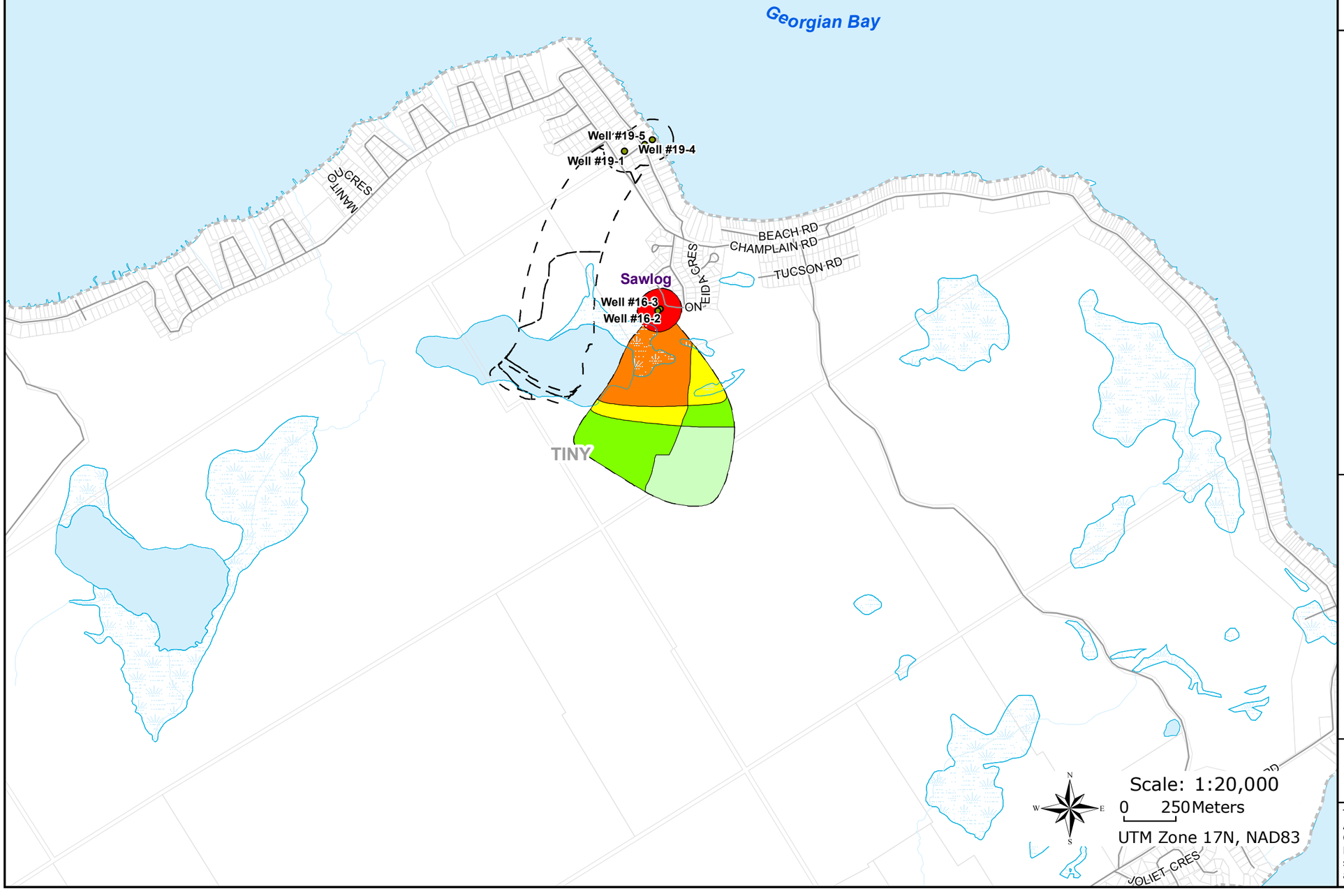
**13I-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Sawlog Bay
# Well 16-2 and 16-3
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SB-2-Final Vulnerability Scoring Sawlog Bay.mxd
Date: 2009-12-14

Ontario

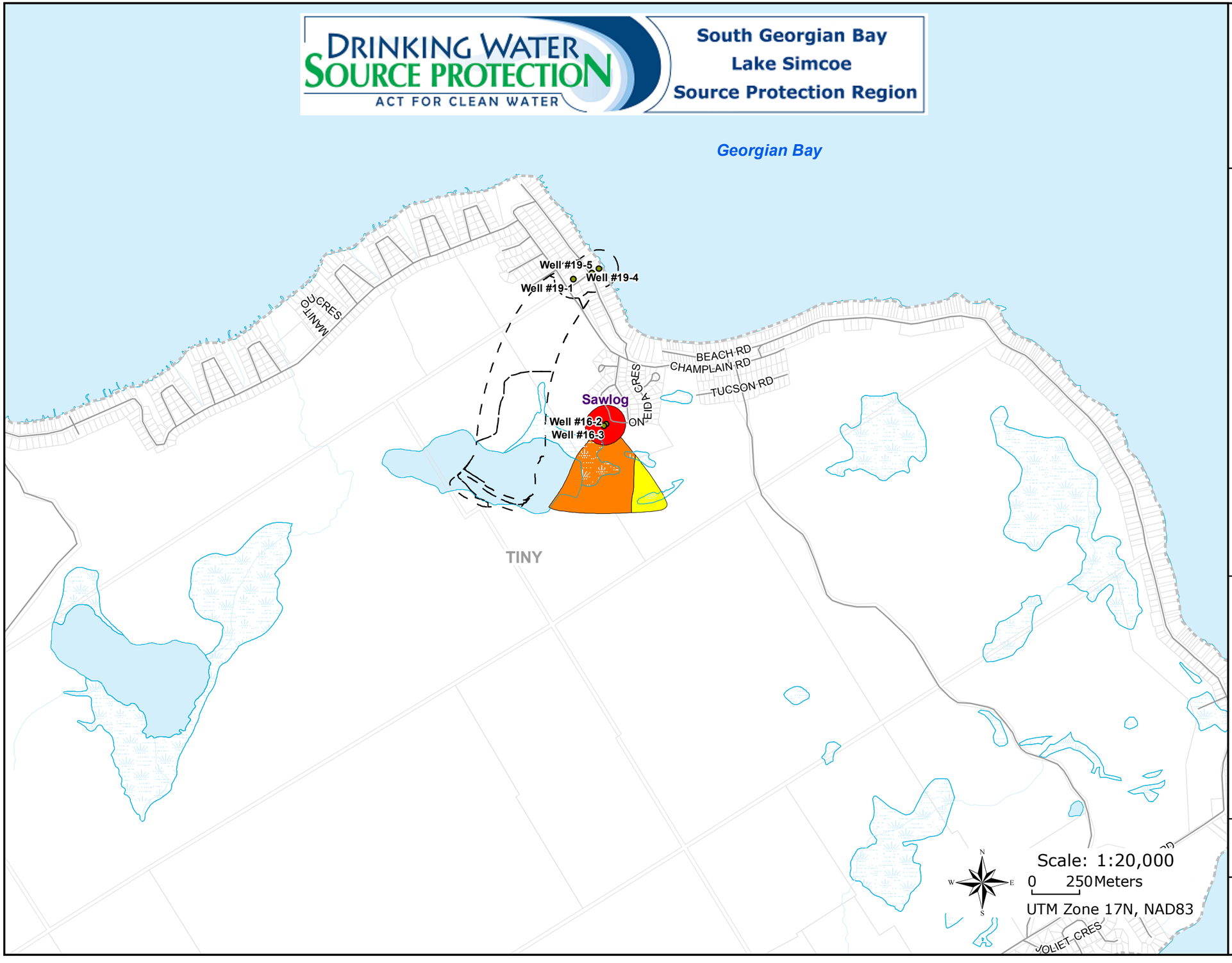
**13I-2**

This map was produced for the Severn Sound Environmental Association for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report.
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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Sawlog Bay Well 16-2 and 16-3 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SB-4-Pathogen Threat Sawlog Bay.mxd
Date: 2010-05-18

Ontario

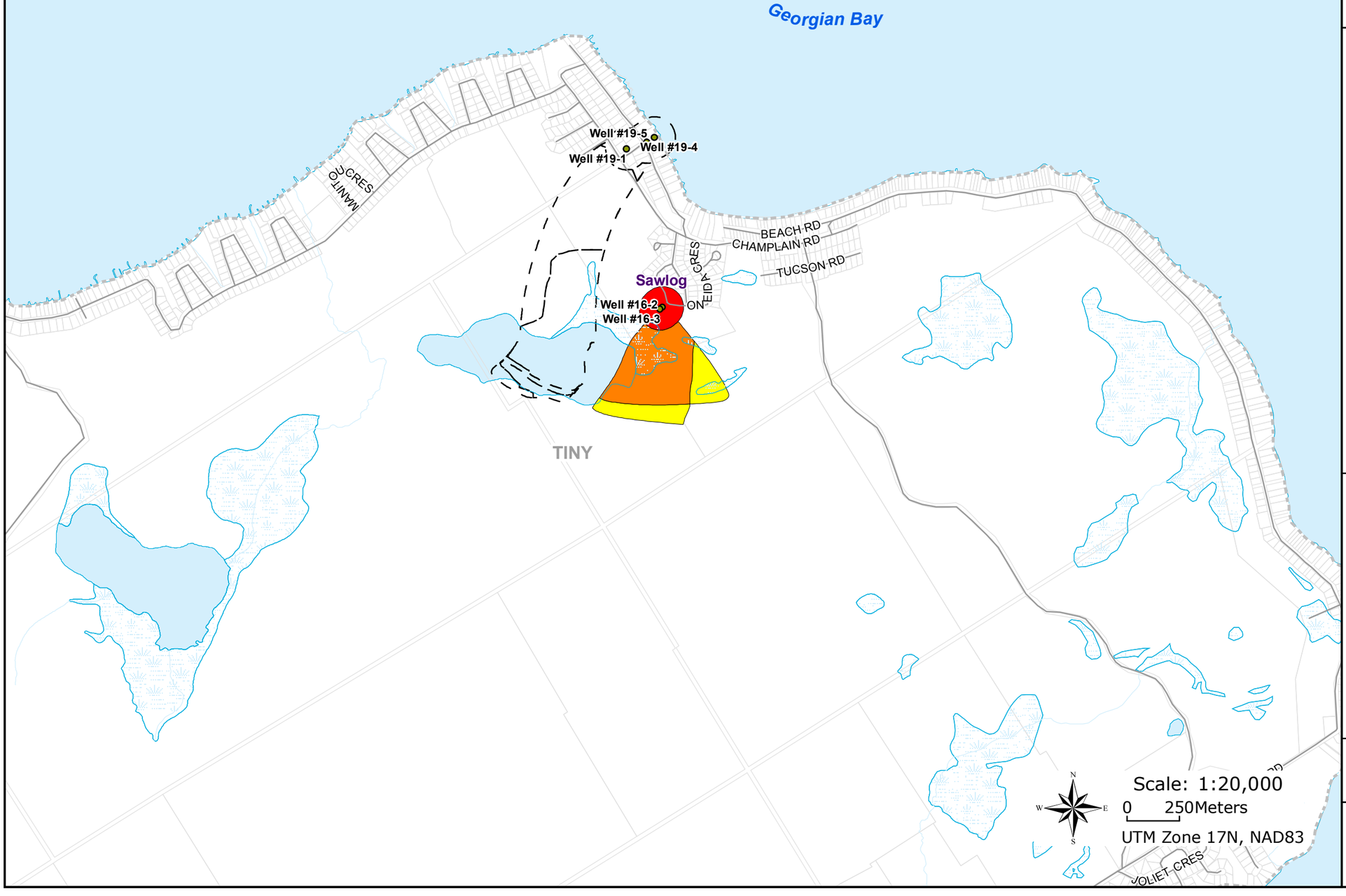
**13I-3**

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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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Sawlog Bay Well 16-2 and 16-3 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SB-3-Chemical Threat Sawlog Bay.mxd
Date: 2009-12-14

Ontario

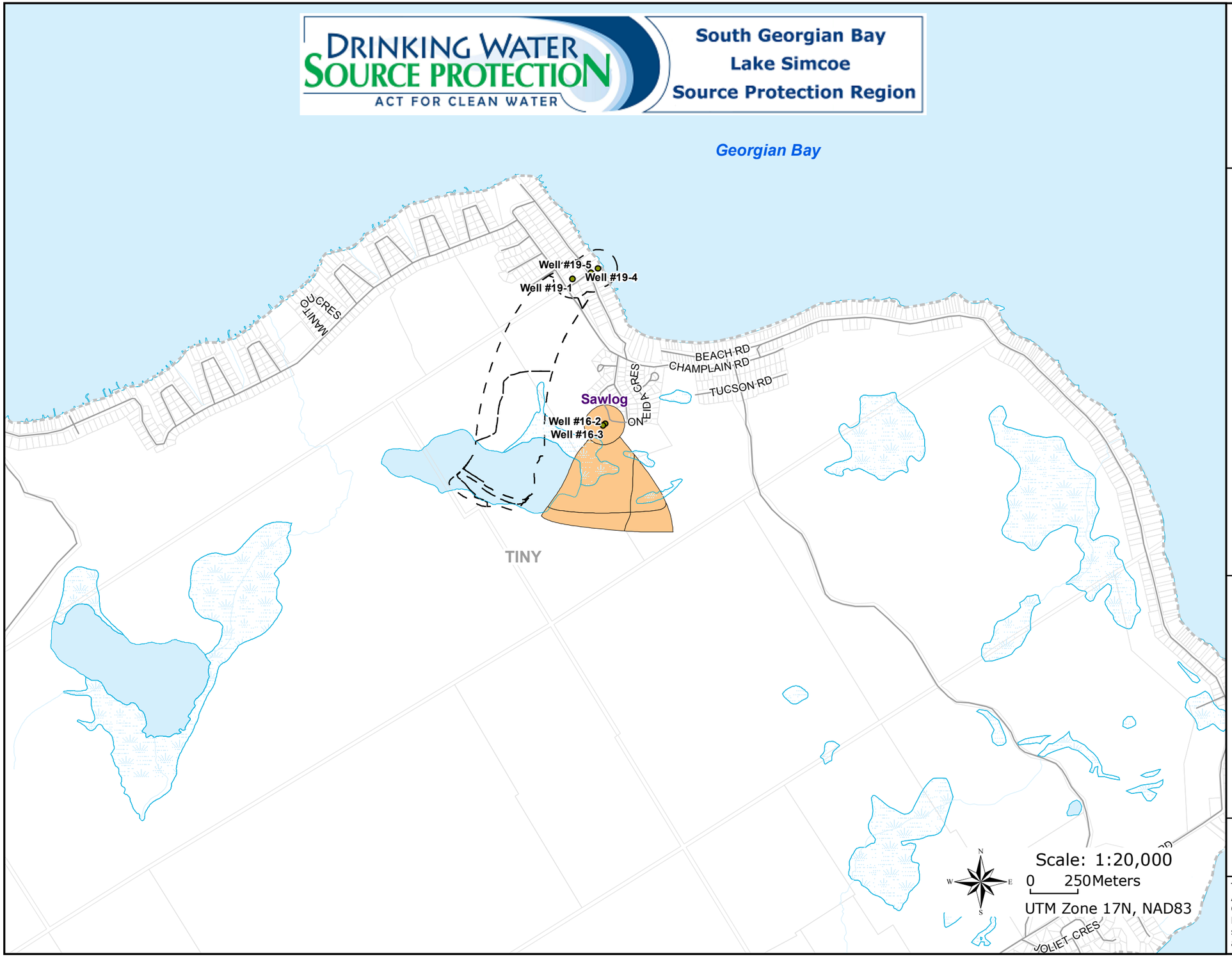
**13I-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Sawlog Bay Well 16-2 and 16-3 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
SB-5-DNAPL Threat Sawlog Bay.mxd
Date: 2010-05-18

