

Chapter 10: Township of Severn

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10 Township of Severn

10.1 Introduction

This chapter contains information on two drinking water systems for the Township of Severn. Various consultants have completed the work presented, all of which was reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group. In this chapter, each of the groundwater systems and surface water systems is discussed separately for easier readability.

Each municipal system section begins with an introduction of the characteristics of the drinking water system. This includes an overview of the location, number of people served, and source of the water supply. The sections following the system introductions are comprised of a Vulnerability Assessment and Issues and Threats evaluation of the system. The Vulnerability assessment includes the delineation of the Vulnerable Area(s) (Wellhead Protection Area or Intake Protection Zone), and the assignment of 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 S) for a more in depth description of the methods used, as well as the Glossary for any unfamiliar terms.

10.2 Drinking Water Systems

The Township of Severn operates groundwater based water supplies in three (3) communities and surface water based supplies in three (3). As shown in Table 10-1 and Figure 10-1 all of the groundwater supplies and the surface water supplies are within the South Georgian Bay – Lake Simcoe (SGBLS) Source Protection Region (SPR). Table 10-1 also indicates the Source Protection Region and corresponding lead Source Protection Authority (SPA) for the municipal water supplies.

Table 10-1: Municipal Surface and Groundwater Supplies in the Township of Severn

Local Municipality	Community Water Supply	Drinking Water Information System (DWIS) Number	Source Water Body/ Aquifer	Number of Intakes/ Wells	Source Protection Region (SPR) & Source Protection Authority (SPA)	Location where entire Assessment can be obtained
Township of Severn	Sand Castle Estates Water Treatment Plant	220010654	Lake Couchiching	1	SPR: SGBLS SPA: Lake Simcoe & Couchiching / Black River	Lake Simcoe and Couchiching Assessment Report: Part 2 (Chapter 9)
Township of Severn	Washago Water Treatment Plant	220005161	Lake Couchiching	1	SPR: SGBLS SPA: Lake Simcoe & Couchiching / Black River	Lake Simcoe and Couchiching Assessment Report: Part 2 (Chapter 9)
Township of Severn	West Shore Water Treatment Plant	260061958	Lake Couchiching	1	SPR: SGBLS SPA: Lake Simcoe & Couchiching / Black River	Lake Simcoe and Couchiching Assessment Report: Part 2 (Chapter 9)
Township of Severn	Severn Estates	220005152	Granite bedrock aquifer	1	SPR: SGBLS SPA: Lake Simcoe & Couchiching / Black River	Lake Simcoe and Couchiching Assessment Report: Part 2 (Chapter 9)
Township of Severn	Bass Lake Woodlands	220005143	Confined artesian overburden aquifer	3	SPR: SGBLS SPA: Severn Sound	This chapter
Township of Severn	Coldwater	220001110	Confined overburden aquifer	3	SPR: SGBLS SPA: Severn Sound	This chapter

While still in the Township of Severn and in the SGBLS Source Protection Region, the Sand Castle Estates, Washago and West Shore Water Treatment Plants, as well as the Severn Estates Water Supply system, is located in the Black-Severn River watershed and can be found in the Lake Simcoe and Couchiching-Black River Assessment Report (Part 2, Chapter 9).

Two IPZs, for surface intakes located outside the Township, extend into Severn. These being the IPZs for the Robe Subdivision Surface Intake (Township of Tay), and the Port Severn Surface Intake (Muskoka). Further, the Intake Protection Zones for Washago and Sandcastle Estates surface water intakes, located within Lake Couchiching, extend into the Town of Ramara. Finally, both the Bass Lake Woodlands and Coldwater WHPAs cross into the Township of Oro-Medonte (Table 8-2).

Table 10-2: IPZs that cross into or out of the Township of Severn in the SGBLS SPR.

Local Municipality that IPZ extends into	Municipality where intake is located	Name of Water Supply	Source Protection Region / Lead Conservation Authority (CA)	Location where entire Assessment can be obtained
Township of Ramara	Township of Severn (Lake Couchiching)	Washago Water Treatment Plant	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA	Lake Simcoe and Couchiching Assessment Report: Part 2 (Chapter 9)
Township of Ramara	Township of Severn (Lake Couchiching)	Sandcastle Water Treatment Plant	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA	Lake Simcoe and Couchiching Assessment Report: Part 2 (Chapter 9)
Township of Oro-Medonte	Township of Severn	Bass Lake Woodlands	SGBLS SPR & Severn Sound SPA	This Chapter
Township of Oro-Medonte	Township of Severn	Coldwater	SGBLS SPR & Severn Sound SPA	This Chapter
Township of Severn	District Municipality of Muskoka (Little Lake)	Port Severn Water Treatment Plant	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA	Lake Simcoe and Couchiching Assessment Report: Part 2 (Chapter 10)

Local Municipality that IPZ extends into	Municipality where intake is located	Name of Water Supply	Source Protection Region / Lead Conservation Authority (CA)	Location where entire Assessment can be obtained
Township of Severn	Township of Tay	Rope Subdivision Water Treatment Plant	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA	This Report (Chapter 12)

10.3 Bass Lake Woodlands Well Supply

The Bass Lake Woodlands Well Supply supplies a community with a population of approximately 360 (120 lots) located in the Township of Severn. The Bass Lake Woodlands Well Supply consists of three water supply wells: Well 1, Well 2R and Well 3R located on Lot 2, Concession 1. The wells were constructed in 1974, 2024 and 2024 respectively.

The original Well 2 (1976) and Well 3 (1987) were decommissioned and replaced by Well 2R and Well 3R, respectively.

According to the current Permit to Take Water (PTTW) P-300-1724387769, issued on June 26, 2025, and which expires April 28, 2034, the maximum daily taking is 280.8 m³/day for Well 1, 655.2 m³/day for Well 2R and 741.6 m³/day for Well 3R, and not to exceed a combined total of 1211.2 m³/day. Wells 2R and 3R are the production wells while Well 1 is a standby well.

All wells were drilled into confined artesian overburden aquifers. Well 1 is a nominal 152 mm diameter well constructed to a depth of 35.4 mbgl with 4.0 m of 14-slot stainless steel screen. Well 2 is a 203.2 mm diameter well constructed to a depth of 42.21 mbgl with a #14 size stainless-steel slot installed from 38.10 – 39.62 mbgl, and a #18 size stainless-steel slot installed from 35.05 – 38.10 mbgl. Well 3R is a 203.2 mm diameter well constructed to a depth of 33.8 mbgl with 4.6 m of 14-slot stainless steel screen. the screen was sized as a #18 size stainless-steel slot from 38.10 - 39.62 mbgl, and a #14 size stainless-steel slot from 35.05 - 38.10 mbgl.

The three wells draw water from an artesian confined overburden aquifer (A3) found locally in the elevation range of approximately 210 to 225 masl. The aquifer is regionally extensive and overlies a bedrock aquifer. The local static water levels are within 5 m of the surface.

Limestone bedrock is found at a depth of approximately 43 m in the vicinity of the municipal wells, where it is in direct contact with the deepest aquifer. It is believed that these aquifer units are hydraulically connected and the municipal wells draw water from both aquifer units.

The screen interval for Well 1, Well 2R, and Well 3R have been assigned to the A3 Aquifer, in the draft regional hydrostratigraphic model prepared by AquaResource and Golder (2009). The Groundwater Vulnerability rating will be determined for the A3 Aquifer.

Information presented for the Bass Lake Woodlands section of this Chapter is based on the Genivar 2010a and Crozier 2025 reports.

10.3.1 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 Bass Lake Woodlands groundwater supply has been delineated following the process recommended in the Technical Rules. The areas determined to contribute groundwater to the wells within the 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Bass Lake Woodlands WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

10.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Bass Lake Woodlands Well Supply wells were delineated in 2005 by Golder using a 3-dimensional numerical groundwater flow model. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the Bass Lake Woodlands well locations. Golder reviewed the WHPA delineation and provided updated WHPA in 2010. Further adjustments were made in 2025 to account for the replacement of Wells 2 and 3. The WHPA boundaries did not change with the replacement Wells 2 and 3 as the consultant found that the time-of-travel distances did not change as a result of the decommissioning/replacement process. The updated well locations and the WHPA are shown in Figure 10a-1. WHPA delineation and adjustment details are documented in Genivar, 2010a and in Crozier 2025.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2005) study delineated time-of-travel zones (TOT) for 50 days, 2 years, 10 years and 25 years. The 10 year TOT area was used as WHPA-C1 for the determination of Vulnerability Scores.

The WHPA reflect groundwater flow from south to north toward the wells. The WHPA extends beneath Bass Lake Woodlands.

10.3.1.2 *Groundwater Vulnerability*

The Bass Lake Woodlands wells draw water from a confined aquifer layer (regional aquifer systems A3). The Groundwater Vulnerability for the municipal aquifer in the area was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is illustrated in Technical Memorandum B1 – Regional Groundwater Vulnerability Mapping.

The Groundwater Vulnerability within the WHPA of the municipal wells in the Bass Lake Woodlands Well Supply is shown in Figure 10a-2. The Groundwater Vulnerability for the municipal water supply aquifer within the WHPA is Low.

10.3.1.3 *Transport Pathway Increase*

Technical Memorandum A2 (Appendix MO) documents the consideration of Transport Pathways to increase the Vulnerability Rating as per the Technical Rules. The Vulnerability Rating can be increased from Medium to High, Low to Medium, or from Low to High in accordance with the potential for artificial Transport Pathways to increase the observed vulnerability.

Private wells, and particularly wells that either do not contain seals that will prevent water from moving down around the outside of the well pipe, and wells that are no longer used and/or that have not been sealed present the greatest potential for increasing the rated Vulnerability. The available data from the Provincial Water Well Information System (WWIS) database was screened to identify wells that penetrate to the water supply aquifers and have potential to increase the Vulnerability of the natural stratigraphic profile. There is potential that other wells may exist that are not included in the database, particularly in areas now serviced by municipal water that formerly obtained water supply from private wells.

No potential Transport Pathways were identified within the WHPA that would increase the assigned rating. The Groundwater Vulnerability map (Figure 10a-2), is therefore proposed to be used to generate the Vulnerability Scores.

10.3.1.4 *WHPA-E / WHPA-F*

None of the wells in this study have been identified as Groundwater Under the Direct 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.

10.3.1.5 Vulnerability Score

The WHPA zones for the Bass Lake Woodlands Water Supply System, as shown in Figure 10a-1, and the Groundwater Vulnerability, as shown in Figure 10a-2, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 10a-3 illustrates the Vulnerability Scores for the Bass Lake Woodlands Water Supply System. Figure 10a-3 will be used to assess Drinking Water Threats in Section 10.3.3.

10.3.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating of either High or Low be assigned with each Vulnerable Area as outlined in Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)). A component of the Uncertainty Rating is to be provided for the WHPA delineation by the technical peer review consultant. A second component of the Uncertainty Rating is to be provided in association with the Vulnerability Assessment.

The uncertainty delineation of the Bass Lake Woodlands WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Bass Lake Woodlands WHPAs is High. The full results of the WHPA delineation Peer Review process, for Bass Lake Woodlands is available in Appendix S and discussed in Chapter 5 (Methods Overview).

The assessment of uncertainty for the Vulnerability Assessment 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.

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Bass Lake Woodlands WHPA is High. The Vulnerability Rating for the Bass Lake Woodlands Water System has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1 (Appendix MO).

10.3.2 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.

Available data describing raw water quality and treated water quality for the Bass Lake Woodlands municipal water supplies has been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for Bass Lake Woodlands are provided in Technical Memorandum N4 – Drinking Water Issues Evaluation – Severn Groundwater (Appendix S).

No Drinking Water Issues were identified with the Bass Lake Woodlands Water Supply.

Parameters whose concentrations occasionally exceed Aesthetic/Operational guidelines under the Ontario Drinking Water Quality Standards include turbidity. This parameter is likely naturally-occurring.

Sodium concentrations have exceeded the guideline of 20 mg/L used by the Medical Officer of Health for sodium restricted diets but are not projected to exceed the ODWQS objective of 200 mg/L within 50 years.

10.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Bass Lake Woodlands Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an Activity, or Condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any Activity or Condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Bass Lake Woodlands Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

10.3.3.1 List of Drinking Water Threats – Activities

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

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

10.3.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the Bass Lake Woodlands Water Supply system:

- Files provided by the Ministry of the Environment local offices pertaining to licenses, and records of spills in the area of the delineated WHPA.
- Records available from the Ministry of the Environment website containing registry of Brownfield Sites.
- Records from available technical studies and previous contaminant source inventories that identified situations that may qualify as conditions.
- Interviews of Township of Severn staff to identify potential conditions within the identified WHPA for the drinking water supply.

No confirmed Conditions have been identified for the Bass Lake Woodlands Water Supply. No potential Conditions have been identified for consideration at this time.

10.3.3.3 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 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>

10.3.3.3.1 Pathogen Parameters

The Key Table on Figure 10a-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 Bass Lake Woodlands Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be

observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

10.3.3.3.2 Chemical Parameters

The Key Table on Figure 10a-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 Bass Lake Woodlands Water Supply. Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

10.3.3.3.3 DNAPL Chemical Parameters

Figure 10a-6 illustrates the area of 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 Bass Lake Woodlands Water Supply. The Key Table on Figure 10a-6 can be used to identify the circumstances in which these Activities would be Significant or Moderate Drinking Water Threats.

10.3.3.4 *Identifying Areas of Significant/Moderate/Low Threats – Conditions*

Further to Section 10.3.3.2, no Conditions have been confirmed within the WHPA for the Bass Lake Woodlands 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 10a-3 illustrates the Vulnerability Score map for Bass Lake Woodlands Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Bass Lake Woodlands Water System has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO) and refined using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report. There are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 10-3 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA. Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10 and for parcels within WHPA-C1 that are identified as potentially having a threat related to DNAPLs.

