Chapter 6: City of Orillia

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6 City of Orillia

6.1 Introduction

This chapter contains information on the drinking water system for the City of Orillia. Various consultants have completed the work presented, which has also been reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group or the Source Protection Committee~~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 O) for a more in depth description of the methods used, as well as the Glossary for any unfamiliar terms.

6.2 Drinking Water Systems

The City of Orillia, located at the confluence of Lake Simcoe and Lake Couchiching, operates groundwater and surface based water supplies in one (1) community. As shown in Table 6-1 and Figure 6-1, the groundwater and surface water supply are within the South Georgian Bay – Lake Simcoe (SGBLS) Source Protection Region (SPR). Table 6-1 also indicates the SPR and corresponding lead Source Protection Authority (SPA) for the municipal water supplies.

Table 6-1: Municipal Surface and Groundwater Supplies in the City of Orillia.

Local Municipality	Community Water Supply	Drinking Water Information System (DWIS) Number	Source Water Body/ Aquifer	Number of Intakes/ Wells	Source Protection Region & Source Protection Authority (SPA)
City of Orillia	Orillia Water Filtration Plant	220001183	Lake Couchiching	1	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA & Severn Sound SPA
City of Orillia	Orillia Well Water Supply System	220001183	Confined Overburden Aquifers (A3, A4)	3	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA & Severn Sound SPA

While the majority of the wells are within the Lakes Simcoe and Couchiching-Black River SPA, one well (West Orillia Well) is within the Severn Sound watershed. Further, the other Orillia WHPAs and IPZs also extend into the Severn Sound watershed. Information on the system that is presented in this report will also be available in the Lakes Simcoe and Couchiching-Black River Assessment Report (Part 2, Chapter 7).

6.3 Orillia Groundwater Supply

The drinking water supply for an estimated population of 31,716 (as of 2010) residents and businesses in the City of Orillia is obtained from the surface water intake and three (3) water supply wells.

The Orillia Water Filtration Plant (discussed in Section 6.4) treats lake water and also receives groundwater from two (2) municipal water supply wells: Well 1 and Well 2. Well 1 and Well 2 are located near the lakeshore near Jarvis Street. Wells 1 and 2 were constructed in 1939. Wells 1 and 2 were operated between 1940 and 2001, and have resumed operation in 2008. Well 1 and Well 2 were temporarily taken out of service in response to presence of trichloroethylene (TCE) and tetrachloroethylene (PCE) in the groundwater.

The West Orillia Well located on Mulcahy Court off West Ridge Boulevard came online in 2006 as part of the water distribution system.

The Orillia wells operate under Permit to Take Water 7638-84FNT2 as issued on April 21, 2010 and which expires on March 31, 2020. The wells listed on the Permit To Take Water include the West Orillia Well, Well 1, Well, 2 and Well 3. Well 3 is used only to monitor the water levels in the aquifer adjacent to Well 1 and Well 2. Well 3 is not used as a municipal supply well and therefore was not included in the Terms of Reference for the Source Protection Plan and a WHPA has not been delineated. The former Sandra Drive Well was decommissioned.

The West Orillia Well is limited to a maximum day taking of 7,920 m^3/day. Well 1 and 2 are limited to a maximum daily taking of 5,760 m^3/day for both wells combined. Well 3 is limited to a maximum taking of 3,930 m^3/day.

The three wells were drilled into a confined sand and gravel aquifer. Well 1 is a 356 x 660 mm diameter gravel wall well constructed to a total depth of 15.24 m with a 3.1 m screen. The well was rehabilitated before being put back into operation in 2008. Well 2 is a 356 x 660 mm diameter louvered wall well constructed to a total depth of 20.4 m with a 3.1 m screen. The West Orillia Well is a 406 x 305 mm diameter gravel pack well with 9.1 m of 60 and 40 slot stainless steel wire wound well screen between 48.8 and 57.9 mbgl.

The Orillia wells are constructed in a predominantly confined aquifer identified in the central part of the City of Orillia that appears to have a limited lateral extent. It is usually referred to as the Lower Aquifer. At Well 1 and Well 2 by the lakeshore, the aquifer is approximately 15 m thick and is composed of materials ranging from fine sand to coarse gravel. The extent of the aquifer appears to be limited to an east-west trending swath approximately 1 to 2 km wide. The coarsest part of the aquifer appears to be confined to a buried bedrock valley that extends to the west under the Bass Lake Kame Moraine.

The screen intervals for Well 1, Well 2 and West Orillia Well have been assigned to the A4, A4 and A3 Aquifers respectively, in the draft regional hydrostratigraphic model prepared by AquaResource and Golder (2009). The Groundwater Vulnerability rating will be determined for the A4 Aquifer for Wells 1 and 2 and for the A3 Aquifer for West Orillia Well.

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

6.3.1 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 Orillia groundwater supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and consideration was included to consider 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 Orillia WHPA. Details of the methods for the Vulnerability Analysis are provided in Technical Memorandum A1 – Groundwater Vulnerability Assessment Methods (Appendix MO).

6.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPA for the wells in the City of Orillia 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 well locations and the WHPA. The updated well locations and the WHPA are shown in Figure 6a-1. 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 (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 determination of Vulnerability Scores. The WHPA for the wells reflect groundwater flow from west to east, towards Lake Couchiching. This is reasonable based on available data describing regional groundwater flow patterns.

6.3.1.2 Groundwater Vulnerability

The Orillia wells draw water from two confined overburden aquifer layers (regional aquifer systems A3 and A4). The Groundwater Vulnerability for the municipal overburden aquifers 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 City of Orillia is shown in Figure 6a-2. The Groundwater Vulnerability for the WHPA at Well 1 and Well 2 is determined for the A4 aquifer layer. The Groundwater Vulnerability for the WHPA at West Orillia Well is determined for the A3 aquifer layer. The Groundwater Vulnerability for the three municipal water supply aquifers within the WHPA is considered to be predominantly Low. The Groundwater Vulnerability appears to increase from west to east in the two WHPAs. The Groundwater Vulnerability increases from Medium to High towards Lake Couchiching and along the south boundary of the WHPA for Well 1 and Well 2. There is an area of Medium Vulnerability within WHPA-B and WHPA-C1 for West Orillia Well.

6.3.1.3 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.

Three wells that could potentially be considered to be transport pathways were located within WHPA-C1 for the West Orillia Well. The three wells are located within an area of Low Vulnerability according to the proposed Groundwater Vulnerability map (Figure 6a-2). The Groundwater Vulnerability within the 30 m radius around the Transport Pathway wells has been increased to Medium. Mapping of the transport pathways and increased vulnerability were presented in the technical study completed by GENIVAR (2010). Ultimately the locations of transport pathways and increased vulnerability are reflected in the maps of Vulnerability Scores (See Section 6.3.1.5).

6.3.1.4 WHPA-E ~~/ WHPA-F~~

None of the wells in this study have been identified as GUDI (Groundwater Under the Direct Influence), 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.~~

6.3.1.5 Vulnerability Score

The WHPA zones for the Orillia groundwater supply, as shown in Figure 6a-1, and the Groundwater Vulnerability, as shown in Figure 6a-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 6a-3 illustrates the Vulnerability Scores for the Orillia groundwater supply. Figure 6a-3 will be used to assess Drinking Water Threats in Section 6.3.3. The Transport Pathways are illustrated as circles with 30 m radius in the WHPA for the West Orillia Well.

6.3.1.6 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 Orillia WHPAs was determined by peer reviewers from Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Orillia WHPAs is High. The full results of the WHPA delineation Peer Review process, for Orillia is available in Appendix O 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 groundwater vulnerability, and the nature of the groundwater flow system.

The Uncertainty Rating assigned for the Vulnerability Assessment component for the Orillia WHPA is High. The Vulnerability Rating for the Orillia Water Supply 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).

6.3.2 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 Orillia Groundwater Supply have 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 the City of Orillia are provided in Technical Memorandum K1 – Drinking Water Issues Evaluation – City of Orillia (Appendix O).

Several parameters were observed on occasion or in low concentrations that are consistently less than the Ontario Drinking Water Standard. Increasing trends were not observed for the majority of these parameters. Several other naturally occurring water quality parameters are present in the water in concentrations that may exceed the aesthetic or operational guidelines of the Ontario Drinking Water Quality Standards (ODWQS), including organic nitrogen. These parameters were not considered to be Drinking Water Issues.

Two Drinking Water Issues were identified with the Orillia Groundwater Supply.

Two parameters, tetrachloroethylene (or perchloroethylene (PCE)) and trichloroethylene (TCE), have been identified as Drinking Water Issues for Well 1 and Well 2 in the Orillia Groundwater Supply. PCE and TCE are relatively common industrial solvents and are considered to be Dense Non-Aqueous Phase Liquids (DNAPLs). When present together, TCE is often observed to be a product of natural degradation of PCE.

Trace concentrations of PCE and TCE were observed in the raw water for Well #1 and Well #2 throughout the 1990's. The City of Orillia withdrew the wells from service in 2001. The concentrations in treated water were not observed to be greater than historical guidelines. In 2001, the concentrations in raw water at Well 2 were greater than the current standard and an increasing trend was observed. In 2006, the Maximum Acceptable Concentration 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 or 5 µg/L. 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 PCE/TCE and to evaluate options available to the City 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 PCE or TCE, nor were they successful in fully delineating the extent of impacts from PCE and TCE in groundwater. The work completed concluded that the PCE and TCE resulted from a historical land use and not from a current land use activity.

PCE and TCE present substantial challenges for work to understand the distribution and extent in the subsurface and for remediation from the raw groundwater sources. PCE and TCE can be

removed from groundwater but the greatest likelihood of success occurs when the source area of PCE or TCE is completely removed. Success in these initiatives is also typically **very** expensive. Technologies for removing PCE and 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 PCE or TCE.

Following review of options, the City of Orillia decided to proceed and provide treatment to remove PCE and TCE from the groundwater. This system was supported by the Ontario Ministry of the Environment[1] through issuance of a Certificate of Approval to operate a treatment system. An air stripping treatment system was installed and began operating in 2008. The treatment system has been effectively reducing the concentrations of TCE and PCE in the groundwater supply from Well 1 and Well 2 since 2008. Results of raw water quality testing on TCE and PCE 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 and PCE in groundwater for the near future.

In consideration of the best available information, the 25 year Time-of-Travel Area, WHPA-D for Well 1 and Well 2 as shown in Figure 6a-1 is proposed for use as the Issues Contributing Area for TCE. The Issues Contributing Area will be used in the assessment of Threats to drinking water in Section 6.3.3. 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 City of Orillia currently collects and analyzes samples of raw water for indicators of TCE and PCE on a three (3) month frequency. Samples are also obtained at a sentry well established upgradient of the wells. 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 the City of Orillia.

- A List of prescribed drinking water threats activities that may lead to the Issue is to be prepared (See section 6.3.1.1). 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 6.3.3.2)
- 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

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

Issues Contributing Area where these activities are or would a Significant, drinking water threat (Section 6.3.3.4).

- 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 6.3.3.5)

6.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Orillia Groundwater 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 Orillia Groundwater 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.

6.3.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for Orillia Groundwater 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.

6.3.3.2 List of Drinking Water Threats – Conditions

The following information sources were consulted to identify existing Conditions that could affect the Orillia Groundwater Supply system:

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

No confirmed Conditions have been identified for the Orillia Groundwater Supply. No potential Conditions have been identified for consideration at this time.

6.3.3.3 Identifying Areas of Significant/Moderate/Low Threats – Activities

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

6.3.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores~~The Key Table~~ on Figure 6a-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 Orillia Groundwater 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.

6.3.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 6a-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 Orillia Groundwater 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.

6.3.3.3.3 DNAPL Chemical Parameters

Figure 6a-6 illustrates the area where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Orillia Groundwater Supply. The Issues Contributing Area, WHPA-D has been used for Well 1 and Well 2. The 10-year time-of-travel zone, WHPA-C1 has been used for the West Orillia Well. The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 6a-6 ~~can be used~~ to identify the circumstances in which these activities associated with DNAPL threats would be Significant or Moderate Threats.

6.3.3.3.4 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 Wellhead Protection Area -Issue~~s~~ Contributing Area are to be considered as Significant Drinking Water Threats, even if they would have been considered Moderate or Low level Threats outside of the WHPA ICA. ~~Table 6-2 provides a list of the land uses activities and circumstances that can potentially release TCE to the environment within the identified Issues Contributing Area for Wells 1 and 2 (WHPA-D). This list of activities is a subset of the activities identified as DNAPL Chemical Parameters as it contains only circumstances related to TCE and not all DNAPLS.~~

Table 6-2: Number of Significant Circumstances that are or would be Significant Threats for TCE in Issues Contributing Area.

Parameter	Threat Subcategory	Quantity Threshold for a Significant Threat (ICA)
Trichloroethylene (TCE)	Landfilling (Hazardous Waste or Liquid Industrial Waste)	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Landfilling (Municipal Waste)	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Liquid Industrial Waste Injection into a well	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Storage of Subject Waste at a Waste Generation Facility: site requires generator registration under Section 3 of O. Reg. 347	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Industrial Effluent Discharges	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Wastewater Collection Facilities and Associated Parts	Any quantity for IPZs/WHPA-Es; > 1000 m3/day for WHPAs
Trichloroethylene (TCE)	Wastewater Treatment Facilities and Associated Parts	Any quantity for IPZs/WHPA-Es and WHPAs
Trichloroethylene (TCE)	Handling and Storage of a Dense Non-Aqueous Phase Liquid (DNAPL)	Any quantity for IPZs/WHPA-Es and WHPAs

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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

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

Further to Section 6.3.3.2, no Conditions have been confirmed within the WHPA for the Orillia Groundwater 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 6a-3 illustrates the Vulnerability Score map for Orillia Groundwater Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

6.3.3.5 Enumerating Drinking Water Threats

~~*6.3.3.5*~~

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The number of Significant Drinking Water Threats for the Orillia Groundwater Supply 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.

Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10 and for parcels within WHPA-B and WHPA-C1 that are identified as potentially having a threat related to DNAPL, and where activities were identified to potentially contribute to the Drinking Water Issue within the Issues Contributing Area. Table 6-3 documents the enumeration of activities within the WHPA for Wells 1 and 2. Table 6-4 documents the enumeration of activities within the WHPA for the West Orillia Well.

For the Well 1 and Well 2 WHPA, two (2) activities that are considered to be potential Significant Drinking Water Threats were identified in association with one (1) land parcel as shown in Table 6-3. One (1) parcel and two (2) threat activities have been assigned to represent the municipal sanitary sewer system and connections as well as the potential use of residential fuel within the area with Vulnerability Score of 10. PCE and TCE parameters that are identified as a Drinking Water Issue are DNAPL chemical parameters. No parcels were identified as having activities relating to potential handling and storage of DNAPL within the Issues Contributing Area (WHPA-D) for Well 1 and Well 2.

For the West Orillia Well WHPA, eight (8) activities that are considered to be potential Significant Drinking Water Threats were identified in association with eight (8) land parcels as shown in Table 6-4. One parcel and threat activity has been assigned to represent the municipal sanitary sewer system and connections within the area with a Vulnerability Score of 10. Seven (7) parcels are associated as having potential for activities involving the handling and storage of DNAPLs.

Table 6-3: Number of Significant Drinking Water Threats for the Orillia Groundwater (Wells 1 & 2) 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.	3~~0~~
2.	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.	1
3.	The application of agricultural source material to land.	0
4.	The storage of agricultural source material to land.	0
5.	The management of agricultural source material.	0
6.	The application of non-agricultural source material to land.	0
7.	The handling and storage of non-agricultural source material.	0
8.	The application of commercial fertilizer to land.	0
9.	The handling and storage of commercial fertilizer to land.	0
10.	The application of pesticide to land.	0
11.	The handling and storage of pesticide.	0
12.	The application of road salt.	0
13.	The handling and storage of road salt.	0
14.	The storage of snow.	0
15.	The handling and storage of fuel.	1
16.	The handling and storage of dense non-aqueous phase liquid.	0

Threat Number	Threat	Significant threat counts Number of threats
17.	The handling and storage of an organic solvent.	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	~~42~~* significant threats (on 4 properties)

*2 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

Table 6-4: Number of Significant Drinking Water Threats for the Orillia Groundwater (West Orillia Well) 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.	1
3.	The application of agricultural source material to land.	0

Threat Number	Threat	Significant threat counts Number of threats
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.	0
16.	The handling and storage of dense non-aqueous phase liquid.	7
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

Threat Number	Threat	Significant threat counts Number of threats
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	**8*** significant threats (on **8** properties)

*4 verified existing Threats and 4 potential Threats that require further investigation (2015)

6.3.3.5.1 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~~Technical Rules.

Managed Lands were identified and the Managed Lands proportions were determined for the WHPA of the Orillia Groundwater 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 6.3.3.5). 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 6a-8 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Orillia Groundwater Supply where Vulnerability Scores were 6 or greater for WHPA-A to WHPA-D.

6.3.3.5.2 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~~Technical Rules.

The Livestock Density was determined for the delineated WHPA zones for the Orillia Groundwater 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 6.3.3.5). 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 6a-9 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Orillia Groundwater 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).