Ontario

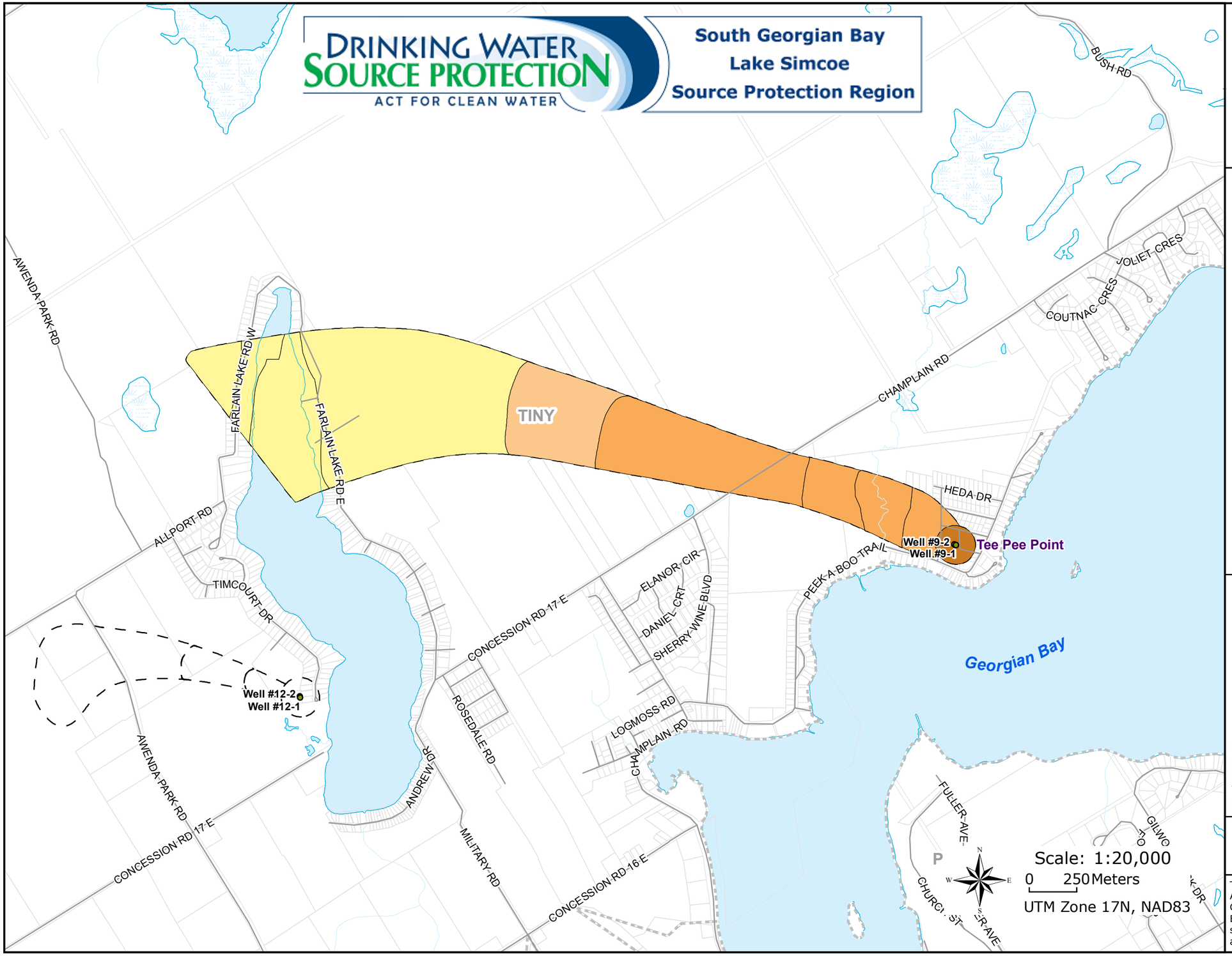
**13I-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tee Pee Point
# Well 9-1 and 9-2
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TP-1-Wellhead Protection Area Tee Pee Point.mxd
Date: 2009-12-14

Ontario

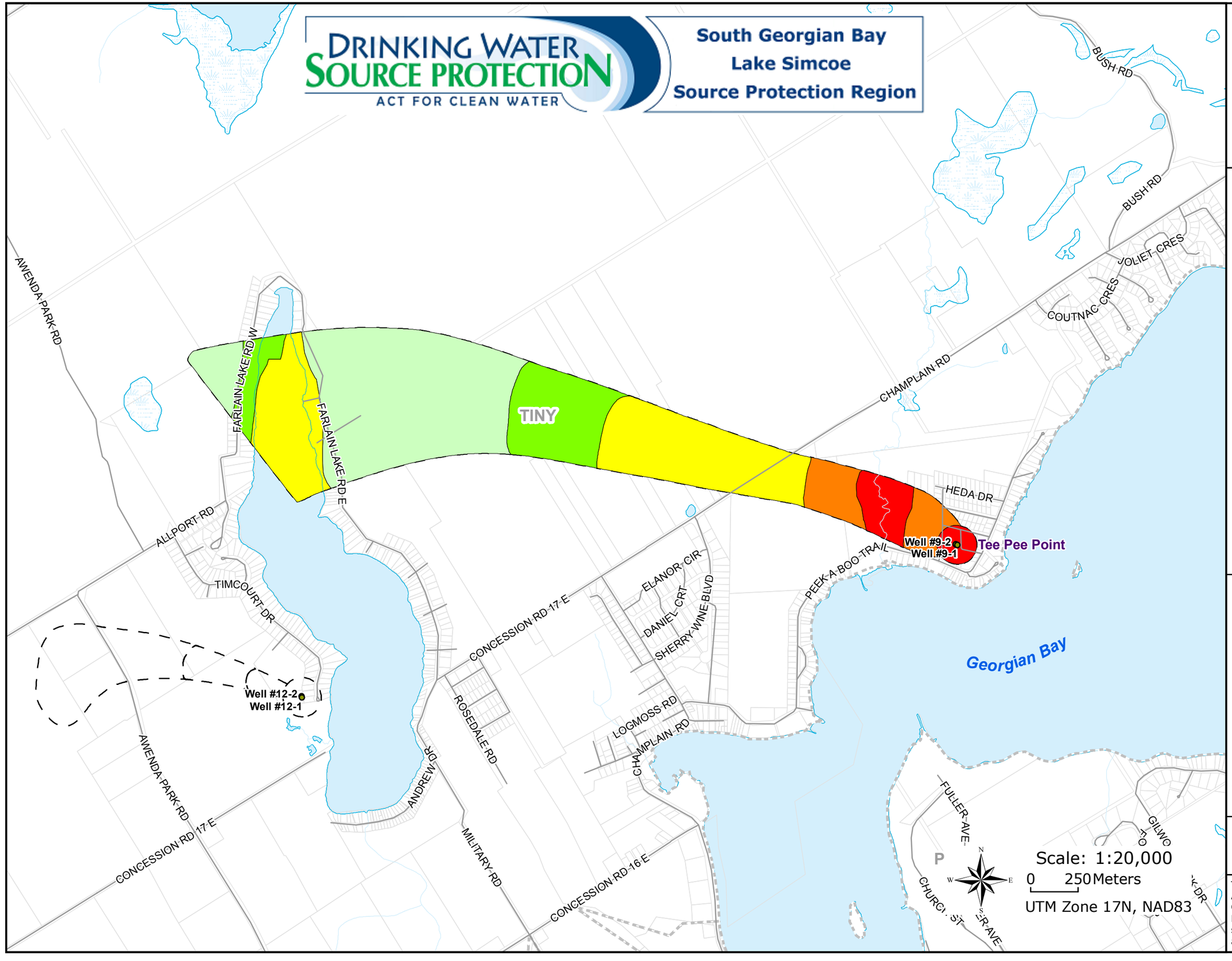
**13m-1**

This map was produced for the Severn Sound Environmental Association 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.

DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tee Pee Point
# Well 9-1 and 9-2
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TP-2-Final Vulnerability Scoring Tee Pee Point.mxd
Date: 2009-12-14

Ontario

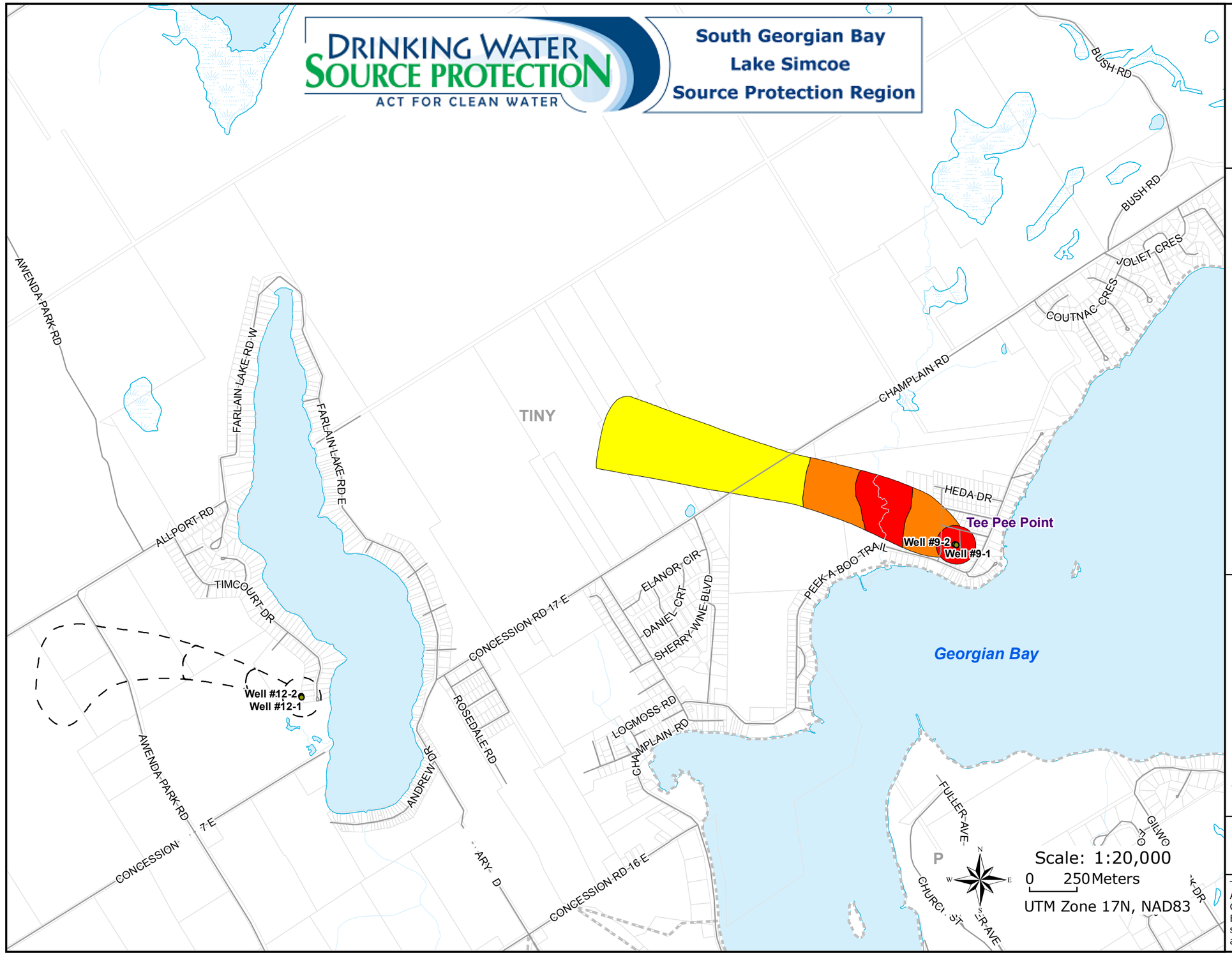
**13m-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tee Pee Point
# Well 9-1 and 9-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TP-4-Pathogen Threat Tee Pee Point.mxd
Date: 2010-05-18

Ontario

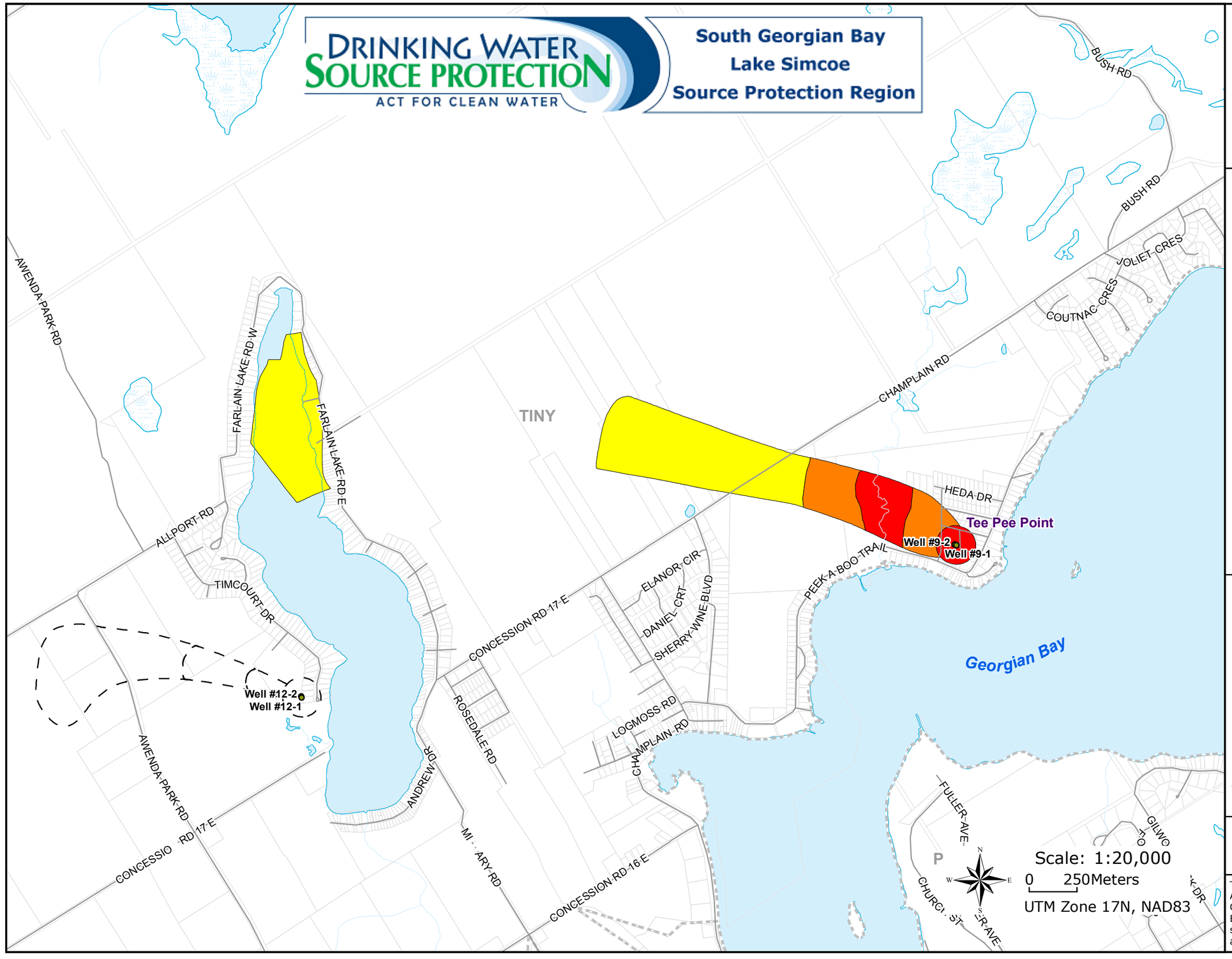
**13m-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tee Pee Point
# Well 9-1 and 9-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Scale: 1:20,000
0 250Meters
UTM Zone 17N, NAD83

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TP-3-Chemical Threat Tee Pee Point.mxd
Date: 2009-12-14

Ontario

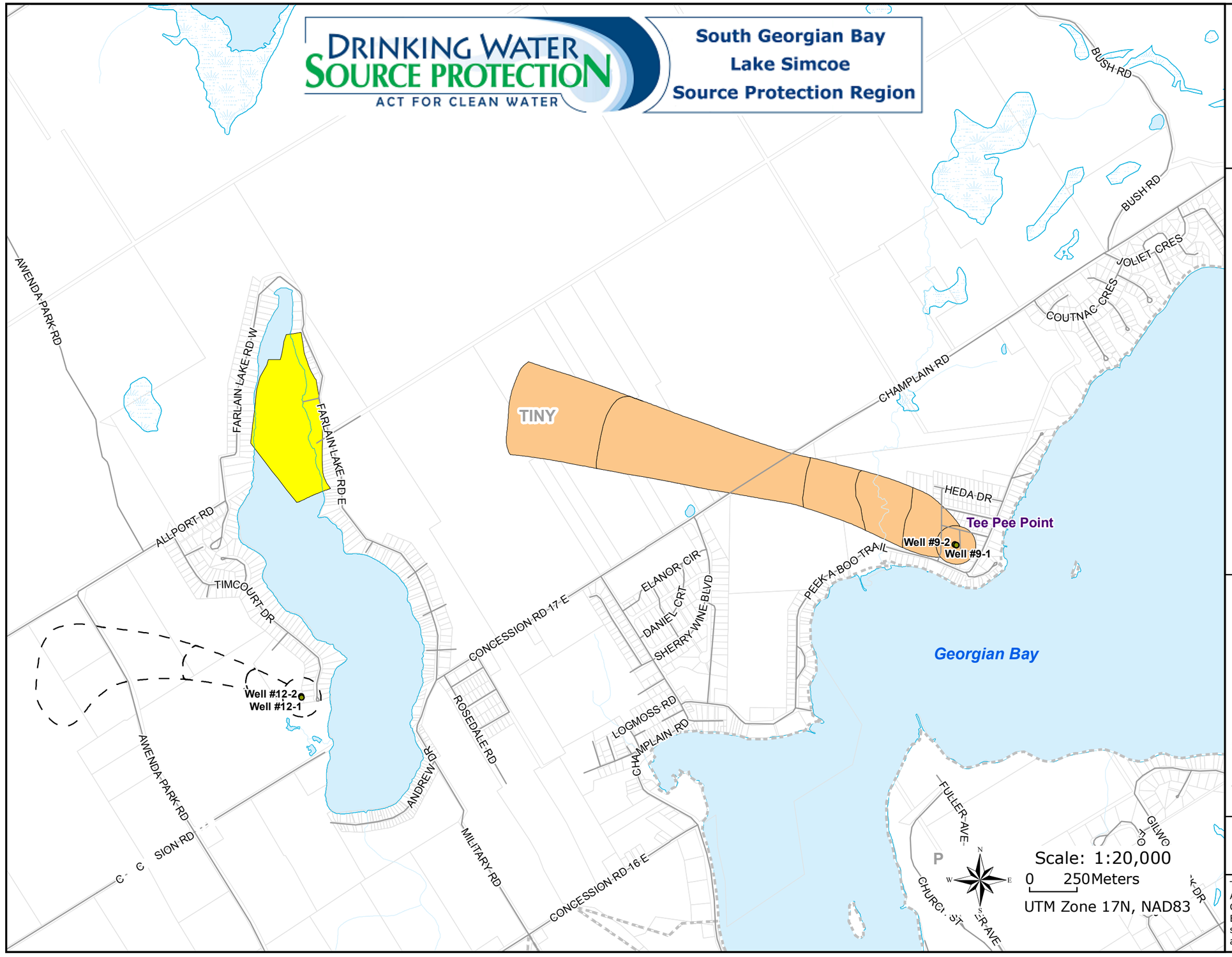
**13m-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tee Pee Point
# Well 9-1 and 9-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TP-5-DNAPL Threat Tee Pee Point.mxd
Date: 2010-05-18

