

Chapter 6: Regional Municipality of Durham

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6 Regional Municipality of Durham

6.1 Introduction

This chapter contains information on six drinking water systems for the Regional Municipality of Durham, four of which are in the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). The other two are located just outside the SGBLS SPR but have Wellhead Protection Areas (WHPAs) that cross over. [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.](#) 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 a Vulnerability Score for the delineated area. An Uncertainty Rating is also provided for the Vulnerable Area delineation and the Vulnerability Assessment as per Technical Rules 13-15 [Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)] to express the level of confidence in the results based on the information that was available for the study.

The Issues evaluation is intended to identify chemical parameters or pathogens in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now or in the future. Any Issues identified for the systems will be listed in this section, along with a map illustrating the Issues Contributing Area if an Issue is known. The Threats evaluation identifies potential Significant Drinking Water Threats within the delineated Vulnerable Areas. This process includes creating lists for Drinking Water Threats for Activities and Conditions, generating maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats, and a final enumeration of Significant Drinking Water Threats. This report has been updated with new WHPAs and current threat enumeration data for the Cannington and Sunderland drinking water supply systems. The updated information is current up to and inclusive of [August 28, 2025](#).

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

6.2 Drinking Water Systems

The Region of Durham operates groundwater-based water supplies in eight (8) communities and surface water-based supplies in six (6). As shown in Table 6-1 and Figure 6-1, three (3) of the groundwater supplies and one (1) of the surface water supplies 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 Durham Region

Local Municipality	Community Water Supply	Drinking Water Information System (DWIS) Number	Permit To Take Water (PTTW)	Source Protection Region / Lead Source Protection Authority (SPA)
Township of Brock	Beaverton Surface Water Intake	220004929	6556-863K95	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA
Township of Brock	Cannington	220000745	555BATLPP	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA
Township of Brock	Sunderland	220004910	4812-BJ4M7K	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA
Municipality of Clarington	Orono	220004769	3577-7WLJ9P	TCC SPR & Ganaraska Region SPA
Municipality of Clarington	Newcastle Surface Water Intake	220004787	4548-863LMN	TCC SPR & Ganaraska Region SPA
Township of Scugog	Greenbank	220003760	1671-6MMNB6	TCC SPR & Kawartha SPA
Township of Scugog	Blackstock	220003751	1503-AHFUFV	TCC SPR & Kawartha SPA
Township of Scugog	Port Perry	220004830	0765-6BDQKL	TCC SPR & Kawartha SPA
Township of Uxbridge	Uxbridge Urban Area	220000763	3588-6TKLAA	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA

Local Municipality	Community Water Supply	Drinking Water Information System (DWIS) Number	Permit To Take Water (PTTW)	Source Protection Region / Lead Source Protection Authority (SPA)
Township of Uxbridge	Uxville Water Supply System	730002312	2331-6NJJN6L	CTC SPR & Toronto and Region SPA
Town of Ajax	Ajax Surface Water Intake	220008890	2170-6KARNS	CTC SPR & Toronto and Region SPA
Community of Bowmanville	Bowmanville Surface Water Intake	220000852	7767-84XMF4	CTC SPR & Central Lake Ontario SPA
City of Oshawa	Oshawa Surface Water Intake	220000772	3010-862RTS	CTC SPR & Central Lake Ontario SPA
Town of Whitby	Whitby Surface Water Intake	220000754	3663-862S4Q	CTC SPR & Central Lake Ontario SPA

Studies conducted for the Trent Conservation Coalition (TCC) Source Protection Region have identified that Wellhead Protection Areas (WHPAs) for the Greenbank Drinking Water System extend into the SGBLS SPR. The WHPAs, which are primarily within the Kawartha Conservation Area, extend to the west and a small portion crosses the boundary within the SGBLS SPR. Similarly, the Uxville Water Supply System, which is located near the York-Durham regional boundary, extends over from the Credit Valley, Toronto and Region, Central Lake Ontario (CTC) Source Protection Region into the SGBLS SPR in the Town of Uxbridge. While the full assessment of these systems can be found in their respective Assessment Reports (see Table 6-2), the last sections of this chapter provide a detailed assessment of the Green Bank and Uxville Drinking Water Systems.

In addition, a small section of the Mount Albert WHPA crosses the York Region municipal boundary into the Town of Uxbridge—see the York Region chapter (Chapter 13) for more information on this system.

Table 6-2: WHPA that cross into the Durham Region of the SGBLS SPR.

Local Municipality that WHPA extends into	Municipality where wellhead is located	Name of Water Supply	Source Protection Region / Lead Conservation Authority (CA)	Location where entire Assessment can be obtained
Township of Uxbridge	York Region (East Gwillimbury)	Mount Albert Well Supply	SGBLS SPR & Lakes Simcoe and Couchiching / Black River SPA	This report (Chapter 13)
Township of Uxbridge	Township of Uxbridge	Uxville Water Supply System	CTC SPR Toronto and Region CA	CTC SPR Assessment Report
Township of Brock	Township of Scugog	Greenbank Water Supply	TCC SPR Kawartha CA	TCC SPR Assessment Report

6.3 Cannington Well Supply

The Community of Cannington is located 4.7 kilometres east of Highway 12, approximately 50 kilometres north of the City of Oshawa, in the Township of Brock, Regional Municipality of Durham. Approximately 2,100 residents in Cannington are serviced by municipal water and sewers (R.V. Anderson Associates, 2018). The Cannington drinking water supply system includes five operating wells, MW2, MW3, MW4, MW7, and MW8, the decommissioned well, MW6, and two recently installed wells, MW9 and MW10. The drinking water system also includes one above ground standpipe (reservoir), and approximately 13.6 kilometres of water main. The Cannington Groundwater Supply, identified as Drinking Water System #220000745, operates under Permit To Take Water #555BATLPP, which expires May 17, 2029.

The Cannington Gravel Pit Wellfield, located at the west end of the community, comprises the supply wells MW2, MW7, MW9 and MW10. Wells MW7, MW9 and MW10 are screened in the sediments of the Cannington Esker, while MW2 is open across the bedrock beneath the esker. Bedrock in the Cannington area is comprised of shale with interbedded limestone of the Blue Mountain Formation.

The Cannington Arena Wellfield comprises wells MW4, and MW8. Well MW6 was also located in the Arena Wellfield and was included in the 2010 threats assessment (GENIVAR, 2010), however well MW6 was deactivated in 2012 and decommissioned in 2016. The two wells in the Arena Wellfield are open across intervals of the bedrock. Well MW3 is located between the Gravel Pit Wellfield and the Arena Wellfield and is also open across the bedrock.

The direction of groundwater movement, in the bedrock aquifer in the vicinity of the Arena Wellfield, is to the northwest. Near the Gravel Pit Wellfield shallow groundwater moves in a more northerly direction. The wellhead protection areas (WHPAs) reflect the direction of local groundwater flow towards the municipal supply wells.

Information presented for the Cannington section of this Chapter is based on the S.S. Papadopoulos memorandum (2021), WSP 2021 report, [2025 Lloyd Lemon Geoscience Consulting \(LLGC\) report](#), and builds upon previous studies done on behalf of Durham Region by GENIVAR (2010b) and Jagger Hims Limited (2004 and 2007).

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 Cannington drinking water supply has been updated by S.S. Papadopoulos (2021) following the process recommended in the Technical Rules (MOE, 2008a). The areas determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The groundwater vulnerability within the WHPA was assessed and included consideration for the effects of man-made (anthropogenic) structures that may increase the vulnerability. The WHPA and the intrinsic vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Community of Cannington. Details of the methods for the vulnerability analysis are provided in S.S. Papadopoulos (2021). Updates to the Vulnerability Assessment by WSP are outlined in Technical Memorandum A1 – Vulnerability Increase – Transport Pathways - Methods and in Technical Memorandum B1 – Vulnerability Increase for Transport Pathways – Cannington, which were prepared by WSP and included in the WSP 2021 report.

6.3.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPAs for the Cannington Municipal Water Supply wells, as delineated by S.S. Papadopoulos (2021), are shown in Figure 6a-1. WHPA-A has been added to include the 100 m radius from each municipal well. The WHPAs were delineated using a 3-dimensional numerical groundwater flow model. Further details can be found in S.S. Papadopoulos (2021).

6.3.1.2 Groundwater Vulnerability

The Groundwater Vulnerability within the WHPAs of the seven municipal wells in Cannington is shown in Figure 6a-2. The Groundwater Vulnerability has been determined by S.S. Papadopoulos (2021) using a SWAT approach. The Groundwater Vulnerability is typically considered to be high in the areas near the municipal wells, adjacent to the Beaver River and in other areas where the overburden thickness is known to be relatively thin. The Groundwater Vulnerability is observed to be variable throughout WHPA-B and -C.