6.3.3.5.3 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~~Technical Rules.

The proportion of Impervious Surfaces within the delineated WHPA zones for the Orillia Groundwater Supply was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 6.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

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

6.4 Orillia Water Filtration Plant

The Orillia Surface Water Supply is processed through the Orillia Water Filtration Plant, located on the southwest shore of Lake Couchiching in the City of Orillia. The facility has a capacity of 27,200 m^3/day, servicing the City of Orillia's residential, commercial and industrial users (City of Orillia, 2006). The population of the City of Orillia in 2006 was 30,908 (City of Orillia, 2006).

Construction of the original Orillia Water Filtration Plant and associated intake pipe was completed in 1914. A new intake and associated intake pipe were constructed in 1994/1995. The Orillia Water Filtration Plant has historically treated surface water from Lake Couchiching (with a firm capacity of 27, 200 m_3/day) as well as groundwater from two nearby wells (Well 1 and Well 2 with a combined capacity of 5,725 m^3/day). Well 1 and Well 2 were taken offline in January 2001 due to low levels of trichloroethylene (TCE) and tetrachloroethylene (PCE) contamination. Between January 2001 and May 2008, when a new groundwater treatment building with an Air Stripping process that removes TCE and PCE was built, the WFP only treated water from Lake Couchiching (City of Orillia, 2006). Another well, the West Orillia Well was completed and commissioned in late 2005 and put into operation in September 2006. The Orillia Water Filtration Plant uses up to date technology to treat the water from Lake using polyaluminum chloride, dual media (granular activated carbon and sand filtration) and post chlorination. Three Ultraviolet light (UV) reactors (two duty and one stand-by) are also used for disinfection. The treatment process is monitored with an on-line Supervisory Control and Data Acquisition (SCADA) system. A chlorine diffuser is located near the mouth of the intake to deter colonization by zebra mussels.

The intake is located 374 m offshore, in a water depth of 5.4 m. The top of the intake structure is located 2 m above the lakebed, making the total water depth of the intake 3.4 m for this study. Water is delivered from the intake to the WFP via 374 m of 1000 mm diameter polyethylene pipe that runs from the intake structure to the shoreline.

Based on the interview with representatives of the Orillia Water Filtration Plant, conducted by personnel from LSRCA on August 22, 2006, the WFP can be shut down within 5 to 10 minutes upon notification (the WFP is staffed full time). WFP personnel estimated notification time (by ~~MOE~~MECP) in the event of a spill to be 30 minutes.

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

6.4.1 Methods and Uncertainties

6.4.1.1 Surface Water Vulnerability

The Orillia intake is classified as Type D surface water intake (Rule 55; MOE, 2008a). For Type D intakes, three zones are to be delineated: the IPZ-1 is based on a fixed radius around the intake crib; the IPZ-2 acts as a secondary protection zone around the IPZ-1; and the IPZ-3 is considered an additional protection zone. For the purposes of delineating the IPZ-3, the Lake Simcoe

intakes are also identified as a special case (Rule 68) and those rules applicable to Type A and B intakes also apply in this regard.

6.4.1.2 Delineating IPZ-1 and IPZ-2

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

The IPZ-2 is defined based on the area that may contribute water to the intake where the time of travel to the intake is equal to or less than the time that is sufficient to allow the operator of the system to respond to an adverse condition in the quality of the surface water (Rule 65; MOE, 2008a). The two hour minimum response time was used for the Orillia WFP, as the operator response time to shut-down the intake was within 5 to 10 minutes of receiving notification.

The IPZ-2 is comprised of four areas:

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

6.4.1.2.1 <u>In-lake IPZ-2 delineation</u>

The approach used in this study was to define the in-water IPZ-2 based on the currents predicted by the MIKE3 hydrodynamic model as described in Baird (2010g). The Lake Simcoe model is based on the original model developed for the Assimilative Capacity Studies as described in Baird (2006). This previous work demonstrated that DHI's MIKE3 model could successfully simulate both wind driven currents and thermocline development in Lake Simcoe. A new model with a 100 m grid was developed for Lake Couchiching. The model was calibrated with measured current data. There was limited data available for the calibration, for Lake Couchiching due to an instrument malfunction, however, based on the calibration undertaken, the model seemed to capture the general trends in current speed and direction.

For delineating IPZ-2, currents were developed for 10 year return period wind events, for eight wind directions, run at 45^{o} intervals for both the Lake Simcoe and Lake Couchiching models (Baird 2010g, Appendix O). For each wind condition, the model was run with a constant wind applied to the surface of the lake, until the currents in the lake were fully developed. Reverse particle tracking was used to track the paths that the currents would have transported neutrally buoyant particles to the intake over a 2 hour period. Although the intakes are located near the

lakebed, particles were introduced at the surface and near the lakebed. The particles released at both depths were considered in delineating the IPZ-2, as this is a more conservative approach. The impact of the water withdrawn by the intake on the local currents was also investigated, with the model indicating that the intake only significantly influences the currents within a 2 m to 5 m radius of the intake.

Currents inshore of the breaker or surf zone are complex and are not well defined by existing numerical models. However, it is recognized that there is potential for currents in the surf zone to transport a contaminant in an offshore direction from the shoreline. The significance of this increases for intakes located in high wave energy environments and for intakes located within the surf zone. A preliminary assessment of the location of the surf zone was undertaken by Baird (2010g). The assumption is that mixing processes inside the surf zone could transport a contaminant to the offshore limit of the surf zone. Estimated depth at offshore limit of surf zones is presented in Appendix O – Table 5.1, Baird, 2010g.

6.4.1.2.2 Up Tributary

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

There are two tributaries located within the IPZ-2 for the Orillia intake: one located north of the intake and one located south of the intake. Both tributaries were assumed to have a flow velocity of 1 m/s (Appendix O - Baird, 2010g). Tributary velocities provided by the LSRCA where used where available. Alternatively, the velocity was estimated from bank full discharge divided by the approximate area of the cross-section at the mouth of the tributary.

6.4.1.2.3 Inland Setback

Where the IPZ-1 abuts land, it includes a setback on land that is the greater of the area of land that drains into the surface water body measured from the HWM and not exceeding 120 m; if a Conservation Authority Regulation Limit is in effect, the area of land that is within the Conservation Authority Regulation Limit [Rules 62 (1) and 62 (2); MOE, 2008a]. Lake Couchiching is not a regulated area and therefore a setback of 120 m was used.

6.4.1.2.4 Transport Pathways

The IPZ-2s were modified to include potential Transport Pathways based on Rules 72 to 74. A complete description of the methodology, analysis and Transport Pathway delineation is provided in Baird 2010g.

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

The sewersheds discharging into the IPZ-2 were identified from LSRCA and municipal storm water network datasets. Residence time and the velocity were then used to estimate a maximum within-sewershed travel distance. A summary of travel distance calculations for Orillia can be found in Baird 2010g. In all sewersheds, the travel distance was greater than the assumed longest flow path in the sewershed, so the entire sewershed was included in the revised IPZ-2.

6.4.1.3 Delineating IPZ-3

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

For the intakes in Lake Couchiching, the IPZ-3 includes the watershed upstream of the intake, which does not fall within the IPZ-1 or IPZ-2. Lake Couchiching lies within the Black-Severn Watershed. The total drainage area is 2,805 km^2. The Black River watershed is divided into seven sub-watersheds, one of which is Lake Couchiching. The area of the Lake Couchiching subwatershed is 98 km_2 as described in Chapter 2: Watershed Characterization.

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

6.4.1.4 IPZ Vulnerability Scores

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

B x C

where,

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

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

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

It is important to note that even though Vulnerability Scores were developed for each IPZ-3 subarea for the Orillia intake (and all intakes in the watershed), the final Vulnerability Score applied is based on the highest Vulnerability Score of all the surface water intakes in Lakes Simcoe and Couchiching. Applying the highest Vulnerability Score is necessary as one surface area cannot have different Vulnerability Scores.

6.4.1.4.1 Area Vulnerability Factor

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

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

For the IPZ-2, a 'base' Area Vulnerability Factor of 8 (the median factor for an IPZ-2) was initially assigned, and then altered by four modifier scores based factors such as land cover, hydrology, slope and the characteristics of the subwatershed that the IPZ-2 is located in (the four potential modifiers can be found in Baird, 2010g).

The IPZ-2 base Area Vulnerability Factor, modifiers and final Area Vulnerability Factor for the Orillia WFP are listed in Table 6-5.

Table 6-5: Derivation of IPZ-2 Area Vulnerability Factor (B) for Orillia WFP.

Intake	Sub-watershed Closest to Intake	Base Area Vuln. Factor	IPZ-2 Land % Modifier[1]	Drainage Density Modifier[1]	SCS Curve Number Modifier	Land Use Modifier	Relief/ Length Ratio Modifier	IPZ-2 Final Area Vuln. Factor (B)
Orillia	Lake Couchiching	8	0	-1	0	0	0	7

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

The Area Vulnerability Factors for the IPZ-3 sub-areas were determined, using the same methodology as IPZ-2, with some minor additions. IPZ-3 sub-areas were defined as the sub-watersheds within the Lake Simcoe watershed and Lake Couchiching subwatershed. The Lake Simcoe and Lake Couchiching water bodies were also defined as IPZ-3 sub-areas. As stated previously, the Area Vulnerability Factors that are assigned to the IPZ-3 sub-areas cannot be

greater than the Area Vulnerability Factor assigned to the IPZ-2 (Rule 91; MOE, 2008a). Methodology can be found in Baird, 2010g.

The IPZ-3 sub-area base Area Vulnerability Factors, modifiers and final Area Vulnerability Factors for the Orillia WFP are listed in Table 6-6.

Table 6-6: Derivation of IPZ-3 Area Vulnerability Factors for Orillia WFP.

IPZ-3 Sub-zones	Base Are Vulnerability Factor	Distance Modifier[1]	Drainage Density Modifier[2]	SCS Curve Number Modifier[3]	Land Use Modifier[4]	Relief Length Modifier[5]	Final Area Vulnerability Factors (B)[6]
Lake Couchiching waterbody (including islands)	6	0	-	-	-	-	6
Lake Simcoe waterbody (including islands)	6	0	-	-	-	-	6
Lake Couchiching subwatershed	6	0	-1	0	0	0	5
Oro Creeks North subwatershed	6	-1	0	0	1	1	6
Ramara Creeks subwatershed	6	-1	0	0	0	0	5
Hawkestone Creek subwatershed	6	-2	0	-1	0	1	4
Oro Creeks South subwatershed	6	-2	0	0	0	0	4
Upper + Lower Talbot River subwatershed	6	-2	0	-1	0	-1	2
Whites Creek subwatershed	6	-2	0	0	0	0	4
Beaver River subwatershed	6	-2	0	-1	0	0	3
Black River subwatershed	6	-3	0	0	0	0	2
Pefferlaw Brook + Uxbridge Brook subwatershed	6	-3	0	0	0	0	2

IPZ-3 Sub-zones	Base Are Vulnerability Factor	Distance Modifier[1]	Drainage Density Modifier[2]	SCS Curve Number Modifier[3]	Land Use Modifier[4]	Relief Length Modifier[5]	Final Area Vulnerability Factors (B)[6]
Georgina Creeks subwatershed	6	-3	-1	1	0	0	3
Hewitts Creek subwatershed	6	-3	0	0	0	0	3
Lovers Creek subwatershed	6	-3	0	0	0	0	3
Innisfil Creeks subwatershed	6	-3	0	0	0	0	3
Barrie Creek subwatershed	6	-3	0	0	1	1	5
Maskinonge subwatershed	6	-4	0	1	0	0	3
West Holland subwatershed	6	-4	1	0	0	0	3
East Holland subwatershed	6	-4	0	0	0	0	3

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

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

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

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

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

[6] Final Area Vulnerability Factor plus/minus all modifiers

6.4.1.4.2 Source Vulnerability Factor

A Source Vulnerability Factor is assigned to each surface water intake (Rule 94; MOE, 2008a). Source Vulnerability for intakes within the SGBLS Source Protection Region was based on that developed by the Michigan Department of Environmental Quality (MDEQ). The first three rows in Table 6-7 were taken directly from MDEQ (2004), while the fourth row lists the corresponding Vulnerability Factor assigned for the Orillia WFP.

Table 6-7: Intake Vulnerability Criteria based on Intake Distance from Shore and Depth (adapted from MDEQ, 2004).

Category[1]	Nearshore-Shallow Water	Nearshore-Deep Water	Offshore-Shallow Water	Offshore-Deep Water
Parameters[1]	<3500 m offshore <6 m depth	<3500 m offshore >6 m depth	>3050 m offshore <6 m depth	>3500 m offshore >6 m depth
Vulnerability [1] (MDEQ)	High	High to Moderate	High to Moderate	Moderate
Recommended Source Vulnerability Factor based on Intake Offset and Depth	1.0	0.9	0.9	0.8

[1]Category, parameters and vulnerability based on MDEQ (2004).

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None of the water filtration plant operators interviewed by LSRCA for this study reported a plant shut down due to water quality issues, similarly the Issues Evaluation (below) did not identify any Issues for this intake. As no Water Quality Issues were identified the Source vulnerability Score was based on the water depth and distance offshore only. The Orillia WFP intake is located 374 m from shore at a water depth of 3.4 m. A Source Vulnerability Factor (C) of 0.9 was therefore assigned, based on the values presented in ~~Error! Reference source not found.~~ (MDEQ, 2004).

6.4.1.5 Uncertainty Assessment

This section summarizes some of the uncertainty identified by Baird (2010g) when delineating IPZs and the assigning Vulnerability Scores; the entire discussion of uncertainties is presented in Appendix O, Baird 2010g. This assessment was used by Baird (2010g) to assign Uncertainty Ratings of either "High" or "Low" for the IPZ and Vulnerability Scores.

6.4.1.5.1 Data Quality and Gaps:

Data gaps and data quality issues identified during the study included: bathymetry and shoreline delineation data sets that may be out of date or too low resolution; wind data from a single location (Lagoon City Buoy) being applied to the entire lake; tributary flow data being limited to the major tributaries; lower level of confidence in the calibration for the Lake Couchiching model, due to the limited measured current data used in the model calibration; and limited raw water quality data is available. Complete list of data quality and gaps listed in Baird 2010g, Appendix O.

6.4.1.5.2 Model Capabilities and Application

A model is a tool that is used to improve our understanding of the physical processes. It is important to understand the model limitations, as well as the limitations of the application, that is how the model was set up, the data was used as input to the model, the model runs undertaken, and the interpretation of the results. The limitations of the model used in this study include: (A complete list and description of model uncertainties is provided by Baird (2010g) (Appendix O)

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

6.4.1.5.3 Quality Assurance/Quality Control

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

6.4.1.5.4 Extent and Level of Model Calibration/Validation

The MIKE3 model was calibrated with measured current data from two locations on Lake Simcoe, and one location in Lake Couchiching. It is important to note that the ADCP data sets

are of limited duration and spatial coverage. They did not include the extreme events that were modeled for the matrix runs. The level of calibration was based on the available data and in general, the models captured the trends in the surface currents. Based on the calibration undertaken, the model seemed to capture the general trends in current speed and direction.

6.4.1.5.5 Area and Source Vulnerability Factors

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

6.4.2 Results Orillia Water Filtration Plant

6.4.2.1 Intake Protection Zones (IPZ)

The IPZ-1 and IPZ-2 for the City of Orillia WFP are shown in Figure 6b-1. IPZ-1 consists of a 1 km radius centered on the crib of the intake, extending 120 m inland. The IPZ-2 includes Transport Pathways, such as drains and ditches that extend the IPZ-2 in various locations within the Orillia community. The IPZ-3 for the Orillia WFP, as with all intakes in Lake Couchiching, has been defined as the entire Lake Simcoe and Lake Couchiching sub-watershed (Figure 6b-2). The Lake Couchiching water body and watershed were included as IPZ-3 sub-areas because current flow measurements show reverse flow (i.e. from Lake Couchiching to Lake Simcoe), do occur.

6.4.2.2 Intake Protection Zone (IPZ) Vulnerability Scores

The Vulnerability Factors and scores for the IPZ-1, IPZ-2 and IPZ-3 sub-areas are summarized below in Table 6-8 and Figure 6b-1 and Figure 6b-2.

Table 6-8: Summary of Vulnerability Factors and Scores for Orillia WFP.