Ontario

**13m-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Thunder Bay
# Well 20-1 and 20-2
# Wellhead Protection Area

Georgian Bay

Well #20-1
Well #20-2
Thunder Bay

TINY

NORTH SHORE DR
WEST SHORE DR
CENTRE BEACH RD
GREEN POINT RD
EAST BEACH RD
SILVER BIRCH DR
DORION RD
HILLCREST RD
CONCESSION RD 19 W
COUNTY 26 RD
CEDAR POINT RD
CONCESSION RD 18 W
THUNDER BEACH RD
COUNTY RD 6
CONCESSION RD 17 E
CONCESSION RD 17 W

- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)

N
W E
S

Scale: 1:20,000
0 250Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TB-1-Wellhead Protection Area Thunderbay.mxd
Date: 2010-05-20

Ontario

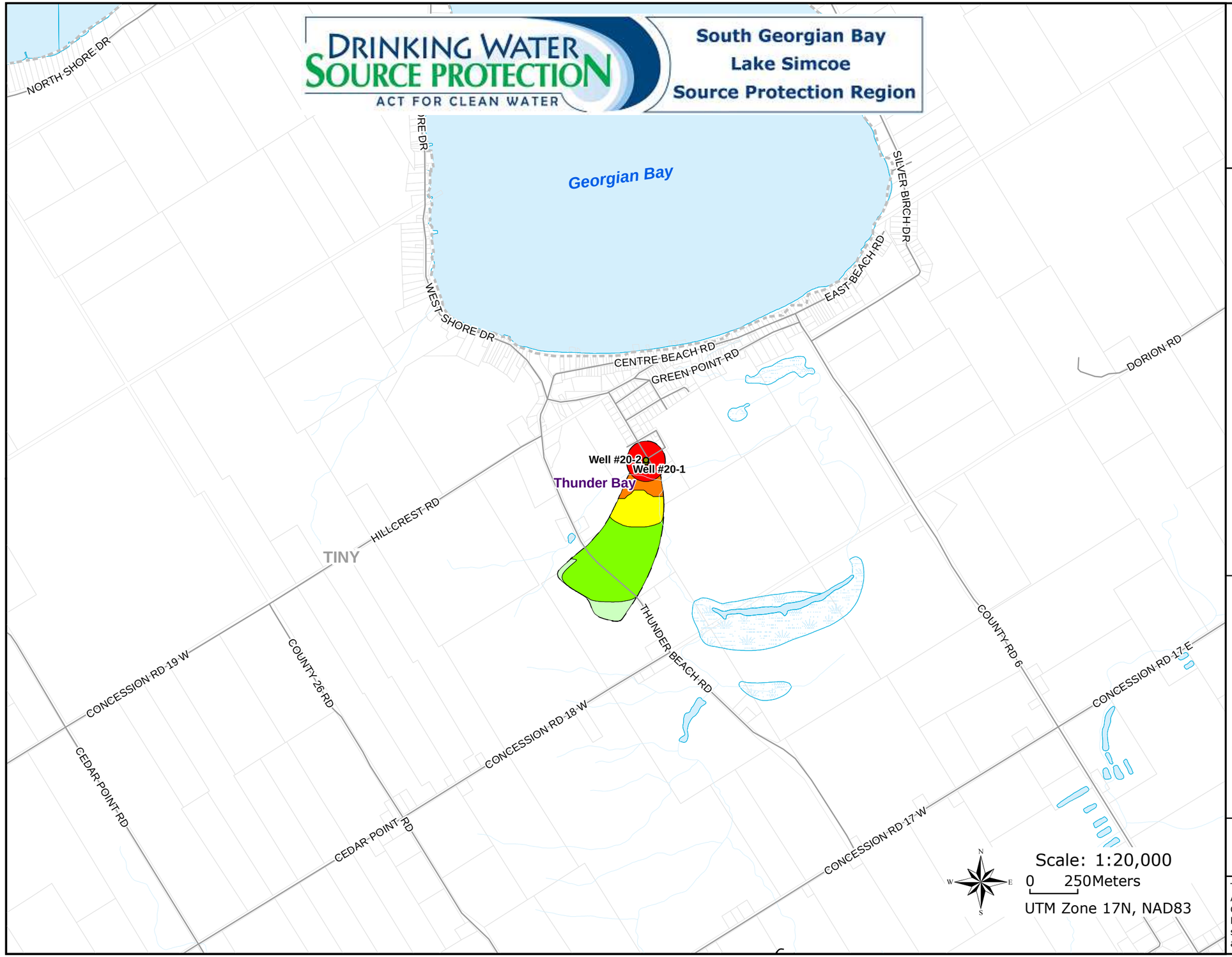
**13n-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Thunder Bay
# Well 20-1 and 20-2
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TB-2-Final Vulnerability Scoring Thunderbay.mxd
Date: 2010-05-20

Ontario

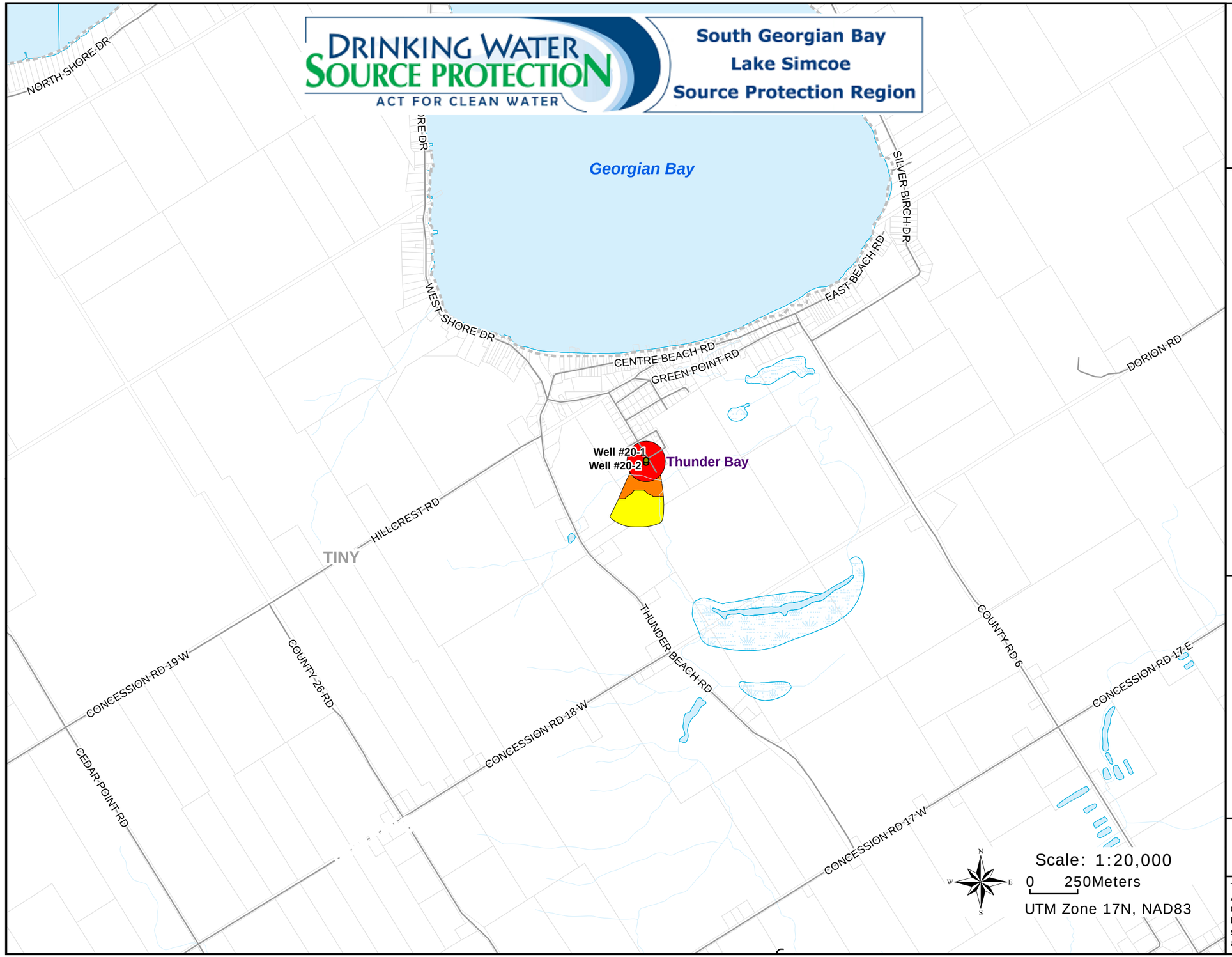
**13n-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Thunder Bay Well 20-1 and 20-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TB-4-Pathogen Threat Thunderbay.mxd
Date: 2010-05-18

Ontario

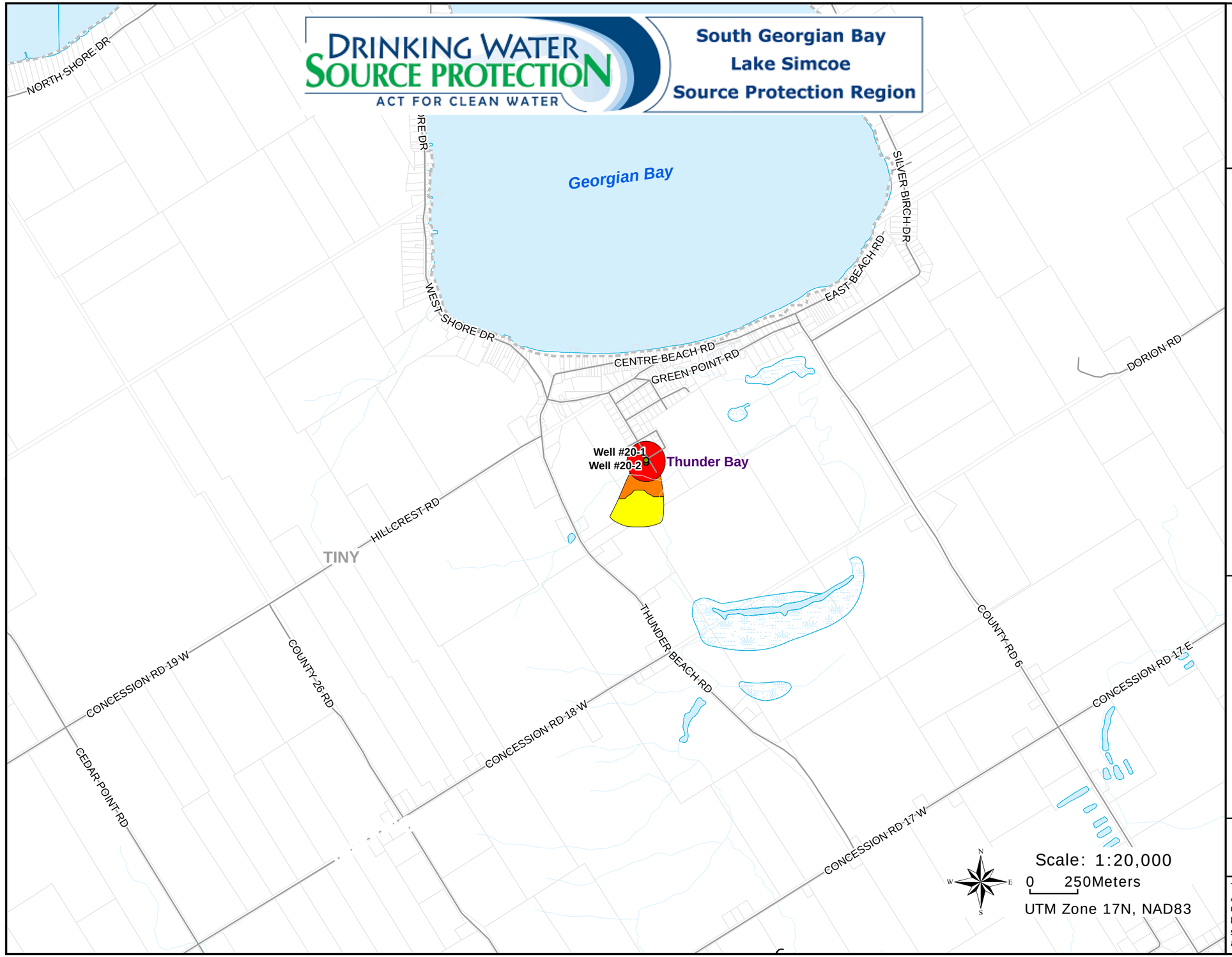
**13n-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Thunder Bay Well 20-1 and 20-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TB-3-Chemical Threat Thunderbay.mxd
Date: 2009-12-14

Ontario

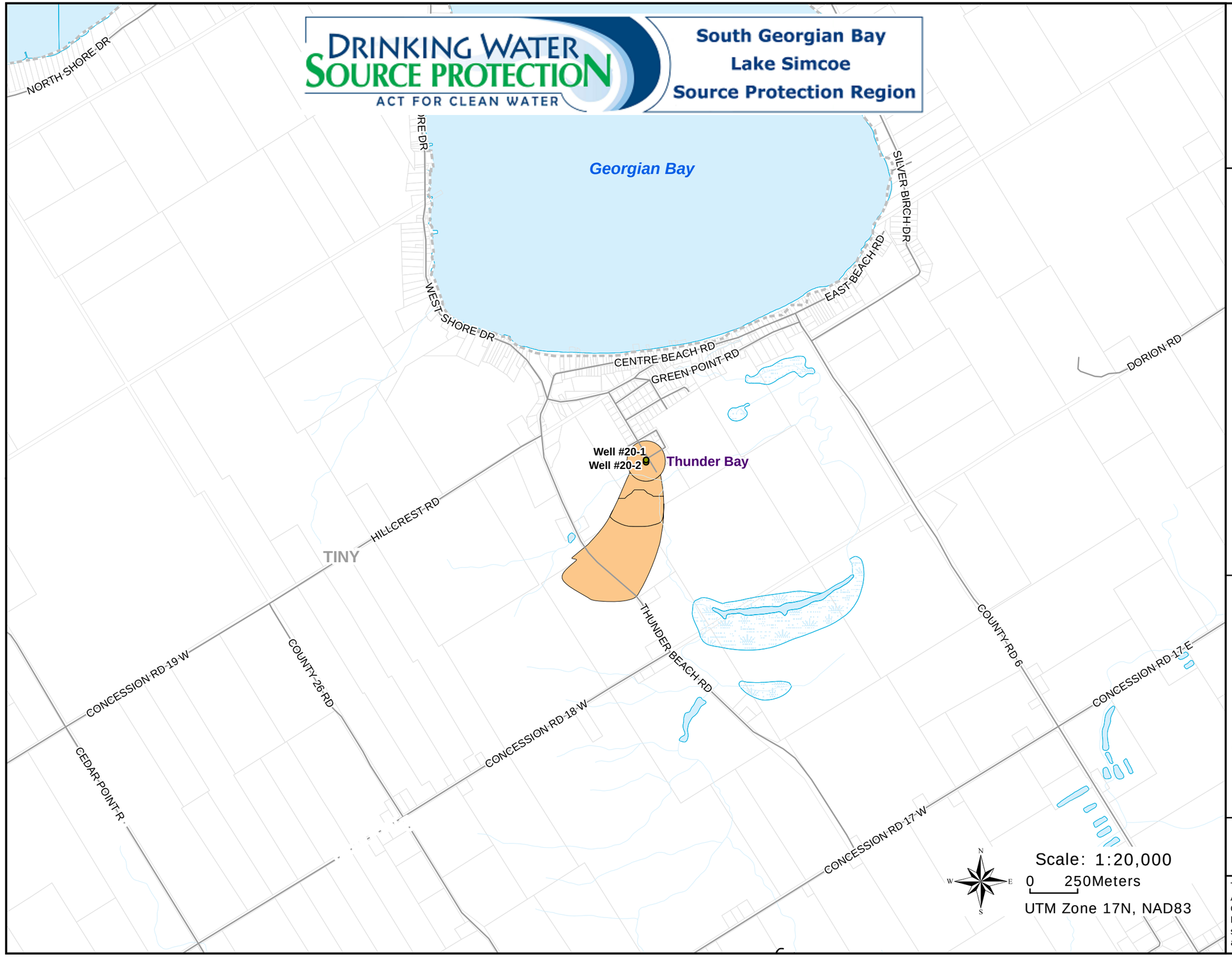
**13n-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Thunder Bay Well 20-1 and 20-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TB-5-DNAPL Threat Thunderbay.mxd
Date: 2010-05-18