Twenty-four (24) activities that are considered to be Significant Drinking Water Threats were identified in association with twenty-four (24) land parcels in the WHPA for the Bass Lake Woodlands wells. Activities on twenty-three (23) parcels are associated with residential land use and include private 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 10-3: Number of Significant Drinking Water Threats for the Bass Lake Drinking 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.	23
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

Threat Number	Threat	Significant threat counts Number of threats
16.	The handling and storage of dense non-aqueous phase liquid.	0
17.	The handling and storage of an organic solvent.	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the same 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
-	Totals:	24* significant threat (on 24 properties)

*23 verified existing Threats and 1 potential Threat that require further verification (2025)

10.3.3.4.1 Managed Lands

Technical Rule 16(9) (August 2009) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including 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 Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Bass Lake Woodlands Well Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). The Managed Lands are used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 10a-7 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Bass Lake Woodlands Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D.

10.3.3.4.2 Livestock Density

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 Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Bass Lake Woodlands Well Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). Nutrient units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock

Figure 10a-8 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Bass Lake Woodlands Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

10.3.3.4.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within 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 Table of Drinking Water Threats.

The proportion of impervious surfaces within the delineated WHPA zones for the Bass Lake Woodlands Well Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 10a-9 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Bass Lake Woodlands Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D.

10.4 Coldwater Well Supply

The Coldwater Well Supply supplies a community with a population of approximately 1,200 (505 lots) located in the Township of Severn. The Coldwater Well Supply consists of three water supply wells: Well 1, Well 2 and Well 3 located on Lots 21 and 22, Concessions 11 and 12. The three wells are located in a confined granite bedrock aquifer which may also contain some overburden. The wells were constructed between 1989 and 1993.

According to the current Permit to Take Water (PTTW) 93-P-3071, which expires July 31, 2013, the maximum daily taking is 2,141 m³/day for Well 1, 982 m³/day for Well 2 and 982 m³/day for Well 3. Well 1 is used as the lead well while Well 2 and Well 3 are listed as a standby source.

All wells were drilled into a confined bedrock aquifer. Well 1 is a nominal 203 mm diameter well constructed to a depth of 32.6 mbgl and encountered bedrock at a depth of 18.9 m. The casing is set to a depth of 19.5 m, 0.6 m into the bedrock. Well 2 is a 152 mm diameter well constructed to a depth of 25.9 mbgl and encountered bedrock at a depth of 17.0 m. The steel casing is set to a depth of 17.4m, 0.4 m into the bedrock. Well 3 is a 203 mm diameter well constructed to a depth of 25.9 mbgl at a depth of 15.8 m. The steel casing was set to a depth of 17.4 m, 1.6 m into the bedrock.

The three wells are located in a confined bedrock aquifer (A4), although granular materials are noted in various wells in overburden. The construction details indicated that the large capacity wells in the bedrock have not all been sealed within the bedrock. As a result, these wells are most likely drawing water from a combination of the overburden and bedrock aquifer system. The bedrock aquifer outcrops approximately 3 km north-east of the wellfield, and is otherwise overlain by a thin till layer to the east. Although the granite is generally a marginal aquifer outside of the channel, it does yield quantities of water sufficient for residential and small communal needs.

The screen intervals for Well 1, Well 2 and Well 3 have been assigned to the A4 Aquifer, in the draft regional hydrostratigraphic model prepared by AquaResource and Golder (2009). The groundwater vulnerability rating will be determined for the A4 Aquifer.

Information presented for the Coldwater section of this Chapter is based on Genivar 2010a report.

10.4.1 Ground Water Vulnerability

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 Coldwater groundwater supply has been delineated following the process recommended in the Technical Rules. The areas determined to contribute groundwater to the wells within the 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and included consideration for the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Coldwater WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

10.4.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the Well 1, Well 2 and Well 3 of the Coldwater Well Supply were first delineated in 2005 by Golder using a 3-dimensional numerical groundwater flow model constructed using MODFLOW. An updated survey of well locations was commissioned by SGBLS in 2009 to provide improved accuracy for delineation of the WHPA. A minor translation was required to adjust the Coldwater well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 10b-1.

Peer review of the 2005 WHPA indicated that the WHPA only considered pumping of Well 1 and did not reflect the average daily pumping rate of 459 m³/day as observed in 2009. As a result, Golder Associates (2010) provided an updated WHPA for the Coldwater Well Supply. The updated WHPA considers the maximum permitted pumping rate, and distributes the pumping between the three wells. An allowance is also included to consider uncertainties in the modelling process. The WHPA as shown in Figure 10b-1 covers a larger area than the 2005 version. This is consistent with the changes made to increase pumping rates and to consider pumping. The updated WHPA will be used to assess the threats to drinking water for the draft Assessment Report. WHPA delineation and adjustment details are documented in Genivar, 2010a.

WHPA-A has been added to include the 100 m radius from each municipal well. The Golder (2010) study delineated time-of-travel zones (TOT) for 2 years, 5 years and 25 years.

The WHPA for Wells 1, 2 and 3 reflect groundwater flow from two directions: southeast and southwest that converges toward the wells in the north. This is reasonable based on available data describing the geological structures and regional groundwater flow patterns.

10.4.1.2 Groundwater Vulnerability

The Coldwater wells draw water from a confined bedrock aquifer layer (regional aquifer systems A4). The Groundwater Vulnerability for the municipal bedrock aquifer in the area was determined using the regional Aquifer Vulnerability Index (AVI methods outlined in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO). The regional Groundwater Vulnerability is illustrated in Technical Memorandum B1 – Regional Groundwater Vulnerability Mapping.

The Groundwater Vulnerability within the WHPA of the municipal wells in the Coldwater Well Supply is shown in Figure 10b-2. The Groundwater Vulnerability for the municipal water supply aquifer within the WHPA is variable within the WHPA, from Low at the furthestmost extremities of the WHPA to High near the center and Medium immediately surrounding the municipal wells.

10.4.1.3 Transport Pathway Increase

Technical Memorandum A2 (Appendix MO) documents the consideration of Transport Pathways to increase the Vulnerability Rating as per the Technical Rules. The Vulnerability Rating can be increased from Medium to High, Low to Medium, or from Low to High in accordance with the potential for artificial Transport Pathways to increase the observed vulnerability.

Private wells, and particularly wells that either do not contain seals that will prevent water from moving down around the outside of the well pipe, and wells that are no longer used and/or that have not been sealed present the greatest potential for increasing the rated Vulnerability. The available data from the Provincial Water Well Information System (WWIS) database was screened to identify wells that penetrate to the water supply aquifers and have potential to increase the Vulnerability of the natural stratigraphic profile. There is potential that other wells may exist that are not included in the database, particularly in areas now serviced by municipal water that formerly obtained water supply from private wells.

Four wells were identified within the Coldwater WHPA that are considered to have the potential to be a Transport Pathway. The Vulnerability for private wells located within the area of Medium Vulnerability was increased for a 30 m radius surrounding the wells from Medium to High Vulnerability. The Vulnerability for private wells located within the area of Low Vulnerability was increased for a 30 m radius surrounding the wells from Low to Medium Vulnerability.

Four parcels were identified as having potential for aggregate extraction. The Vulnerability within these areas was increased from Low to Medium or from Medium to High.

10.4.1.4 WHPA-E / WHPA-F

None of the wells in this study have been identified as Groundwater Under the Direct 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.

10.4.1.5 Vulnerability Score

The WHPA zones for the Coldwater Water Supply, as shown in Figure 10b-1, the Groundwater Vulnerability, as shown in Figure 10b-2, and the increased vulnerability discussed in Section 10.4.1.3 were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 10b-3 illustrates the Vulnerability Scores for the Coldwater WHPA. Figure 10b-3 will be used to assess Drinking Water Threats in Section 10.4.3.

10.4.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating of either High or Low be assigned with each Vulnerable Area as outlined in Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)). A component of the Uncertainty Rating is to be provided for the WHPA delineation by the technical peer review consultant. A second component of the Uncertainty Rating is to be provided in association with the Vulnerability Assessment.

The uncertainty delineation of the Coldwater WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Coldwater WHPAs is High. The full results of the WHPA delineation Peer Review process, for Coldwater is available in Appendix S and discussed in Chapter 5 (Methods Overview).

The assessment of uncertainty for the Vulnerability Assessment 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.

The Uncertainty Rating assigned for the Vulnerability Assessment Component for the Coldwater WHPA is High. The Vulnerability Rating for the Coldwater Water System has been determined using decisions and assumptions that would err on the conservative side (higher Vulnerability Scores). In this case, the High Uncertainty Rating reflects that additional data to describe the continuity, thickness and types of soils within the delineated WHPA could potentially be used to improve the understanding of local hydrostratigraphy and to increase the confidence in the Vulnerability Analysis. For further information, refer to Technical Memorandum A1 (Appendix MO).

10.4.2 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.

Available data describing raw water quality and treated water quality for the Coldwater municipal water supplies has been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for Coldwater are provided in Technical Memorandum N4 – Drinking Water Issues Evaluation – Severn Groundwater (Appendix S).

Parameters whose concentrations occasionally exceed Aesthetic/Operational guidelines under the Ontario Drinking Water Quality Standards include iron, manganese and turbidity. These parameters are naturally-occurring and are not proposed as Drinking Water Issues.

Sodium concentrations have exceeded the guideline of 20 mg/L used by the Medical Officer of Health for sodium restricted diets but are not projected to exceed the ODWQS objective of 200 mg/L within 50 years.

One Drinking Water Issue was identified with the Coldwater Water Supply.

Trichloroethylene (TCE) has been detected in low concentrations at all three Coldwater wells. The measured concentrations of TCE have exceeded the ODWQS value of 0.005 mg/L. The Maximum Acceptable Concentration (MAC) for TCE as per the Ontario Drinking Water Quality Standard was reduced from 0.05 mg/l (50 µg/L) to 0.005 mg/L (5 µg/L) in June 2006. Observed concentrations of TCE have been variable and there is no clear apparent trend. Monitoring to date has not identified the presence of other degradation products from PCE or TCE, specifically vinyl chloride, in the groundwater.

Studies were undertaken to identify potential sources of TCE and to evaluate options available to the Township for maintaining the quantity and quality of the water supply system. The studies to date were not successful in identifying specific source areas of the TCE, nor were they successful in fully delineating the extent of impacts from TCE in groundwater. The work completed concluded that the TCE resulted from a historical land use and not from a current land use activity.

TCE presents substantial challenges for work to understand the distribution and extent in the subsurface and for remediation from the raw groundwater sources. TCE can be removed from groundwater but the greatest likelihood of success occurs when the source area of TCE is completely removed. Success in these initiatives is also typically **very** expensive. Technologies

for removing TCE from water are known to be highly effective and are an industry-accepted option around the world for allowing continued use of a water source that has been impacted by TCE.

Following review of options, the Township of Severn decided to proceed and provide treatment to remove TCE from the groundwater. This system was supported by the Ontario Ministry of the Environment through issuance of a Certificate of Approval to operate a treatment system. A Granular Activated Carbon (GAC) filtration system was installed and began operating in 2008. The treatment system has been effectively reducing the concentrations of TCE in the groundwater supply since 2008. Results of raw water quality testing on TCE since the treatment system has been established do not identify an increasing concentration trend. It is therefore anticipated that the existing treatment system is robust and capable of continuing to provide effective treatment of the TCE in groundwater for the near future.

In consideration of the best available information, the 25 year Time-of-Travel Area, WHPA-D for the Coldwater wells is proposed for use as the Issues Contributing Area (Figure 10b-1). The Issues Contributing Area will be used in the assessment of Threats to drinking water in Section 10.4.3. In the case of DNAPL threats to drinking water, it is not necessary that the land use activity (existing or historical) must be within the delineated capture area for the wells. Liquid phase DNAPL parameters are known to spread as driven by gravity. As a minimum, the liquid phase contaminants must have spread from the source area into the capture area for the wells in order to be present at the wells. Use of WHPA-D as the Issues Contributing Area in this case is reasonable as the chemical parameters are already known to have been present in water at the well.

In conjunction with the operation of the treatment system, the Township of Severn currently collects and analyzes samples of raw water for indicators of TCE on an annual basis. Monitoring at these locations will serve to provide early warning of a change in water quality at the wells so that action can be taken as necessary to maintain the quantity and quality of water available to the users in Coldwater.

When a Drinking Water Issue 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 10.4.3.1). 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 10.4.3.2)
- 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 10.4.3.3.4).

- 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 10.4.3.5)

10.4.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Coldwater Water Supply was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO). A Drinking Water Threat is defined as “an Activity, or Condition that adversely affects or has the potential to adversely affect, the quality and quantity of any water that is or may be used as a source of drinking water, and includes any Activity or Condition that is prescribed by the regulations as a drinking water threat.” An Activity is one or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use, whereas a Condition refers to the presence of a contaminant in the soil, sediment, or groundwater resulting from past activities. Therefore, it is not only presently existing Threats that must be regulated, but future ones as well.

The Drinking Water Threats Assessment for the Coldwater Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

10.4.3.1 List of Drinking Water Threats – Activities

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

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

10.4.3.2 List of Drinking Water Threats – Conditions

Methods used to assess Conditions are described in Technical Memorandum A5 (Appendix MO). The following information sources were consulted to identify existing Conditions that could affect the Coldwater Water Supply system:

- Files provided by the Ministry of the Environment local offices pertaining to licenses, and records of spills in the area of the delineated WHPA.
- Records available from the Ministry of the Environment website containing registry of Brownfield Sites.
- Records from available technical studies and previous contaminant source inventories that identified situations that may qualify as conditions.
- Interviews of Township of Severn staff to identify potential conditions within the identified WHPA for the drinking water supply.

No confirmed Conditions have been identified for the Coldwater Water Supply. No potential Conditions have been identified for consideration at this time.

10.4.3.3 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 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>

10.4.3.3.1 Pathogen Parameters

The Key Table on Figure 10b-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 Coldwater Water Supply. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 10. Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A and WHPA-B.

10.4.3.3.2 Chemical Parameters

The Key Table on Figure 10b-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 Coldwater Water Supply, Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than 8.

10.4.3.3.3 DNAPL Chemical Parameters

Figure 10b-6 illustrates the area of 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 Coldwater Water Supply. The Key Table on Figure 10b-6 can be used to identify the circumstances in which these Activities would be Significant Drinking Water Threats.

10.4.3.3.4 Drinking Water Issue (TCE)

TCE 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. Table 10-4 provides a list of the activities and circumstances that can potentially release TCE to the environment within the identified Issues Contributing Area for the Coldwater Water Supply Wells (WHPA-D).