6.3.1.3 Transport Pathway Increase

Technical Memorandum B1, prepared by WSP and included in the WSP 2021 report, documents the consideration of Transport Pathways 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, or 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 reviewed 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. A vulnerability increase is reasonable for areas within the WHPA where wells are known to intersect the water supply aquifers.

In general, the delineated WHPAs are not in areas where there are building foundations and municipal services. The areas closest to the wellheads are typically assigned a high vulnerability therefore, a Transport Pathway increase is not recommended for the Cannington Drinking Water Supply aquifers to deal with building foundations and buried infrastructure.

The Groundwater Vulnerability for the 30 m radius around each well identified as a potential pathway has been increased by one step from “Medium” to “High” or from “Low” to “Medium”. Mapping of the transport pathways and increased vulnerability were presented in the technical study completed by WSP (2021). Ultimately the locations of transport pathways and increased vulnerability are reflected in the maps of Vulnerability Scores (See Section 6.3.1.4).

6.3.1.4 Vulnerability Score

The WHPA zones for the Cannington Water Supply, as shown in Figure 6a-1, the Groundwater Vulnerability, as shown in Figure 6a-2, and vulnerability increases due to Transport Pathways 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 Cannington Water 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.

6.3.1.5 WHPA-E

Municipal well MW8 in the Arena Wellfield of the Cannington Drinking Water Supply is designated as Groundwater Under Direct Influence of Surface Water (GUDI) with effective in-situ filtration and therefore, analysis was undertaken to assess the value of delineating a WHPA-E. Technical Memorandum B-2, prepared by WSP and included in the WSP 2021 report,

provides details of work to assess the requirement for a WHPA-E for the Arena Wellfield at the Cannington Drinking Water Supply. Review of the available groundwater monitoring results demonstrates that the capture zones for MW4 and MW8 of the Arena Wellfield, are not connected to local surface water sources in a manner that the security of the water supply would benefit from establishing a WHPA-E (WSP, 2021). The previously established WHPA-E has therefor been removed.

Amendments to the Technical Rules in 2021 (after the 2021 WSP report was published) changed the requirements for delineation of WHPA-E. WHPA-E is no longer required based on evidence of GUDI, but on presence of water quality parameters associated with surface water in the wells. An updated WHPA-E delineation for the Arena Wellfield, as shown in Figure 6a-4, was completed by LLGC in 2025 to comply with the Technical Rules (MECP, 2021). Details of the updated WHPA-E delineation can be found in the report entitled “Updated Drinking Water Issue Evaluation, Cannington Drinking Water System” (LLGC, 2025).

6.3.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating be assigned with each Vulnerable Area as outlined in Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MOECP, 2017)). The Uncertainty associated with the WHPA delineation and the groundwater vulnerability scoring was assessed by S.S. Papadopoulos (2021).

The Uncertainty Rating for the delineation of the Cannington WHPAs is High. The Uncertainty Rating for the Cannington groundwater vulnerability scoring of WHPAs is High. The full results of the uncertainty assessment are available in S.S. Papadopoulos (2021). A High Uncertainty Rating corresponds to a relatively low degree of confidence that the Vulnerability Assessment for the water supply wells reflects the conditions that dictate the Vulnerability of the municipal wells to contamination from activities at surface.

6.3.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogens) in the raw drinking water that will limit the ability of the water to serve as a drinking water source, either now or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114(1,2,3)). 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, treated water quality, and water quality monitoring in sentry wells in the area around the Cannington Drinking Water Supply was reviewed by GENIVAR (2010) and LLGC (2025) 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. Water quality monitoring data for the active municipal wells and the available groundwater monitoring well network were reviewed to identify potential changes to the identified issues since 2010. Details of the Drinking Water Issues Evaluation for Cannington are provided in Technical Memorandum B3 – Drinking Water Issues Evaluation - Cannington, prepared by WSP and included in the WSP 2021 report.

Two (2) Drinking Water Issues have been identified for the Cannington Drinking Water System. Both (TCE and nitrate) affect the Arena Wellfield, and one (nitrate) affects the Gravel Pit Wellfield.

Trichloroethylene (TCE) was identified as a Drinking Water Issue for the Arena Wellfield. Low concentrations of TCE were measured in the raw water at the Arena Wellfield. Durham Region is currently monitoring the situation and dissolved TCE concentrations have not exceeded the Ontario Drinking Water Quality Standard (ODWQS) in MW4 and MW8. Durham Region currently operates MW4 and MW8 in an alternating pattern to manage the TCE concentrations. This action has resulted in a decreasing concentration trend since 2008. The MECP is investigating the sources of the TCE. Durham Region has developed alternate groundwater supply sources (MW9 and MW10) to reduce the reliance on the Arena Wellfield in the future.

The Wellhead Protection Area - Issue Contributing Area (WHPA-ICA) that has been delineated for TCE at the Arena Wellfield in Cannington is shown in Figure 6a-5. This area has been identified based on review of potential sources of TCE, groundwater quality monitoring data, and evaluations using the numerical groundwater flow model constructed to delineate the WHPA.

Nitrate was identified as a Drinking Water Issue for the Arena and Gravel Pit Wellfields. Significant increases in dissolved nitrate concentrations were observed in the bedrock well MW8 (Arena Wellfield) between 2015 and 2017 and then between 2020 and October 2023. The dissolved nitrate concentration in October 2023 was greater than 9 mg/L relative to the Ontario Drinking Water Standard (ODWQS) of 10 mg/L and MW 8 was temporarily removed from service while investigations continue. The dissolved nitrate concentrations at MW8 decreased rapidly when MW8 was removed from service in 2023. Durham Region continues to use MW8 when required but is closely monitoring nitrate concentration trends and will continue to limit use as necessary.

-Dissolved nitrate concentrations at MW4 (Arena Well Field), MW2 and MW7 (Gravel Pit Well Field), and new wells MW9 and MW10 (Gravel Pit Well Field) show increasing trends that, if unmitigated, would reach the ODWQS within 50 years. The other bedrock well (MW3) also demonstrates an increasing trend but does not project to reach the ODWQS within 50 years.

The WHPA-ICAs have been delineated for nitrate at the Arena and Gravel Pit wellfields are shown in Figure 6a-6 and 6a-7. WHPA-ICA for nitrate is not required for Well 3 at this time due to the observed dissolved nitrate concentrations trends.

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

- A List of prescribed drinking water threats activities that may lead to the Issue is to be prepared (See Section 6.3.3.1). No additional local circumstances were identified by the SPC that may lead to the Drinking Water Issue.
- Conditions that may contribute to the Issue were investigated. While none were confirmed additional studies are required to confirm if a Condition is present (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 Issues Contributing Area where these activities are or would a Significant, drinking water threat (Section 6.3.3.3).
- 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 Cannington Drinking Water Supply was completed in accordance with the methodology presented in Technical Memorandum – A4, prepared by WSP and included in the WSP 2021 report. 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 Cannington Drinking Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

6.3.3.1 List of Drinking Water Threats – Activities

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

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

6.3.3.2 List of Drinking Water Threats – Conditions

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

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

Durham Region staff were consulted in 2021 to identify potential conditions within the identified WHPA for the drinking water supply.

No confirmed Conditions have been identified for the Community of Cannington Water Supply.

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 -prepared by MECP 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/>.

6.3.3.3.1 Pathogen Parameters

The [Technical Rules](#) can be used in conjunction with the Vulnerability Scores on [Figure 6a-3](#) to identify the areas where Activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Cannington Water Supply ([Figure 6a-8](#)). 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 on [Figure 6a-3](#) to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Cannington Water Supply ([Figure 6a-9](#)). 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-10](#) illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a vulnerability score of at least 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Cannington Water Supply. The [Technical Rules](#) can be used in conjunction with the Vulnerability Scores -on [Figure 6a-3](#) to identify the circumstances in which these activities associated with DNAPL threats would be Significant or Moderate Drinking Water Threats.

The [TCE](#) Issue Contributing Area for the Arena Wellfield is within WHPA-C and therefore the activities that would be Significant Threats within the Issues Contributing Area are considered in [Figure 6a-5](#).

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 Issues Contributing Area are to be considered as Significant Drinking Water Threats. Table 6-3 provides a list of the activities and circumstances that can potentially release TCE to the environment within the identified Issues Contributing Area for the Arena Wellfield. 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 6-3: Number of Significant Circumstances that are or would be Significant Threats for TCE in [the WHPA-ICA](#).