Ontario

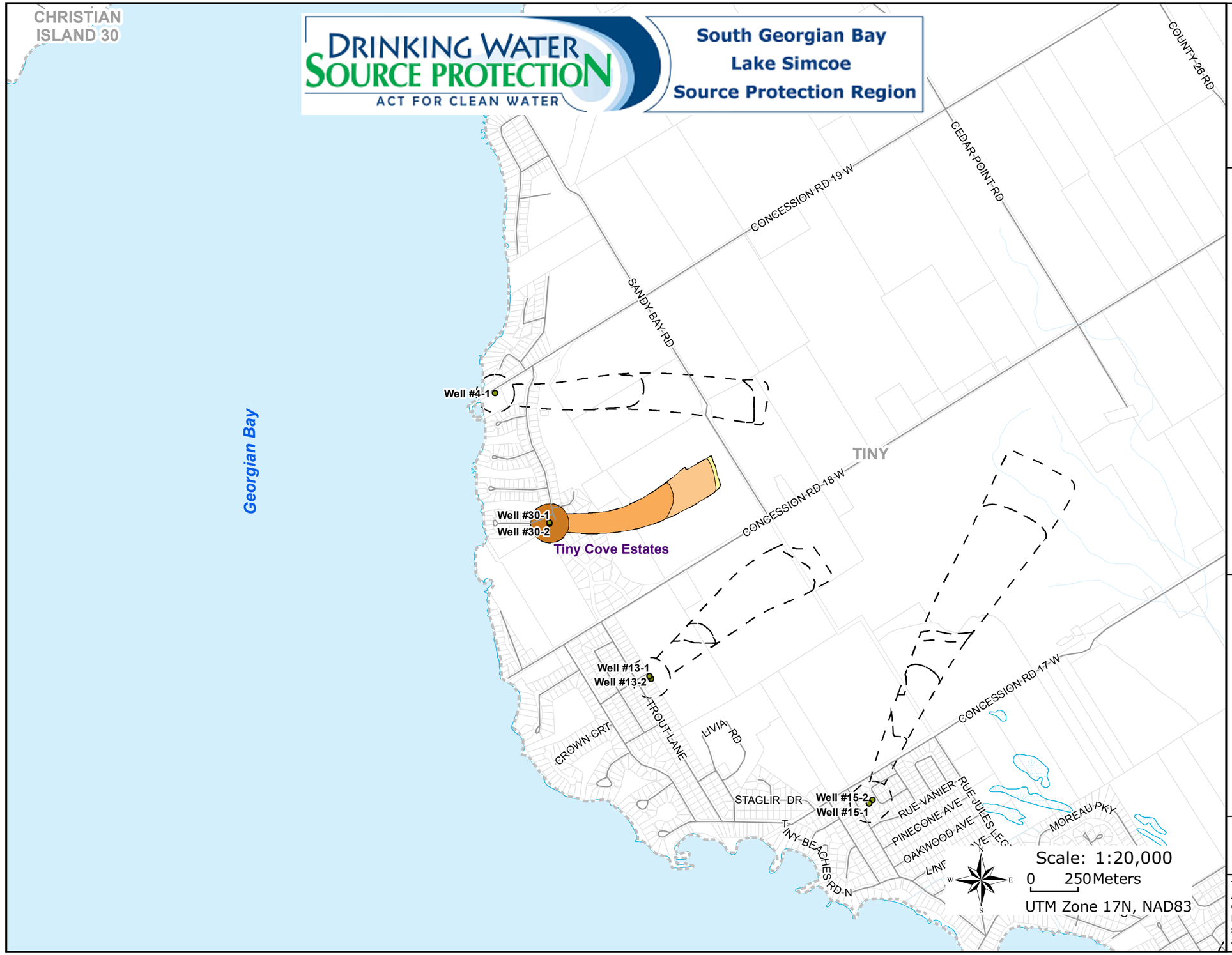
**13n-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tiny Cove Estates
# Well 30-1 and 30-2
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TC-1-Wellhead Protection Area Tiny Cove Estates.mxd
Date: 2009-12-14

Ontario

**13o-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tiny Cove Estates
# Well 30-1 and 30-2
# Final Vulnerability Scoring

CHRISTIAN ISLAND 30

Georgian Bay

Well #4-1

Well #30-1
Well #30-2

Tiny Cove Estates

Well #13-1
Well #13-2

Well #15-2
Well #15-1

TINY

CONCESSION RD 19 W
CEDAR POINT RD
COUNTY 26 RD
SANDY BAY RD
CEDAR POINT RD
CONCESSION RD 18 W
CONCESSION RD 17 W
CROWN CRT
TROUT LANE
LIVIA RD
STAGLIR DR
TINY BEACHES RD N
RUE VANIER
RUE JULES LEC
PINECONE AVE
OAKWOOD AVE
MOREAU PKY

Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TC-2-Final Vulnerability Scoring Tiny Cove Estates.mxd
Date: 2009-12-14

Ontario

**13o-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tiny Cove Estates
# Well 30-1 and 30-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen

CHRISTIAN ISLAND 30

Georgian Bay

TINY

CONCESSION RD 19 W
CONCESSION RD 18 W
CONCESSION RD 17 W
SANDY BAY RD
CEDAR POINT RD
COUNTY 26 RD
CROWN CRT
TROUT LANE
LIVIA RD
STAGLIR DR
TINY BEACHES RD N
RUE VANIER
RUE JULES LEC
PINECONE AVE
OAKWOOD AVE
MOREAU PKY

Well #4-1
Well #30-1
Well #30-2
Tiny Cove Estates
Well #13-1
Well #13-2
Well #15-2
Well #15-1

- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TC-4-Pathogen Threat Tiny Cove Estates.mxd
Date: 2010-05-18

Ontario

**13o-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Tiny Cove Estates
# Well 30-1 and 30-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical

CHRISTIAN ISLAND 30

Georgian Bay

Well #4-1

Well #30-1
Well #30-2
Tiny Cove Estates

Well #13-1
Well #13-2

Well #15-2
Well #15-1

TINY

CONCESSION RD 19 W
CONCESSION RD 18 W
CONCESSION RD 17 W
COUNTY 26 RD
CEDAR POINT RD
SANDY BAY RD
TROUT LANE
CROWN CRT
LIVIA RD
STAGLIR DR
TINY BEACHES RD N
RUE VANIER
RUE JULES LEC
PINECONE AVE
OAKWOOD AVE
MOREAU PKY

Municipal Wells
**Vulnerability Score**
10
8
6
Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250Meters
UTM Zone 17N, NAD83

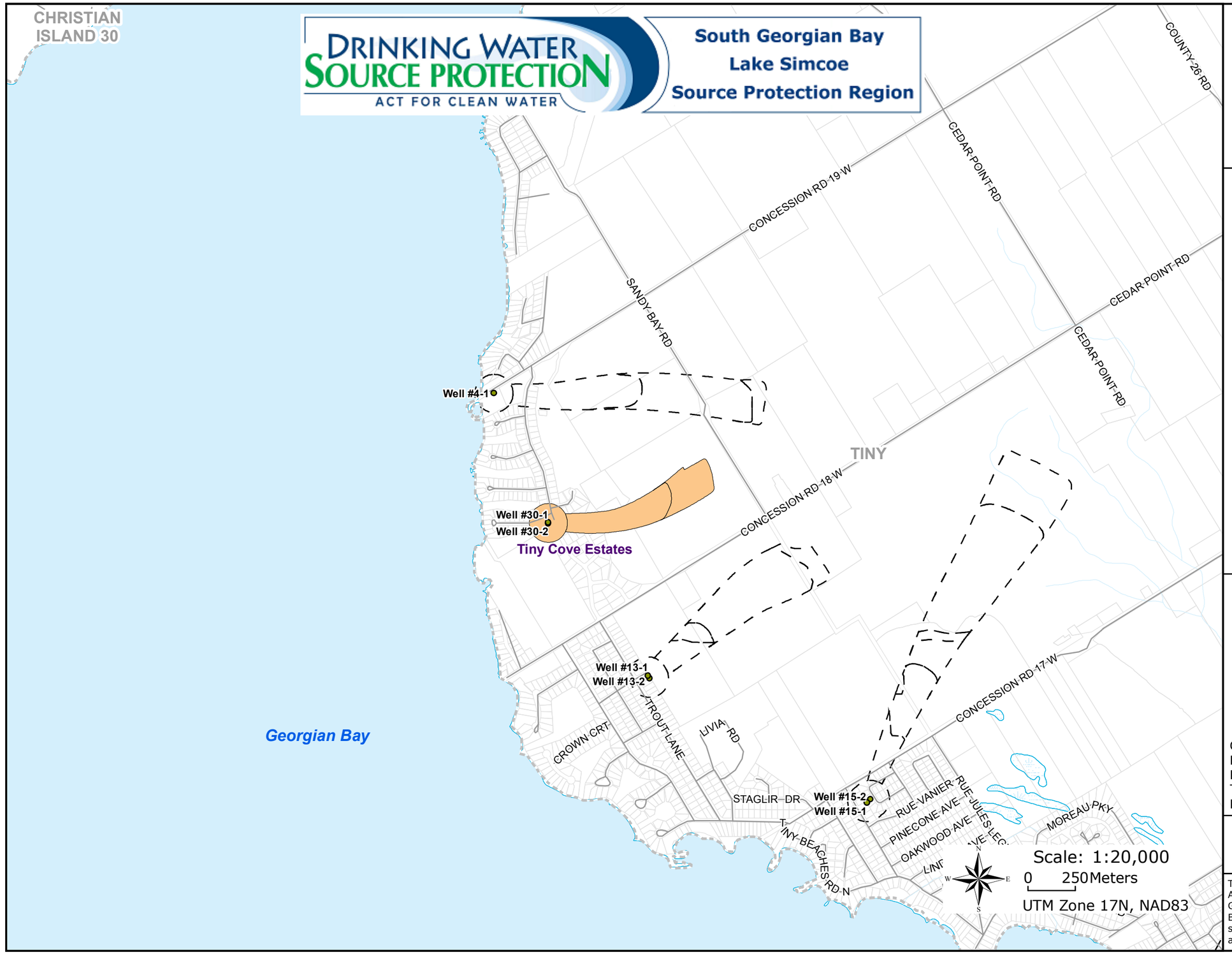
Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TC-3-Chemical Threat Tiny Cove Estates.mxd
Date: 2009-12-14

Ontario

**13o-4**

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# Township of Tiny
# Tiny Cove Estates
# Well 30-1 and 30-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs

- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
TC-5-DNAPL Threat Tiny Cove Estates.mxd
Date: 2010-05-18

Ontario

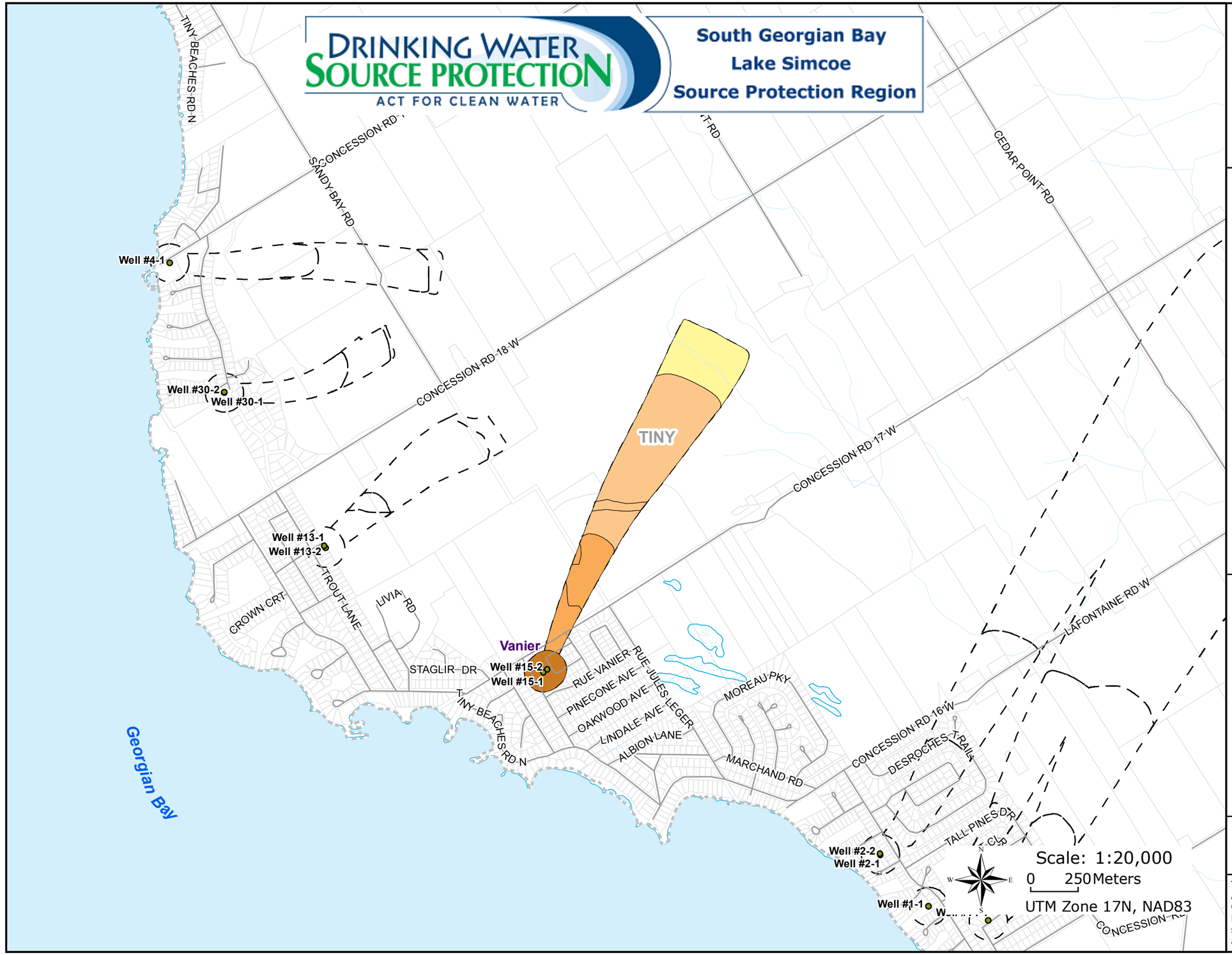
**13o-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Vanier Woods
# Well 15-1 and 15-2
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
VW-1-Wellhead Protection Area Vanier Woods.mxd
Date: 2009-12-14

Ontario

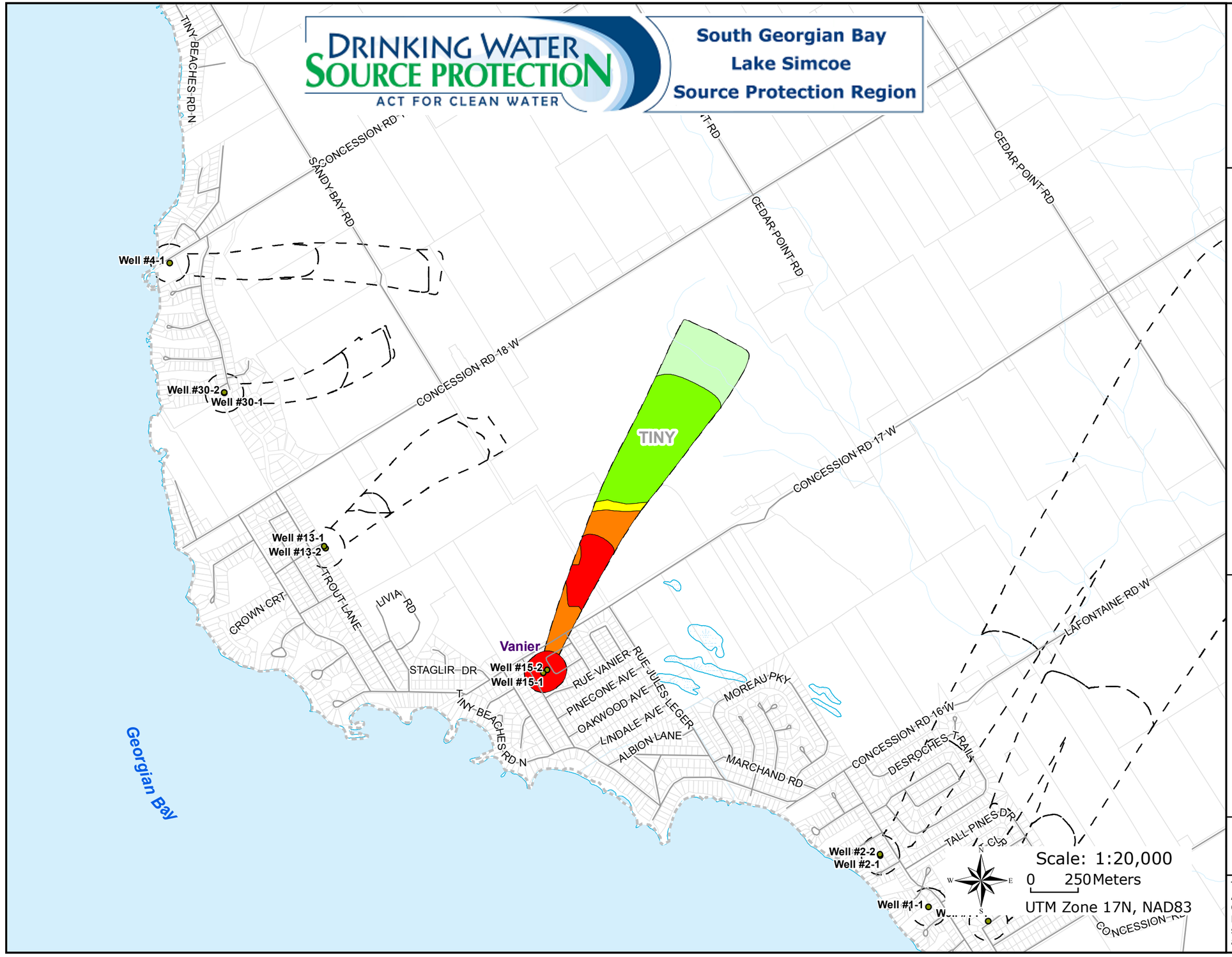
**13p-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Vanier Woods
# Well 15-1 and 15-2
# Final Vulnerability Scoring




Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
VW-2-Final Vulnerability Scoring Vanier Woods.mxd
Date: 2009-12-14

Ontario

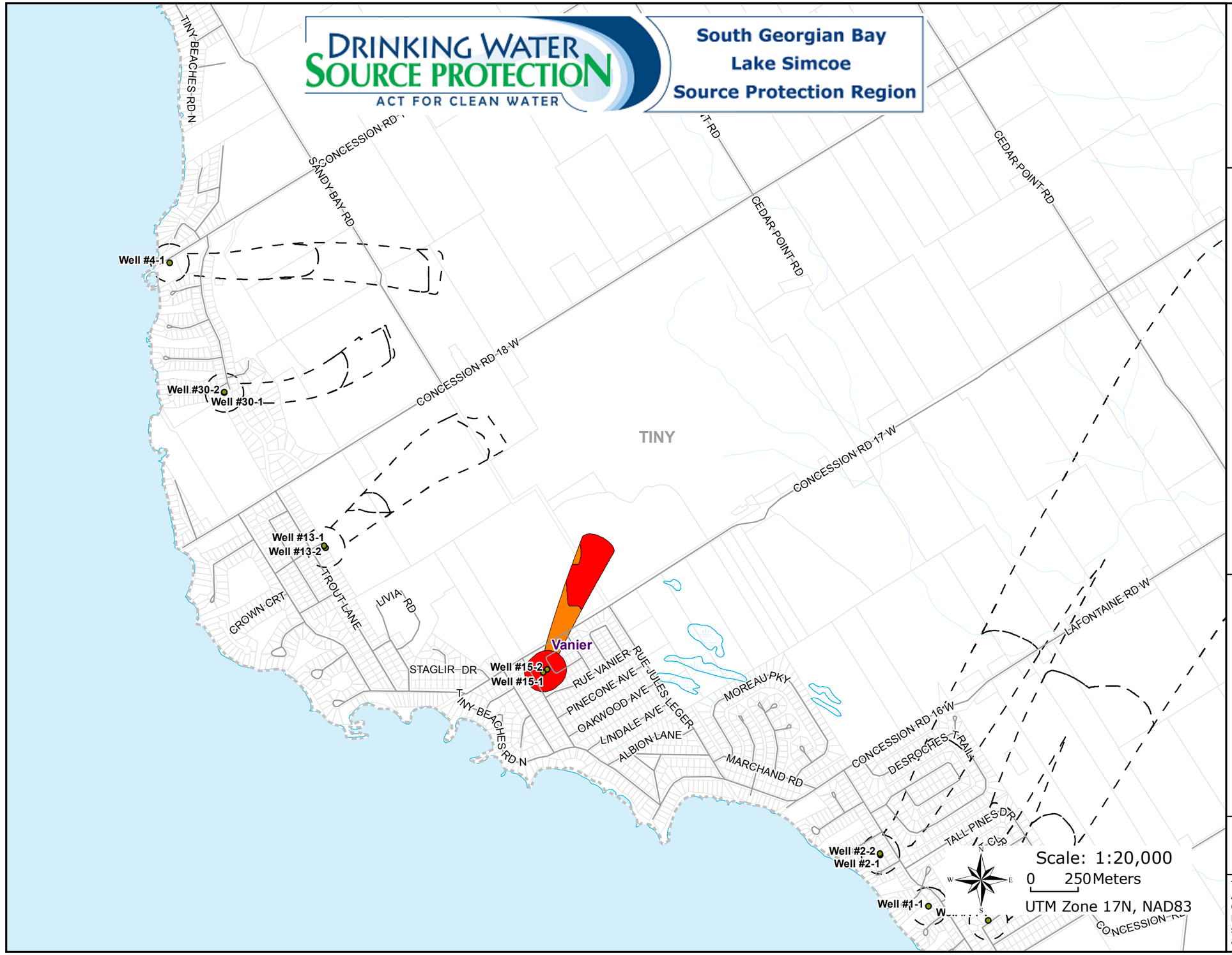
**13p-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Vanier Woods Well 15-1 and 15-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
VW-4-Pathogen Threat Vanier Woods.mxd
Date: 2010-05-18

Ontario

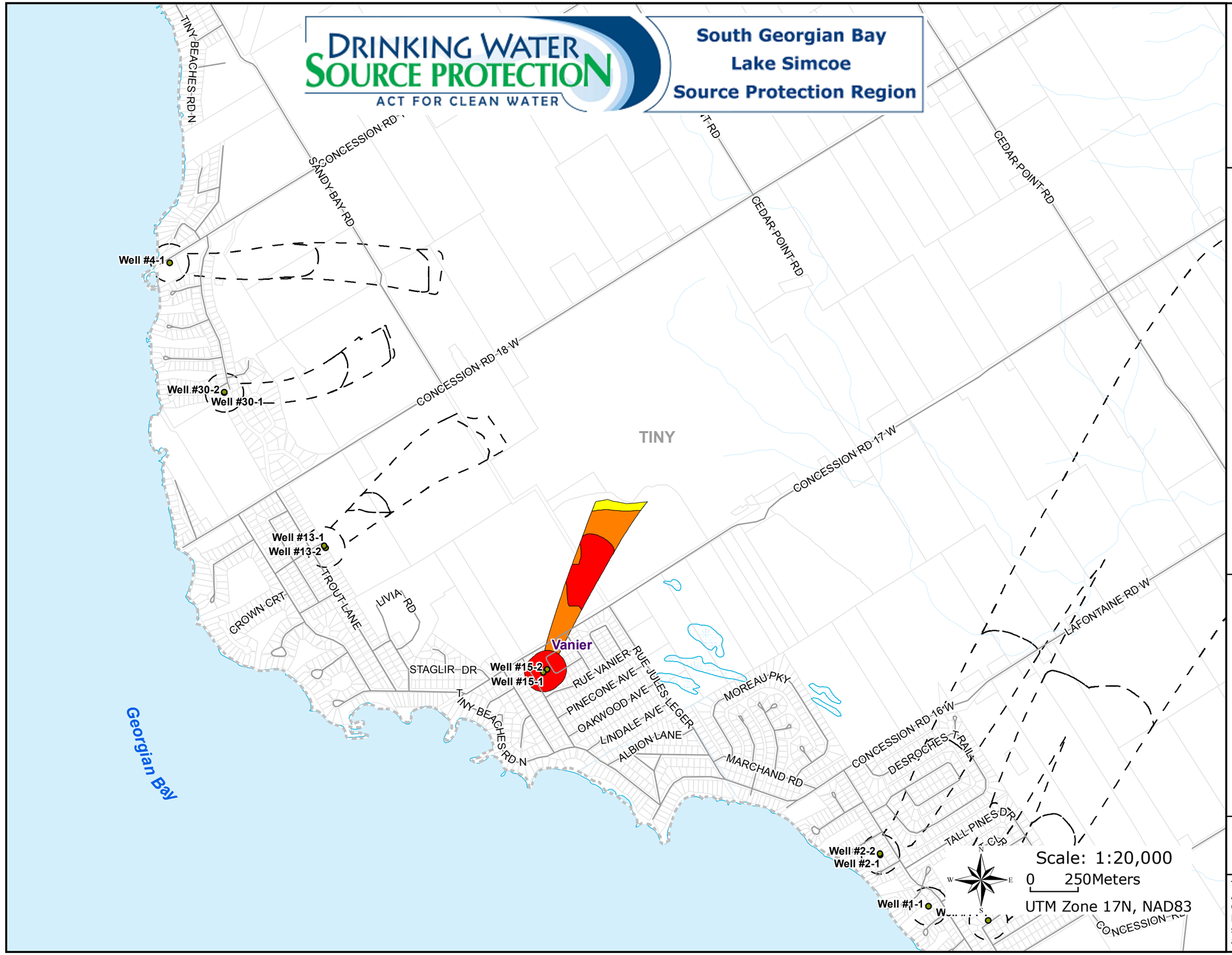
**13p-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Vanier Woods Well 15-1 and 15-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
VW-3-Chemical Threat Vanier Woods.mxd
Date: 2009-12-14

Ontario

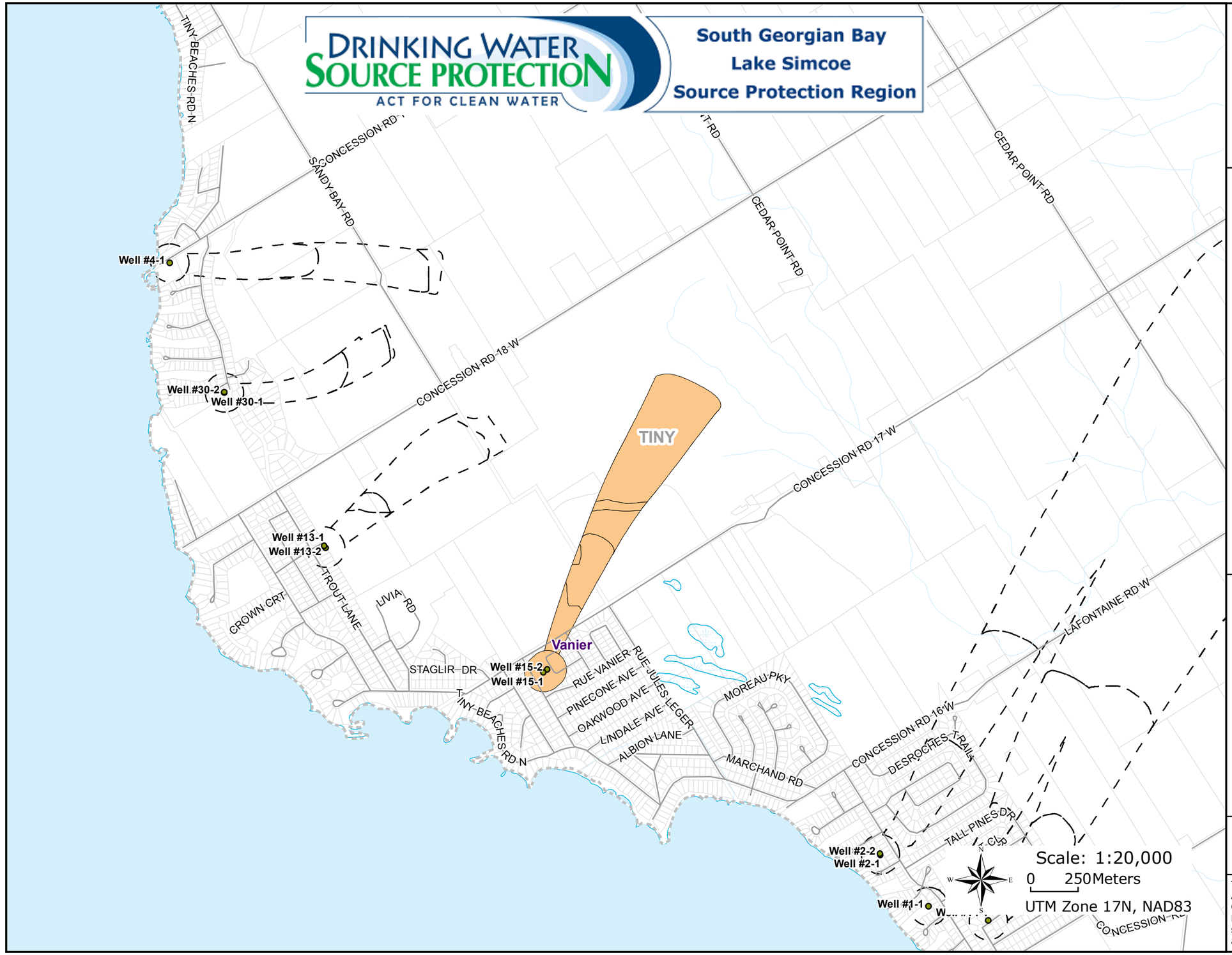
**13p-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Vanier Woods Well 15-1 and 15-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
VW-5-DNAPL Threat Vanier Woods.mxd
Date: 2010-05-18

Ontario

**13p-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Whip-Poor-Will
# Well 21-1 and 21-2
# Wellhead Protection Area

Well #3
Well #21-2
Well #21-1
Whip-Poor-Will
TINY
MIDLAND
SHENE

CONCESSION RD 14 E
CÔTE DE LA DALLE
CONCESSION RD 13 E
TIMBERLAND CRT
COPELAND CREEK L
KINGFISHER CRES
WHIP POORWILL DR
OVERHEAD BRIDGE RD
GOLF LINK RD
PENETANGUISHENE RD
MURRAY RD
VINDIN ST
PAR FOUR DR
WILSON RD
CONCESSION RD 12 E
COUNTY RD 6
CONCESSION RD 12 W
CONCESSION RD 11 E
OLD SCHOOL HOUSE RD
BA
RD S

- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

N
W E
S

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WW-1-Wellhead Protection Area Whip-Poor-Will.mxd
Date: 2009-12-14

Ontario

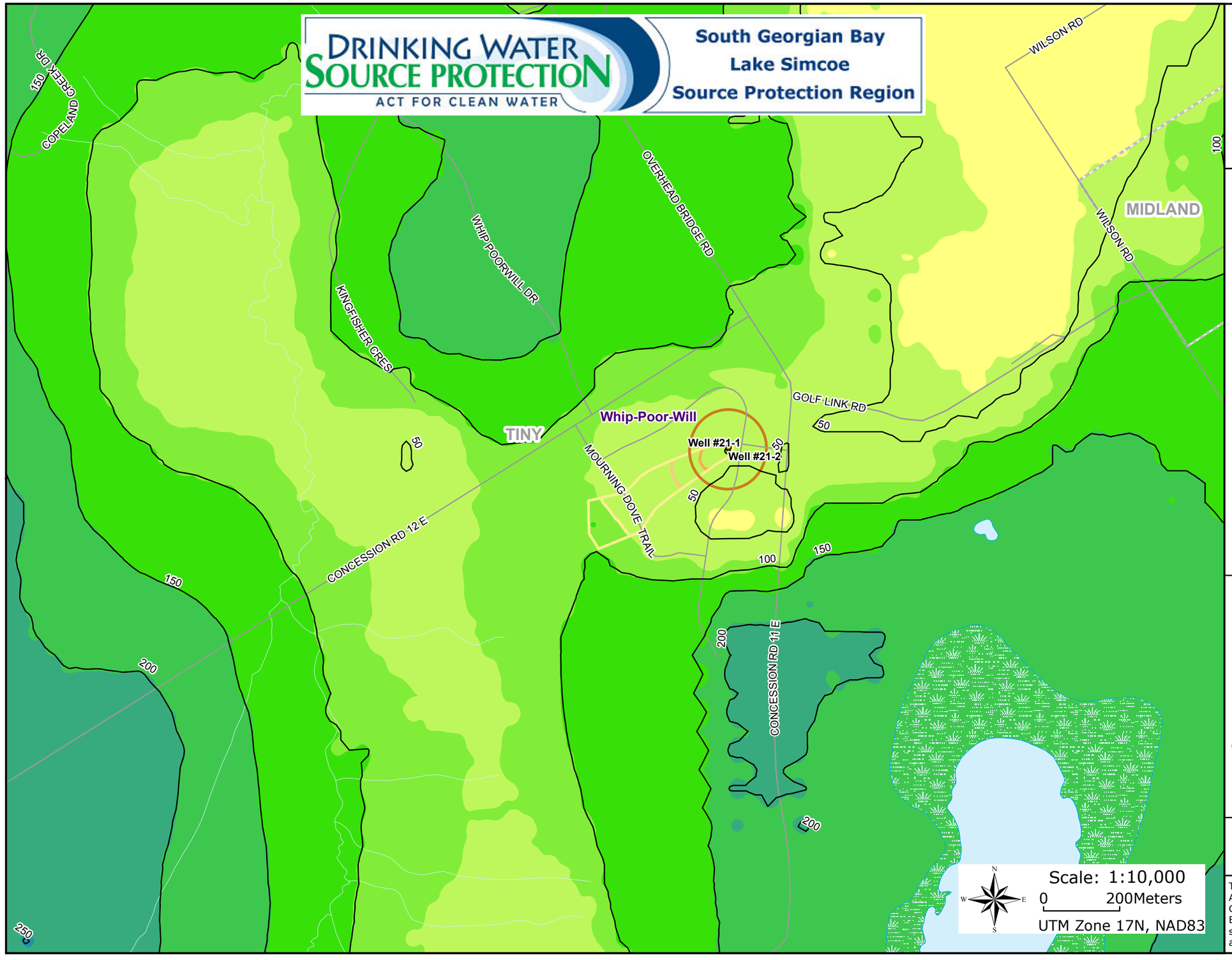
**13q-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Model Calculated AVI
# To Top of Model Layer 4
# (Aquifer A2
# Midland-Penetanguishene
# Model Domain)




Municipal Well
Contour (50 AVI)

**Model Calculated Aquifer Vulnerability Index**
- 0 - 30
- 31 - 80
- 81 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 300
- 301 - 350
- 351 - 400
- 401 - 450

**WHPA TOT**
- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)

Principal Highway
Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Municipal Boundary

Notes:
Low Vulnerability (AVI > 80)
Medium Vulnerability (AVI 30 to 80)
High Vulnerability (AVI < 30)

Figure illustrates only AVI score for WHPAs corresponding to this model layer

Scale: 1:10,000
0 200Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
Fig_A-7_Topof4Whip-poor-will.mxd
Date: 2009-12-23