Figure 10b-7 illustrates the Issues Contributing Area where activities listed in Table 10-4 are considered to be a Significant Drinking Water Threat for the Coldwater Water Supply. The Key Table on Figure 10b-7 identifies the circumstance numbers from the Table of Drinking Water Threats that would result in an Issue.

Table 10-4: Number of Significant Circumstances that are or would be Significant Threats for TCE in Issues Contributing Area.

Threat Subcategory	Quantity Circumstance	RIM Circumstance	Chemical Of Concern	Circumstance Number
Handling Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The below grade handling of a DNAPL in relation to its storage	Tetrachloroethylene (PCE)	104
Handling Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The below grade handling of a DNAPL in relation to its storage	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	105
Handling Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The handling of a DNAPL at or above grade, in relation to its storage	Tetrachloroethylene (PCE)	109
Handling Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The handling of a DNAPL at or above grade, in relation to its storage	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	110
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent < 500 m3/d on an annual average	STP holding tank that is installed at or above grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	913
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent < 500 m3/d on an annual average	STP holding tank that is installed completely below grade, except for the access points	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	926
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent < 500 m3/d on an annual average	STP holding tank that is installed partially below grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	939
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥500 m3/d but < 2,500 m3/d on an annual average	STP holding tank that is installed at or above grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	952
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥500 m3/d but < 2,500 m3/d on an annual average	STP holding tank that is installed completely below grade, except for the access points	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	965
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥500 m3/d but < 2,500 m3/d on an annual average	STP holding tank that is installed partially below grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	978
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥2,500 m3/d or < 17,500 m3/d on an annual average	STP holding tank that is installed at or above grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	991
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥2,500 m3/d or < 17,500 m3/d on an annual average	STP holding tank that is installed completely below grade, except for the access points	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1004
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥2,500 m3/d or < 17,500 m3/d on an annual average	STP holding tank that is installed partially below grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1017
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥17,500 m3/d or < 50,000 m3/d on an annual average	STP holding tank that is installed at or above grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1030
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥17,500 m3/d or < 50,000 m3/d on an annual average	STP holding tank that is installed completely below grade, except for the access points	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1043
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥17,500 m3/d or < 50,000 m3/d on an annual average	STP holding tank that is installed partially below grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1056
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥50,000 m3/d on an annual average	STP holding tank that is installed at or above grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1069
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥50,000 m3/d on an annual average	STP holding tank that is installed completely below grade, except for the access points	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1082
Sewage System Or Sewage Works - Storage Of Sewage (E.G. Treatment Plant Tanks)	Sewage Treatment Plants that discharge treated effluent ≥50,000 m3/d on an annual average	STP holding tank that is installed partially below grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1095
Storage Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The storage of a DNAPL at or above grade	Tetrachloroethylene (PCE)	1100
Storage Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The storage of a DNAPL at or above grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1101
Storage Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The storage of a DNAPL completely below grade	Tetrachloroethylene (PCE)	1105
Storage Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The storage of a DNAPL completely below grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1106
Storage Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The storage of a DNAPL partially below grade	Tetrachloroethylene (PCE)	1110
Storage Of A Dense Non Aqueous Phase Liquid (DNAPL)	Any quantity	The storage of a DNAPL partially below grade	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1111
Waste Disposal Site - Landfilling (Municipal Waste)	Landfill area < 1 ha	The land disposal of municipal waste	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1648
Waste Disposal Site - Landfilling (Municipal Waste)	Landfill area 1 - 10 ha	The land disposal of municipal waste	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1660
Waste Disposal Site - Landfilling (Municipal Waste)	Landfill area > 10 ha	The land disposal of municipal waste	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1672
Waste Disposal Site - Landfilling (Solid Non Hazardous Industrial or Commercial)	Landfill area < 1 ha	The land disposal of solid non hazardous industrial or commercial	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1684
Waste Disposal Site - Landfilling (Solid Non Hazardous Industrial or Commercial)	Landfill area 1 - 10 ha	The land disposal of solid non hazardous industrial or commercial	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1696
Waste Disposal Site - Landfilling (Solid Non Hazardous Industrial or Commercial)	Landfill area > 10 ha	The land disposal of solid non hazardous industrial or commercial	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1708
Waste Disposal Site - Liquid Industrial Waste Injection into a well	Throughput rate of <380 cubic metres per year.	The land disposal of liquid industrial waste by discharging the waste into a geological formation by means of a well	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1732
Waste Disposal Site - Liquid Industrial Waste Injection into a well	Throughput rate of 380 but <3,800 cubic metres per year.	The land disposal of liquid industrial waste by discharging the waste into a geological formation by means of a well	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1756
Waste Disposal Site - Liquid Industrial Waste Injection into a well	Throughput rate of 3,800 but <38,000 cubic metres per year.	The land disposal of liquid industrial waste by discharging the waste into a geological formation by means of a well	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1780
Waste Disposal Site - Liquid Industrial Waste Injection into a well	Throughput rate of 38,000 but <380,000 cubic metres per year.	The land disposal of liquid industrial waste by discharging the waste into a geological formation by means of a well	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1804
Waste Disposal Site - Liquid Industrial Waste Injection into a well	Throughput rate of 380,000 but <3,800,000 cubic metres per year.	The land disposal of liquid industrial waste by discharging the waste into a geological formation by means of a well	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1828
Waste Disposal Site - Liquid Industrial Waste Injection into a well	Throughput rate of 3,800,000 but not <38,000,000 cubic metres per year.	The land disposal of liquid industrial waste by discharging the waste into a geological formation by means of a well	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1852
Waste Disposal Site - Liquid Industrial Waste Injection into a well	Throughput rate of >38,000,000 cubic metres per year.	The land disposal of liquid industrial waste by discharging the waste into a geological formation by means of a well	Trichloroethylene or another DNAPL that could degrade to Trichloroethylene	1876

10.4.3.4 Identifying Areas of Significant/Moderate/Low Threats – Conditions

Further to Section 10.4.3.2, no Conditions have been confirmed within the WHPA for the Coldwater 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 10b-3 illustrates the Vulnerability Score map for Coldwater Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Coldwater Water System has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO) and refined using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report. There are no Significant Threats associated with Conditions or specifically linked to Drinking Water Issues. Several Activities or currently unrecognized Conditions within the Issues Contributing Area may contribute to the observed Drinking Water Issue of TCE. These activities are identified under the 'Handling and storage of a dense non-aqueous phase liquid (DNAPL)' threat category.

Table 10-5 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPA for the Coldwater Well Supply. Significant Drinking Water Threats were identified within areas where the Vulnerability Score is

8 or greater and for parcels within WHPA-B & WHPA-C that are identified as potentially having a threat related to handling and storage of dense non-aqueous phase liquids (DNAPLs).

Twenty-four (24) activities that are considered to be potential Significant Drinking Water Threats were identified in association with eighteen (18) land parcels in the WHPA for the Coldwater Well Supply. Eleven (11) parcels were identified as having potential 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. There are 22 residential parcels within this area. Two (2) other parcels were identified with activities with potential for fuel storage. Two (2) parcels were identified for potential application of agricultural source material (ASM) to land. Six (6) parcels were identified for activities that may involve application of pesticide to land. Two (2) parcels were identified for activities that may include handling and storage of DNAPLs.

Table 10-5: Number of Significant Drinking Water Threats for the Coldwater Drinking 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.	2
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.	6
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

Threat Number	Threat	Significant threat counts Number of threats
16.	The handling and storage of dense non-aqueous phase liquid.	2
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
-	Totals:	24*

*9 verified existing Threats and 15 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

10.4.3.4.1 Managed Lands

Technical Rule 16(9) (August 2009) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including 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 Table of Drinking Water Threats.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Coldwater Well Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). The Managed Lands are used in the identification of threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 10b-7: Circumstances that Are or Would Be Significant Threats in Issues Contributing Area - Coldwater. Figure 10b-8 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Coldwater Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D.

10.4.3.4.2 Livestock Density

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 Table of Drinking Water Threats.

The Livestock Density was determined for the delineated WHPA zones of the Coldwater Well Supply as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). Nutrient units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock

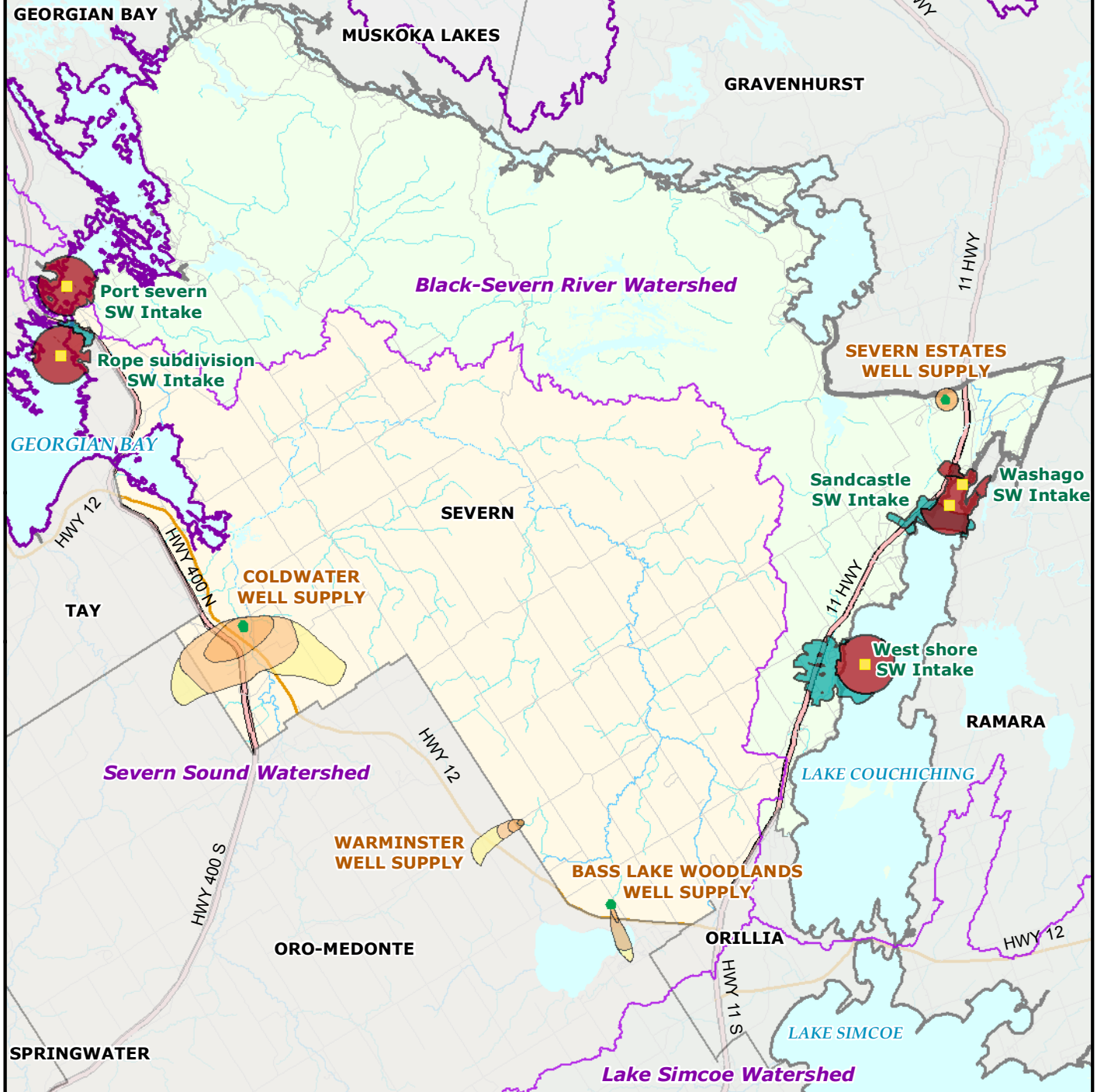
Figure 10b-9 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Coldwater Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A5 (Appendix MO).

10.4.3.4.3 Impervious Surfaces

Technical Rule 16(11) (August 2009) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within 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 Table of Drinking Water Threats.

The proportion of Impervious Surfaces within the delineated WHPA zones for the Coldwater Well Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix A). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 10.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 10b-10 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Coldwater Water Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D.