IPZ	Area Vulnerability Factor (B)	Source Vulnerability Factor (C)	Vulnerability Score (V)
IPZ-1	10	0.9	9.0
IPZ-2	7	0.9	6.3
IPZ-3 Sub-areas			
Lake Couchiching waterbody (incl.islands)	6	0.9	5.4
Lake Simcoe waterbody (incl.islands)	6	0.9	5.4
Lake Couchiching subwatershed	5	0.9	4.5
Oro North Creeks subwatershed	6	0.9	5.4
Ramara Creeks subwatershed	5	0.9	4.5
Hawkestone Creek subwatershed	4	0.9	3.6
Oro South Creeks subwatershed	4	0.9	3.6
Upper + Lower Talbot River subwatershed	2	0.9	1.8
Whites Creek subwatershed	4	0.9	3.6
Beaver River subwatershed	3	0.9	2.7
Black River subwatershed	2	0.9	1.8
Pefferlaw Brook + Uxbridge Brook subwatershed	2	0.9	1.8
Georgina Creeks subwatershed	3	0.9	2.7
Hewitts Creek subwatershed	3	0.9	2.7
Lovers Creek subwatershed	3	0.9	2.7
Innisfil Creeks subwatershed	3	0.9	2.7
Barrie Creeks subwatershed	5	0.9	4.5
Maskinonge subwatershed	3	0.9	2.7
West Holland subwatershed	3	0.9	2.7
East Holland subwatershed	3	0.9	2.7

6.4.2.3 Uncertainty for IPZ Delineation and Vulnerability

Based on the factors discussed above, Baird (2010g) recommended an IPZ delineation Uncertainty Rating for the IPZ-1 as low and IPZ-2 and IPZ-3 as High. The Uncertainty Rating for the IPZ-1, -2 and -3 Vulnerability Scores are all High (Table 6-9).

While the location of the intake was relatively well defined and no Drinking Water Issues were reported (see Section 6.4.3) based on the data analyzed, limited data were available for the Issues Analysis and the operator raised some concerns (Baird, 2010g). A High Uncertainty was therefore assigned to the Vulnerability Score for the IPZ-1.

The IPZ-2 delineation is based on current velocities in the vicinity of the intake. Based on the data, model, model application, and model calibration limitations presented in this section, a High rating of Uncertainty is recommended. The High levels of Uncertainty are not a reflection of the quality of work, but recognition of the limitations presented. With respect to extension of the IPZ-2 up tributaries, the velocities in small tributaries, in many cases were assumed, due to lack of data. Similarly, no fieldwork was undertaken to define the characteristics of Transport Pathways and there are significant data gaps. A High level of Uncertainty was therefore

assigned to the IPZ-2 delineation. Vulnerability Scores for the IPZ-2 were assigned based on the Area and Source Vulnerability Factors. The Uncertainty Rating for the data used to define the Source Vulnerability Factor (offset from shore, depth and history of water quality concerns) is High as discussed for the IPZ-1. The level of Uncertainty for the Area Vulnerability for the IPZ-2 is also High due to the degree of uncertainty in the methodology used to develop the Area Vulnerability Factor. This in part stems from the fact that the Rules (MOE, 2008a) do not provide specific guidance.

Table 6-9: Summary of Uncertainty Ratings for the City of Orillia WFP IPZs and Vulnerability Scores.

IPZ	Uncertainty For IPZ Delineation	Uncertainty For Vulnerability Scores
IPZ-1	Low	High
IPZ-2	High	High
IPZ-3	High	High

The IPZ-3 limits have been defined based on [Rule 70; MOE, 2008a]. The entire watersheds of Lake Couchiching and Lake Simcoe were included in the IPZ-3. Although not required, an analysis to determine whether a spill would result in a contaminant reaching the intake in a concentration that could compromise the drinking water would be beneficial. A High level of Uncertainty has therefore been assigned to the IPZ-3 delineation.

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

6.4.3 Drinking Water Issues

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 Orillia Surface Water Supply have 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 the City of Orillia are provided in Technical Memorandum K1 – Drinking Water Issues Evaluation – City of Orillia (Appendix O).

No Drinking Water Issues were identified with the Orillia Water Filtration Plant.

There are some Parameters whose concentrations occasionally exceed Aesthetic/Operational guidelines. 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. Concentrations do not appear to be increasing.

Trihalomethanes are present in trace concentrations in the treated water as by-products of disinfection by chlorination. Trihalomethane concentrations are typically well below ODWQS values and do not display increasing trends.

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

6.4.4 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Orillia Water Filtration Plant was completed in accordance with the methodology described in GENIVAR (2010a) and 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 Orillia Water Filtration plant 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.

6.4.4.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for Orillia Water Filtration Plant 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.

6.4.4.2 List of Drinking Water Threats – Conditions

The following information sources were consulted to identify existing conditions that could affect the Orillia Water Filtration Plant:

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

No confirmed Conditions have been identified for the Orillia Water Filtration Plant. No potential Conditions have been identified for consideration at this time.

6.4.4.3 Identifying Areas of Significant/Moderate/Low Threats –Activities

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

6.4.4.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 6b-3 ~~can be used in conjunction with the Vulnerability Score~~s to identify the areas where activities associated with pathogen threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Orillia Water Filtration Plant. Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is 9 or greater.

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

6.4.4.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores ~~The Key Table~~ on Figure 6b-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 Orillia Water Filtration Plant. Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is 9 or greater.

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

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

Further to Section 6.4.4.2, no Conditions have been confirmed within the WHPA for the Orillia Water Filtration Plant.

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 6b-1 and Figure 6b-2 illustrates the Vulnerability Score maps for Orillia WFP that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

6.4.4.5 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the surface water source to the Orillia Water Filtration Plant 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 6-10 documents the enumeration of existing activities that are considered to be potential Significant Drinking Water Threats within the IPZ for the Orillia Surface Water Supply. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is greater than 8 in IPZ-1 and IPZ-2.

Three (3) storm sewer outfalls within IPZ-1 have been identified as Significant Drinking Water Threats to the water intake for the Orillia Surface Water Supply.

Table 6-10: Number of Significant Drinking Water Threats for the Orillia Water Filtration Plant.

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.	0
3.	The application of agricultural source material to land.	3
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.	3~~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.	0
16.	The handling and storage of dense non-aqueous phase liquid.	0

Threat Number	Threat	Significant threat counts Number of threats
17.	The handling and storage of an organic solvent.	0
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	**Totals:**	~~36~~ significant threats (on 6 properties)

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~~6.4.4.4.1~~6.4.4.5.1 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 IPZ-1, -2 and -3. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a threat in the ~~Table of Drinking Water Threats~~Technical Rules.

Managed Lands were identified and the Managed Lands proportions were determined for IPZ-1 and IPZ-2 for the water supply to the Orillia WFP as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 6.4.4.5). The Managed Lands are used in the identification of Threat activities associated with the application of Agricultural Source Material, Non-Agricultural Source Material and commercial fertilizer.

Figure 6b-7 illustrates the location and proportion of Managed Lands within the delineated IPZ-1 and IPZ-2 for the Orillia Water Filtration Plant. The Managed Lands proportions for the IPZ-3 associated with the surface water intakes in Lake Simcoe are presented in Figure 6b-8.

~~6.4.4.4.2~~6.4.4.5.2 Livestock Density

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

The Livestock Density was determined for IPZ-1 and IPZ-2 for the water supply to the Orillia WFP as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 6.4.4.5). Nutrient units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material, and the grazing and/or confinement of livestock.

Figure 6b-9 illustrates the distribution of Livestock Density within the delineated IPZ-1 and IPZ-2 for the Orillia Water Filtration Plant where Vulnerability Scores were greater than 6. The Livestock Density for the IPZ-3 associated with the surface water intakes in Lake Simcoe is presented Figure 6b-10.

~~6.4.4.4.3~~6.4.4.5.3 Impervious Surfaces

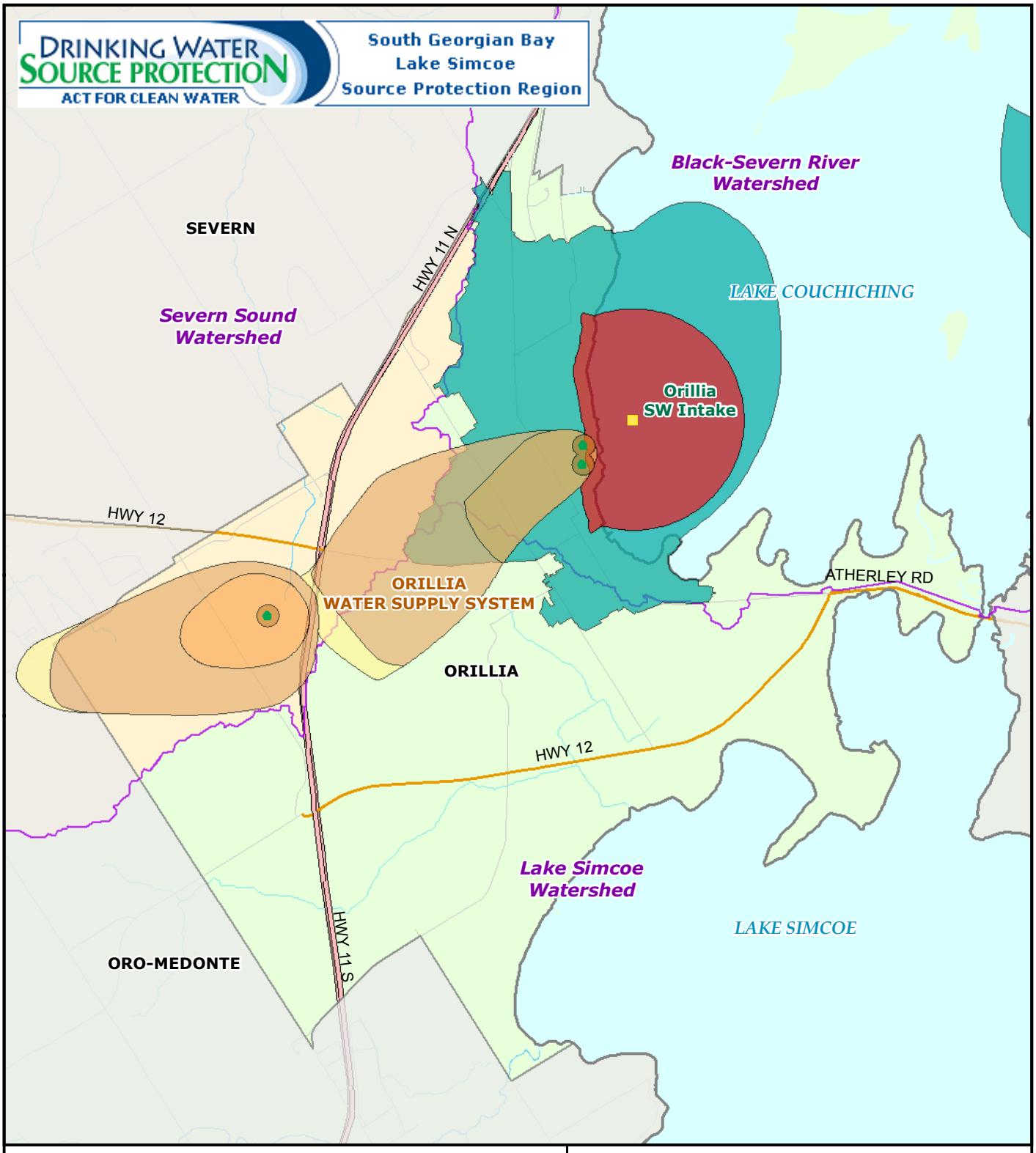
Technical Rule 16(11) ~~(August 2009)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within including IPZ-1, -2 and -3. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the ~~Table of Drinking Water Threats~~Technical Rules.

The proportion of Impervious Surfaces within the delineated IPZ-1 and IPZ-2 for the water supply to the Orillia WFP was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated Intake Protection Zones using the 2021 Technical Rules. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 6.4.4.5). The Impervious Surfaces are used in the identification of Threat activities associated with the application of winter de-icing agents (salt).

Figure 6b-11 illustrates the distribution of Impervious Surfaces within the delineated IPZ-1 and IPZ-2 for the Orillia Water Filtration Plant where the Vulnerability Scores were greater than 6. The proportion of Impervious Surfaces for the IPZ-3 associated with the surface water intakes in Lake Simcoe are presented in Figure 6b-12.

6.5 Data Gaps

Well 3, which was previous referred to as the Sandra Drive Well, was not included in the Terms of Reference for the Source Protection Plan and as such a WHPA has not yet been delineated. This well was not included as is not equipped for pumping, treatment or distribution and is only used to monitor water levels in the aquifer. Whether a WHPA needs to be prepared in the future still needs to be resolved.



- Municipal Surface Water Intakes
- IPZ-1 (1000m on water or 120m inland)
- IPZ-2 (2 hr time of travel)
- Municipal Supply Well in City of Orillia
- WHPA-A (100m)
- WHPA-B (2 years time of travel)
- WHPA-C1 (10 years time of travel)
- WHPA-D (25 years time of travel)