Ontario

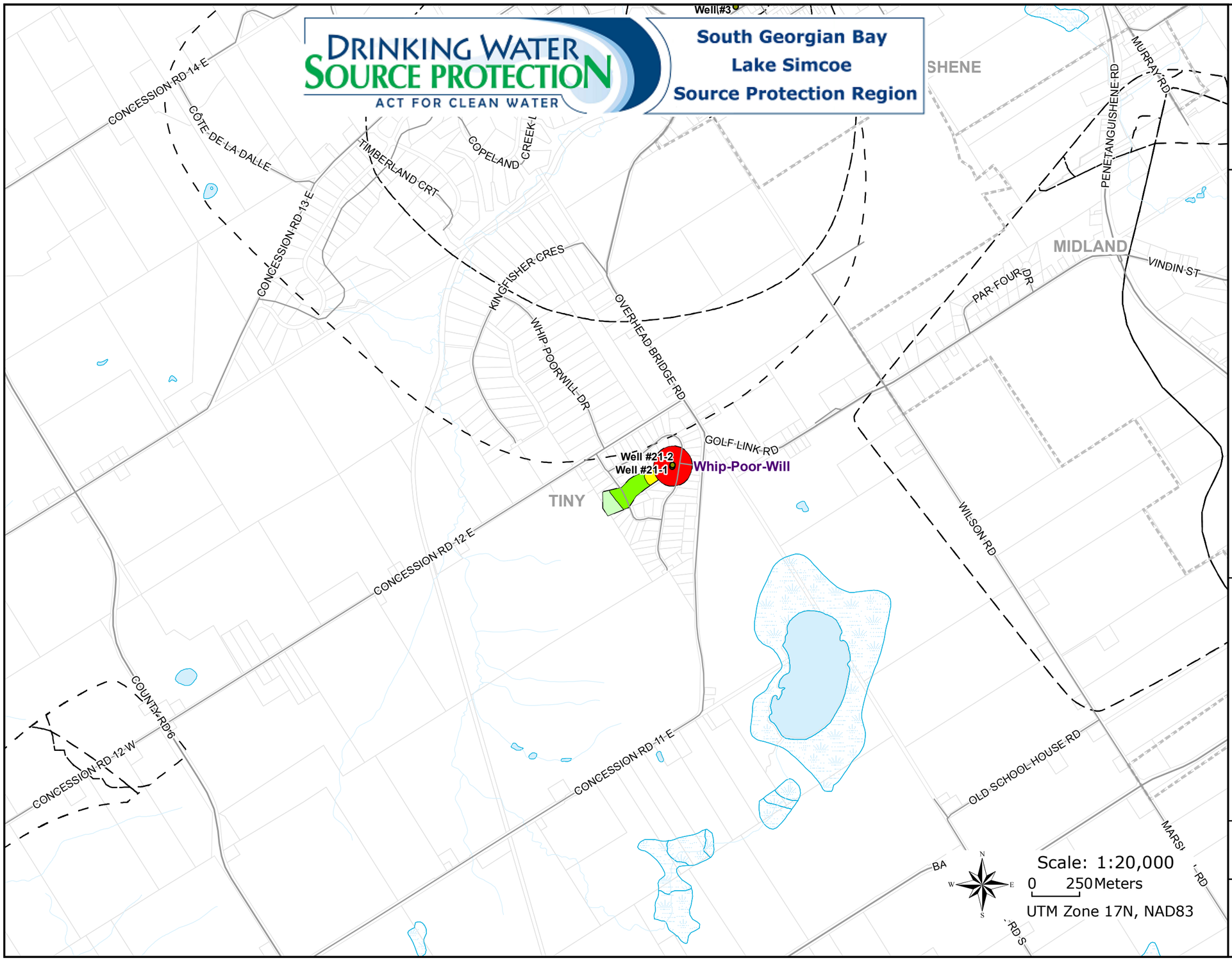
**13q-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Whip-Poor-Will
# Well 21-1 and 21-2
# Final Vulnerability Scoring




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

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Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WW-2-Final Vulnerability Scoring Whip-Poor-Will.mxd
Date: 2009-12-14

Ontario

**13q-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Whip-Poor-Will Well 21-1 and 21-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WW-4-Pathogen Threat Whip-Poor-Will.mxd
Date: 2010-05-18

Ontario

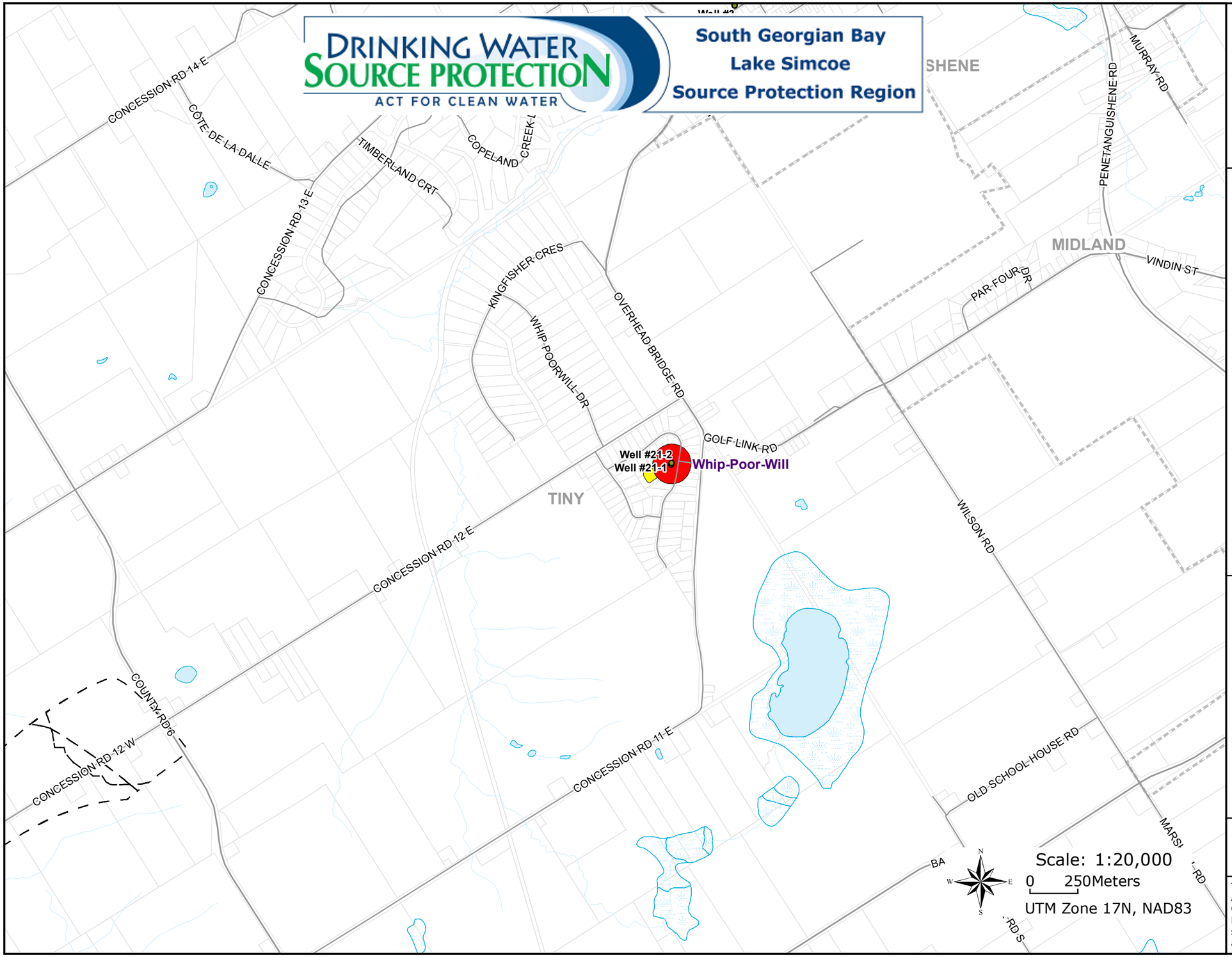
**13q-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Whip-Poor-Will Well 21-1 and 21-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WW-3-Chemical Threat Whip-Poor-Will.mxd
Date: 2009-12-14

Ontario

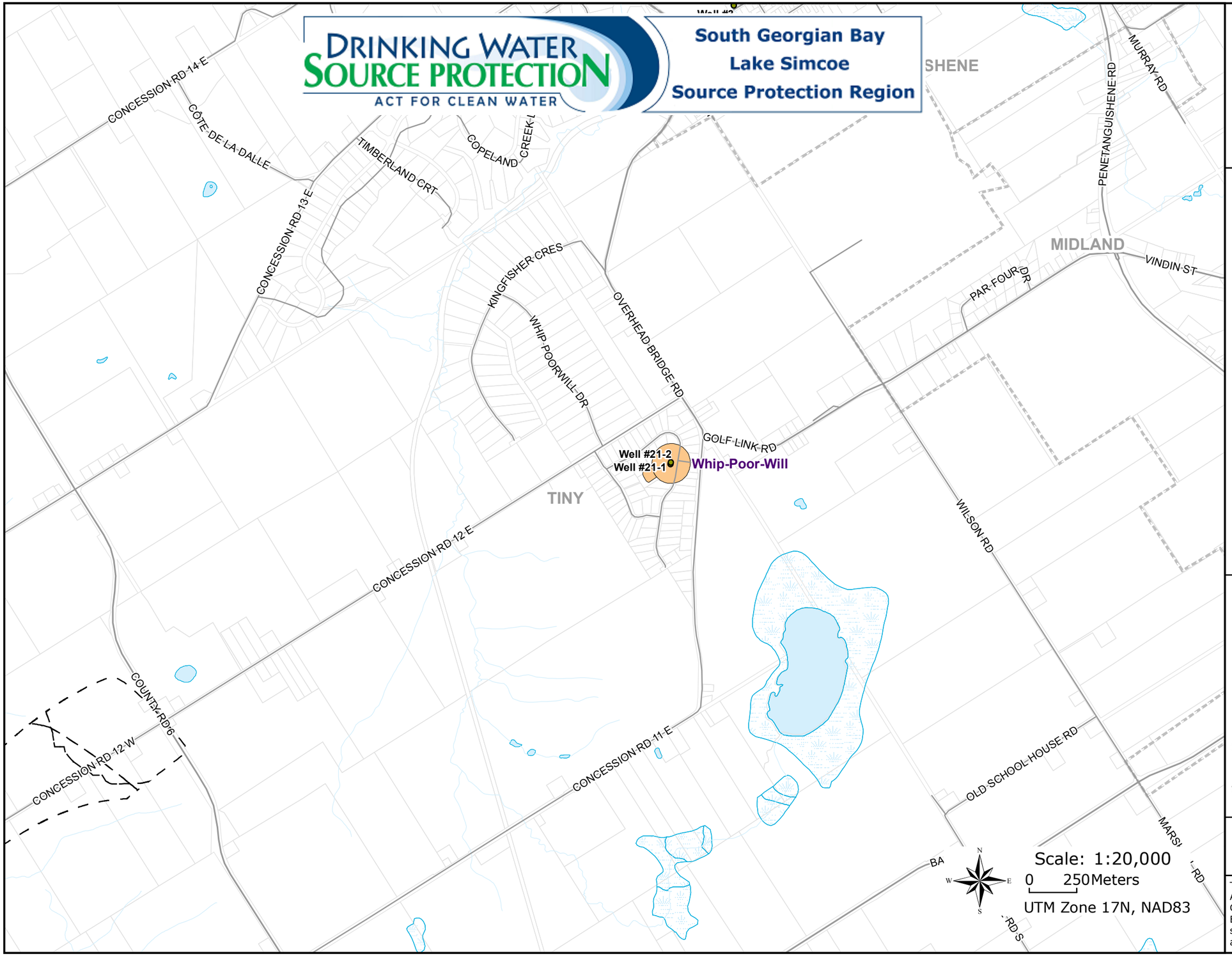
**13q-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Whip-Poor-Will Well 21-1 and 21-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WW-5-DNAPL Threat Whip-Poor-Will.mxd
Date: 2010-05-18

Ontario

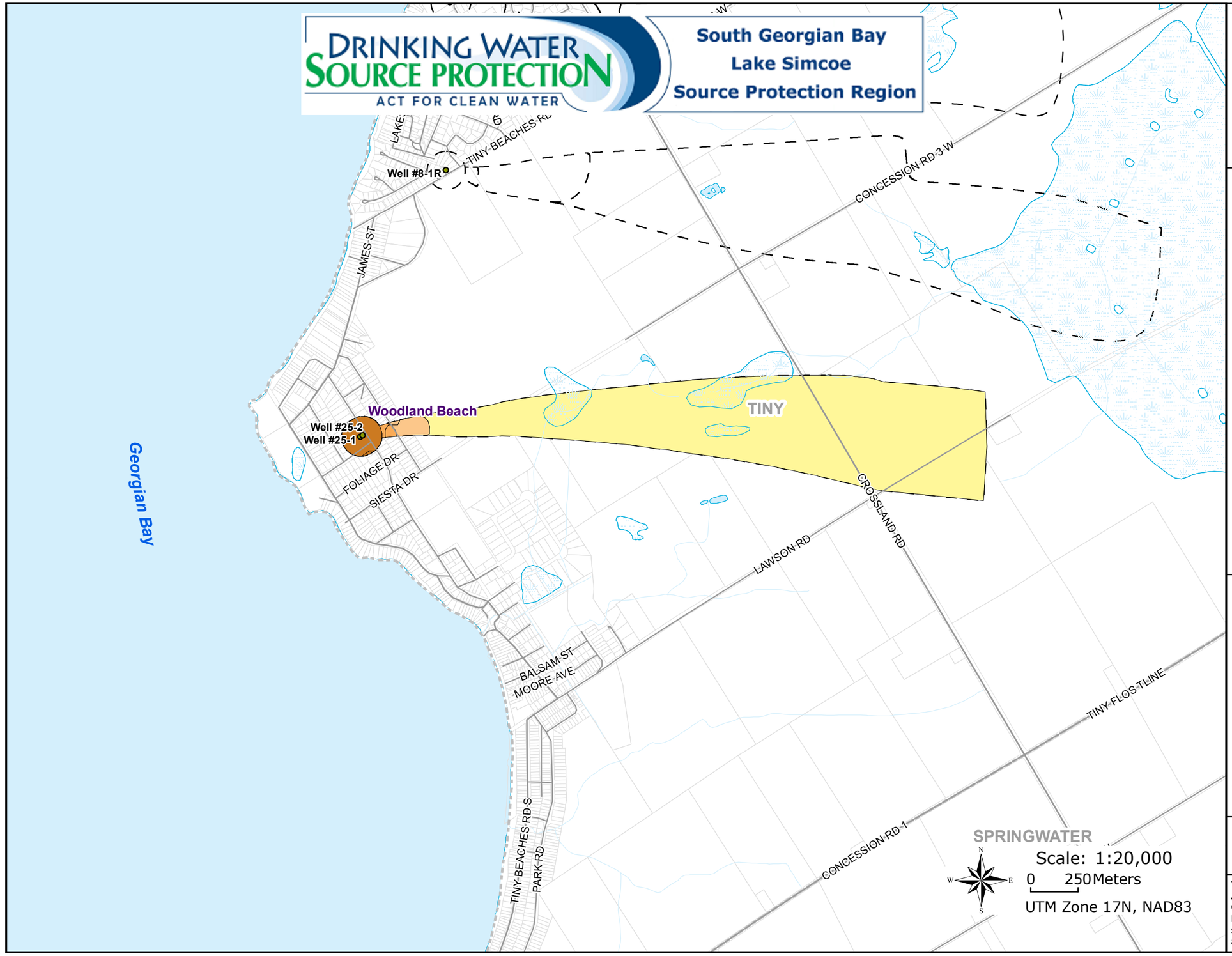
**13q-6**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Woodland Beach
# Well 25-1 and 25-2
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WB-1-Wellhead Protection Area Woodland Beach.mxd
Date: 2009-12-14