- Municipal Surface Water Intakes
- IPZ-1 (1000m on water or 120m inland)
- IPZ-2 (2 hr time of travel)
- Municipal Supply Well in Township of Severn
- 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)

Drinking Water System Vulnerable Areas in Township of Severn

Created by: LSRCA
Date: 2011-03-29



Scale: 1:200,000

0 2 4km

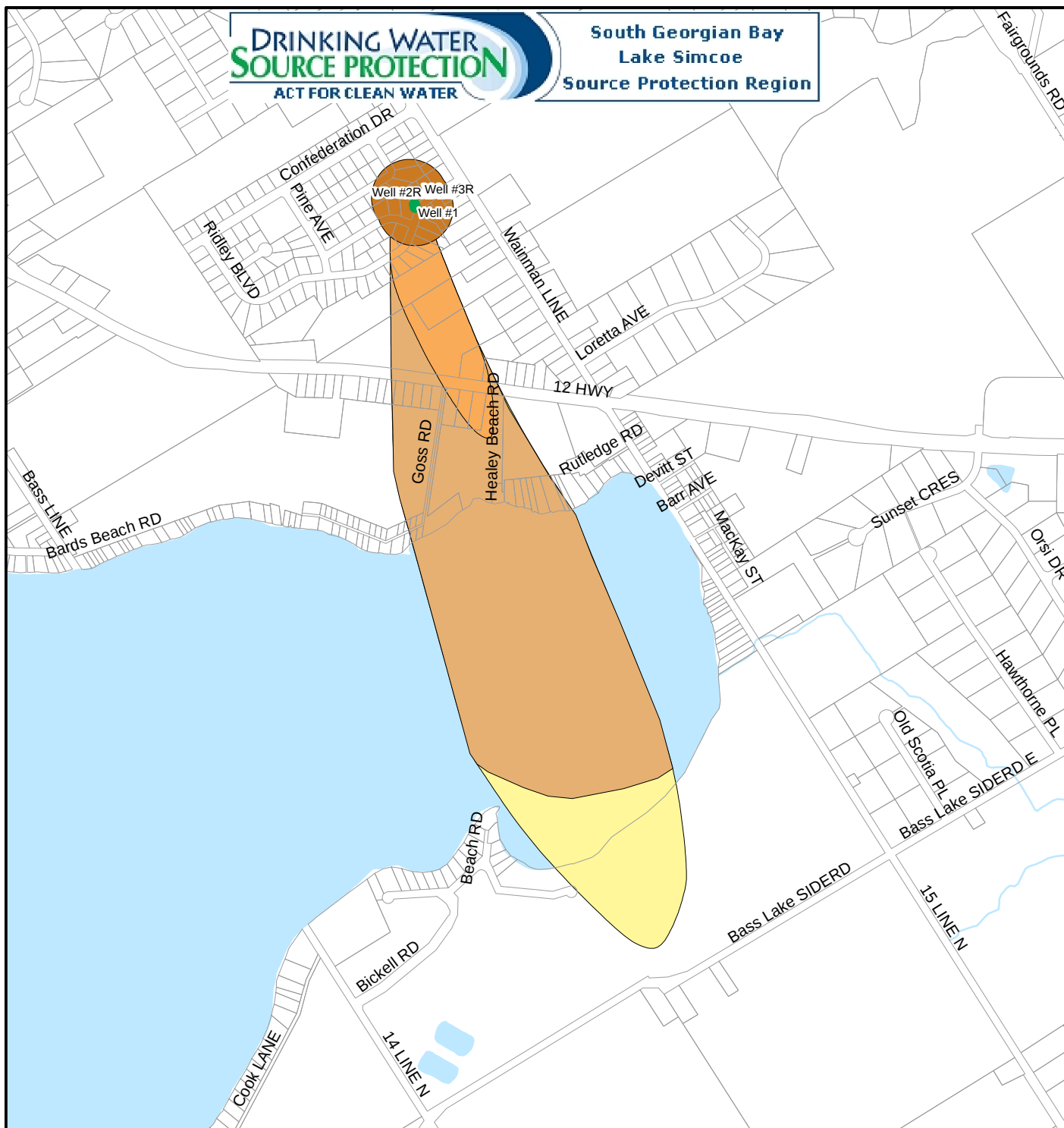
UTM Zone 17N, NAD83



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

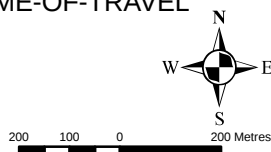


Figure 10-1



Legend

- MUNICIPAL WELL LOCATION
- WHPA-A: 100 m RADIUS
- WHPA-B: 2-YEAR TIME-OF-TRAVEL
- WHPA-C1: 10-YEAR TIME-OF-TRAVEL
- WHPA-D: 25-YEAR TIME-OF-TRAVEL



**WELLHEAD PROTECTION AREAS -
BASS LAKE, SEVERN**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.3-1

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



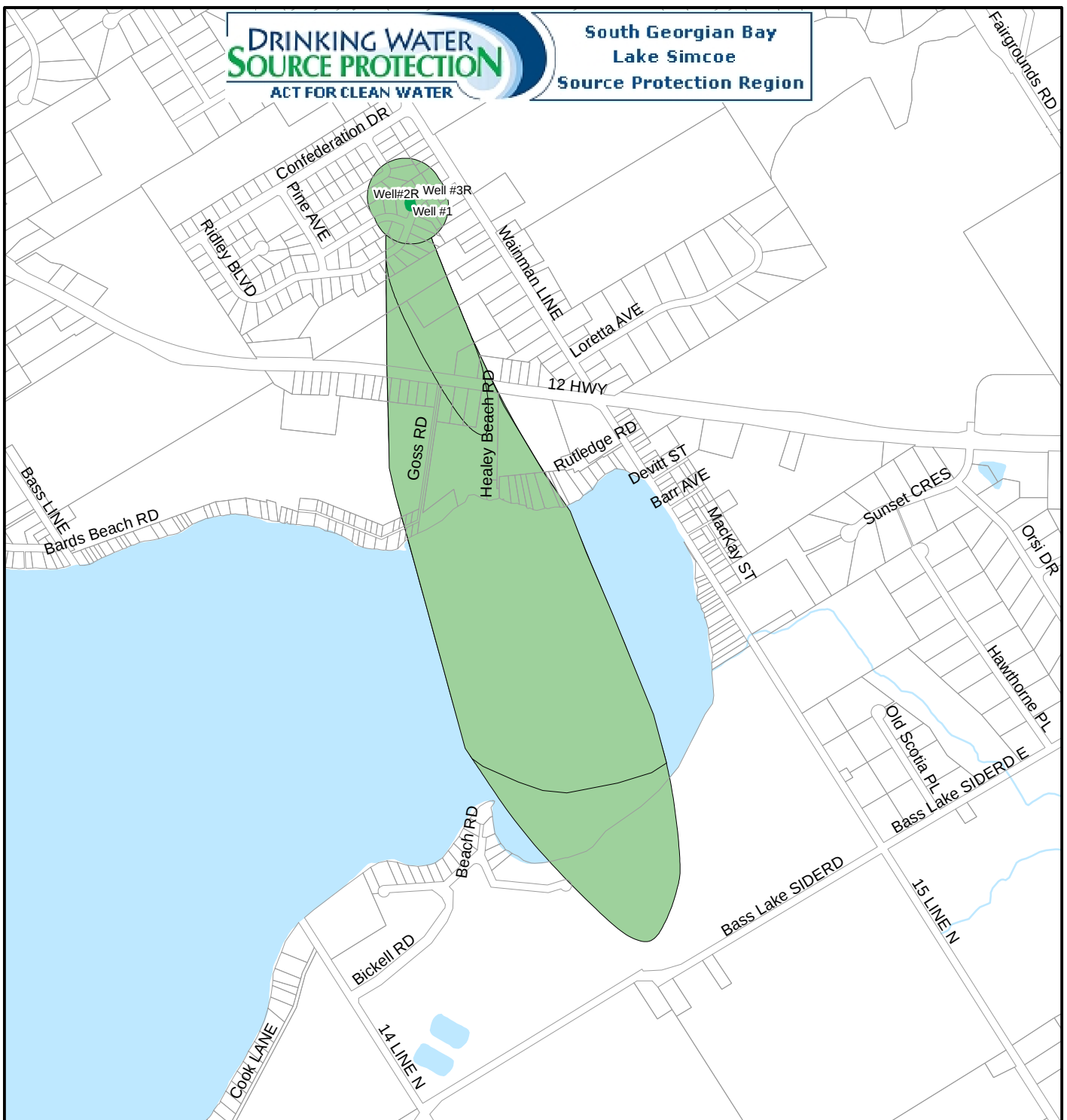
GENIVAR



Ontario

FIGURE

10a-1



Legend

● MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY INDEX

■ HIGH
■ MEDIUM
■ LOW



200 100 0 200 Metres

**GROUNDWATER VULNERABILITY -
BASS LAKE**

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES**
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.3-2

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.



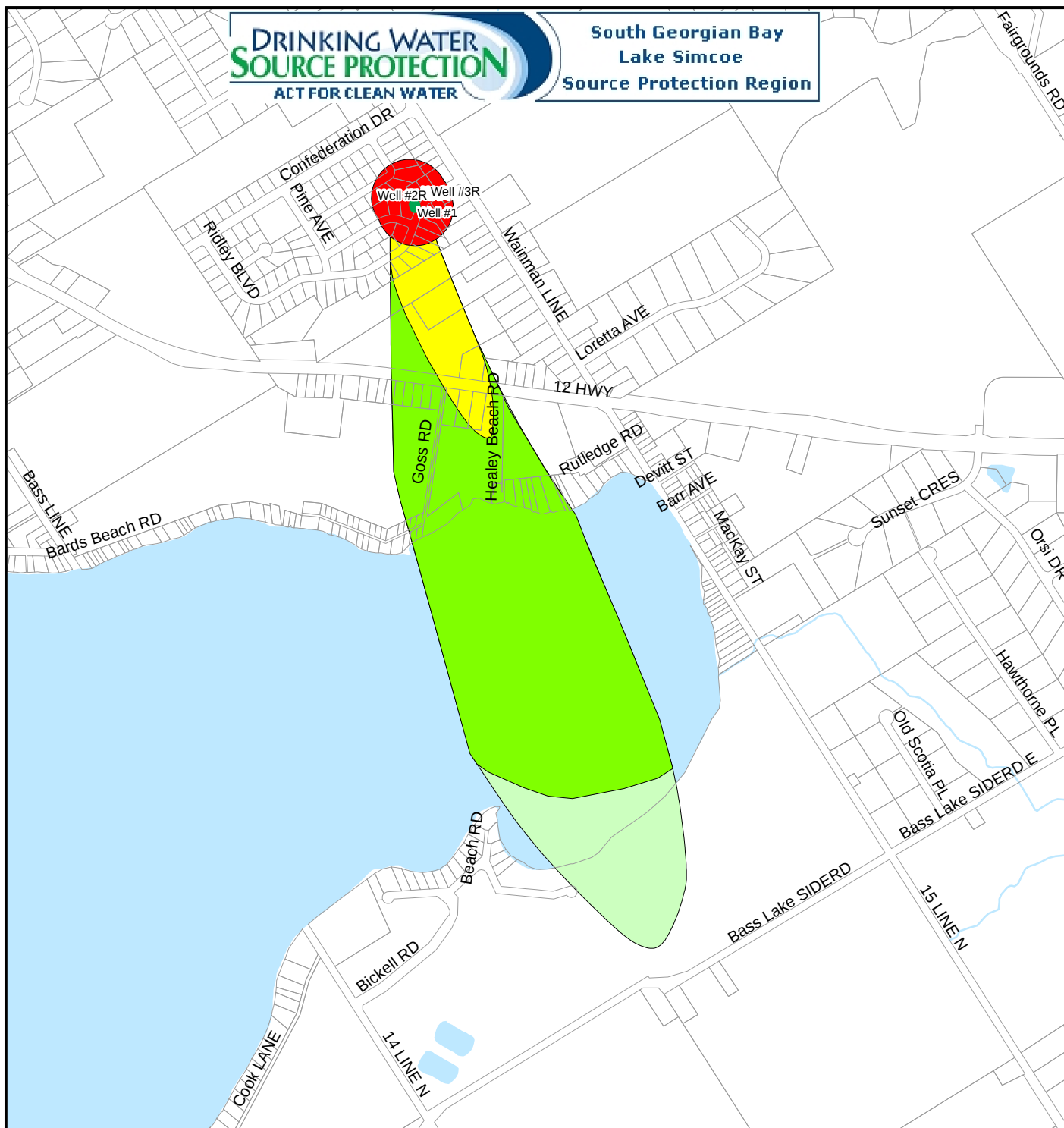
GENIVAR



Ontario

FIGURE

10a-2



LEGEND

● MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

10
8
6
4
2



200 100 0 200 Metres

**VULNERABILITY SCORE -
BASS LAKE**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.3-3

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



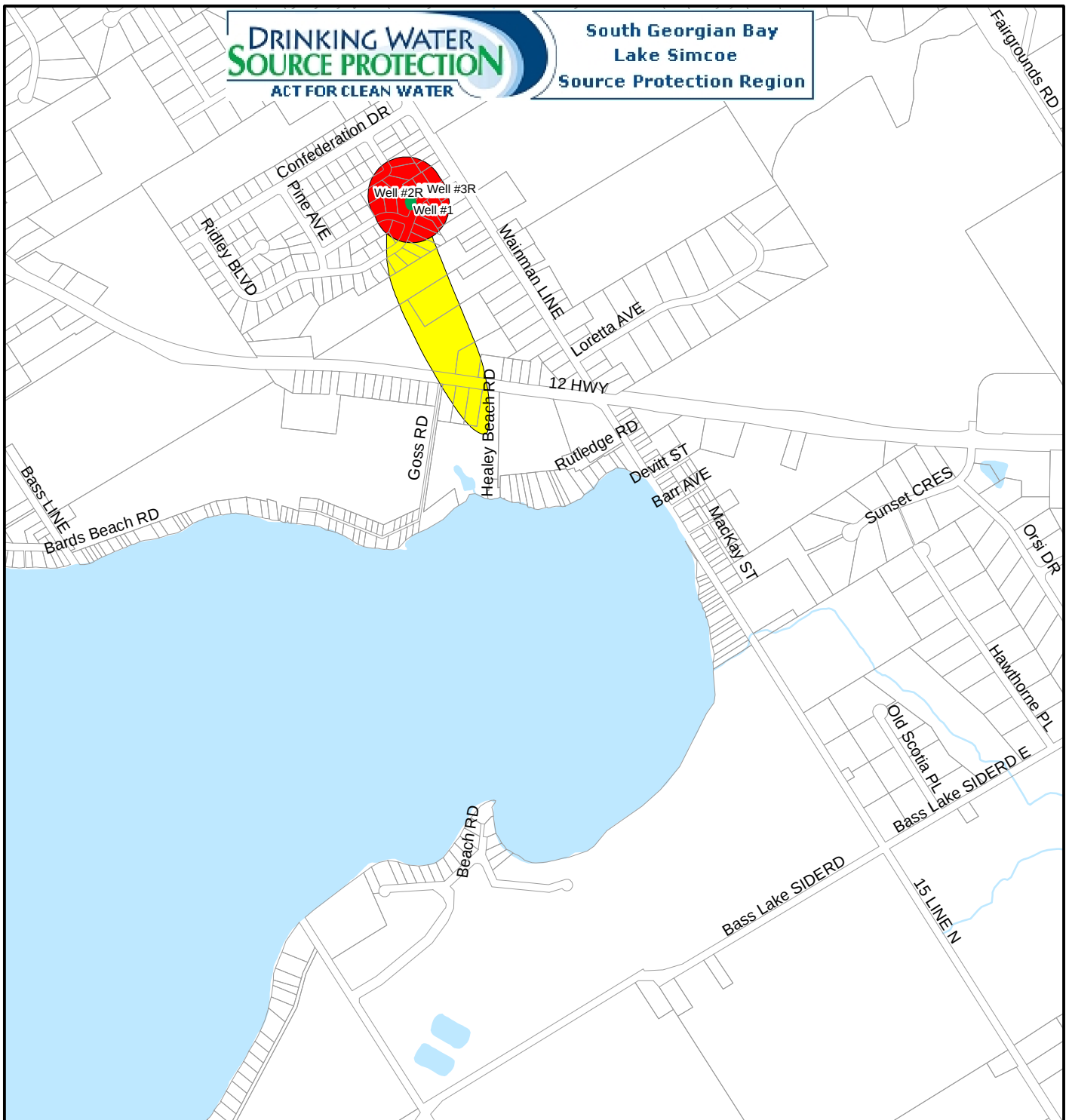
GENIVAR



Ontario

FIGURE

10a-3



LEGEND

● MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6



200 100 0 200 Metres

**AREAS WHERE PATHOGENS ARE OR WOULD
BE SIGNIFICANT, MODERATE, OR LOW
THREATS - BASS LAKE**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

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

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.