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

6.3.3.3.5 Drinking Water Issue (Nitrate)

Nitrate was identified as a Drinking Water Issue. As per the Technical Rules, land use activities that can release parameters that are identified as a Drinking Water Issue within the identified Issues Contributing Area are to be considered as Significant Drinking Water Threats. Table 6-4 provides a list of the activities and circumstances that can potentially release Nitrate to the environment within the identified Issues Contributing Area for the Cannington Drinking Water System.

Table 6-4: Number of Significant Circumstances that are or would be Significant Threats for Nitrate in the WHPA-ICA.

<u>Parameter</u>	<u>Threat Subcategory</u>	<u>Quantity Threshold for a Significant Threat (ICA)</u>
<u>Nitrogen</u>	<u>Disposal of Hauled Sewage to Land</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Application of Processed Organic Waste to Land</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Landfilling (Hazardous Waste or Liquid Industrial Waste)</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Landfilling (Municipal Waste)</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Storage of Hauled Sewage</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Storage of Processed Organic Waste or Waste Biomass</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Storage, Treatment and Discharge of Tailings from Mines</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>

<u>Parameter</u>	<u>Threat Subcategory</u>	<u>Quantity Threshold for a Significant Threat (ICA)</u>
<u>Nitrogen</u>	<u>Industrial Effluent Discharges</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Onsite Sewage Works</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Storm Water Management Facilities and Drainage Systems</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Storm Water Infiltration Facilities and Drainage Systems</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Wastewater Collection Facilities and Associated Parts: Sanitary Sewers</u>	<u>> 250 m3/day for IPZs/WHPA-Es; Any quantity for WHPAs</u>
<u>Nitrogen</u>	<u>Wastewater Collection Facilities and Associated Parts: Outfall of a Combined Sewer Overflow (CSO), or a Sanitary Sewer Overflow (SSO) from a Manhole or Wet Well</u>	<u>Any quantity for IPZs/WHPA-Es; > 250 m3/day for WHPAs</u>
<u>Nitrogen</u>	<u>Wastewater Collection Facilities and Associated Parts: Sewage Pumping Station or Lift Station Wet Well</u>	<u>> 250 m3/day for IPZs/WHPA-Es; Any quantity for WHPAs</u>
<u>Nitrogen</u>	<u>Wastewater Collection Facilities and Associated Parts: a Holding Tank or a Tunnel</u>	<u>> 250 m3/day for IPZs/WHPA-Es; Any quantity for WHPAs</u>
<u>Nitrogen</u>	<u>Wastewater Treatment Facilities and Associated Parts</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Application of Agricultural Source Material (ASM) to land</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>

Parameter	Threat Subcategory	Quantity Threshold for a Significant Threat (ICA)
<u>Nitrogen</u>	<u>Storage of Agricultural Source Material (ASM)</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Handling and Storage of Non-Agricultural Source Material (NASM)</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Application of Commercial Fertilizer to Land</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Handling and Storage of Commercial Fertilizer</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Agricultural Source Material (ASM) Generation - Livestock Grazing or Pasturing</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>
<u>Nitrogen</u>	<u>Agricultural Source Material (ASM) Generation - Outdoor Confinement Area (OCA) or Farm Animal Yard</u>	<u>Any quantity for IPZs/WHPA-Es and WHPAs</u>

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 Cannington Water Supply.

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

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

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

Figure 6a-3 illustrates the Vulnerability Score map for Cannington well 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

The number of Significant Drinking Water Threats for the Cannington Water Supply has been determined using the methodology outlined in Technical Memorandum A4 (WSP, [2021](#)). There are no Drinking Water Threats identified associated with Conditions.

Table 6-[5](#) and Table 6-[6](#) document the enumeration of existing Activities that are considered to be potential Significant Drinking Water Threats within the WHPA for the Cannington Drinking Water Supply. Table 6-[5](#) has been prepared for the Gravel Pit Wellfield and the WHPA associated with MW2, MW3, and MW7, MW9 and MW10. [Table 6-6](#) has been prepared for the Arena Wellfield and the WHPA associated with MW4 and MW8. Potential Significant Drinking Water Threats were identified within areas where the Vulnerability Score is 10 and for two

parcels within WHPA-B and -C at the Arena Wellfield that were previously identified as potentially having a threat related to DNAPL.

One hundred and nine (139) activities that are potential Significant Threats to Drinking Water were identified in association with thirty-eight (38) land parcels in the WHPA and ICA for the Gravel Pit Wellfield. The identified activities include the potential application and storage of Agricultural Source Material (ASM), application of commercial fertilizer, and handling and storage of commercial fertilizer on 22 residential properties. These activities may also be associated with up to three (3) properties with agricultural land use. Two (2) properties are identified to have potential to maintain livestock and one (1) parcel with activities involving application of pesticide. Twenty-eight (28) of the identified activities relate to potential Significant Threats due to homes with private individual sewage disposal systems and the possibility of fuel storage for home heating purposes.

Eight hundred and fourteen (814) activities that are potential Significant Threats to Drinking Water were identified in association with two hundred and two (202) land parcels in the WHPA and ICA for the Arena Wellfield. The identified activities include the potential application and storage of ASM, application of commercial fertilizer, and handling and storage of commercial fertilizer on 178 residential properties. These activities may also be associated with up to ten (10) properties with agricultural land use. Six (6) properties are identified to have potential to maintain livestock, and five (5) activities involve the application of pesticide. Twenty-nine (29) of the identified activities relate to potential Significant Threats due to homes with private individual sewage disposal systems and the possibility of fuel storage for home heating purposes. One (1) parcel is identified as having potential for the handling and storage of DNAPL and/or organic solvents.

The land use activities on one (1) parcel within the WHPA for the Arena Wellfield was identified as having potential to be a Significant Threat to Drinking Water for specific circumstances in the [Technical Rules](#) (MECP, 2021) that relate to the establishment of a waste disposal site. Additional information is required to confirm whether the actual activities on the property correspond to the circumstances that would produce the Significant Threat.

Table 6-5: Number of Significant Drinking Water Threats for the Gravel Pit Wellfield - Cannington 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.	<u>33</u>
3	The application of agricultural source material to land.	<u>24</u>
4	The storage of agricultural source material to land.	<u>24</u>
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.	<u>27</u>
9	The handling and storage of commercial fertilizer to land.	<u>24</u>
10	The application of pesticide to land.	<u>1</u>
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

Threat Number	Threat	Significant threat counts Number of threats
16	The handling and storage of dense non-aqueous phase liquid.	1
17	The handling and storage of an organic solvent.	1
18	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
21	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	<u>4</u>
<u>22</u>	The establishment and operation of a liquid hydrocarbon pipeline	<u>0</u>
-	Totals	<u>139</u> significant threats (on <u>38</u> properties)

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 6-6: Number of Significant Drinking Water Threats for the Arena Wellfield - Cannington 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.	1
2	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.	<u>35</u>
3	The application of agricultural source material to land.	<u>192</u>
4	The storage of agricultural source material to land.	<u>186</u>
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.	<u>194</u>
9	The handling and storage of commercial fertilizer to land.	<u>187</u>
10	The application of pesticide to land.	5
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.	1

Threat Number	Threat	Significant threat counts Number of threats
17	The handling and storage of an organic solvent.	1
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.	<u>12</u>
<u>22</u>	<u>The establishment and operation of a liquid hydrocarbon pipeline</u>	<u>0</u>
-	Totals	814 significant threats (on 202 <u>properties</u>)

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

6.3.3.4.16.3.3.5.1 Managed Lands

Technical Rule 16(9) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the [Technical Rules](#).

Managed Lands were identified and the managed lands proportions were determined for the Cannington WHPA as outlined in Technical Memorandum A-4, prepared by WSP and included in the 2021 WSP report. 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-11](#) illustrates the location and proportion of managed lands within the Cannington Drinking Water Supply [WHPA-A to WHPA-D](#) where vulnerability scores were greater than 6 [and in the WHPA-E with a vulnerability score greater than 4.2](#).

6.3.3.4.26.3.3.5.2 Livestock Density

Technical Rule 16(10) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and -E. This mapping is not required where the vulnerability scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the [Technical Rules](#).

The Livestock Density was determined for the Cannington WHPA as outlined in Technical Memorandum A4 (WSP, 2021). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 6.3.3.5). The Livestock Density is used in the identification of threat activities associated with the storage of Agricultural Source Material, and the grazing and/or outdoor confinement of livestock.

[Figure 6a-12](#) illustrates the distribution of Livestock Density within the Cannington Drinking Water Supply [WHPA-A to WHPA-D](#) where Vulnerability Scores were greater than 6 [and in the WHPA-E with a vulnerability score greater than 4.2](#). The Livestock Density figures reflect the distribution of Agricultural Managed Lands as determined in accordance with Technical Memorandum A4 (WSP, 2021).