Drinking Water System Vulnerable Areas in City of Orillia

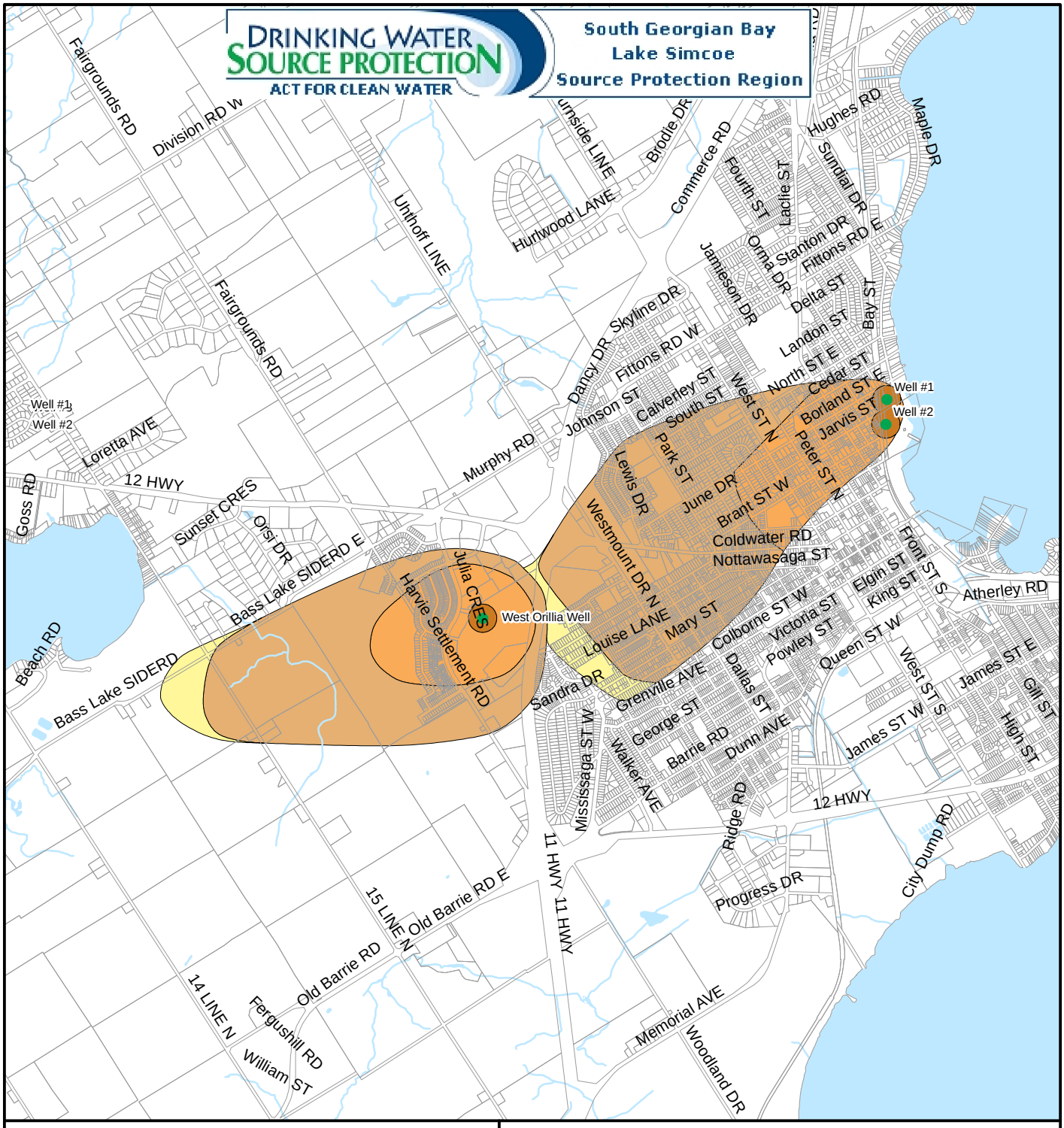
Created by: LSRCA
Date: 2011-03-29

Scale: 1:50,000
0 0.5 1km
UTM Zone 17N, NAD83

Severn Sound Environmental Association

Ontario

Figure 6-1



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

N W E S

500 250 0 500 Metres

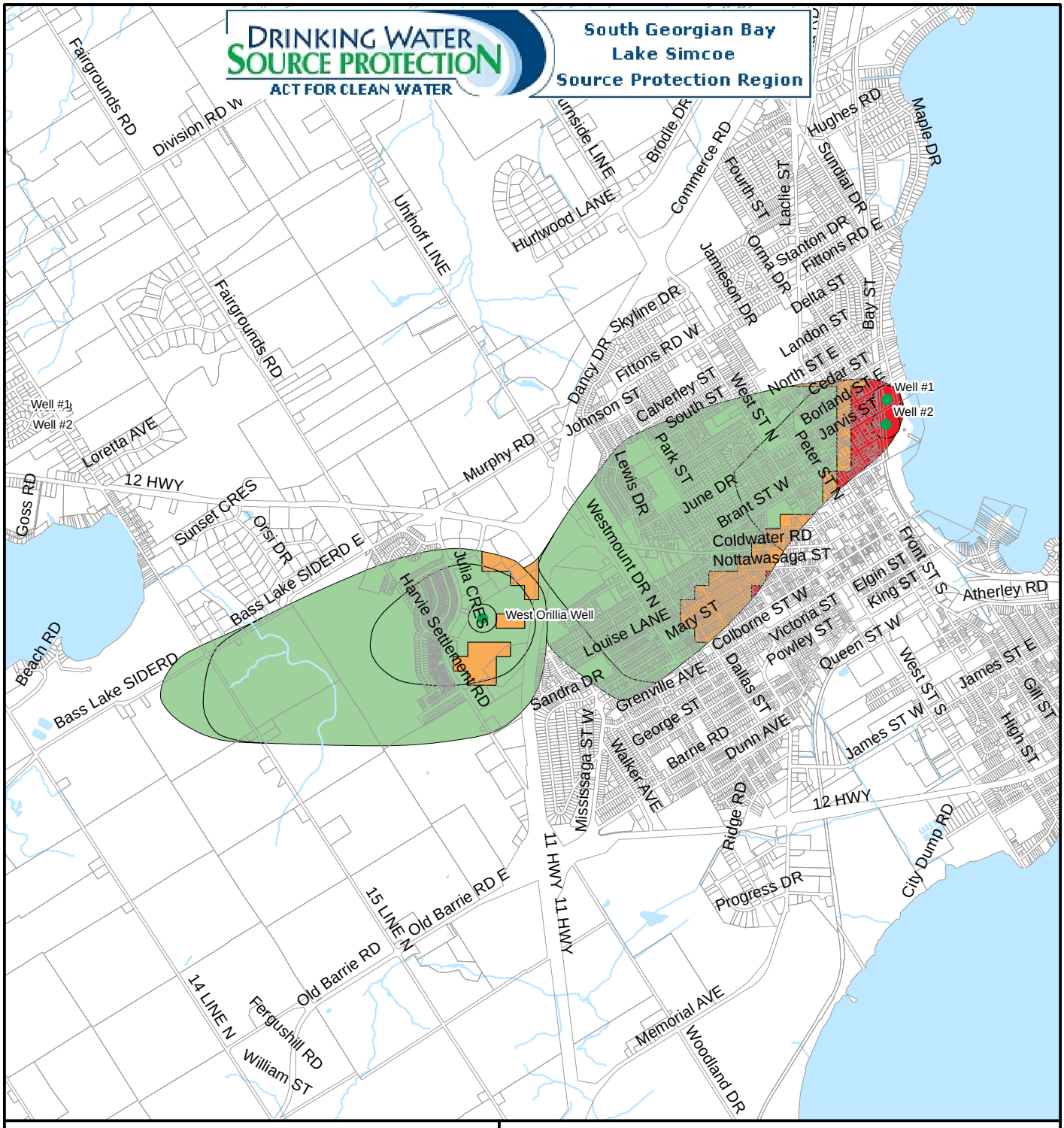
WELLHEAD PROTECTION AREAS - ORILLIA

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

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F12.2-1

GENIVAR Ontario

FIGURE 6a-1



Legend

- MUNICIPAL WELL LOCATION

AQUIFER VULNERABILITY

- HIGH
- MEDIUM
- LOW

N W E S

500 250 0 500 Metres

GROUNDWATER VULNERABILITY - ORILLIA

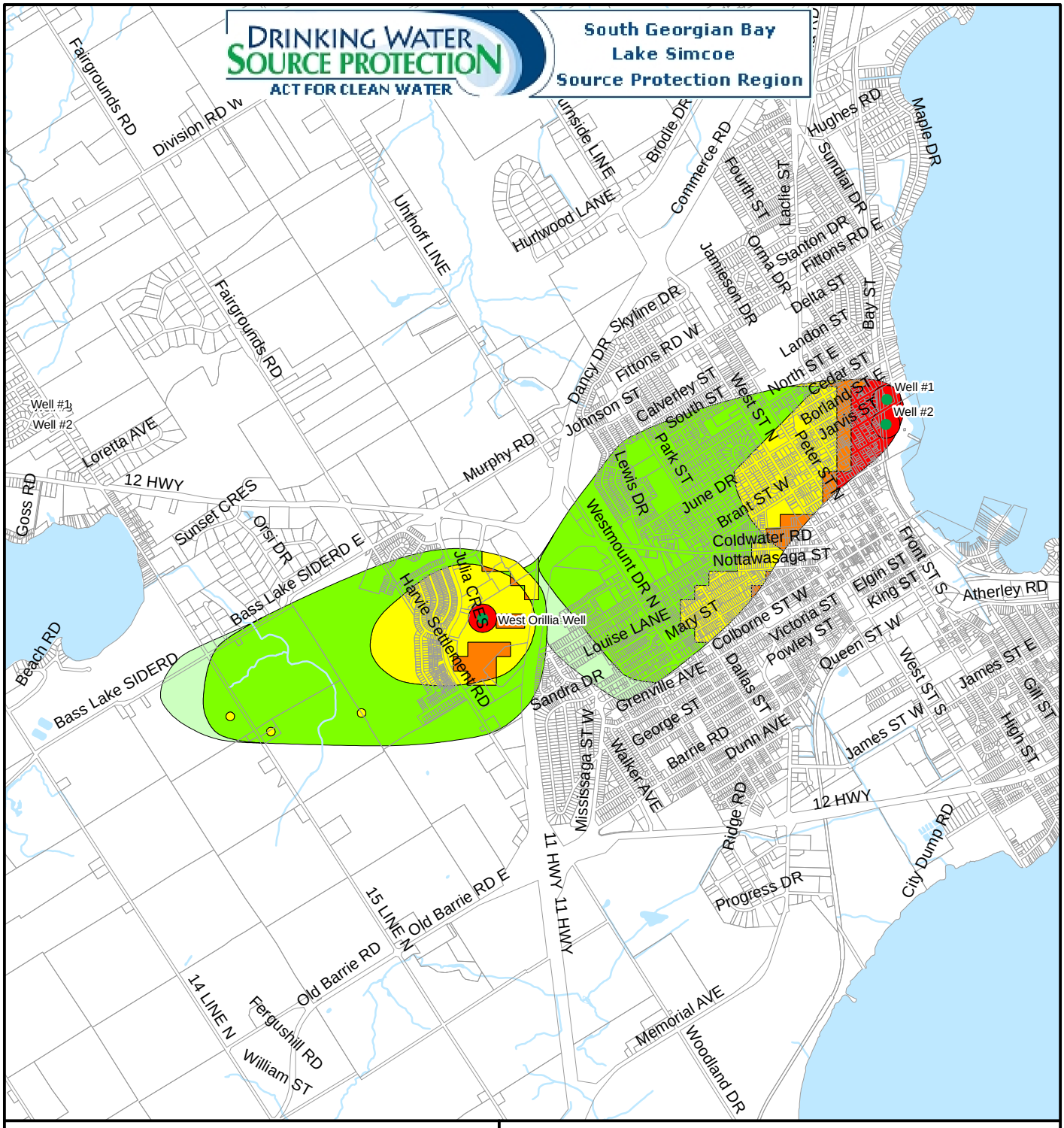
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F12.2-2

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 **6a-2**



Legend

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORE

- 10
- 8
- 6
- 4
- 2

N W E S

500 250 0 500 Metres

VULNERABILITY SCORE - ORILLIA

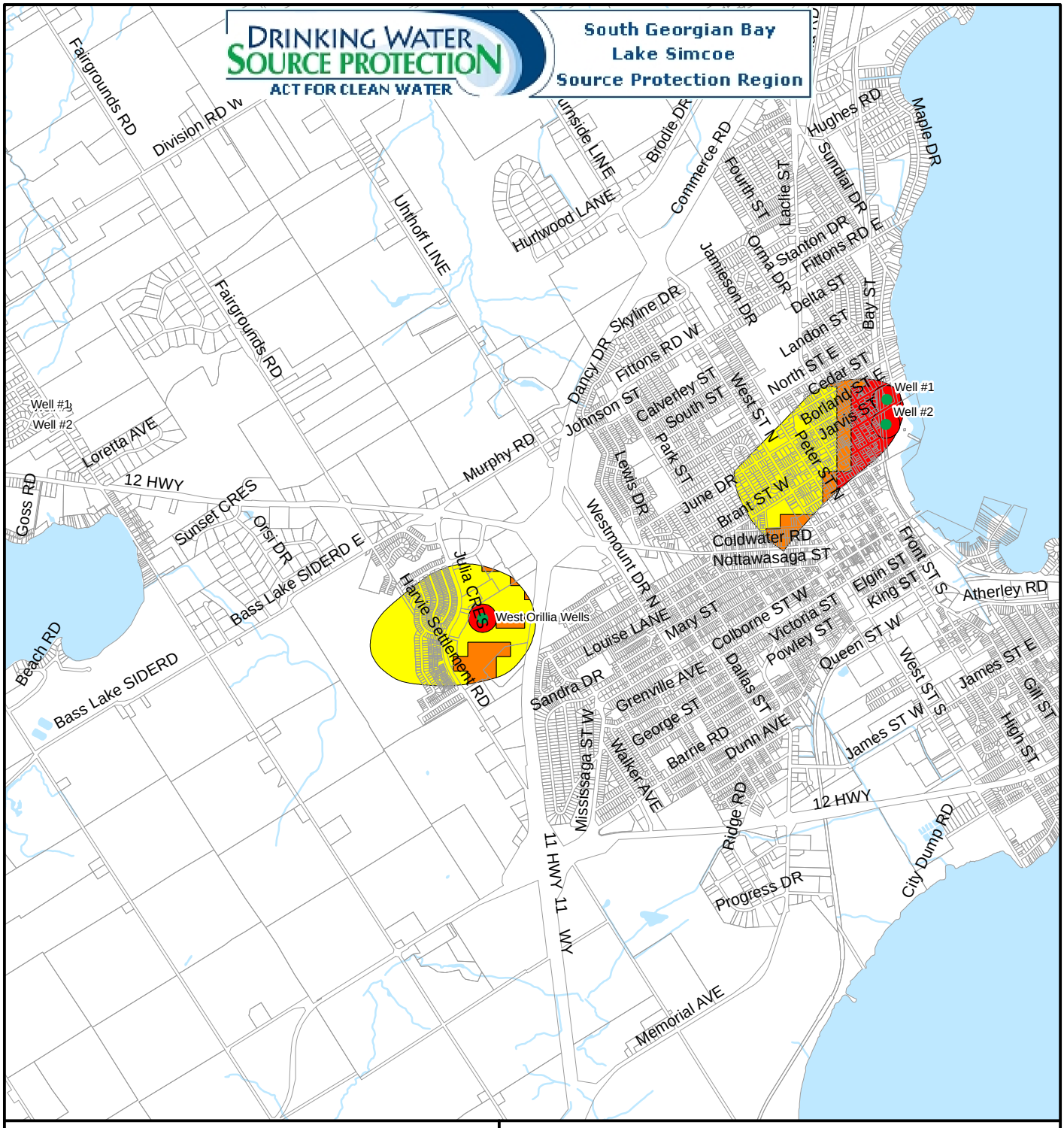
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F12.2-5

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 **6a-3**



LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6

N W E S

500 250 0 500 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.

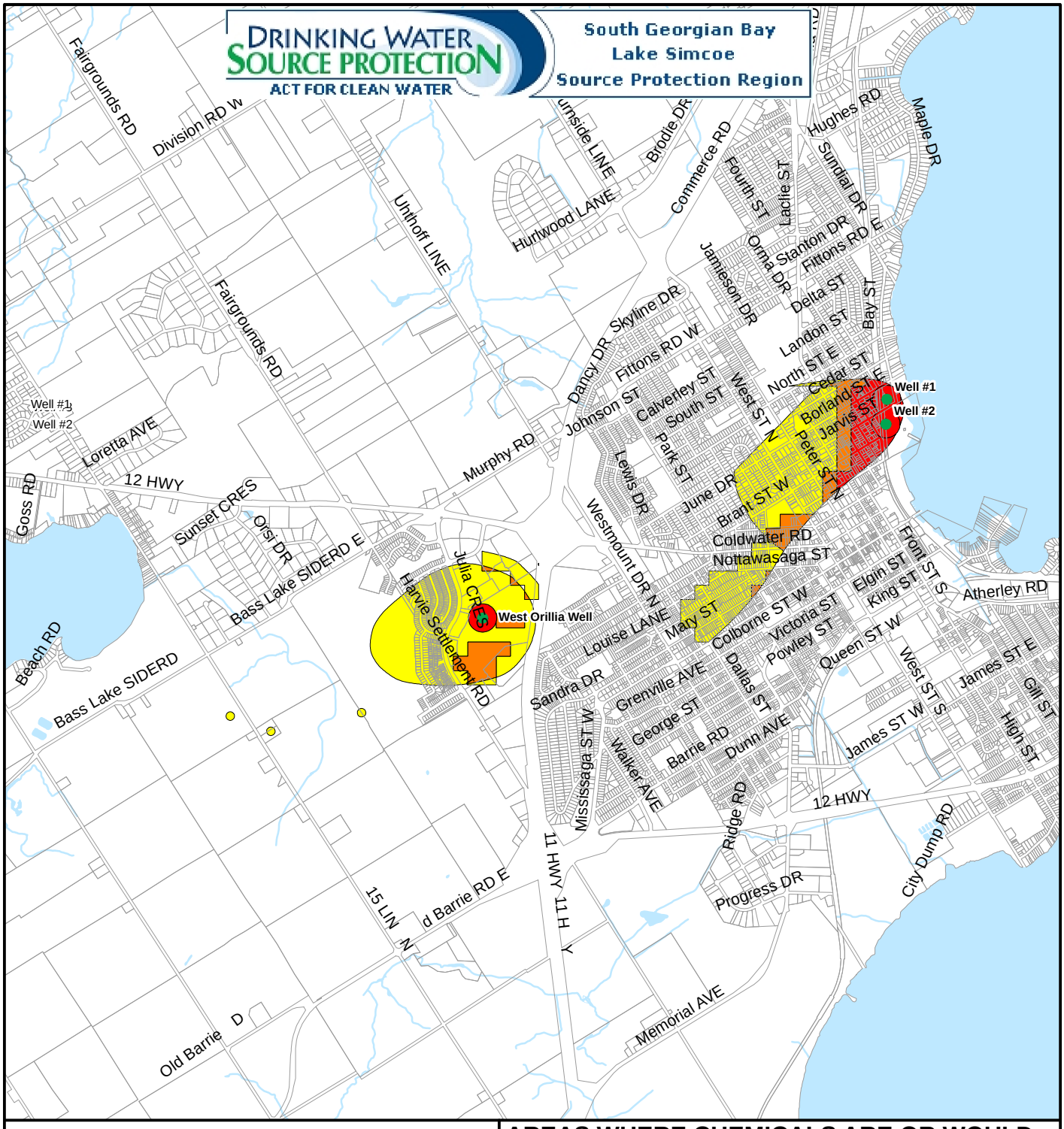
AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - ORILLIA

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

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F12.2-6

GENIVAR Ontario

FIGURE 6a-4



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.