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.3-4



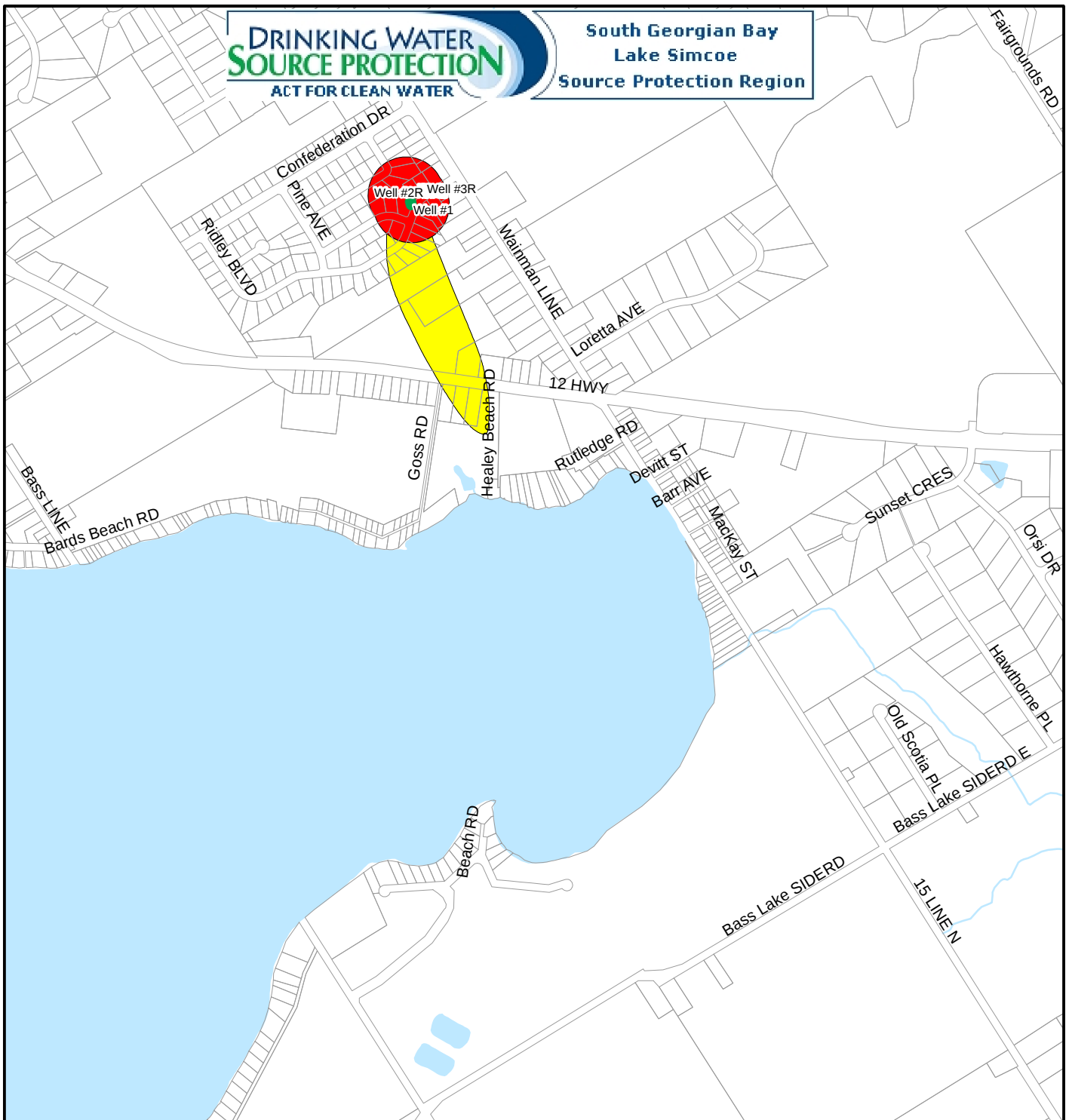
GENIVAR



Ontario

FIGURE

10a-4



LEGEND

● MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

10
8
6



200 100 0 200 Metres

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

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.

AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - BASS LAKE

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region**

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.3-5



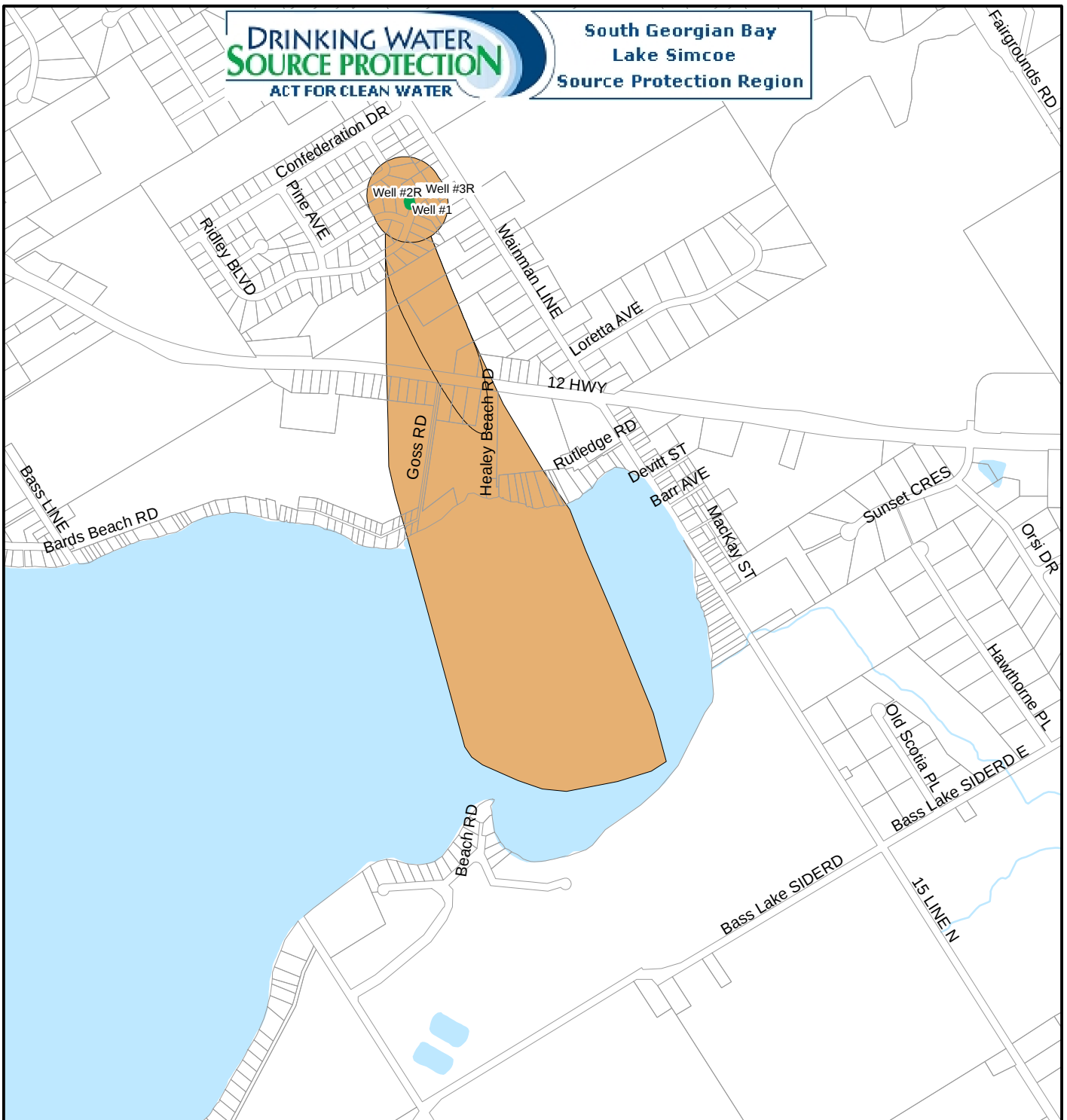
GENIVAR



Ontario

FIGURE

10a-5



Legend

- MUNICIPAL WELL LOCATION
- WHPA-C1: 10-YEAR TIME-OF-TRAVEL



200 100 0 200 Metres

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

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.

AREAS WHERE DNAPLs ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - BASS LAKE

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.3-6



GENIVAR



Ontario

FIGURE

10a-6



Legend

- MUNICIPAL WELL LOCATION
- MANAGED LANDS (<40%)
- MANAGED LANDS (40-80%)
- MANAGED LANDS (>80%)



200 100 0 200 Metres

**MANAGED LANDS -
BASS LAKE**

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES**
South Georgian Bay Lake Simcoe
Source Protection Region

The Managed Land proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

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.

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.3-7



GENIVAR



Ontario

FIGURE

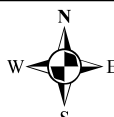
10a-7



Legend

- MUNICIPAL WELL LOCATION
- LIVESTOCK DENSITY (<0.5 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (0.5-1.0 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (>1.0 NUTRIENT UNITS/ACRE)

190 95 0 190 Metres



**LIVESTOCK DENSITY -
BASS LAKE**

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region**

The Livestock Density proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

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.

DATE: JUNE 2010

SCALE: 1:15000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.3-8



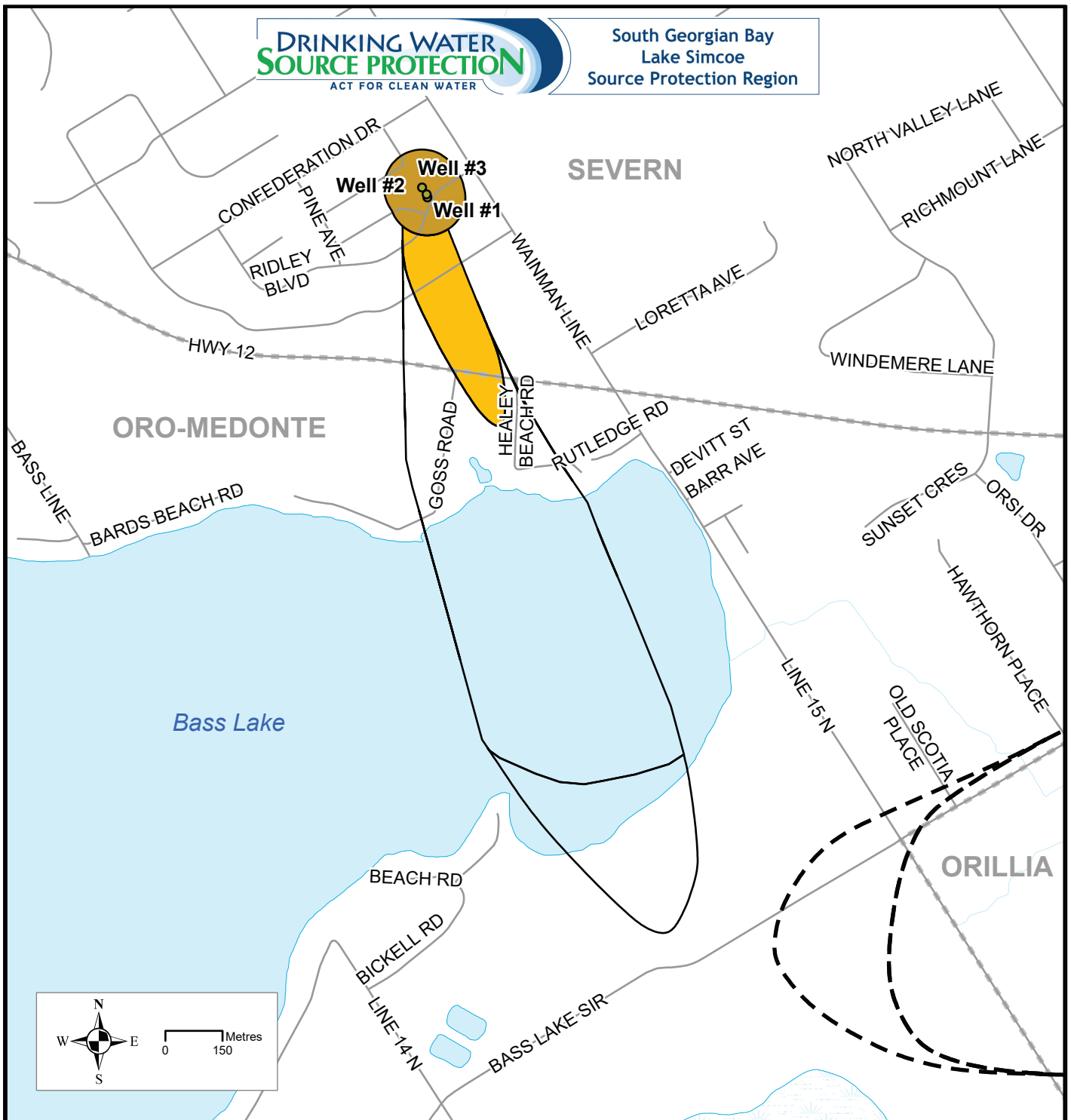
GENIVAR



Ontario

FIGURE

10a-8



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

IMPERVIOUS SURFACES - BASS LAKE

ASSESSMENT OF DRINKING WATER THREATS SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

DATE: AUGUST 2025

SCALE: 1:15,000

The Impervious Surfaces are illustrated for WHPA A-D where the vulnerability score is > 6.