6.3.3.4.36.3.3.5.3 Impervious Surfaces

Technical Rule 16(11) 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 [Technical Rules](#).

The proportion of impervious surfaces within the Cannington WHPA was determined in accordance with the methodology in Technical Memorandum A4 (WSP, 2021). 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-13](#) illustrates the distribution of impervious surfaces within the delineated WHPA zones for the Cannington Drinking Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D.

[6.3.3.5.4 TCE Drinking Water Issue](#)

[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 WHPA-ICA are to be considered as Significant Drinking Water Threats. Table 6-3 provides a list of the land uses that can potentially release TCE to the environment within the identified Issues Contributing Area \(Figure 6a-5\).](#)

[Figure 6a-5 illustrates the WHPA-ICA where activities and circumstances listed in Table 6-3 are considered to be a Significant Drinking Water Threat for the Cannington drinking water system.](#)

~~6.3.3.4~~[6.3.3.5.5 Nitrate Drinking Water Issue](#)

[Nitrate was identified as a Drinking Water Issue. As per the Technical Rules, land use activities that can release parameters that are identified as a Drinking Water Issue within the identified WHPA-ICA are to be considered as Significant Drinking Water Threats. Table 6-4 provides a list of the land uses that can potentially release Nitrate to the environment within the identified Issues Contributing Area \(Figures 6a-6 and 6a-7\).](#)

[Figures 6a-6 and 6a-7 illustrates the WHPA-ICA where activities and circumstances listed in Table 6-4 are considered to be a Significant Drinking Water Threat for the Cannington drinking water system.](#)

6.4 Sunderland Well Supply

The Community of Sunderland is located approximately 13 kilometres northwest of Lake Scugog, 15 kilometres southeast of Lake Simcoe and 45 kilometres north of Ajax, at the intersection of Highway 7/12 and Concession Road 6, in the Township of Brock. Approximately 1,573 residents in the Community of Sunderland are serviced by municipal water and sewers. Sunderland's water system, identified as DWIS# 2200004910 includes three active wells, [one decommissioned well \(MW3\)](#) one above ground reservoir (standpipe) and approximately 9 km of water main. The standpipe is used for pressure equalization and storage.

The Sunderland municipal drinking water supply is sourced from three groundwater wells – designated MW1, MW2, [and MW4](#)– located in two wellfields. The original wells (MW1 and MW2) are located to the east of the community, on the opposing bank of the Beaver River. MW4 is located off Jane Street near the north end of the community, west of the main stem of the Beaver River. The locations of the municipal wells are presented in [Figure 6b-1](#).

The two original drilled wells that provide water to Sunderland are located approximately 100 m from the Beaver River. Sunderland well MW1 has been in service since 1957. This well was constructed with a 250 mm diameter steel casing and a 3.05 m long 250 mm diameter stainless steel screen extending between depths of 5.91 and 8.96 m below ground surface. MW2 was constructed about 30 metres north of MW1 in 1972. This well was constructed with a 250 mm diameter steel casing and a 3.05 m long 250 mm diameter stainless steel screen extending between depths of 8.53 and 11.58 m below ground surface. Wells MW1 and MW2 are screened in coarse-grained sand and gravels of the Channel Aquifer deposits, at the base of the Beaver River incised valley. In May 2017, MW2 was taken offline due to the degradation of raw water quality that inhibited the effectiveness of the existing water treatment system. Despite attempts to rehabilitate the well and restore the water quality, the ultraviolet transmittance (UVT) remained below the acceptable limit required to ensure adequate levels of disinfection.

To compensate for the water supply issues at MW2, the Region of Durham initiated an exploration program, which resulted in the construction and incorporation of TW17-3 (now MW3) into the municipal water supply system. MW3 was constructed in 2017 and was installed approximately 10 m northwest of the standpipe belonging to the Sunderland water distribution system. This well was constructed with 150 mm diameter casing installed to 27.90 m below ground surface followed by a 132 mm diameter 5.9 m long screen, set between 27.90 and 33.80 m below ground surface. [MW4 was drilled in 2024 and is located approximately 20 m to the east of MW3. This well was constructed with 185 mm diameter casing installed to 33.23 m below ground surface and is screened between 26.2 and 31.7 meters below ground level. MW3](#)

and MW 4 are screened across a deposit of medium-grained sand corresponding to the Thorncliffe Formation.

The operation of the Sunderland municipal wellfields is authorized under PTTW number 8370-CVFRGR, secured on October 27, 2023, and expiring May 31, 2033. The PTTW allows for the concurrent continuous pumping from all three wells for 24 hours per day for a total maximum daily taking of 2,745,000 L/day (2,745 m³/day).

Groundwater flowing to Sunderland municipal well MW1 located within the Beaver River incised valley primarily originate within 500 m of the wellfield, in areas of thicker eskerine or Channel Aquifer deposits to the east and west of the Beaver River. Groundwater flowing to wells MW3 and MW4 is directed from northwest to southeast creating a relatively broad and symmetrical shaped WHPA, owing to the confined nature of the Thorncliffe aquifer in this area.

Information presented for the Sunderland section of this Chapter is based on the GeoProcess, 2021a report, WSP 2022 report, GeoProcess 2025 report, and builds upon previous studies done on behalf of Durham Region by GENIVAR, 2010b and Jagger Hims Limited in 2003 and 2007.

6.4.1 Groundwater Vulnerability Assessment

The Wellhead Protection Area (WHPA) is the primary Vulnerable Area delineated to ensure the protection of the municipal water supply wells. The Groundwater Vulnerability has been assessed to provide an indication, within the WHPA, of 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 Sunderland drinking water supply has been updated by GeoProcess (2021a) following the process recommended in the Technical Rules. The areas determined to contribute groundwater to the wells within 25 years were delineated as WHPA. The groundwater vulnerability within the WHPA was assessed and included consideration of the effects of man-made (anthropogenic) structures that may increase the vulnerability. The WHPA and the intrinsic vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Community of Sunderland. Details of the methods for

the vulnerability analysis are provided GeoProcess (2021a). Updates to the vulnerability assessment by WSP (2022) are outlined in Technical Memorandum A1 – Vulnerability Increase – Transport Pathways – Methods and in in Technical Memorandum B1 – Vulnerability Increase for Transport Pathways – Sunderland MW3-, prepared by WSP and included in the WSP 2022 report.

[The delineation of the WHPA and vulnerability assessment for MW4 was carried out by GeoProcess in 2024/2025, as an update to the WHPA previously completed by GeoProcess \(2021a\) and updated by WSP \(2022\). Updates to the WHPA and vulnerability scores for Sunderland are documented in a Technical Memorandum: Sunderland Municipal Water Supply System - Revised Source Protection Mapping, Reporting \(GeoProcess, 2025\).](#)

6.4.1.1 Wellhead Protection Area (WHPA) Delineation

The WHPAs for the Sunderland Municipal Water Supply wells as delineated by GeoProcess (2021a [and 2025](#)) are shown in Figure 6b-1. WHPA-A has been added to include the 100 m radius from each municipal well. The WHPA were delineated using a 3-dimensional numerical groundwater flow model. Further details can be found in GeoProcess (2021a [and 2025](#)) (Appendix D).

The WHPA for Sunderland wells MW1 and MW2 reflects a groundwater flow pattern from east to west toward the Beaver River. The WHPA for Well MW3 [and MW4](#) reflects a groundwater flow pattern from northwest to southeast, also towards the Beaver River.

6.4.1.2 Groundwater Vulnerability

The Groundwater Vulnerability within the WHPAs of the three municipal wells in Sunderland is shown in Figure 6b-2. The Groundwater Vulnerability has been determined by GeoProcess (2021a [and 2025](#)) using the surface to well advection time (SWAT) approach. Both of the Sunderland WHPAs (east and west of the Beaver River), demonstrate a variation in vulnerability scores that closely follow the progression of the WHPAs, with areas within the WHPA-A assigned the highest vulnerability scores of 10 and areas within the WHPA-Ds assigned the lowest scores. The lower vulnerability scores noted for WHPA-C and WHPA-D associated with well [MW4](#) is due to the effective confinement of the Thorncliffe Aquifer by the overlying Newmarket Till, which results in long surface-to-well travel times and therefore a uniformly low vulnerability level assigned across the capture zone. The Groundwater Vulnerability has been assessed as High beneath the entire WHPA associated with wells MW1 and MW2.

6.4.1.3 Transport Pathway Increase

WSP (2022) documents the consideration of Transport Pathways 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, or 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 reviewed 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. A vulnerability increase is reasonable for areas within the WHPA where wells are known to intersect the water supply aquifers.

In general, the delineated WHPAs are not in areas where there are building foundations and municipal services. The areas closest to the wellheads are typically assigned a high vulnerability therefore, a Transport Pathway increase is not recommended for the Sunderland Drinking Water Supply aquifers to deal with building foundations and buried infrastructure.