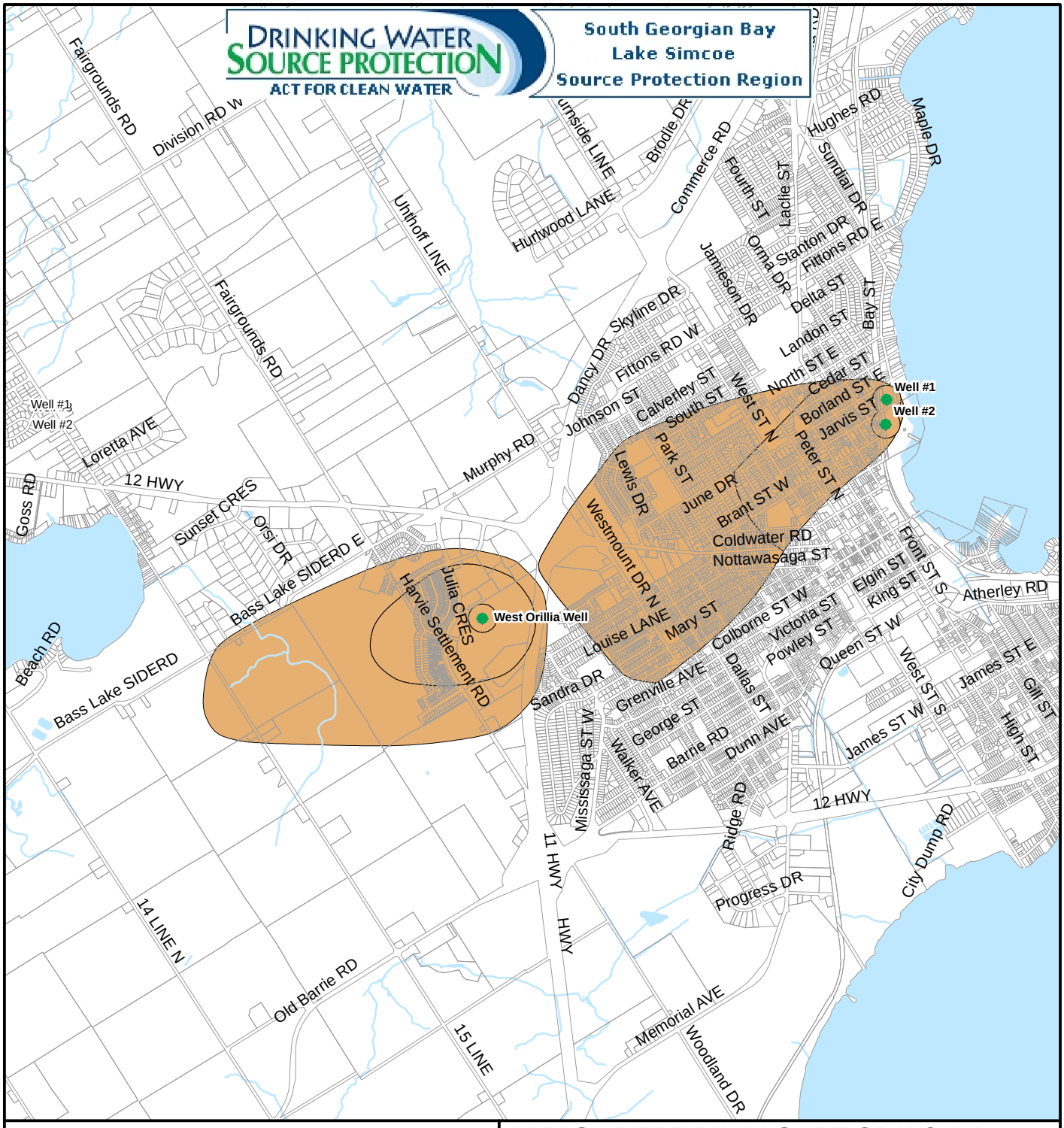
AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - ORILLIA

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

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F12.2-7

GENIVAR Ontario

FIGURE **6a-5**



LEGEND

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

N W E S

500 250 0 500 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.

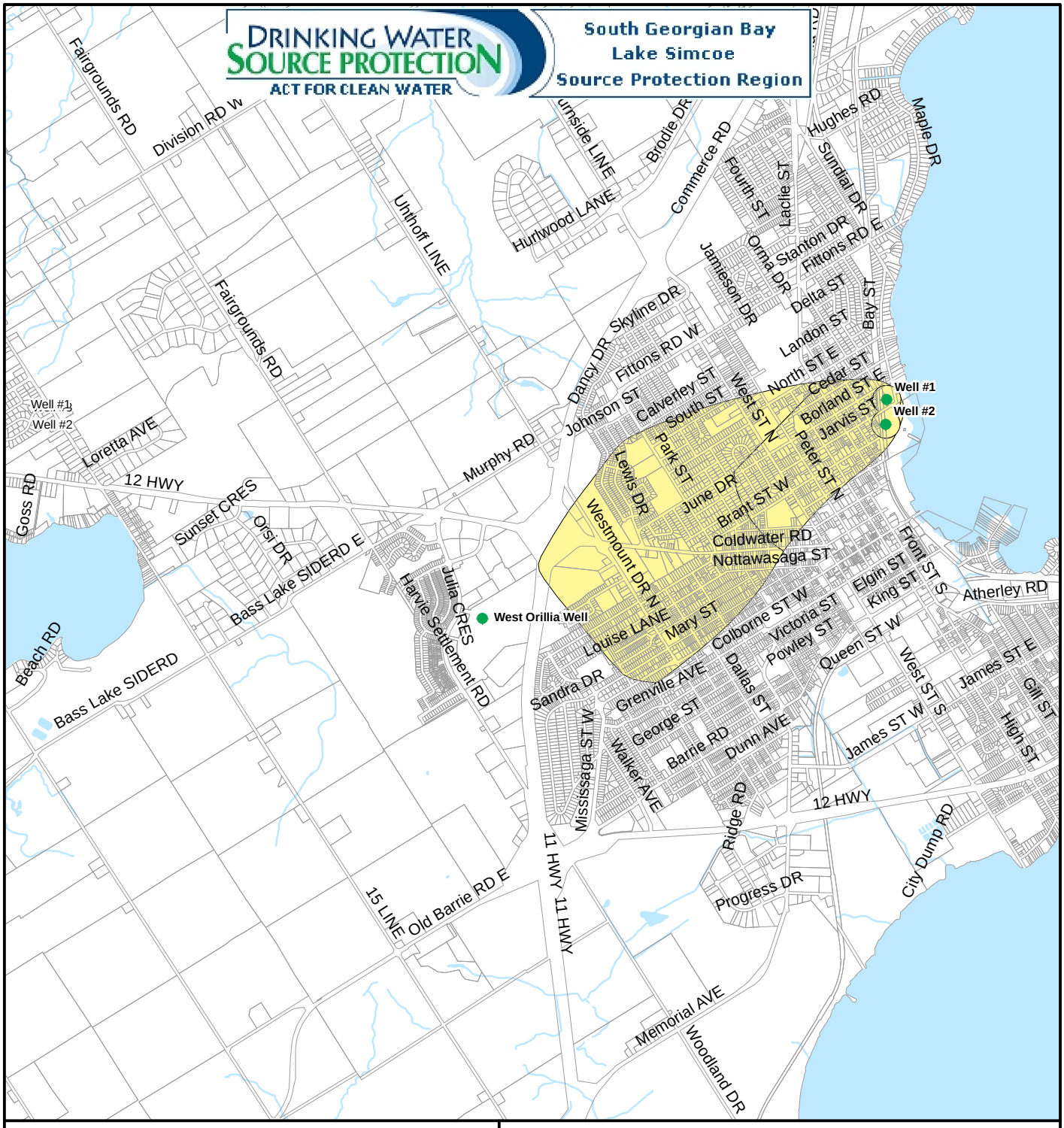
AREAS WHERE DNAPLS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - ORILLIA

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

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F12.2-8

GENIVAR Ontario

FIGURE 6a-6



LEGEND

- MUNICIPAL WELL LOCATION
- ISSUE CONTRIBUTING AREA

N W E S

490 245 0 490 Metres

ARE OR WOULD BE THREATS, ISSUE CONTRIBUTING AREA - ORILLIA

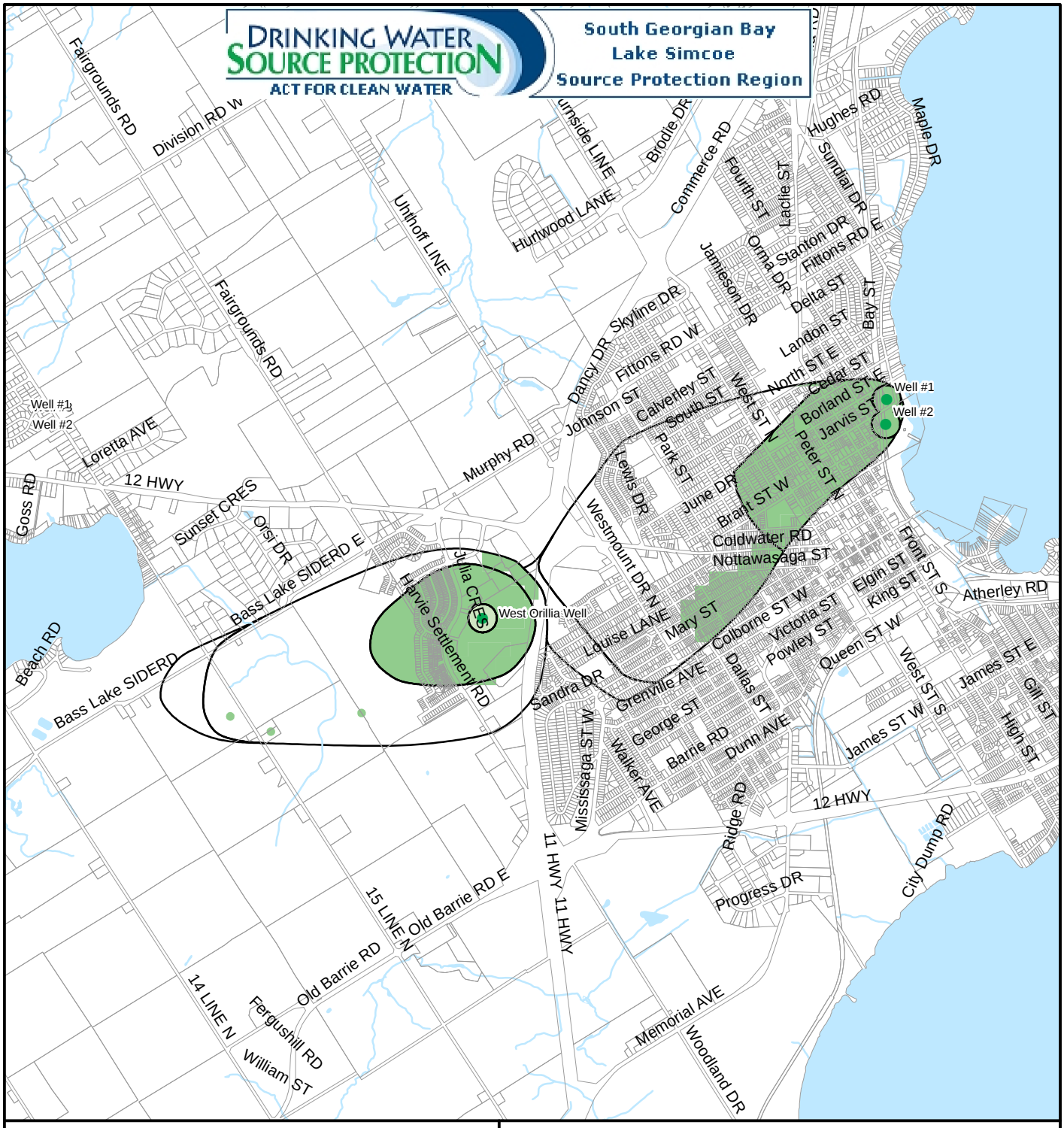
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

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 cimcumstance number in the Provincial Tables of Circumstances which would be a significant drinking water threat.

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F12.2-9

GENIVAR Ontario

FIGURE 6a-7



Legend

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

MANAGED LANDS - ORILLIA

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

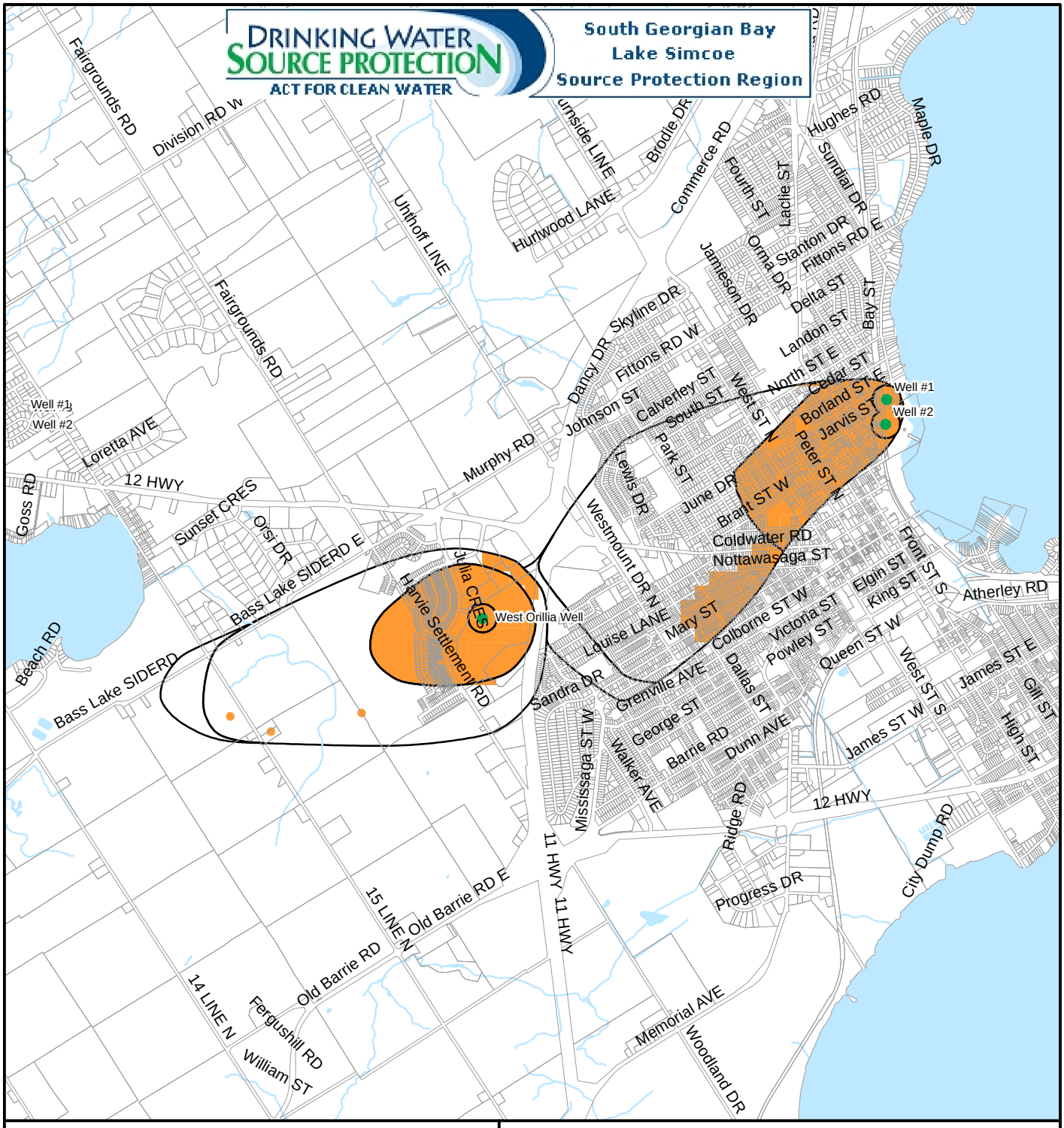
The Managed Land proportion is illustrated for the parts of WHPA A-D where the vulnerability score is greater than 6.

DATE: JUNE 2010 | SCALE: 1:40000

PROJECT: 0-071948.09 | FILE. NO.:0-07194809F12.2-10

GENIVAR Ontario

FIGURE 6a-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)

N W E S

475 237.5 0 475 Metres

LIVESTOCK DENSITY - ORILLIA

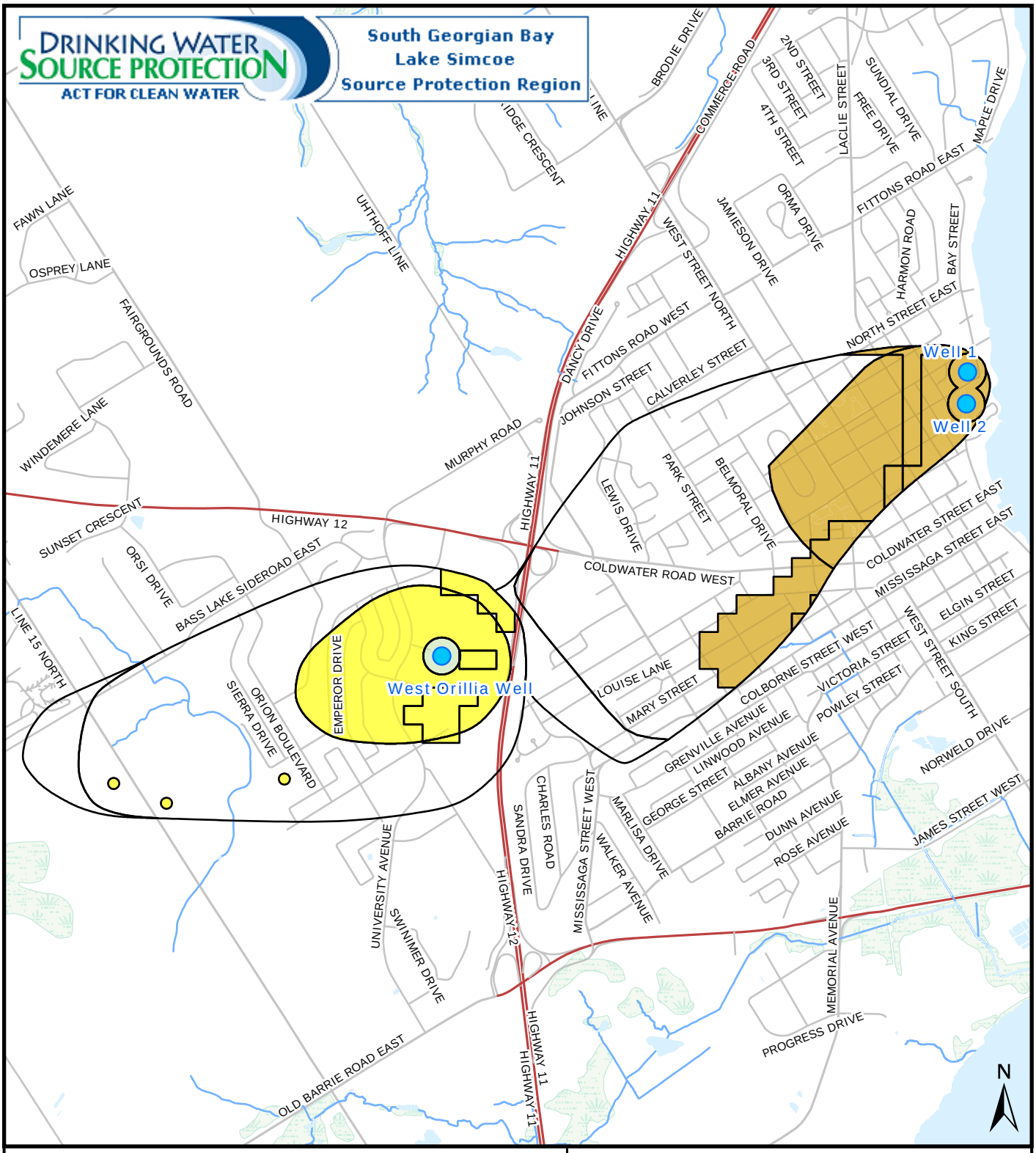
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