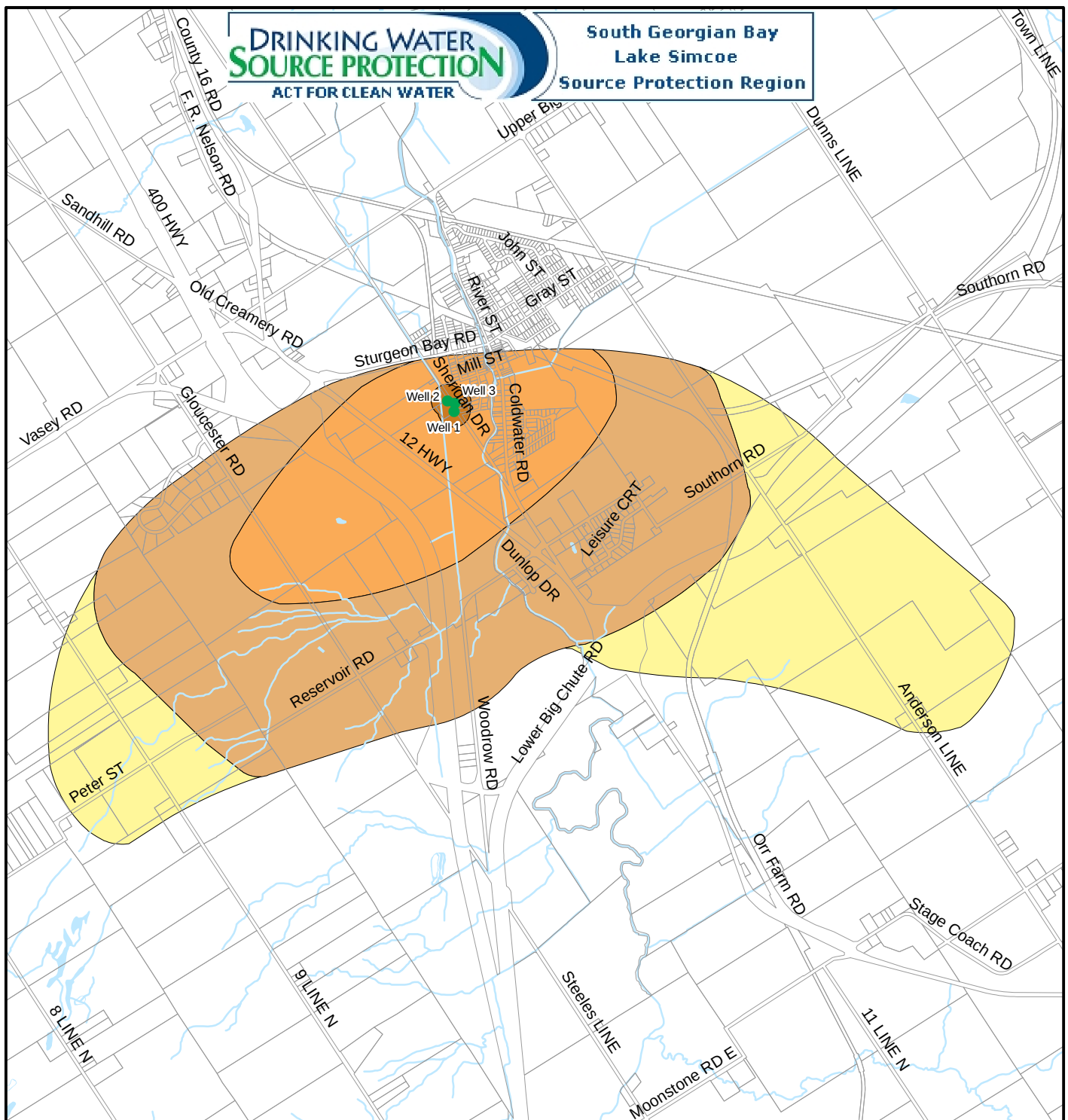
This map was produced for the South Georgian Bay Lake Simcoe Source Protection Region for the purposes of completing the South Georgian Bay Lake Simcoe Assessment Report. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict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



Ontario

FIGURE

10a-9



Legend

- MUNICIPAL WELL LOCATION
- WHPA-A: 100 m RADIUS
- WHPA-B: 2-YEAR TIME-OF-TRAVEL
- WHPA-C: 5-YEAR TIME-OF-TRAVEL
- WHPA-D: 25-YEAR TIME-OF-TRAVEL



350 175 0 350 Metres

**WELLHEAD PROTECTION AREAS -
COLDWATER, SEVERN**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010

SCALE: 1:35000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.4-1

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



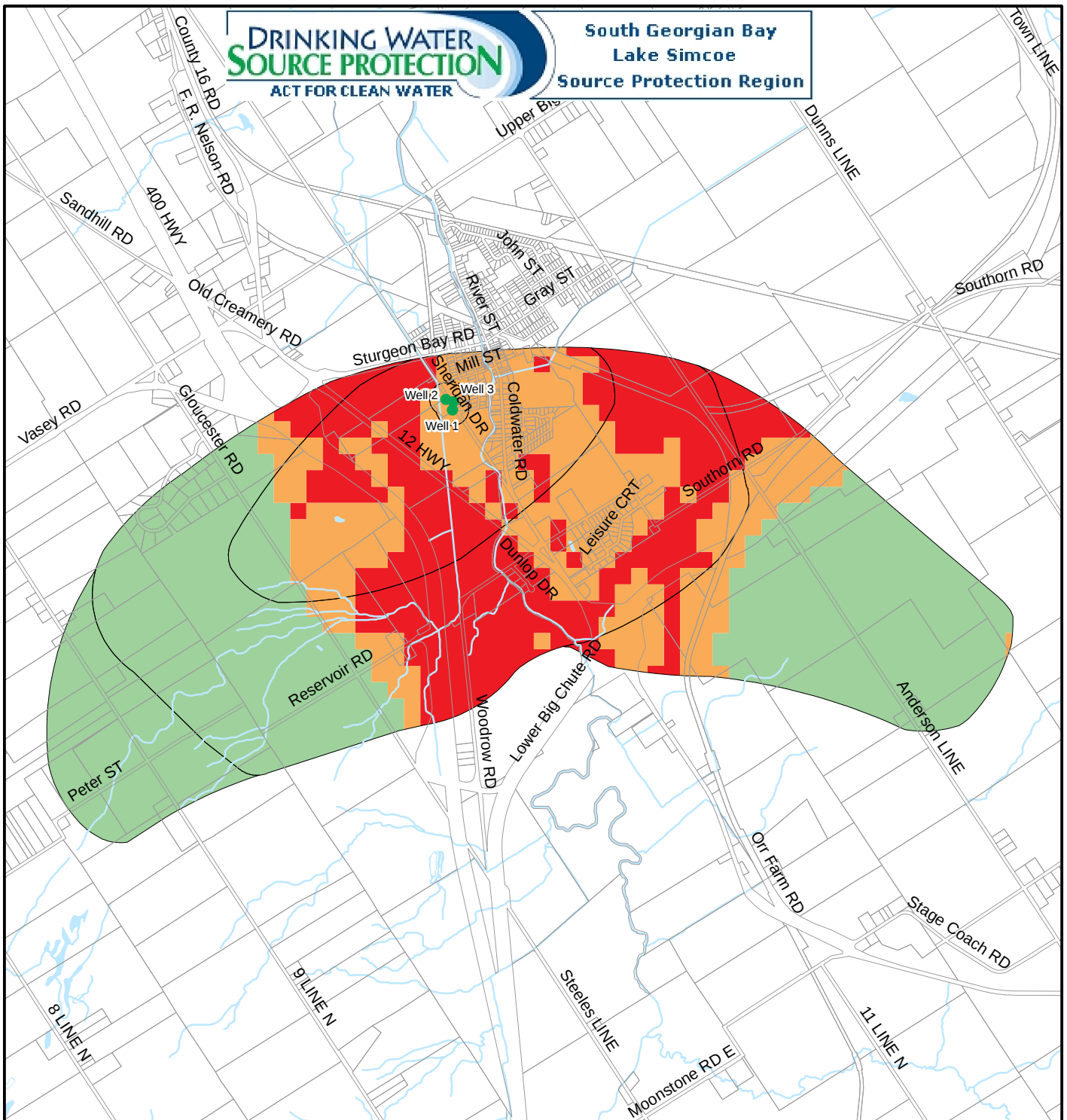
GENIVAR



Ontario

FIGURE

10b-1



LEGEND

● MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY INDEX

■ HIGH

■ MEDIUM

■ LOW



370 185 0 370 Metres

**GROUNDWATER VULNERABILITY -
COLDWATER**

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES**
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010

SCALE: 1:35000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.4-2

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.