The Groundwater Vulnerability for the 30 m radius around each well identified as a potential pathway has been increased by one step from “Medium” to “High” or from “Low” to “Medium”. Mapping of the transport pathways and increased vulnerability were presented in the technical study completed by WSP (2022). Ultimately the locations of transport pathways and increased vulnerability are reflected in the maps of Vulnerability Scores (See Section 6.4.1.4)

6.4.1.4 Vulnerability Score

The WHPA zones for the Sunderland Drinking Water Supply, as shown in Figure 6b-1, the Groundwater Vulnerability, as shown in Figure 6b-2, and vulnerability increases due to Transport Pathways were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 6b-3 illustrates the Vulnerability Scores for the Sunderland Drinking Water Supply. Figure 6b-3 will be used to assess Drinking Water Threats in Section 6.4.3. The Transport Pathways are illustrated as circles with 30 m radius in the WHPA.

6.4.1.5 WHPA-E

Municipal wells MW1 and MW2 in the Sunderland Drinking Water Supply are considered to be Groundwater Under Direct Influence of Surface Water (GUDI) with effective in-situ filtration and therefore a WHPA-E is required. Technical Memorandum C-2 (Appendix D) provides details of work to delineate a WHPA-E for the Sunderland Drinking Water Supply. Sunderland well [MW4](#) is not designated as GUDI and therefore additional assessment to delineate a WHPA-E was not required. This was confirmed by the numerical modelling (GeoProcess, 2021a) and hydraulic testing performed by R.J. Burnside (2018).

Previous assessments and monitoring data have demonstrated that the Beaver River does not contribute to the GUDI condition. Wetland areas that are identified adjacent to the Beaver River and in the area of the Municipal Wells are considered to have the potential to contribute surface water to the aquifer. A WHPA-E has been delineated for a 120 m distance around the delineated wetland adjacent to the municipal wells (Figure 6b-4). There are no known Transport Pathways that can contribute surface water into the WHPA-E area. The Vulnerability Score for the WHPA-E has been determined in accordance with the Technical Rules and is based on ratings for an Area Vulnerability Factor and a Source Vulnerability Factor that reflect the land cover, soil type, permeability, hydrological and hydrogeological conditions and the depth of the well intake. The Vulnerability Score within WHPA-E for Sunderland is shown on Figure 6b-4.

The Vulnerability Score for WHPA-E will be used independently in the Threat Assessment to identify areas that are or would be Drinking Water Threats. The WHPA-E is shown on a separate map from the WHPA-A to WHPA-D, as the WHPA-E area, and the corresponding Vulnerability Score, reflects the potential for land use activities to affect surface water that passes close to the well. The Vulnerability Score of 6.3 out of a possible 10 is assigned to WHPA-E for Sunderland.

6.4.1.6 Uncertainty Rating

The Technical Rules require that an Uncertainty Rating be assigned with each Vulnerable Area as outlined in Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MECPCP, 2017)). The uncertainty associated with the WHPA delineation and the groundwater vulnerability scoring was assessed by GeoProcess (2021a).

The Uncertainty Rating assigned for the delineation of the Sunderland WHPAs is High. The Uncertainty Rating for the Sunderland groundwater vulnerability scoring is also High. The full results of the uncertainty assessment are available in GeoProcess (2021a). The High Uncertainty Rating reflects uncertainties in understanding the groundwater flow system and representing

this system in the numerical model. A High Uncertainty Rating does not correspond to a relatively low degree of confidence that the vulnerability assessment for the water supply wells reflects the conditions that dictate the vulnerability of the municipal wells to contamination from activities at surface.

6.4.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogens) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as a source of drinking water (Technical Rule 114 (1,2,3)). 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, treated water quality, and water quality monitoring in sentry wells in the area around the Sunderland municipal water supplies has been reviewed to identify Drinking Water Issues that are considered likely to deteriorate the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for Sunderland are provided in Technical Memorandum C3 – Evaluation of Drinking Water Issues – Sunderland (Appendix D).

No Drinking Water Issues were identified for the Sunderland Water Supply.

6.4.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Sunderland Water Supply was completed in accordance with the methodology presented in Technical Memorandum – A3, prepared by WSP and included in the 2022 WSP report (the WSP 2022 Technical Memorandum A3)-. [The threat assessment completed for MW4 by Durham Region followed the 2022 WSP approach and methodology but included updates to reflect the Technical Rules – Assessment Report \(MECP, 2021\).](#) 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 Sunderland Water Supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

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

6.4.3.1 List of Drinking Water Threats – Activities

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

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

6.4.3.2 List of Drinking Water Threats – Conditions

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

- Files provided by the Ministry of the Environment, [Conservation and Parks](#) local offices pertaining to licenses, and records of spills in the area of the delineated WHPA.
- Records available from the Ministry of the Environment, [Conservation and Parks](#) website containing registry of Brownfield Sites.
- Records from previous contaminant source inventories that identified situations that may qualify as Conditions.
- Interviews of Durham Region staff to identify potential Conditions within the identified WHPA for the drinking water supply.

Durham Region staff were consulted in 2021 to identify potential conditions within the identified WHPA for the drinking water supply.

No confirmed Conditions have been identified for the Community of Sunderland Drinking Water Supply. No potential Conditions have been identified for consideration at this time.

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps combined with the [Technical Rules](#) threat circumstances prepared by MECP 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/>.

6.4.3.3.1 Pathogen Parameters

The [Technical Rules](#) can be used in conjunction with the Vulnerability Scores on [Figure 6b-3](#) to identify the areas where Activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Sunderland Water Supply ([Figure 6b-5](#)). Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the 2-Year time-of-travel zone (WHPA-B) where the Vulnerability Score is 10. Pathogens can only be a significant, moderate or low threat within WHPA-A and WHPA-B.

6.4.3.3.2 Chemical Parameters

The [Technical Rules](#) can be used in conjunction with the Vulnerability Scores on [Figure 6b-3](#) to identify the areas where activities associated with chemical Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Sunderland Water Supply ([Figure 6b-6](#)). Activities that are or would be Significant Drinking Water Threats for chemical parameters can be observed within the 2-Year time-of-travel zone (WHPA-B) where the Vulnerability Score is equal to or greater than 8.

6.4.3.3.3 DNAPL Chemical Parameters

[Figure 6b-7](#) illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a vulnerability score of at least 6, where Activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Sunderland Water Supply. The [Technical Rules](#) can be used in conjunction with the Vulnerability Scores on [Figure 6b-3](#) to identify the circumstances in which these activities associated with DNAPL threats would be Significant or Moderate Drinking Water Threats.

6.4.3.3.4 WHPA-E

Figure 6b-8 illustrates the area of the WHPA-E where Activities are considered to be Moderate or Low Drinking Water Threats for the Sunderland Water Supply. The [Technical Rules](#) can be used in conjunction with the Vulnerability Scores on Figure 6b-8 to identify the circumstances in which these activities would be Moderate or Low Threats.

Identifying Areas of Significant/Moderate/Low Threats – Conditions

Further to Section 6.4.3.2, no Conditions have been confirmed within the WHPA for the Sunderland Water Supply.

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

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

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

Figure 6b-3 illustrates the Vulnerability Score map for Sunderland that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

6.4.3.4 Enumerating Drinking Water Threats

The number of Significant Drinking Water Threats for the Sunderland Water Supply has been determined using the methodology outlined in the WSP 2022 Technical Memorandum A3 and refined by Region of Durham staff members.

Table 6-7 documents the refined enumeration of existing Activities that are considered to be Significant Drinking Water Threats within the WHPAs for the Sunderland Drinking Water Supply. Potential Significant Drinking Water Threats were only identified within areas where the Vulnerability Score is 10.

Six (6) activities that are considered to be Significant Threats to Drinking Water were identified in the WHPAs for the Sunderland Wellfield. **Three (3)** activities relate to private homes with

private sewage systems. One (1) activity relates to the potential application of agricultural source material to land, one (1) activity relates to the potential application of pesticide to land, and one (1) activity relates to the handling and storage of DNAPL.

Table 6-7: Number of Significant Drinking Water Threats for the Sunderland 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.	<u>3</u>
3	The application of agricultural source material to land.	1
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.	1
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

Threat Number	Threat	Significant threat counts Number of threats
16	The handling and storage of dense non-aqueous phase liquid.	<u>1</u>
17	The handling and storage of an organic solvent.	0
18	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
<u>22</u>	<u>The establishment and operation of a liquid hydrocarbon pipeline</u>	<u>0</u>
	Totals	6 <u>significant threats</u> (<u>on 5 properties</u>)

6.4.3.3.5 6.4.3.4.1 Managed Lands

Technical Rule 16(9) requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the [Technical Rules](#).