Ontario

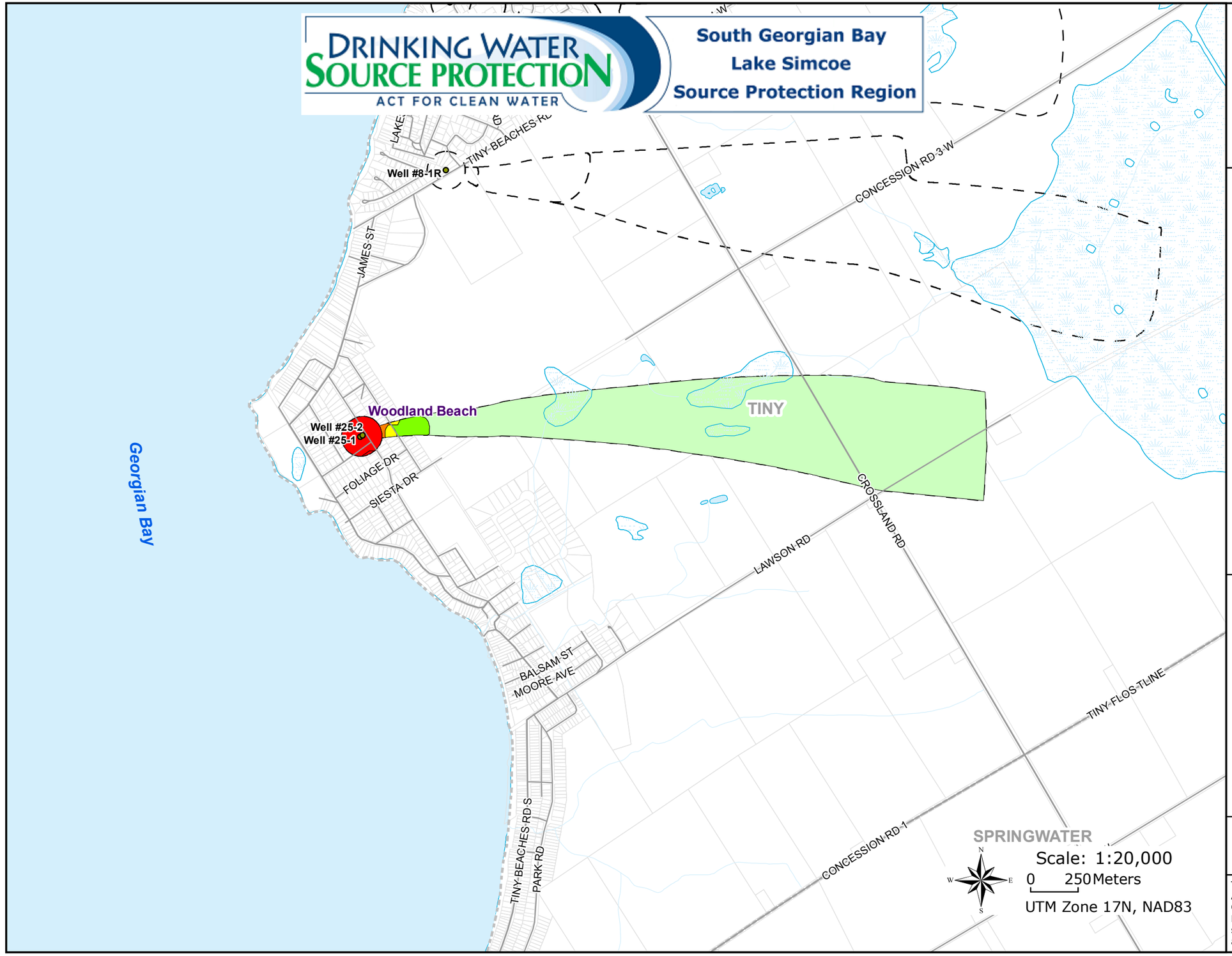
**13r-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Woodland Beach
# Well 25-1 and 25-2
# Final Vulnerability Scoring




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WB-2-Final Vulnerability Scoring Woodland Beach.mxd
Date: 2009-12-14

Ontario

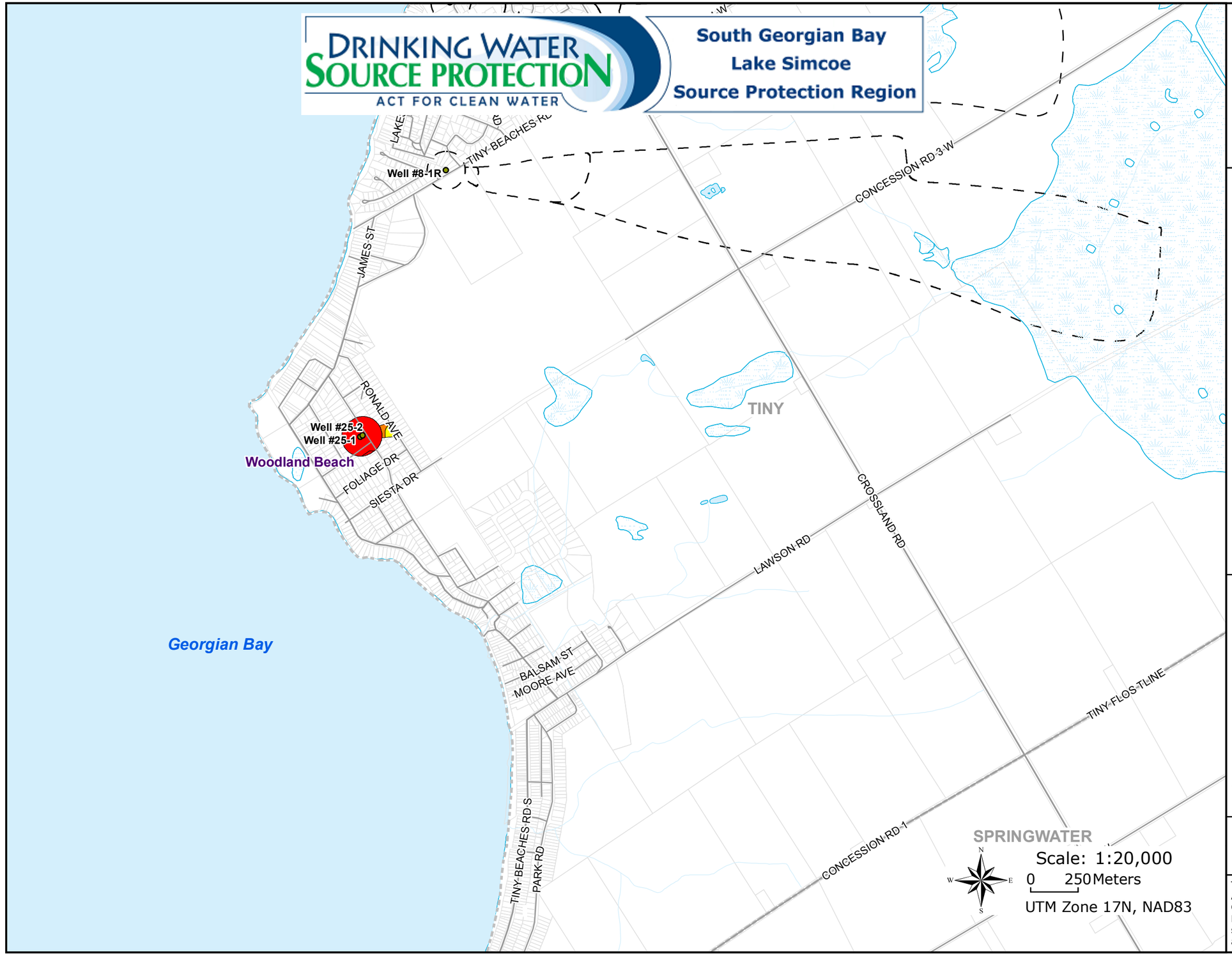
**13r-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Woodland Beach Well 25-1 and 25-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WB-4-Pathogen Threat Woodland Beach.mxd
Date: 2010-05-18

Ontario

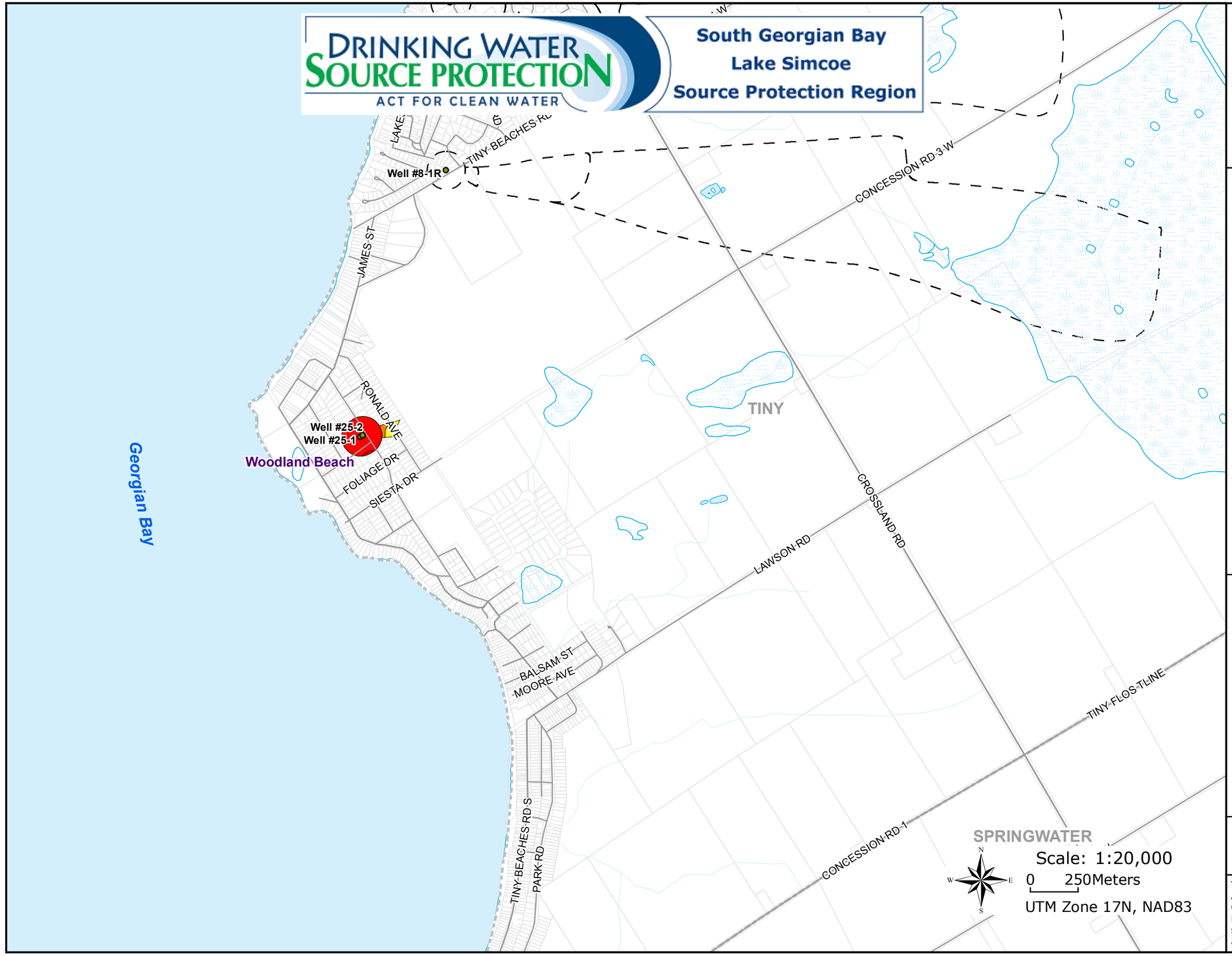
**13r-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Woodland Beach Well 25-1 and 25-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WB-3-Chemical Threat Woodland Beach.mxd
Date: 2009-12-14

Ontario

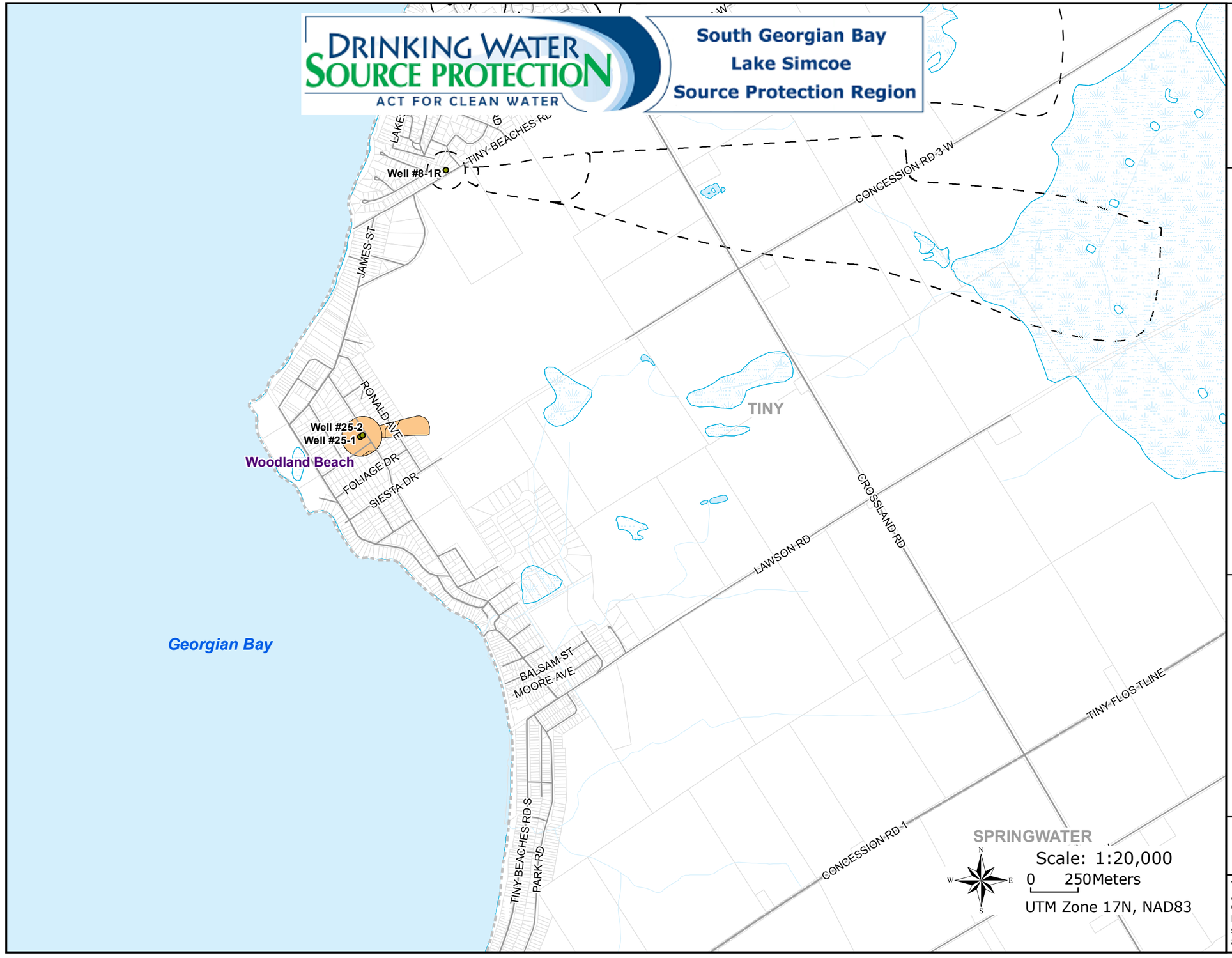
**13r-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny Woodland Beach Well 25-1 and 25-2 Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WB-5-DNAPL Threat Woodland Beach.mxd
Date: 2010-05-18

Ontario

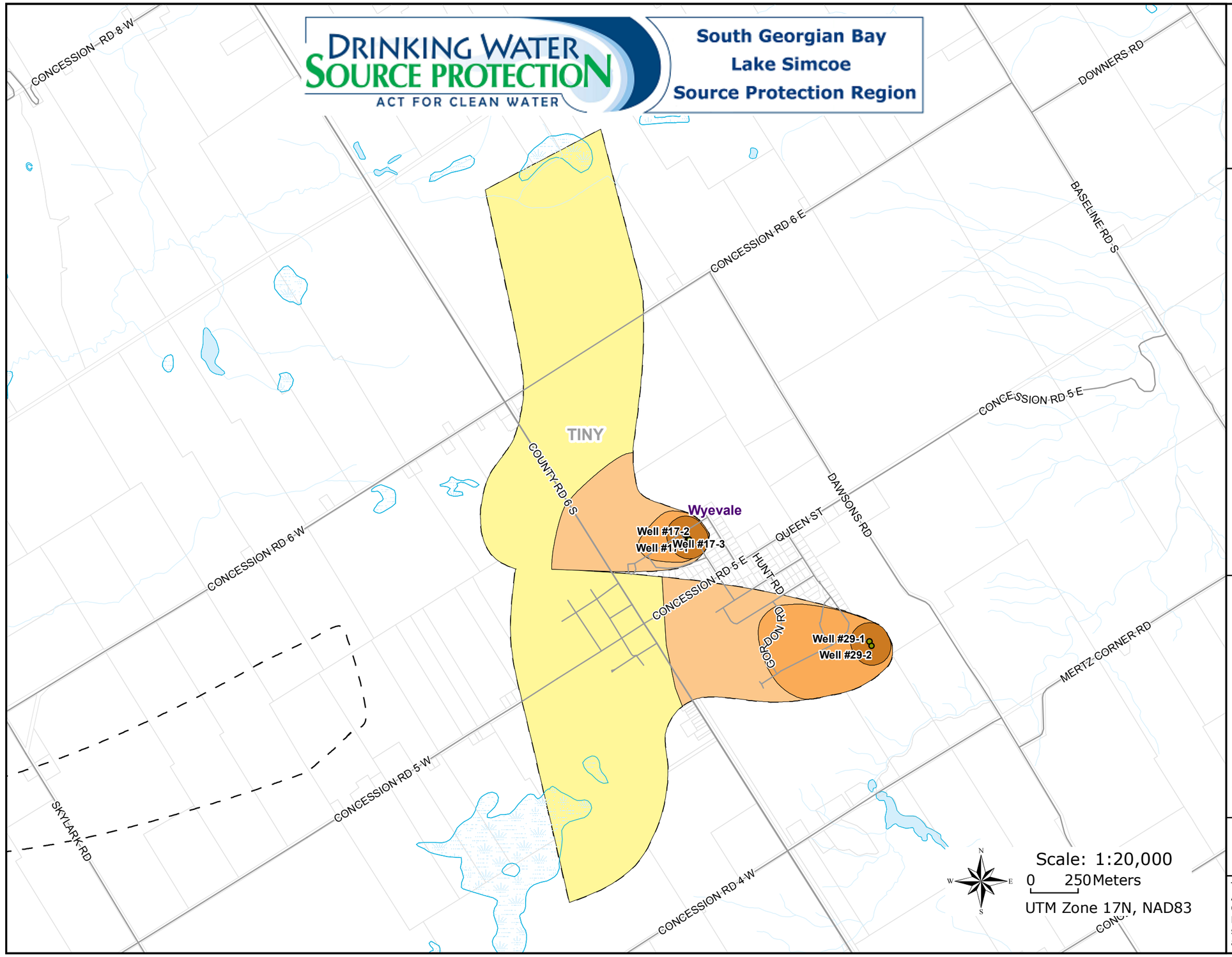
**13r-5**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Wyevale
# Well 17-1, 17-2, 17-3, 29-1, and 29-2
# Wellhead Protection Area




- Municipal Wells
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary

**WHPA TOT**

- WHPA-A (100 m radius)
- WHPA-B (2 yr TOT)
- WHPA-C (5 yr TOT)
- WHPA-D (25 yr TOT)
- Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

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Barrie, Ontario

Created by: Golder Associates Ltd.