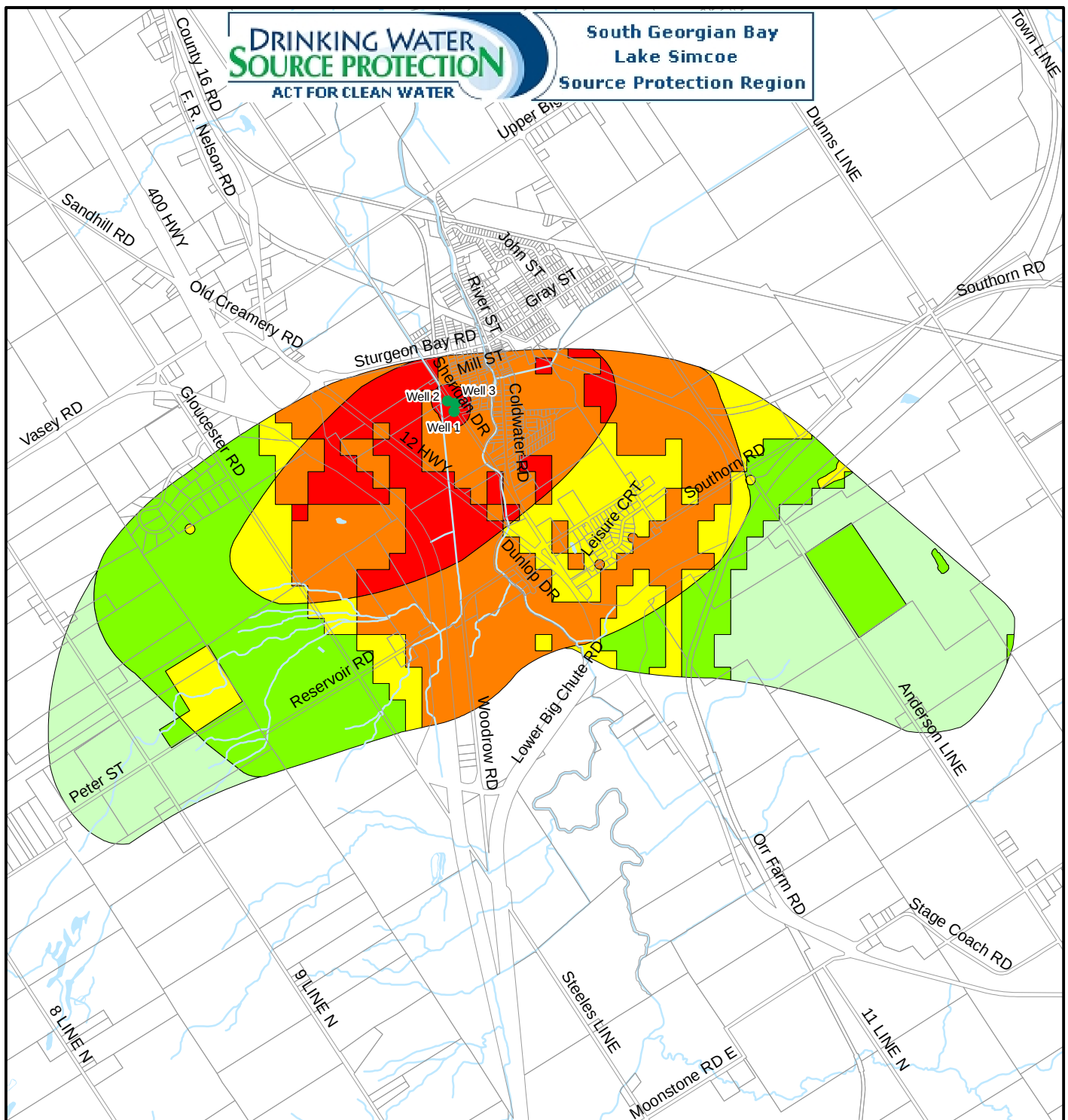
GENIVAR



Ontario

FIGURE

10b-2



Legend

● MUNICIPAL WELL LOCATION

VULNERABILITY SCORE

- 10
- 8
- 6
- 4
- 2



360 180 0 360 Metres

**VULNERABILITY SCORES -
COLDWATER**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010

SCALE: 1:35000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.4-5

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



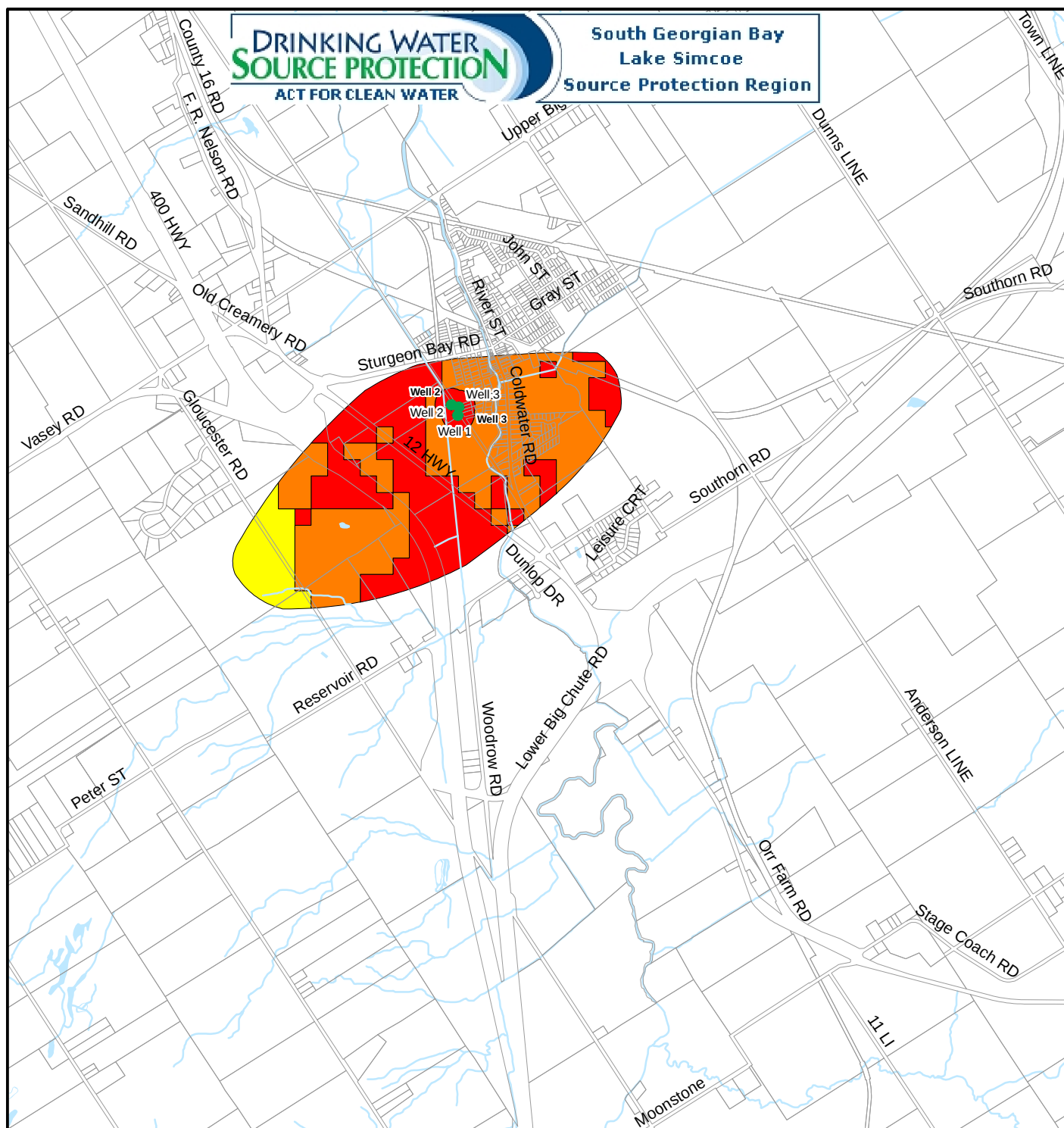
GENIVAR



Ontario

FIGURE

10b-3



LEGEND

● MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

10
8
6

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

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.

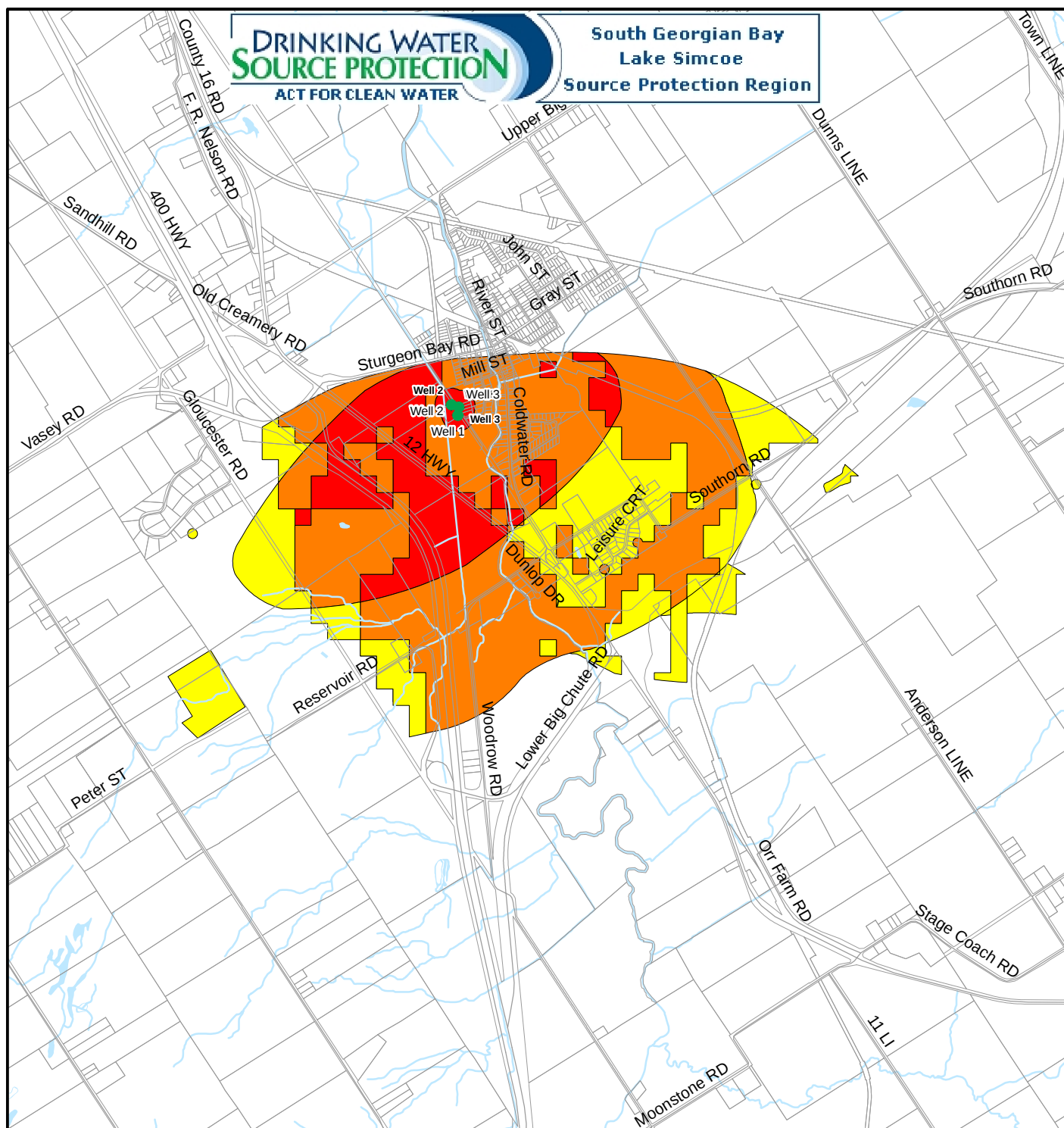
AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - COLDWATER

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region**

DATE: JULY 2010	SCALE: 1:35000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F15.4-6

FIGURE 10b-4

GENIVAR



LEGEND

● MUNICIPAL WELL LOCATION
VULNERABILITY SCORING

10
8
6



350 175 0 350 Metres

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

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AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - COLDWATER

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JULY 2010

SCALE: 1:35000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.4-7



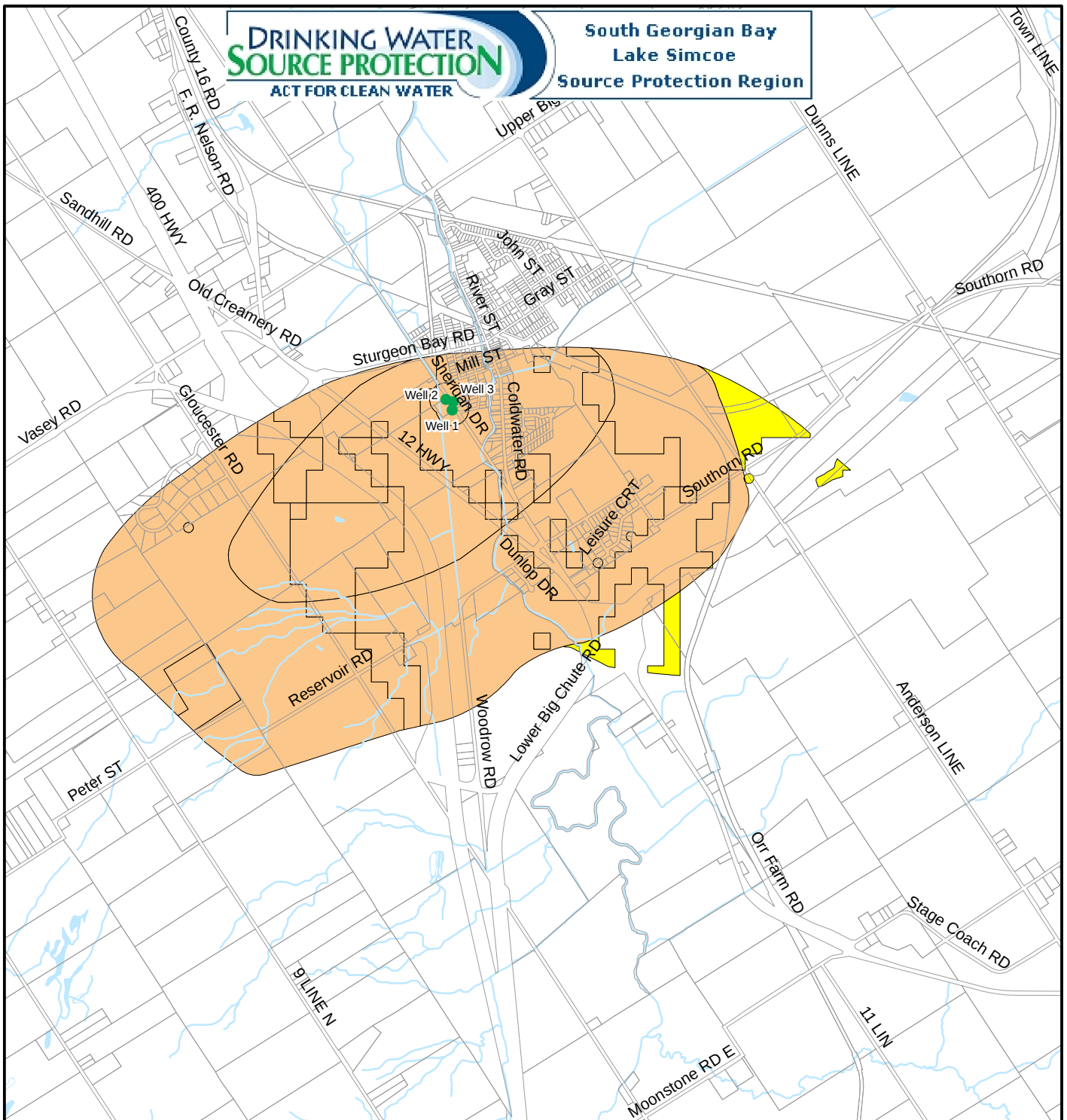
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Ontario

FIGURE

10b-5



LEGEND

- MUNICIPAL WELL LOCATION
- WHPA-C: 5 YEAR TIME-OF-TRAVEL

VULNERABILITY SCORING

■ 6



350 175 0 350 Metres

**AREAS WHERE DNAPLS ARE OR WOULD BE
SIGNIFICANT, MODERATE, OR LOW
THREATS - COLDWATER**

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES**

South Georgian Bay Lake Simcoe
Source Protection Region

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

DATE: JULY 2010

SCALE: 1:35000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.4-8

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.



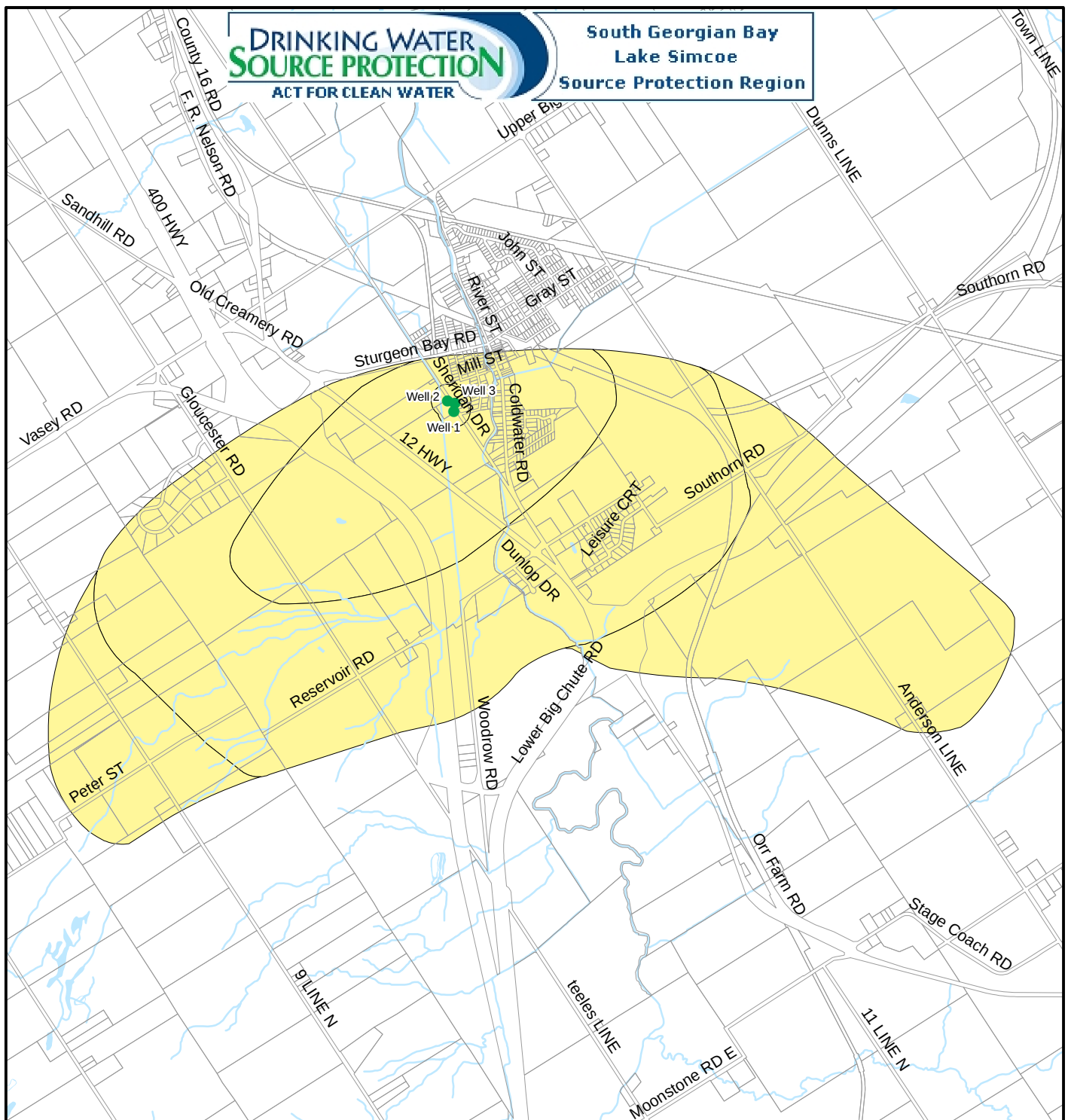
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FIGURE

10b-6



LEGEND

- MUNICIPAL WELL LOCATION
- ISSUE CONTRIBUTING AREA



350 175 0 350 Metres

**CIRCUMSTANCES THAT ARE OR WOULD BE
SIGNIFICANT THREATS IN ISSUES
CONTRIBUTING AREA - COLDWATER**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The table shows the circumstance number in the Provincial Tables of Circumstances which would be a significant drinking water threat.