Managed Lands were identified and the managed lands proportions were determined for the Sunderland WHPA as outlined in the WSP 2022 Technical Memorandum A3. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 6.4.3.4). 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-9 illustrates the location and proportion of managed lands within the delineated WHPA zones for the Sunderland Water Supply where vulnerability scores were greater than 6 for WHPA-A to WHPA-D and greater than 4 for WHPA-E.

6.4.3.3.6 6.4.3.4.2 Livestock Density

Technical Rule 16(10) requires the Assessment Report to include maps showing the livestock density within WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in the [Technical Rules](#).

The Livestock Density was determined in accordance with the methodology in the WSP 2022 Technical Memorandum A3. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 6.4.3.4). The Livestock Density is used in the identification of threat activities associated with the storage of Agricultural Source Material, and the grazing and/or outdoor confinement of livestock.

Figure 6b-10 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Sunderland Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D and greater than 4 for WHPA-E. The Livestock Density figures reflect the distribution of Agricultural Managed Lands as determined in accordance with the WSP 2022 Technical Memorandum A3.

6.4.3.3.7 6.4.3.4.3 Impervious Surfaces

Technical Rule 16(11) 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 [Technical Rules](#).

The proportion of impervious surfaces within the Sunderland WHPA was determined in accordance with the methodology in the WSP 2022 Technical Memorandum A3. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 6.4.3.4). 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 WHPA zones for the Sunderland Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D and greater than 4 for WHPA-E.

Staff Note

The Durham chapter is quite lengthy and includes several water systems in addition to Cannington and Sunderland. Since the Section 34 updates apply only to Cannington and Sunderland, staff has included only these two systems in the technical report prepared for the October 16 meeting.

Figure 6-1: Vulnerable Areas in the Regional Municipality of Durham.

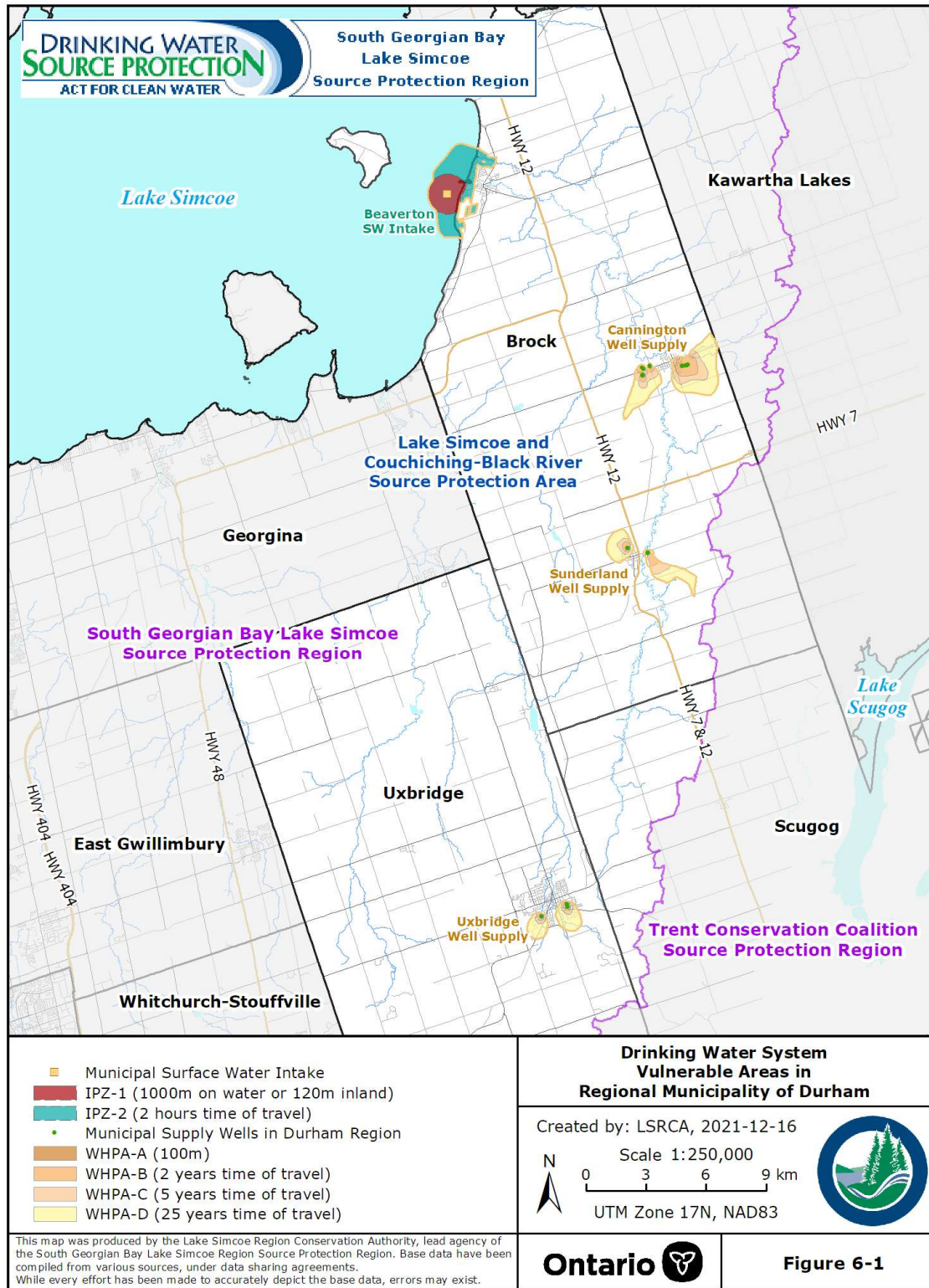


Figure 6a-1: Wellhead Protection Areas – Cannington.

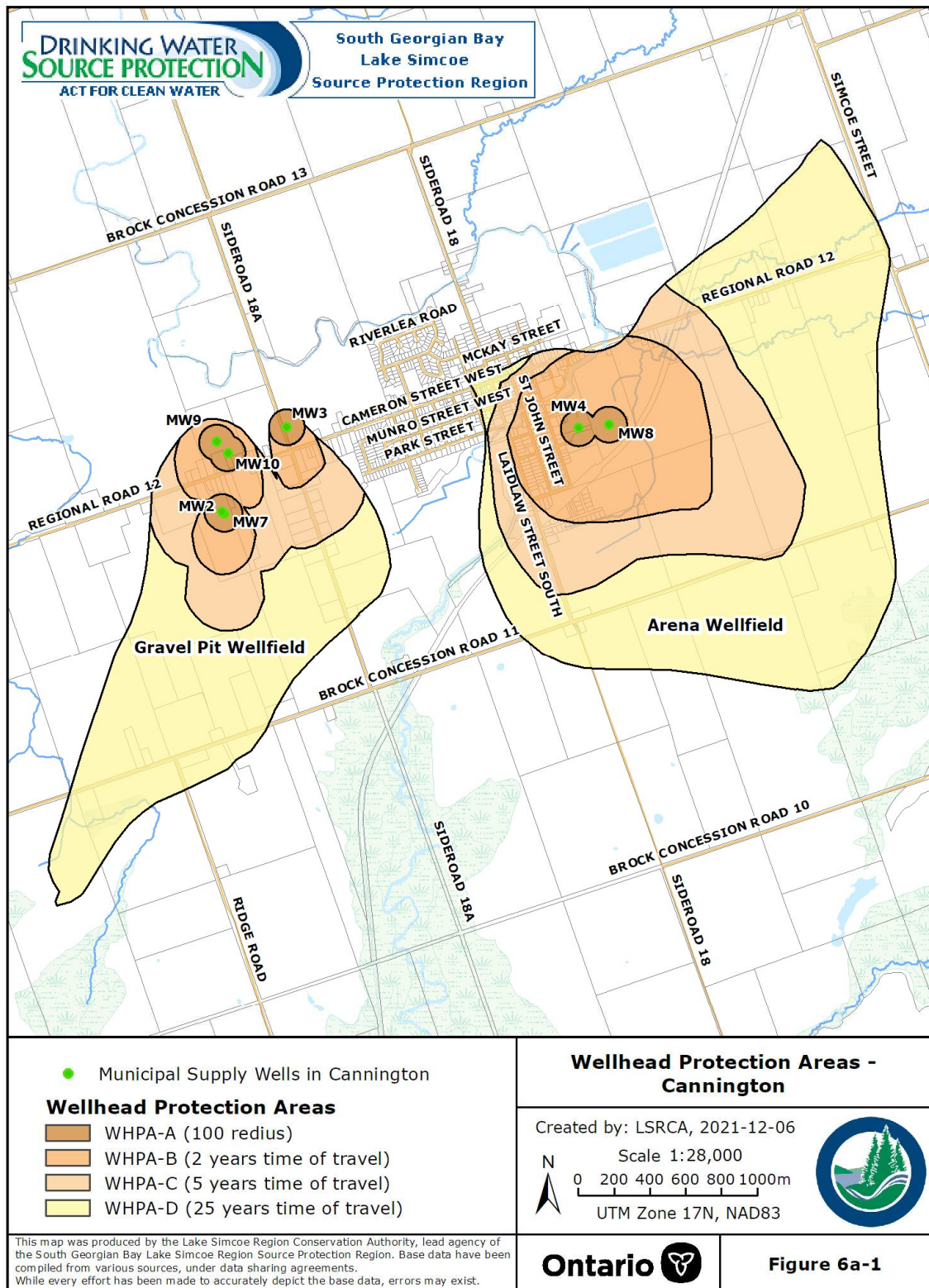


Figure 6a-2: Groundwater Vulnerability – Cannington.