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

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.09	FILE. NO.:0-07194809F12.2-11

GENIVAR Ontario

FIGURE 6a-9



Well

Impervious Surfaces in WHPA

- <1%
- =1 - <6%
- =6 - <8%
- =8 - <30%
- >=30%

Impervious Surfaces - Orillia Wells WHPA

Created by: LSRCA, 2025-08-05

Scale 1:30,000

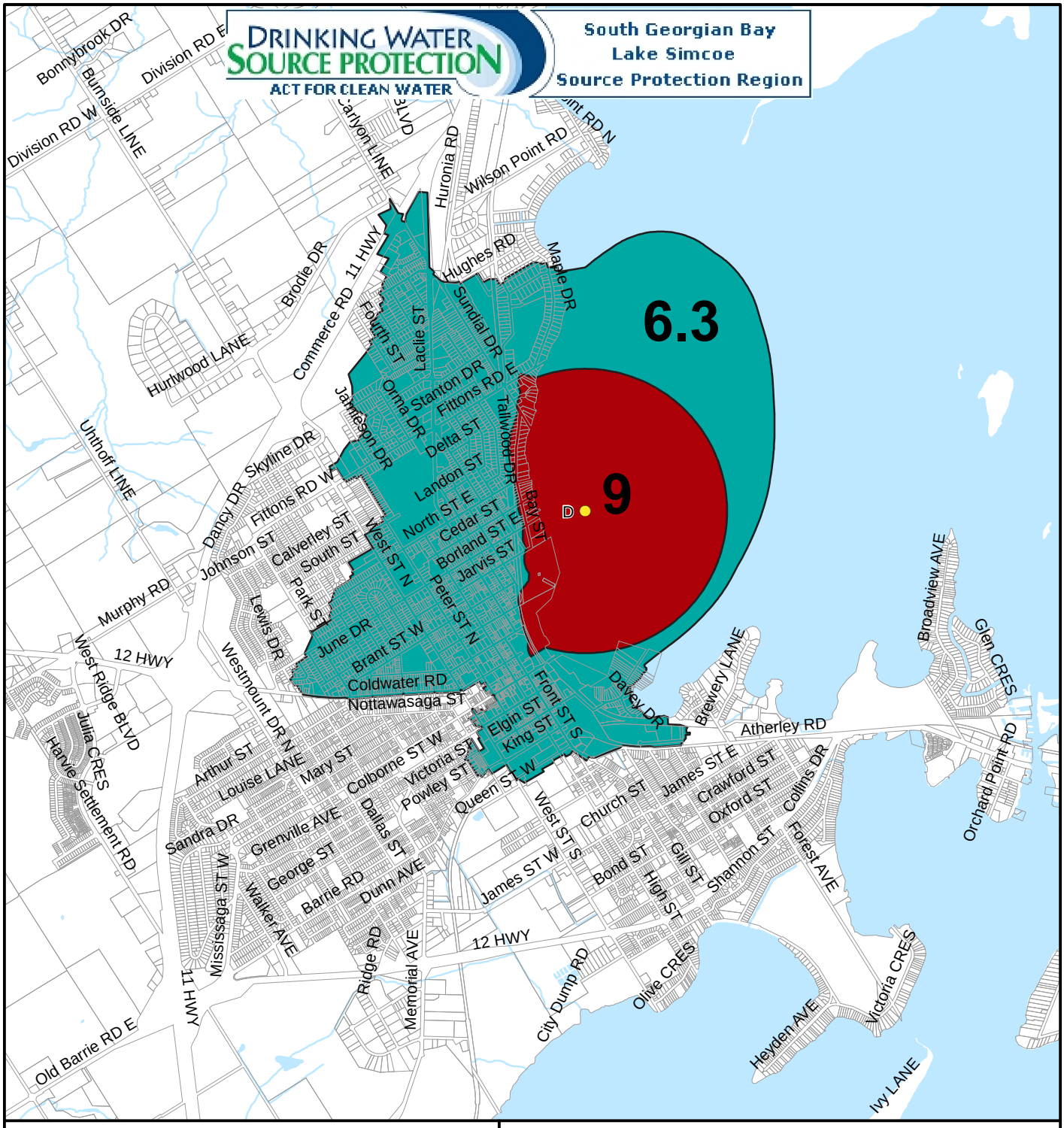
0 260 520 1,040 m

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.

Ontario

Figure **6**a-10



Legend

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

N W E S

500 250 0 500 Metres

INTAKE PROTECTION ZONES AND VULNERABILITY SCORES - ORILLIA

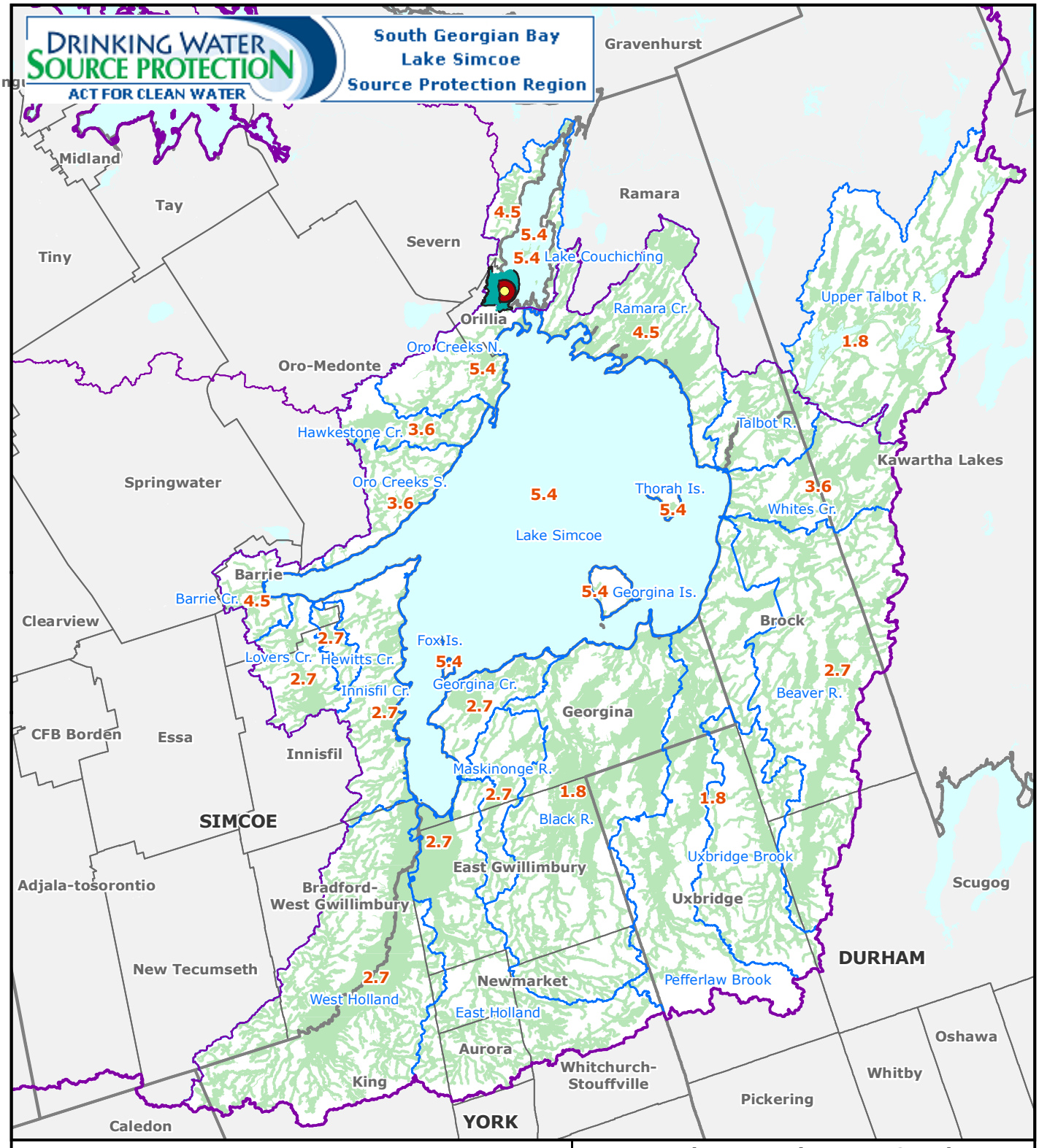
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

DATE: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.06	FILE. NO.:0-07194806F12.1-1

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

GENIVAR Ontario

FIGURE **6b-1**



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

Intake Protection Zone 3 and Vulnerability Scores
Orillia WTP, City of Orillia

Created by: LSRCA
Date: 2010-10-20

GENIVAR

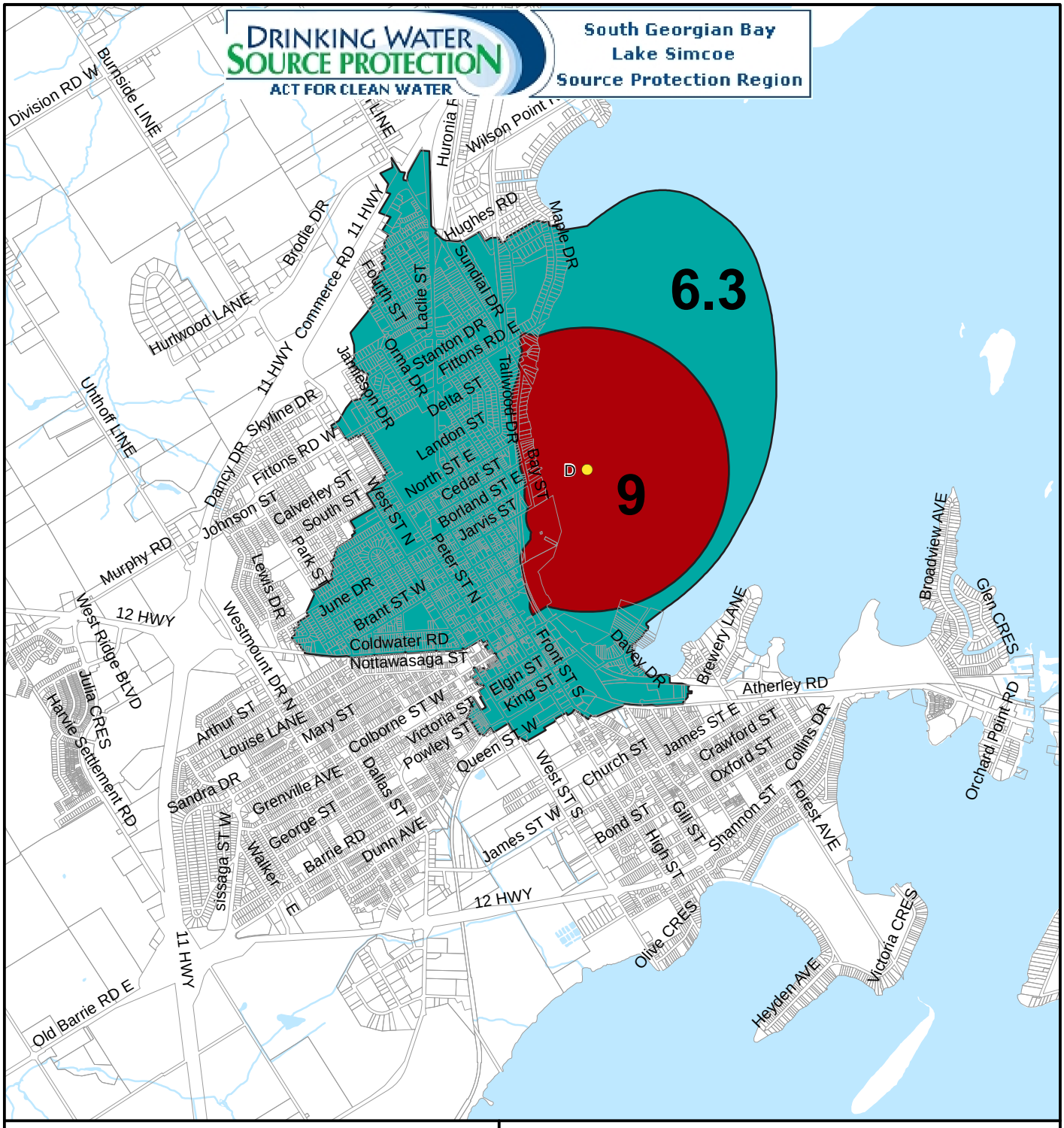
Scale: 1:500,000 0 2 4 6 8 10km

UTM Zone 17N, NAD83

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

Ontario

Figure 6b-2



Legend

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

N W E S

500 250 0 500 Metres

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

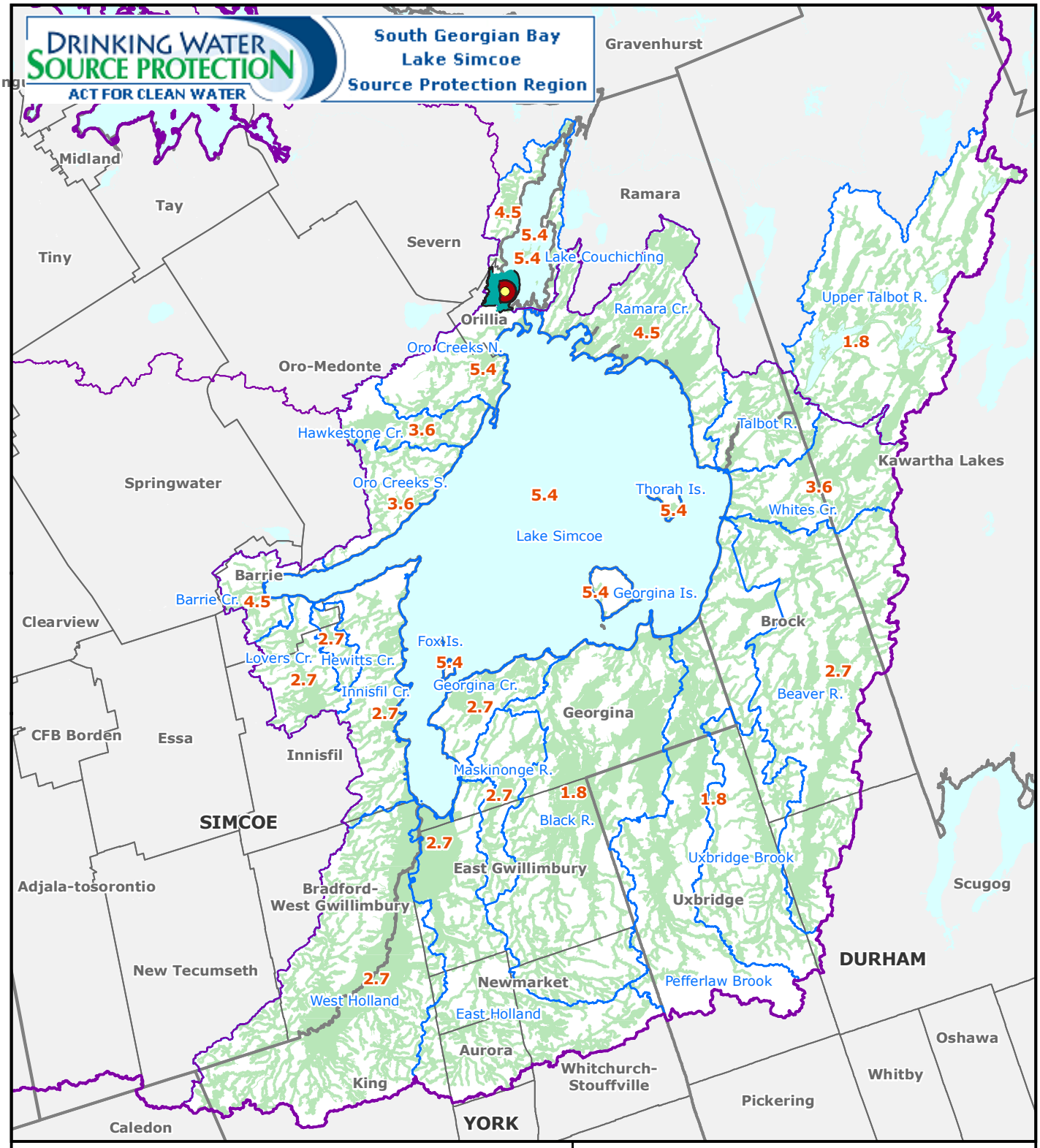
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