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DATE: JULY 2010

SCALE: 1:35000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.4-9



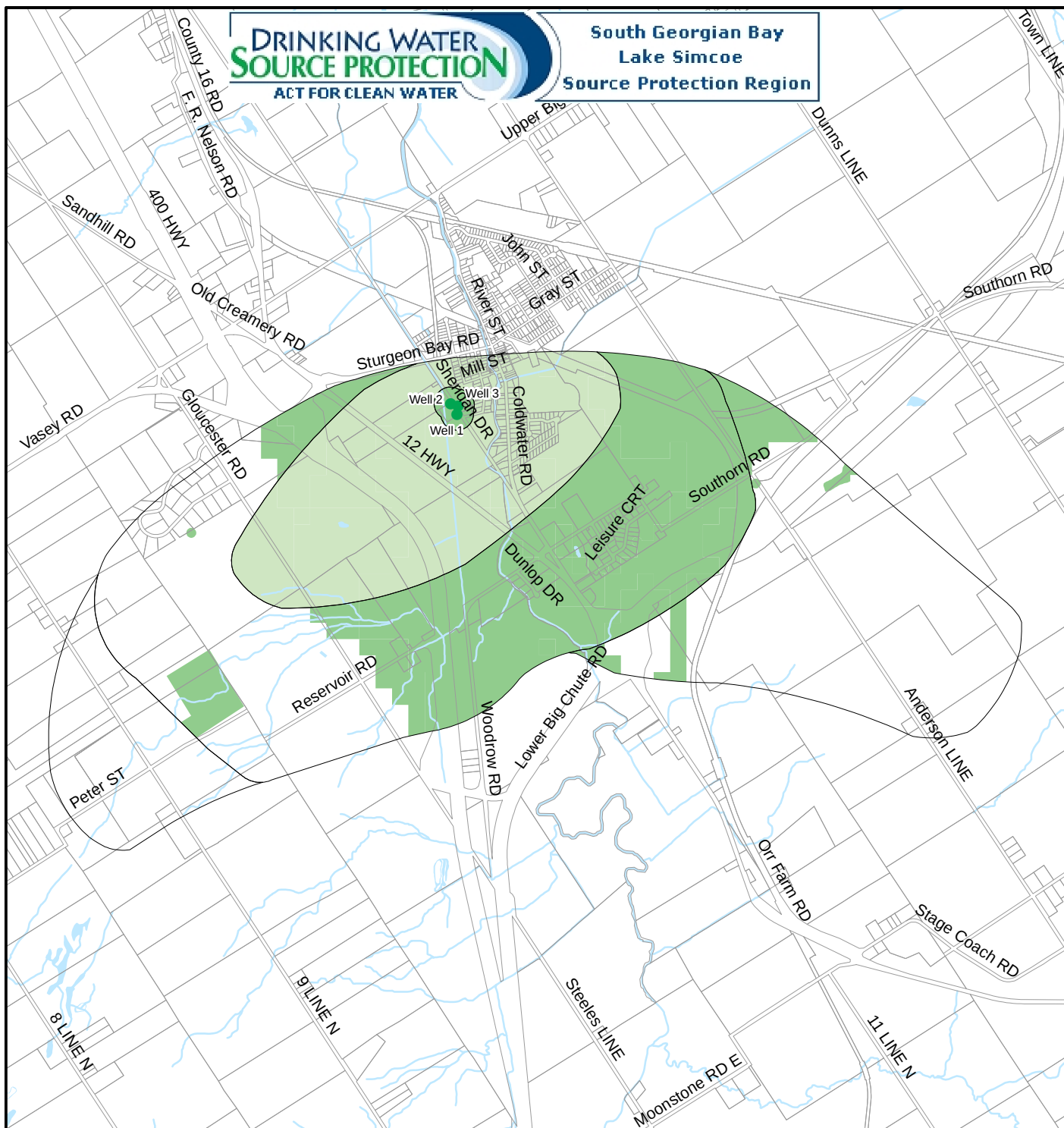
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FIGURE

10b-7



Legend

- MUNICIPAL WELL LOCATION
- MANAGED LANDS (<40%)
- MANAGED LANDS (40-80%)
- MANAGED LANDS (>80%)



340 170 0 340 Metres

**MANAGED LANDS -
COLDWATER**

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region**

The Managed Land proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

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DATE: JULY 2010

SCALE: 1:35000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.4-10



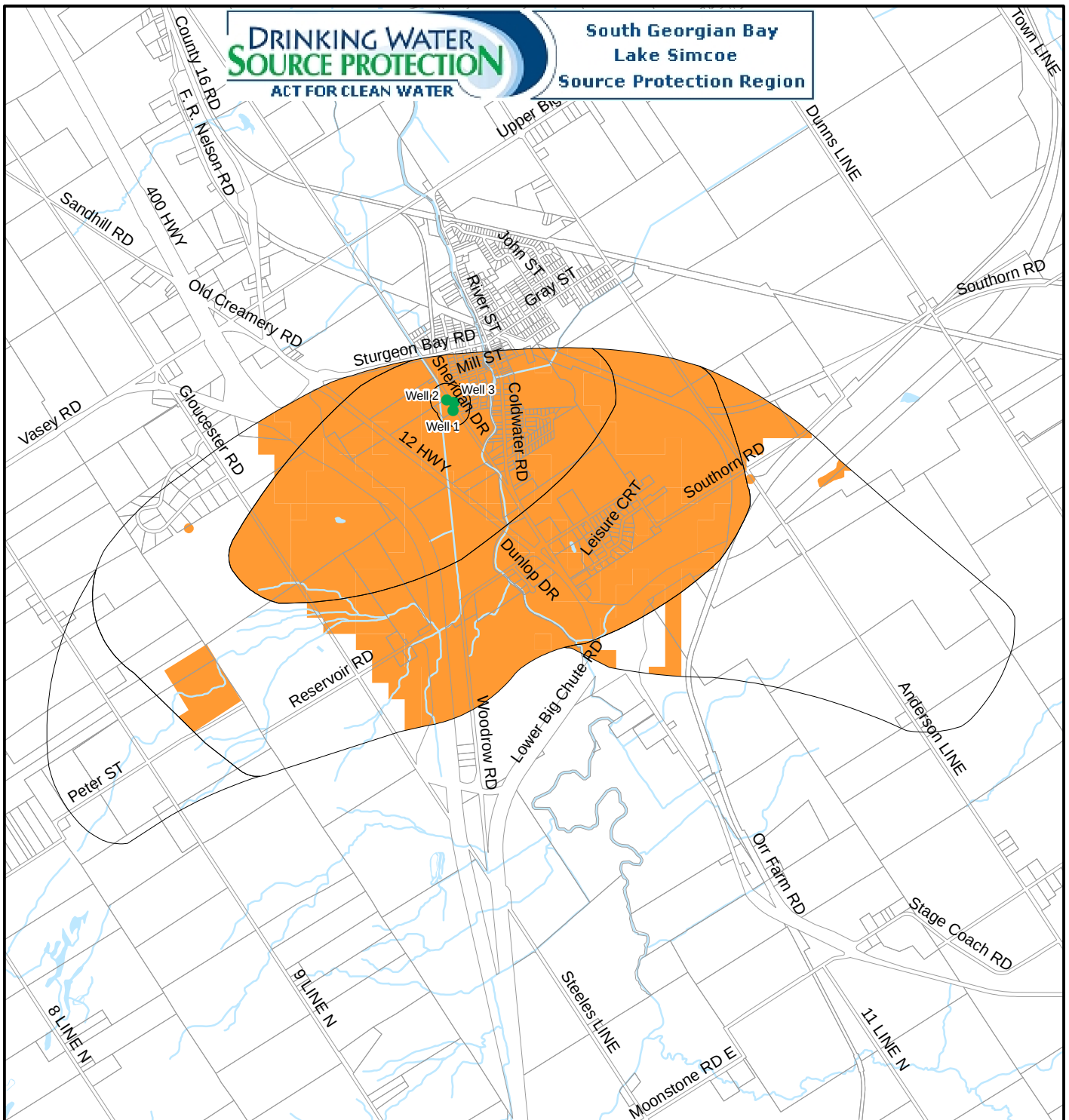
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FIGURE

10b-8



Legend

- MUNICIPAL WELL LOCATION
- LIVESTOCK DENSITY (<0.5 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (0.5-1.0 NUTRIENT UNITS/ACRE)
- LIVESTOCK DENSITY (>1.0 NUTRIENT UNITS/ACRE)



350 175 0 350 Metres

**LIVESTOCK DENSITY -
COLDWATER**

**ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES**
South Georgian Bay Lake Simcoe
Source Protection Region

The Livestock Density proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

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DATE: JULY 2010

SCALE: 1:35000

PROJECT: 0-071948.09

FILE. NO.: 0-07194809F15.4-11



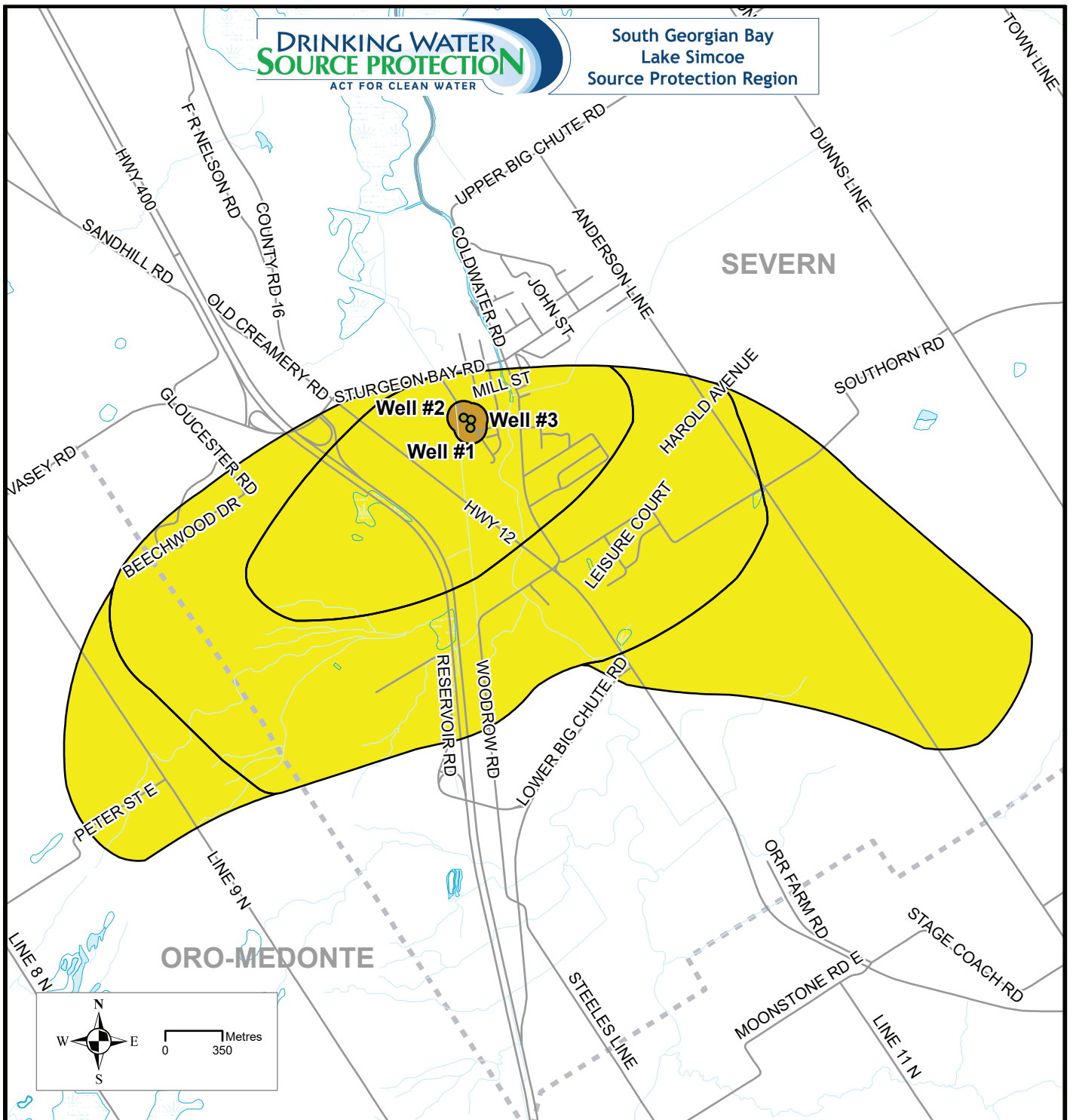
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FIGURE

10b-9



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

IMPERVIOUS SURFACES - COLDWATER

ASSESSMENT OF DRINKING WATER THREATS SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

DATE: AUGUST 2025

SCALE: 1:35,000

The Impervious Surfaces are illustrated for WHPA A-D where the vulnerability score is > 6.

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FIGURE

10b-10