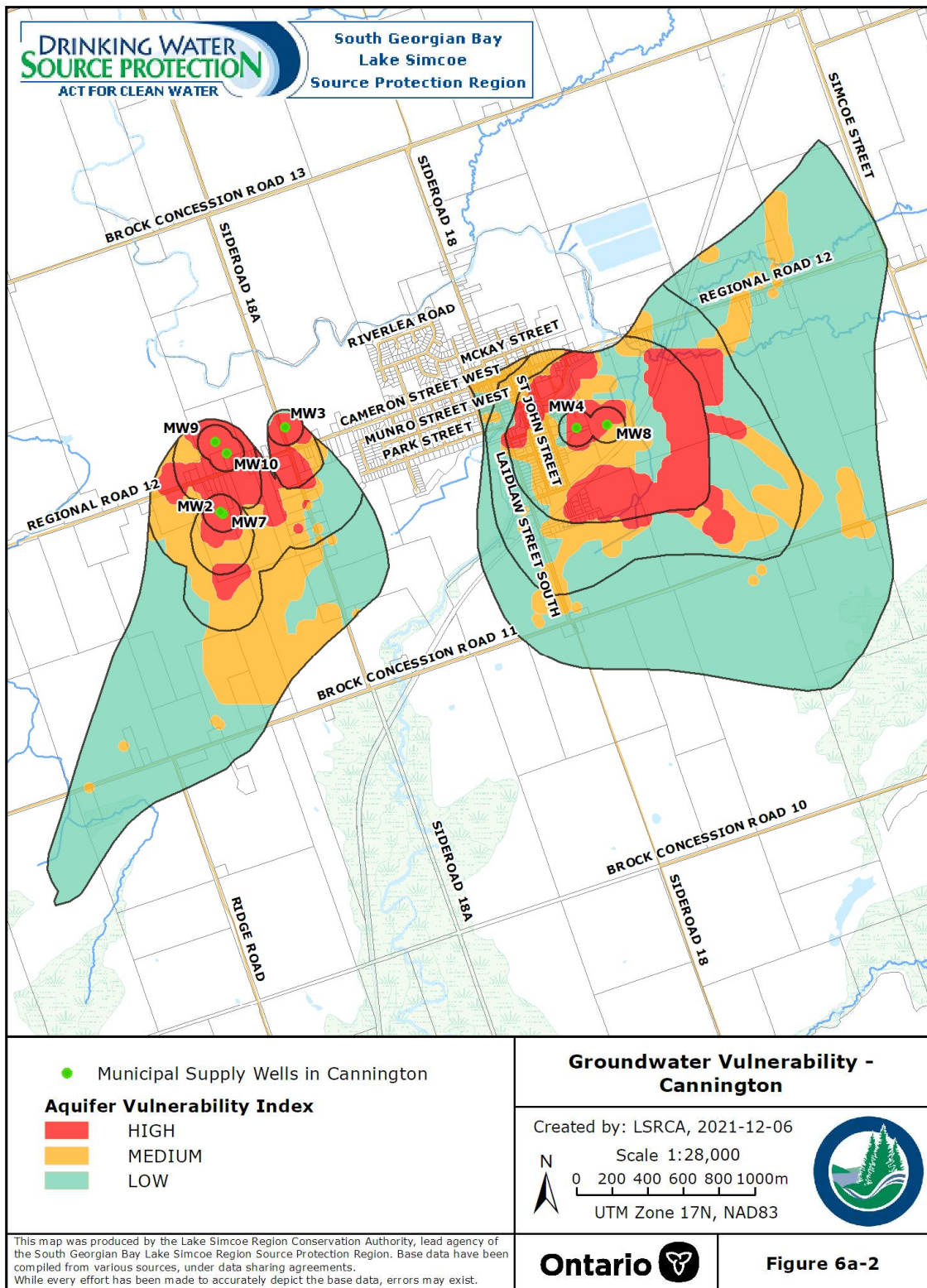


Figure 6a-3: Vulnerability Score - Cannington.

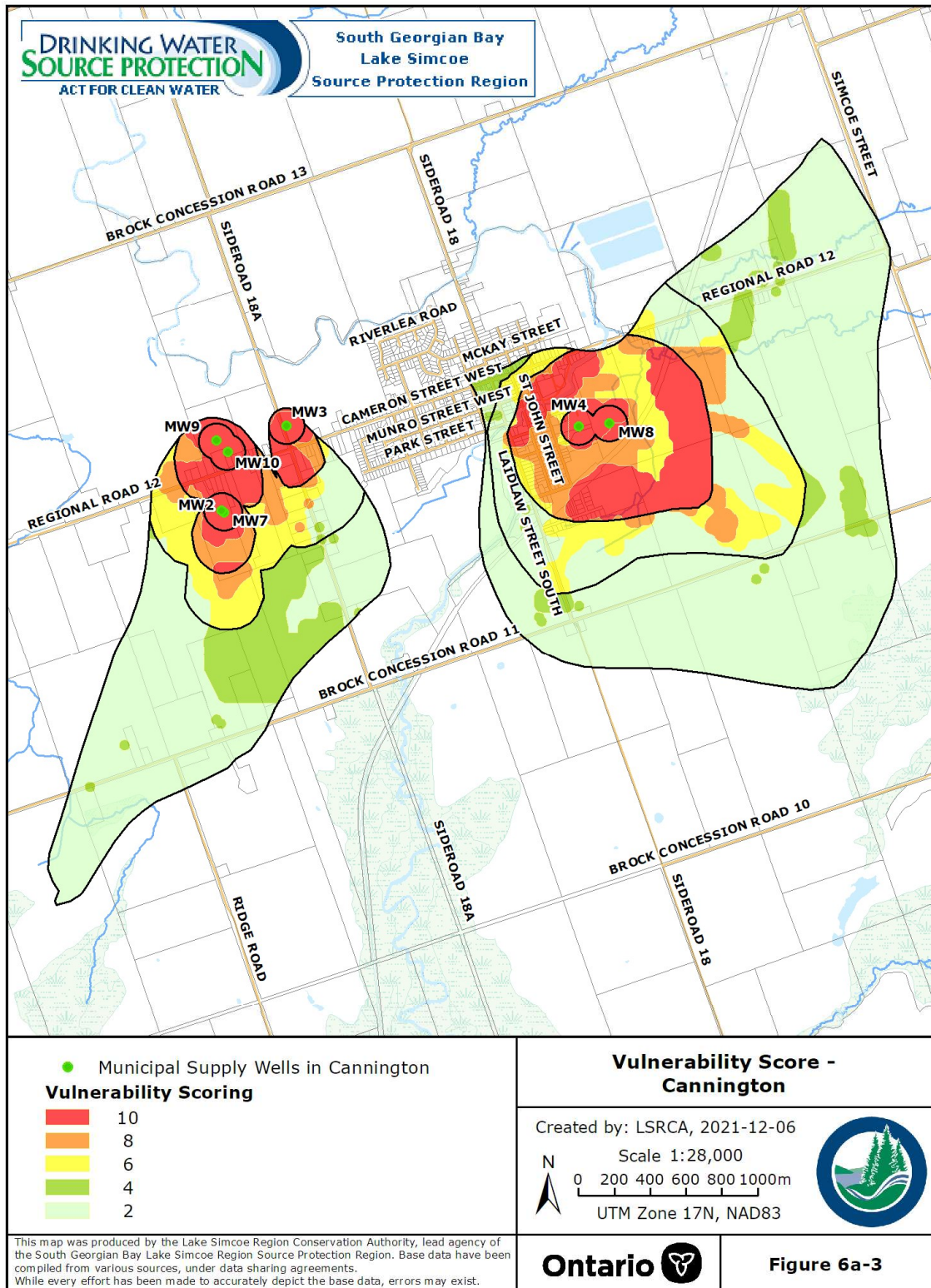


Figure 6a-4: Wellhead Protection Area (WHPA-E) - Cannington.