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: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.06	FILE. NO.:0-07194806F12.1-2

GENIVAR Ontario

FIGURE 6b-3



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

Areas where Pathogens are or would be Significant, Moderate, or Low Threats
Orillia WTP, City of Orillia

Created by: LSRCA
Date: 2010-10-20

GENIVAR

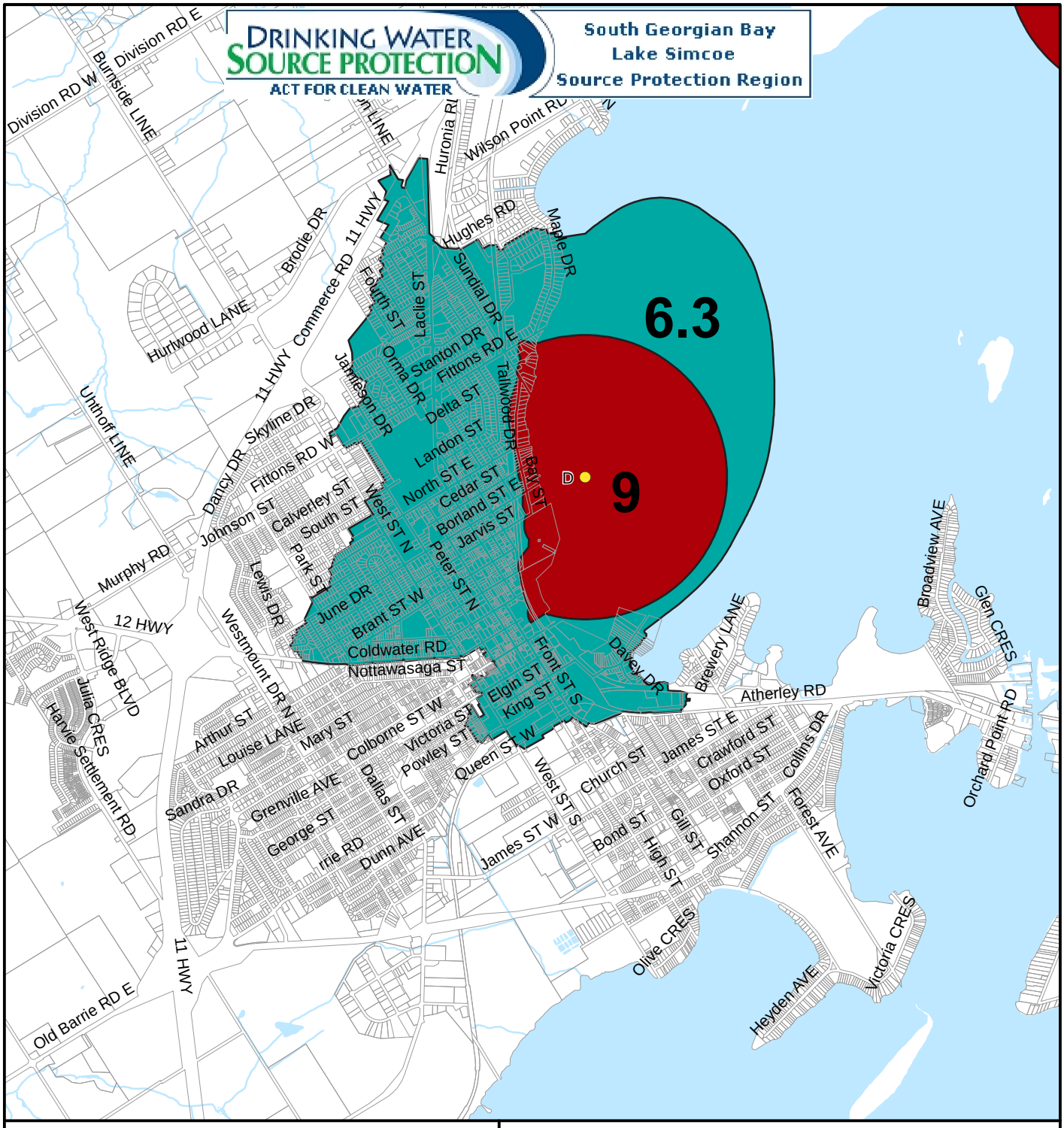
Scale: 1:500,000 0 2 4 6 8 10km

UTM Zone 17N, NAD83

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

Ontario

Figure 6b-4



Legend

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

N W E S

500 250 0 500 Metres

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

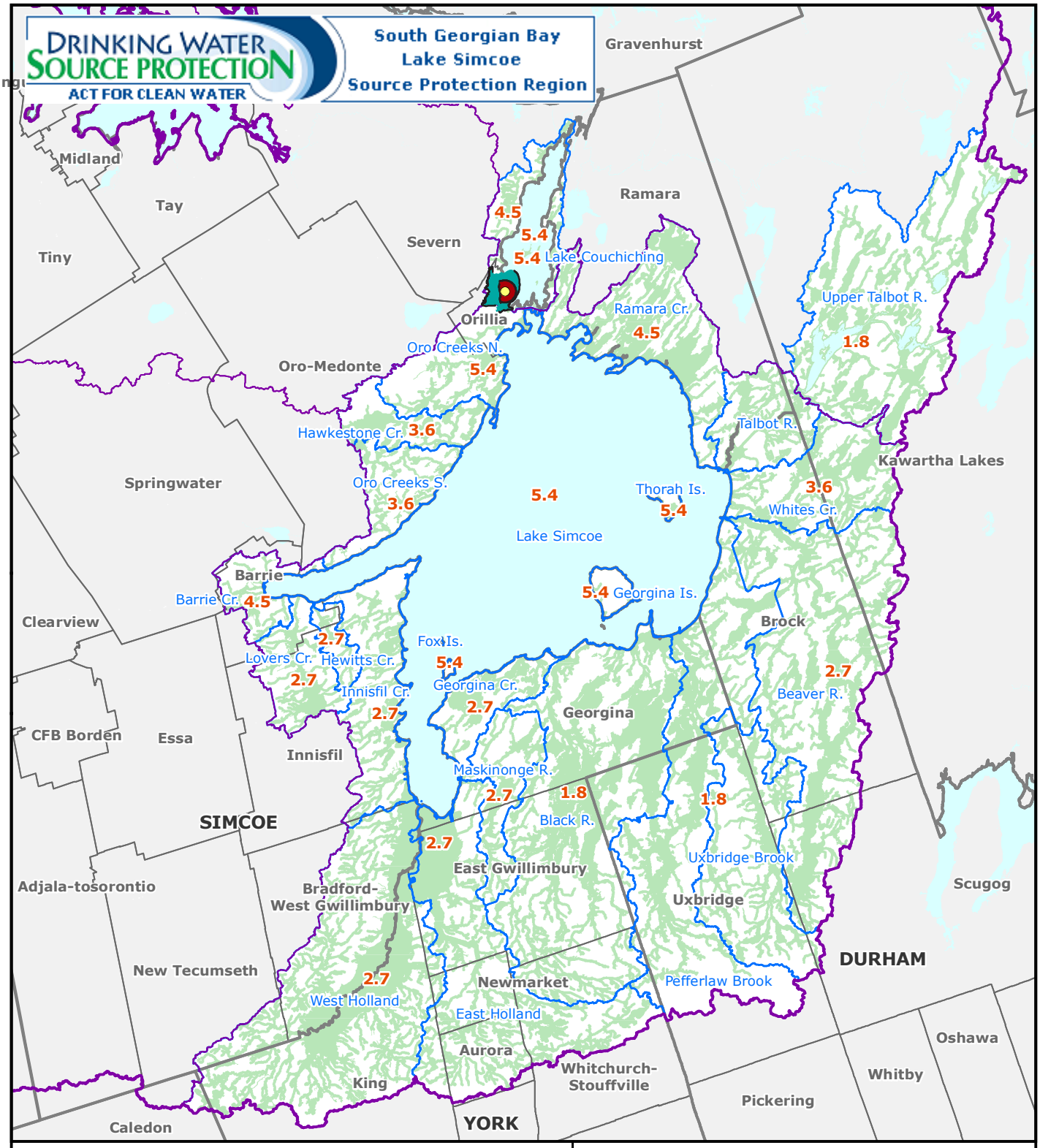
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

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: JUNE 2010	SCALE: 1:40000
PROJECT: 0-071948.06	FILE. NO.:0-07194806F12.1-3

GENIVAR Ontario

FIGURE **6b-5**



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

Areas where Chemicals are or would be Significant, Moderate, or Low Threats
Orillia WTP, City of Orillia