File Number:
WY-1-Wellhead Protection Area Wyevale.mxd
Date: 2009-12-14

Ontario

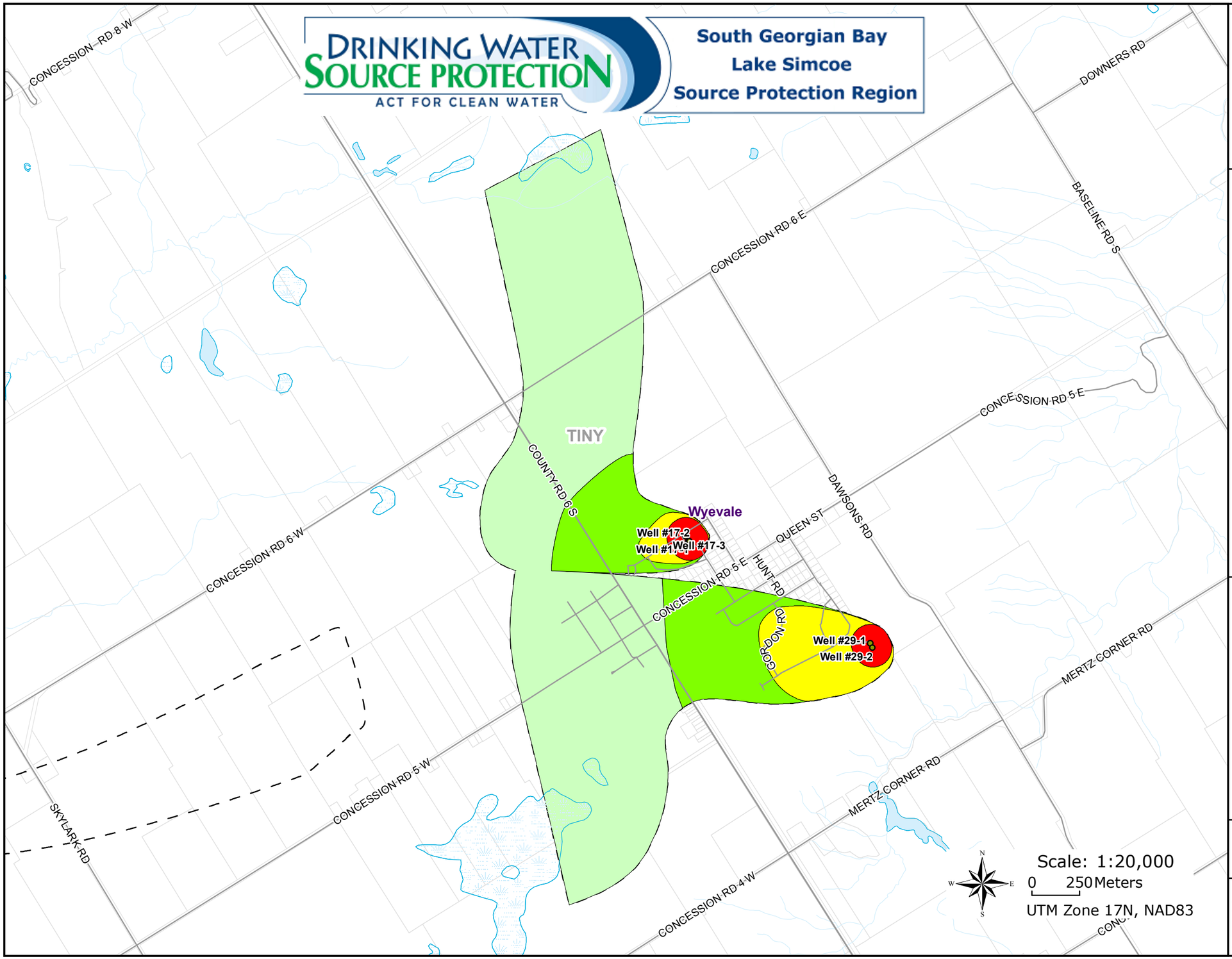
**13s-1**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Wyevale
# Well 17-1, 17-2, 17-3, 29-1, and 29-2
# Final Vulnerability Scoring




Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- 4
- 2

Regional Road
Local Road
Watercourse
Water Area, Permanent
Wetland, Permanent
Parcel Fabric
Municipal Boundary
Adjacent Well Field WHPA

Scale: 1:20,000
0 250 Meters
UTM Zone 17N, NAD83

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WY-2-Final Vulnerability Scoring Wyevale.mxd
Date: 2009-12-14

Ontario

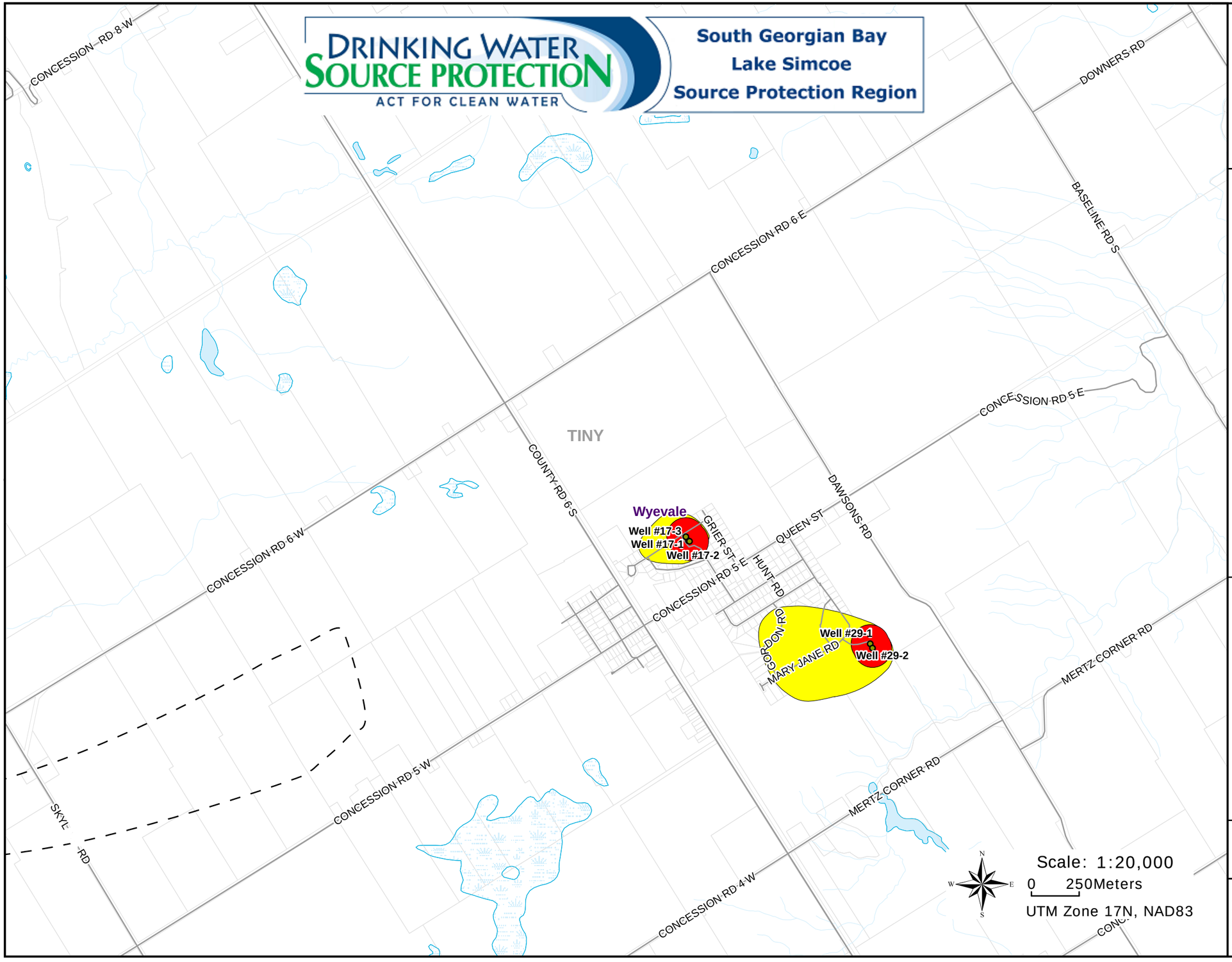
**13s-2**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Wyevale
# Well 17-1, 17-2, 17-3, 29-1, and 29-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Pathogen




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WY-4-Pathogen Threat Wyevale.mxd
Date: 2010-05-18

Ontario

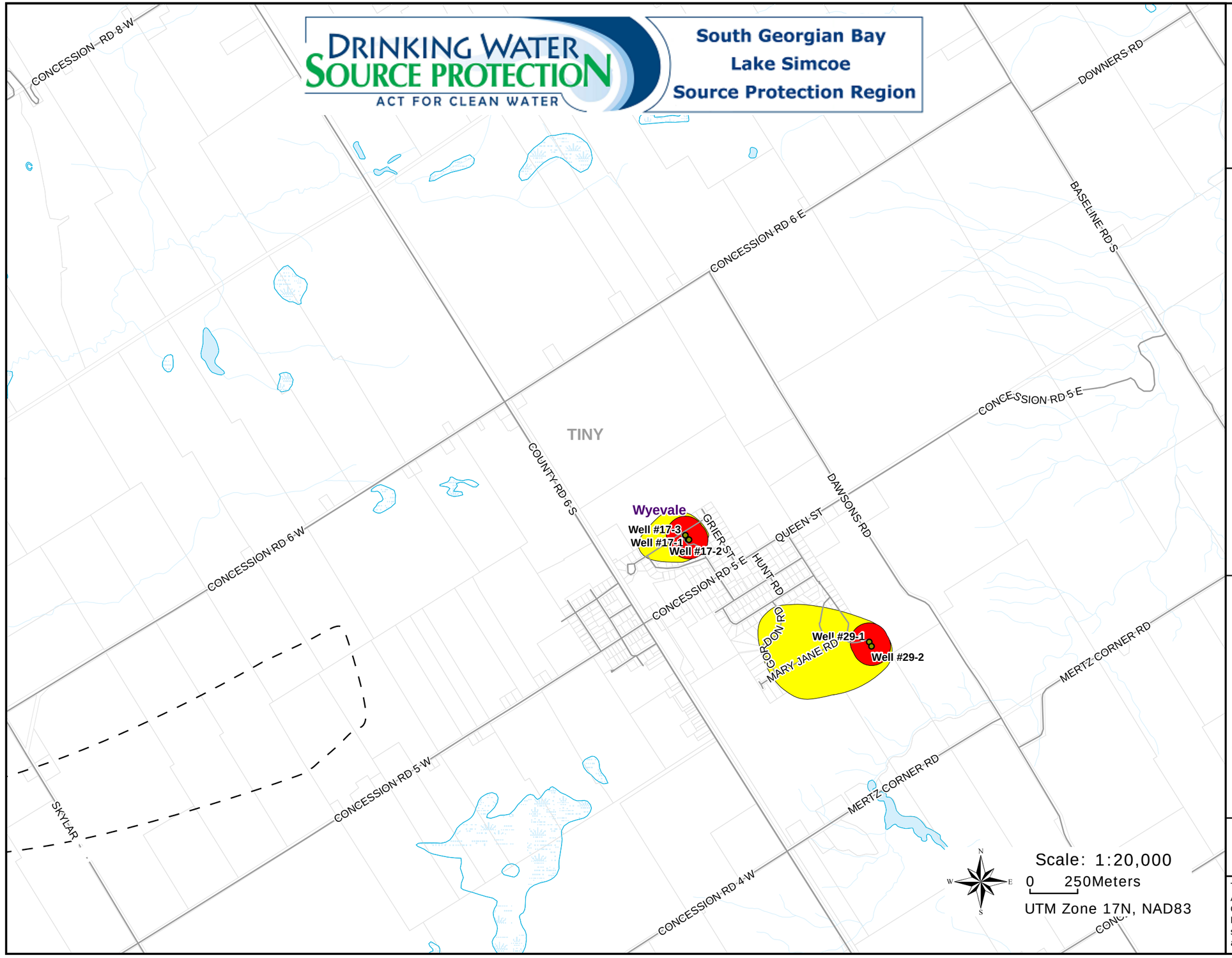
**13s-3**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Wyevale
# Well 17-1, 17-2, 17-3, 29-1, and 29-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities Chemical




- Municipal Wells

**Vulnerability Score**

- 10
- 8
- 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WY-3-Chemical Threat Wyevale.mxd
Date: 2009-12-14

Ontario

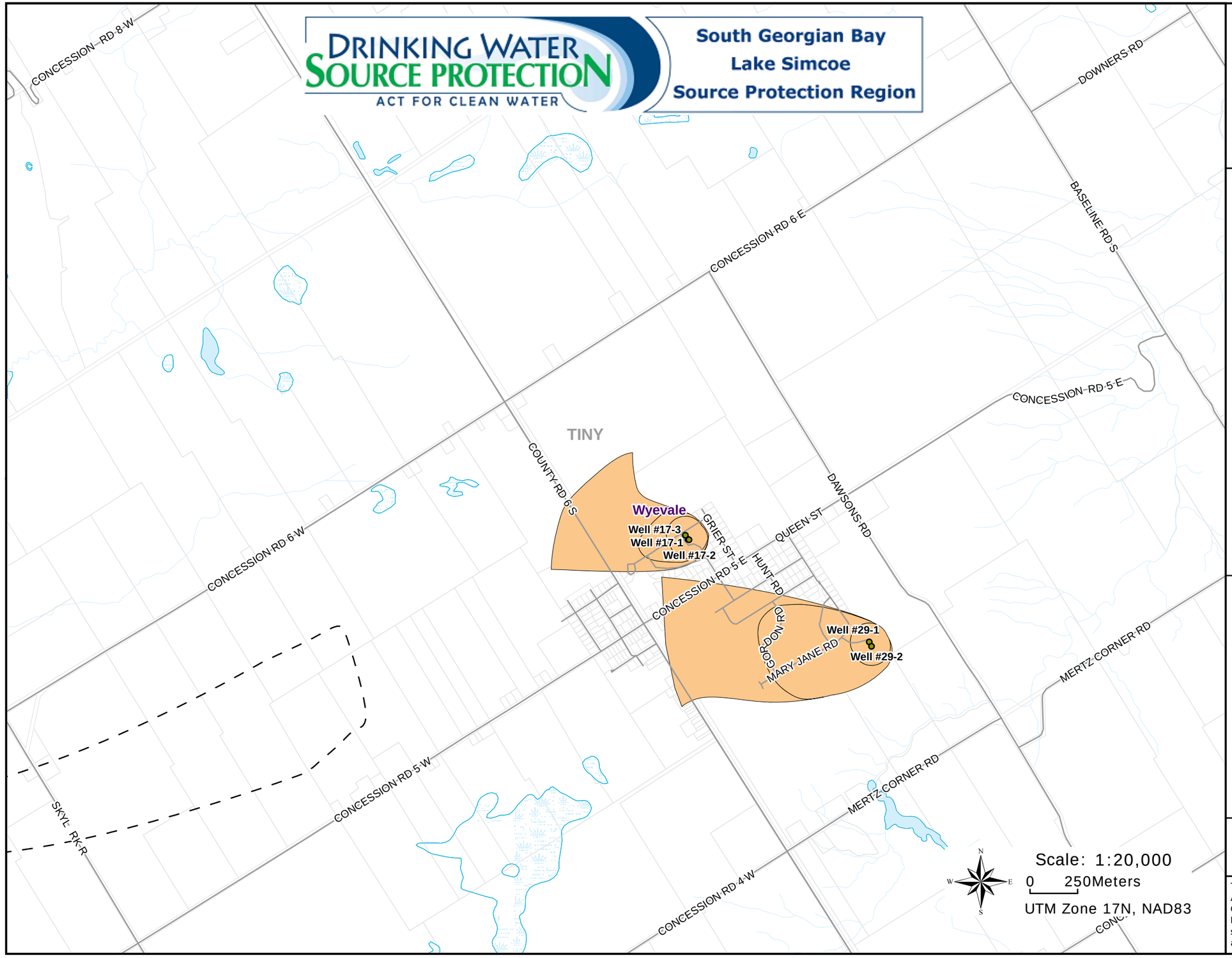
**13s-4**

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DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

# Township of Tiny
# Wyevale
# Well 17-1, 17-2, 17-3, 29-1, and 29-2
# Areas That Are or Would Be Significant, Moderate, or Low Drinking Water Threats: Activities DNAPLs




- Municipal Wells

**WHPA**

- WHPA A, B, C
- WHPA D with Vulnerability >= 6
- Regional Road
- Local Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Parcel Fabric
- Municipal Boundary
- Adjacent Well Field WHPA

Golder Associates
Barrie, Ontario

Created by: Golder Associates Ltd.
Project #: 07-1170-0014
File Number:
WY-5-DNAPL Threat Wyevale.mxd
Date: 2010-05-18

Ontario

**13s-5**

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