Created by: LSRCA
Date: 2010-10-20

GENIVAR

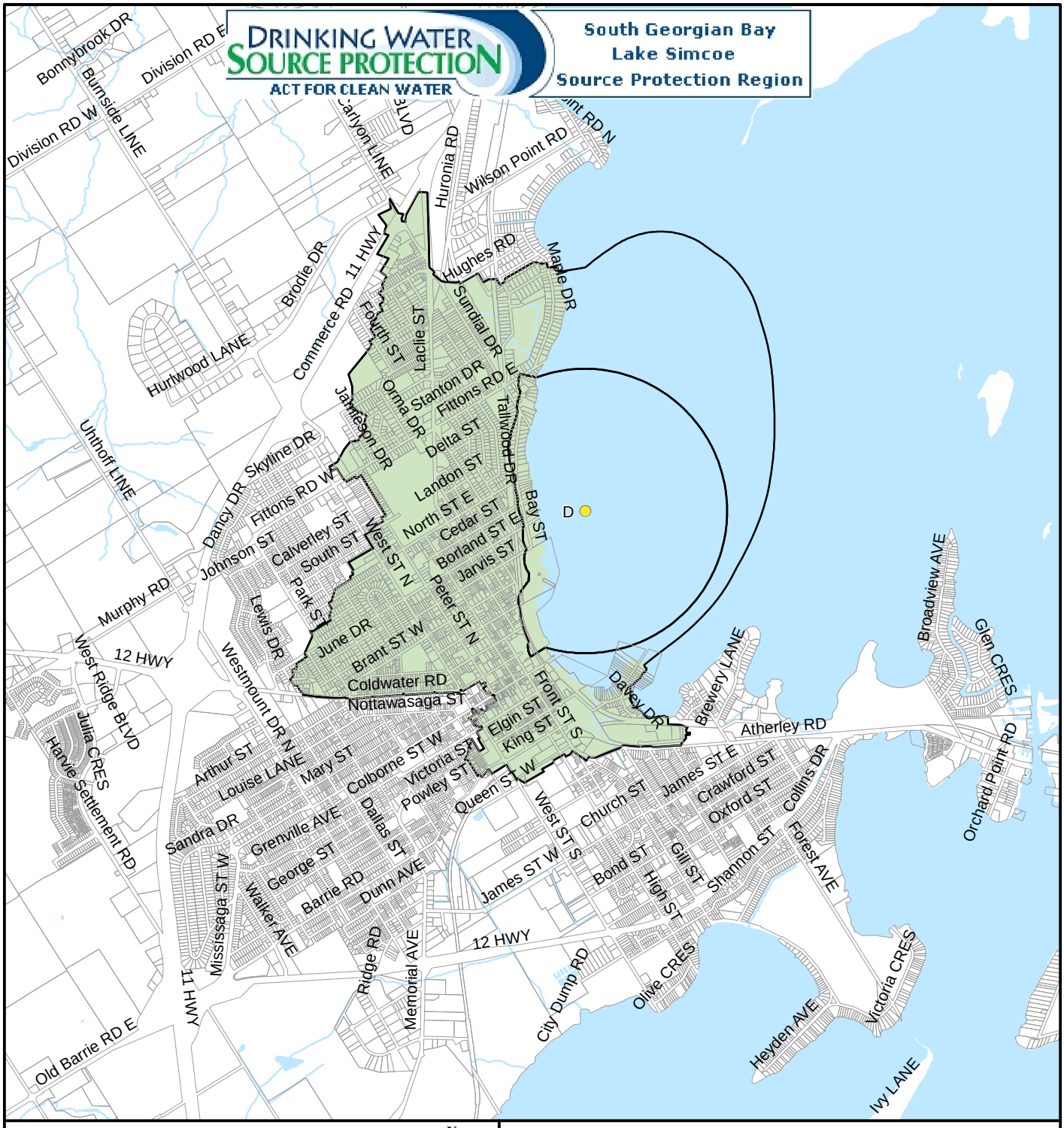
Scale: 1:500,000 0 2 4 6 8 10km

UTM Zone 17N, NAD83

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

Ontario

Figure 6b-6



Legend

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

500 250 0 500 Metres

N W E S

MANAGED LANDS - ORILLIA

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

DATE: JUNE 2010

SCALE: 1:40000

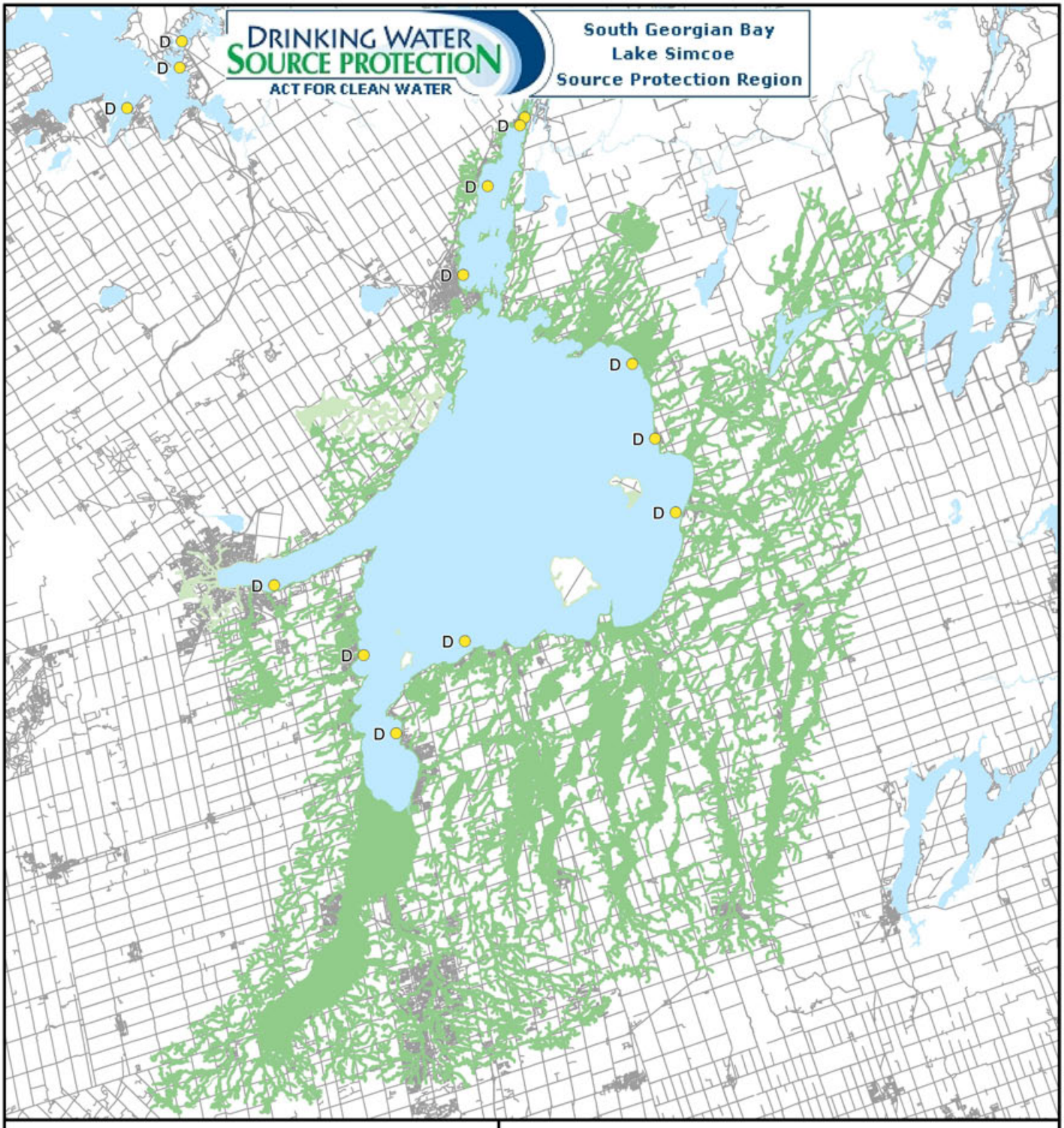
PROJECT: 0-071948.06

FILE. NO.:0-07194806F12.1-4

GENIVAR

Ontario

FIGURE 6b-7



Legend

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

N W E S

5,300 2,650 0 5,300 Metres

MANAGED LANDS - INTAKE PROTECTION ZONE 3

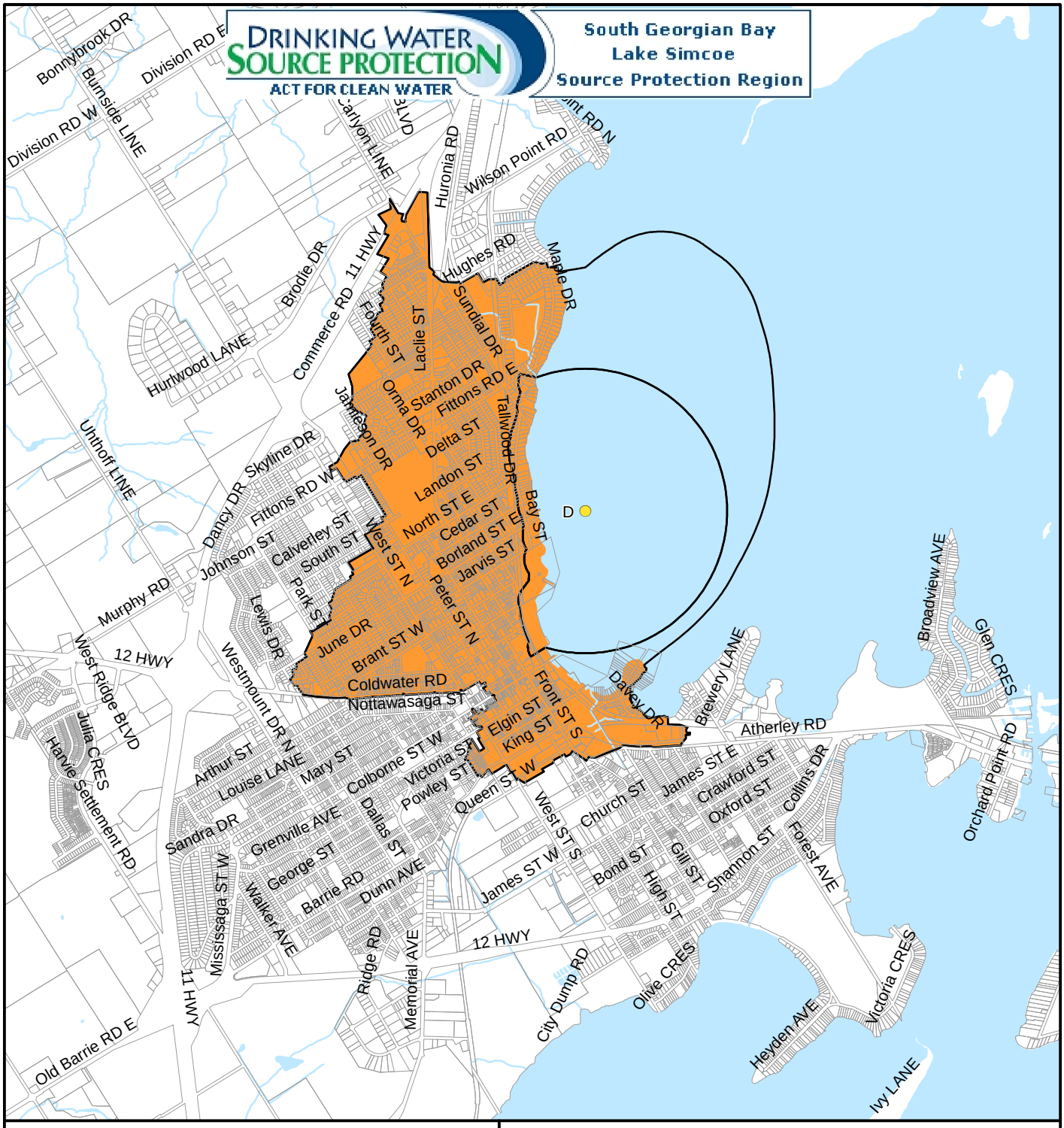
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

The Managed Land proportion is illustrated for the parts of IPZ 3 where the vulnerability score is greater than 4.1.

DATE: JUNE 2010	SCALE: 1:505000
PROJECT: 0-071948.00	FILE. NO.:0-07194800F3.3-4

GENIVAR Ontario

FIGURE **6b-8**



Legend

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

N W E S

500 250 0 500 Metres

LIVESTOCK DENSITY - ORILLIA

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

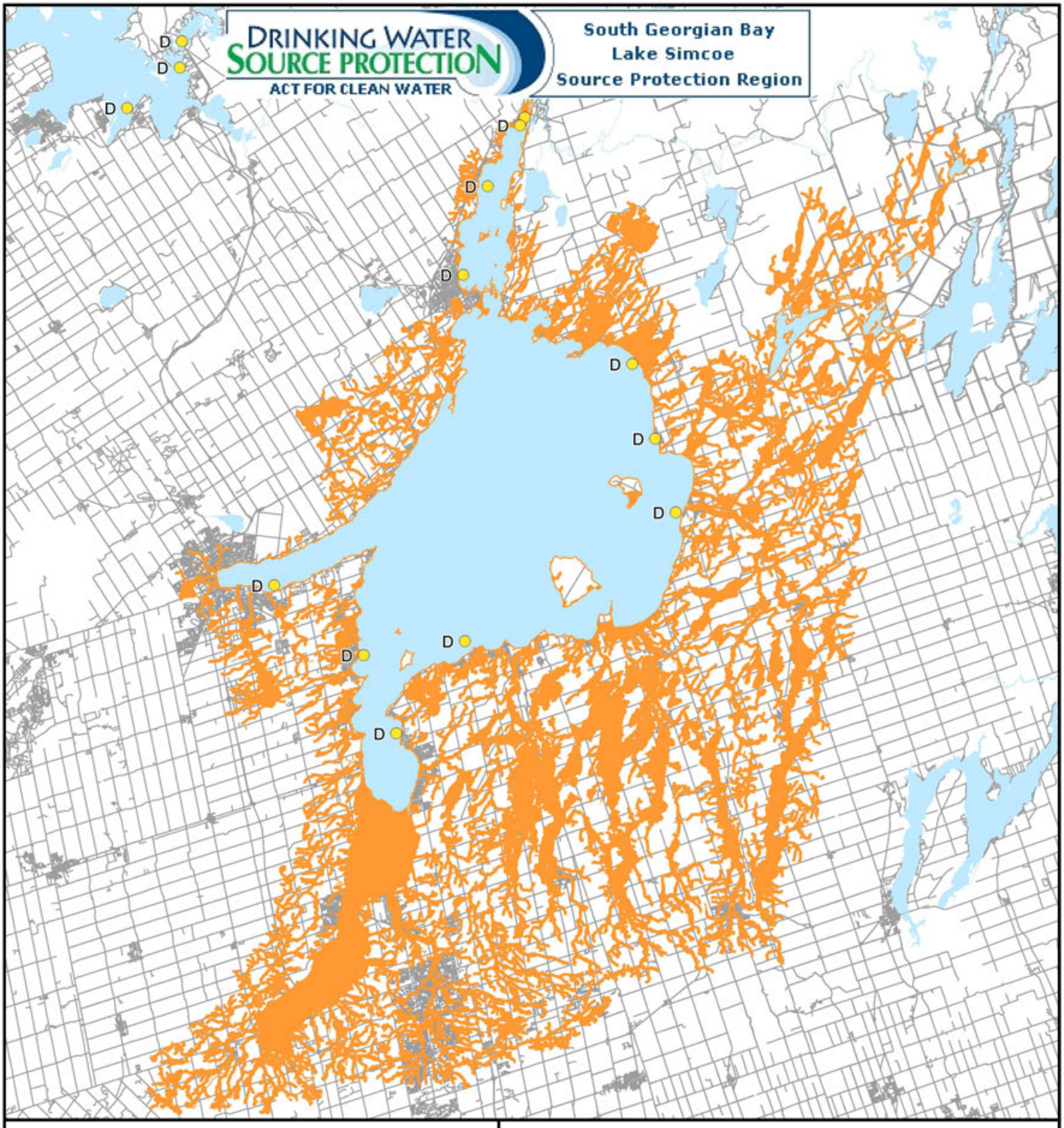
The Livestock Density proportion is illustrated for the parts of IPZ 1 and 2 where the vulnerability score is greater than 4.1.

DATE: JUNE 2010 | SCALE: 1:40000

PROJECT: 0-071948.06 | FILE. NO.:0-07194806F12.1-5

GENIVAR Ontario

FIGURE 6b-9



Legend

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

N W E S

5,300 2,650 0 5,300 Metres

LIVESTOCK DENSITY - INTAKE PROTECTION ZONE 3

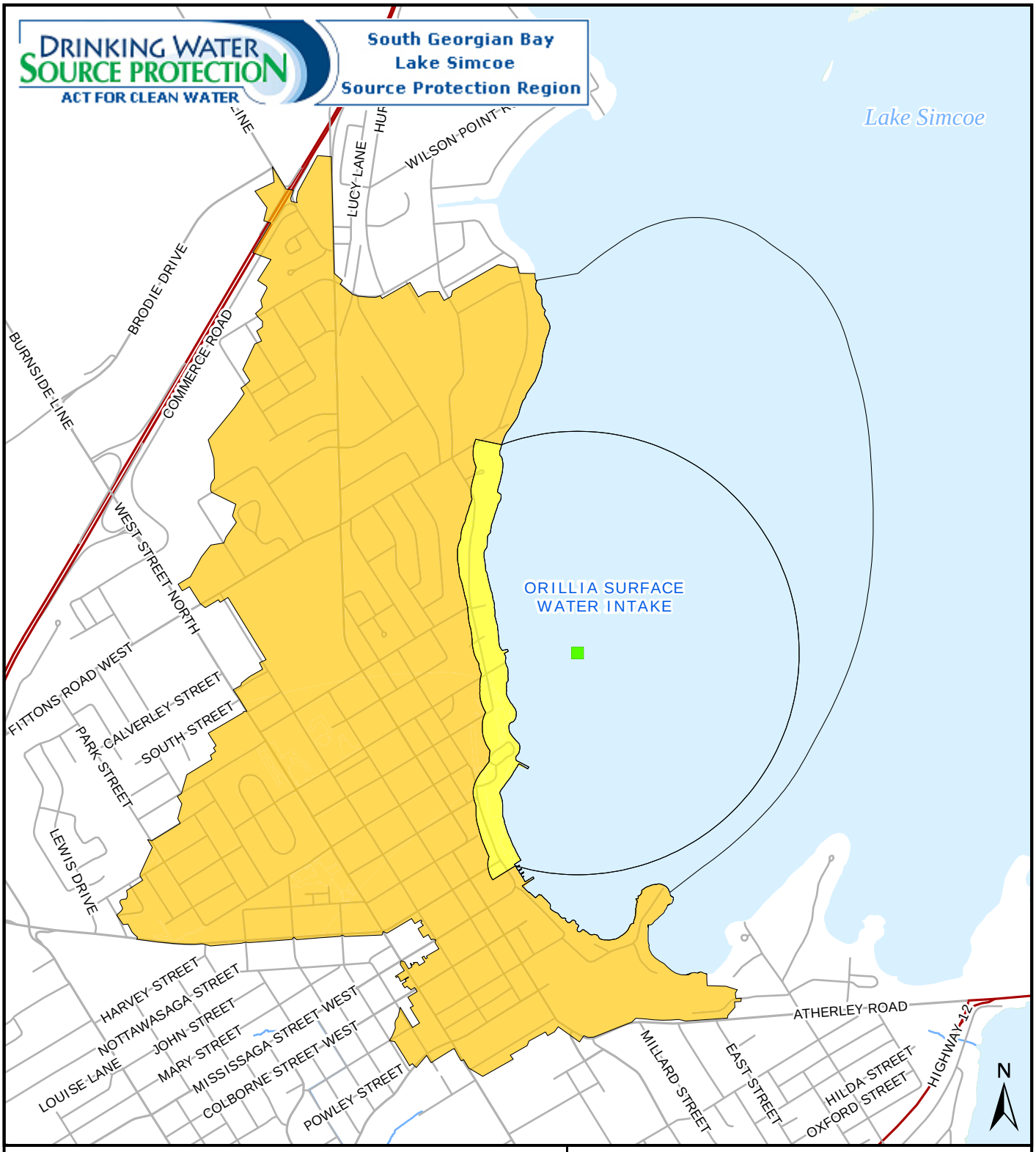
ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES
South Georgian Bay Lake Simcoe
Source Protection Region

The Livestock Density proportion is illustrated for the parts of IPZ 3 where the vulnerability score is greater than 4.1.

DATE: JUNE 2010	SCALE: 1:505000
PROJECT: 0-071948.00	FILE. NO.:0-07194800F3.3-5

GENIVAR Ontario

FIGURE **6b-10**



Surface Water Intake

Impervious Surfaces in IPZ 1 & 2

- <1%
- =1 - <6%
- =6 - <8%
- =8 - <30%
- >=30%

Impervious Surfaces - Orillia Intake Protection Zone 1 & 2

Created by: LSRCA, 2025-08-05

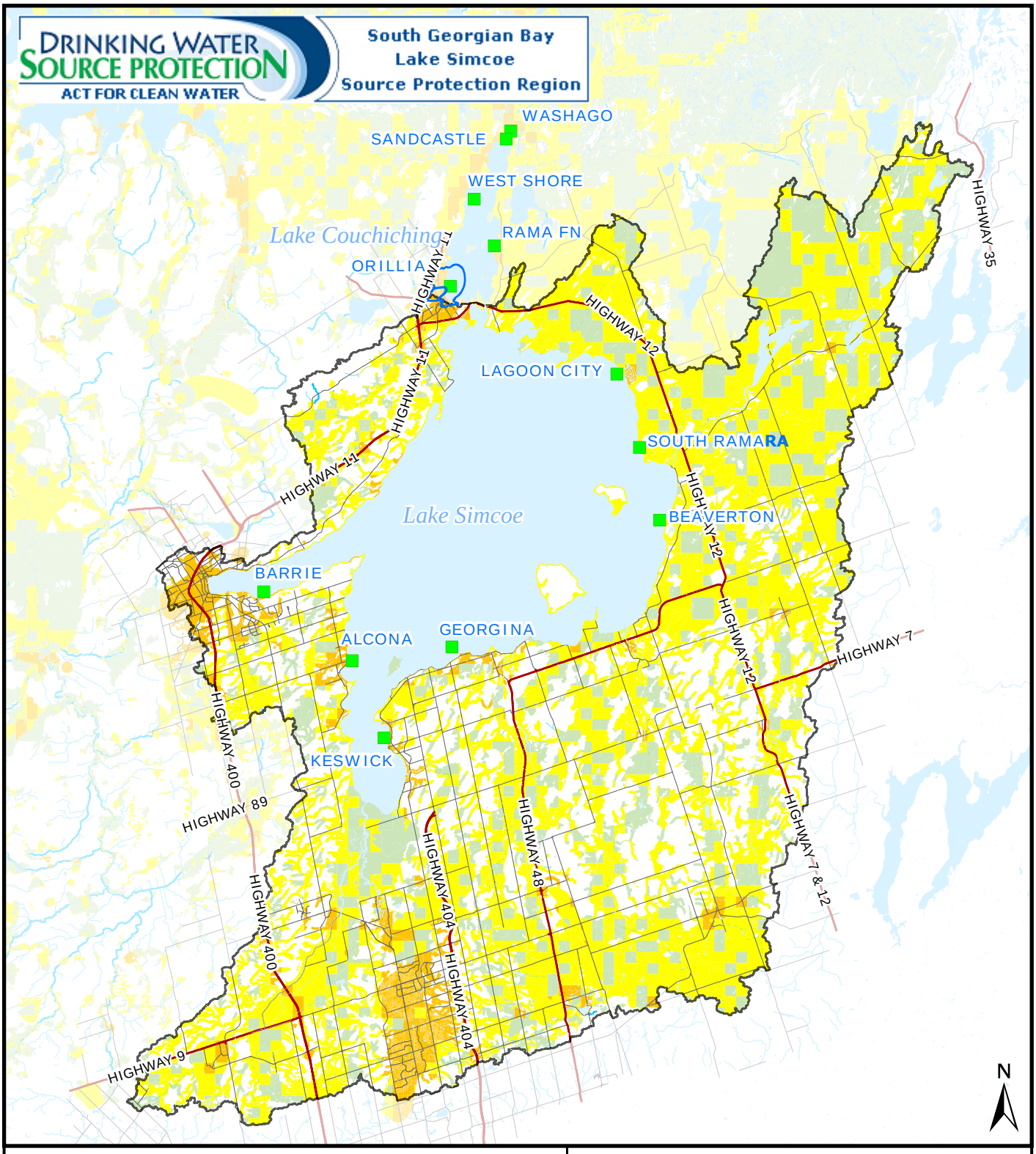
Scale 1:25,000

0 0.25 0.5 1 km

UTM Zone 17N, NAD83

Ontario

Figure **6**b-11



Surface Water Intake

Impervious Surfaces in IPZ 3

- <1%
- =1 - <6%
- =6 - <8%
- =8 - <30%
- >=30%

Impervious Surfaces - Orillia Intake Protection Zone 3

Created by: LSRCA, 2025-08-05

Scale 1:500,000

0 5 10 15 20km

UTM Zone 17N, NAD83

Ontario

Figure **6**b-12