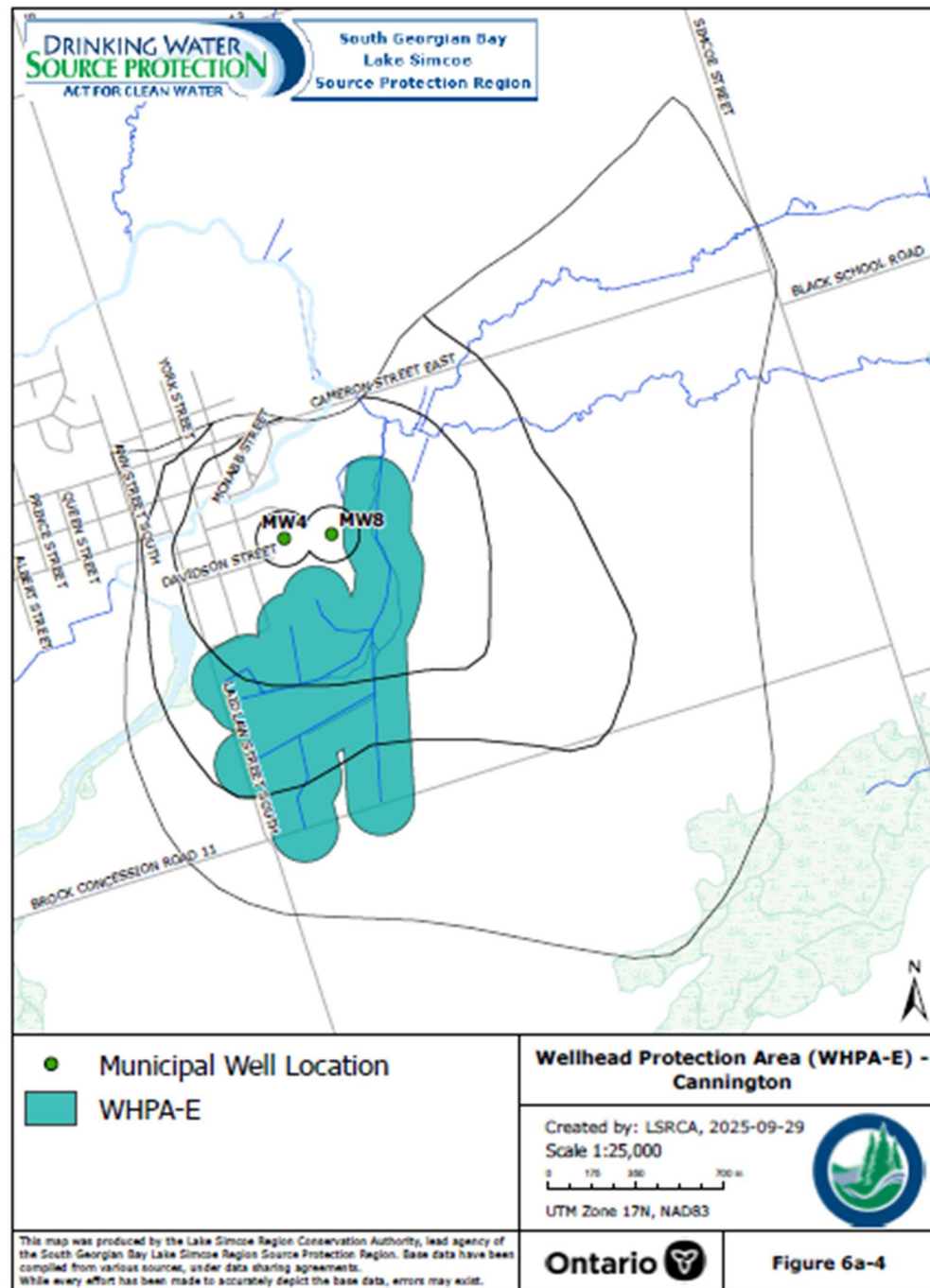
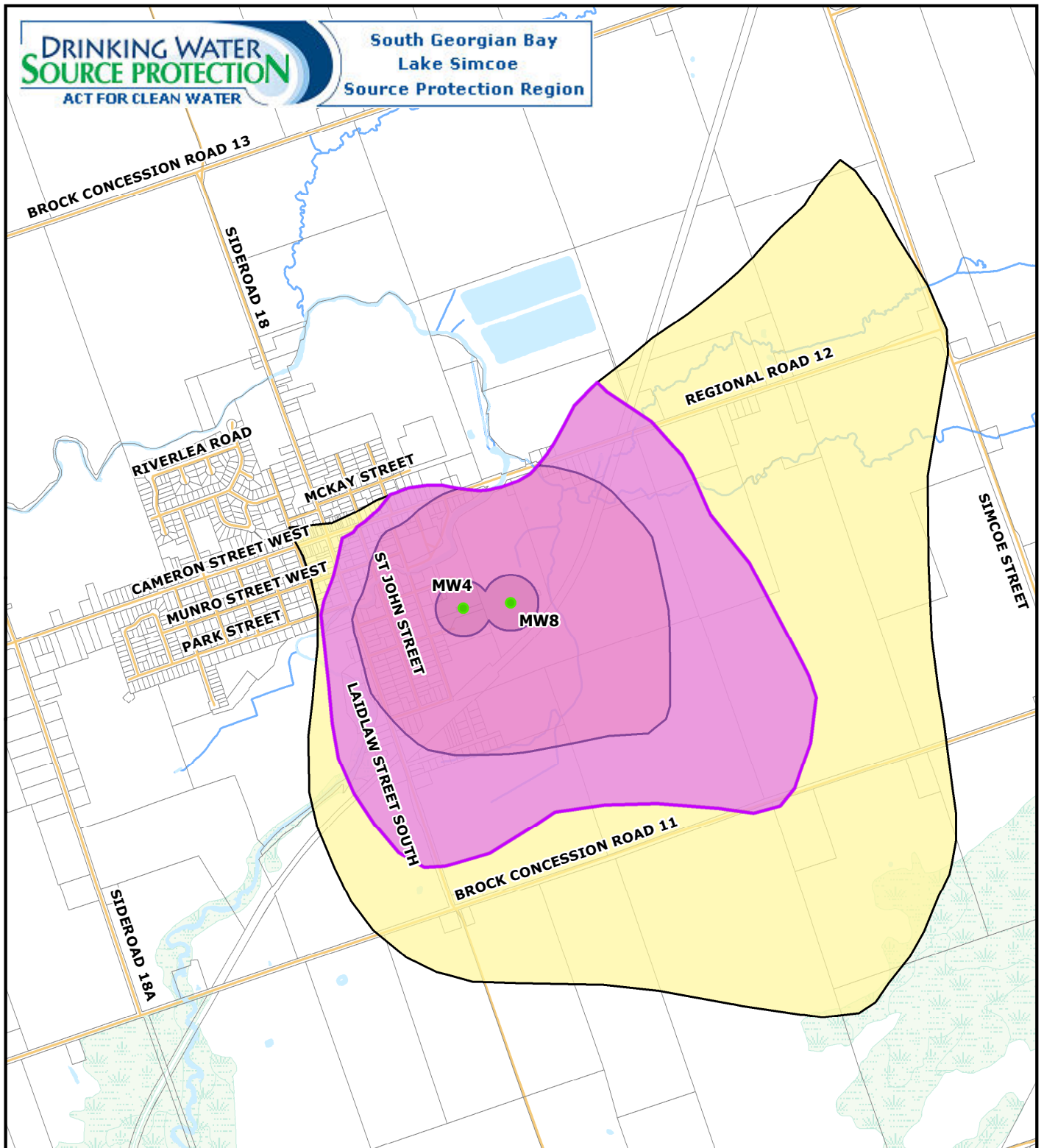


Figure 6a-5: TCE Issues Contributing Area - Arena Wellfield, Cannington.



- Municipal Supply Wells in Cannington
 - Issue Contributing Area
- Wellhead Protection Areas**
- WHPA-A (100 radius)
 - WHPA-B (2 years time of travel)
 - WHPA-C (5 years time of travel)
 - WHPA-D (25 years time of travel)

Issue Contributing Area - Arena Wellfield - Cannington

Created by: LSRCA, 2021-12-06

Scale 1:20,000

N

0 200 400 600 800m

UTM Zone 17N, NAD83

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

Figure 6a-5

Figure 6a-6: Nitrate Issues Contributing Area - Arena Wellfield, Cannington.

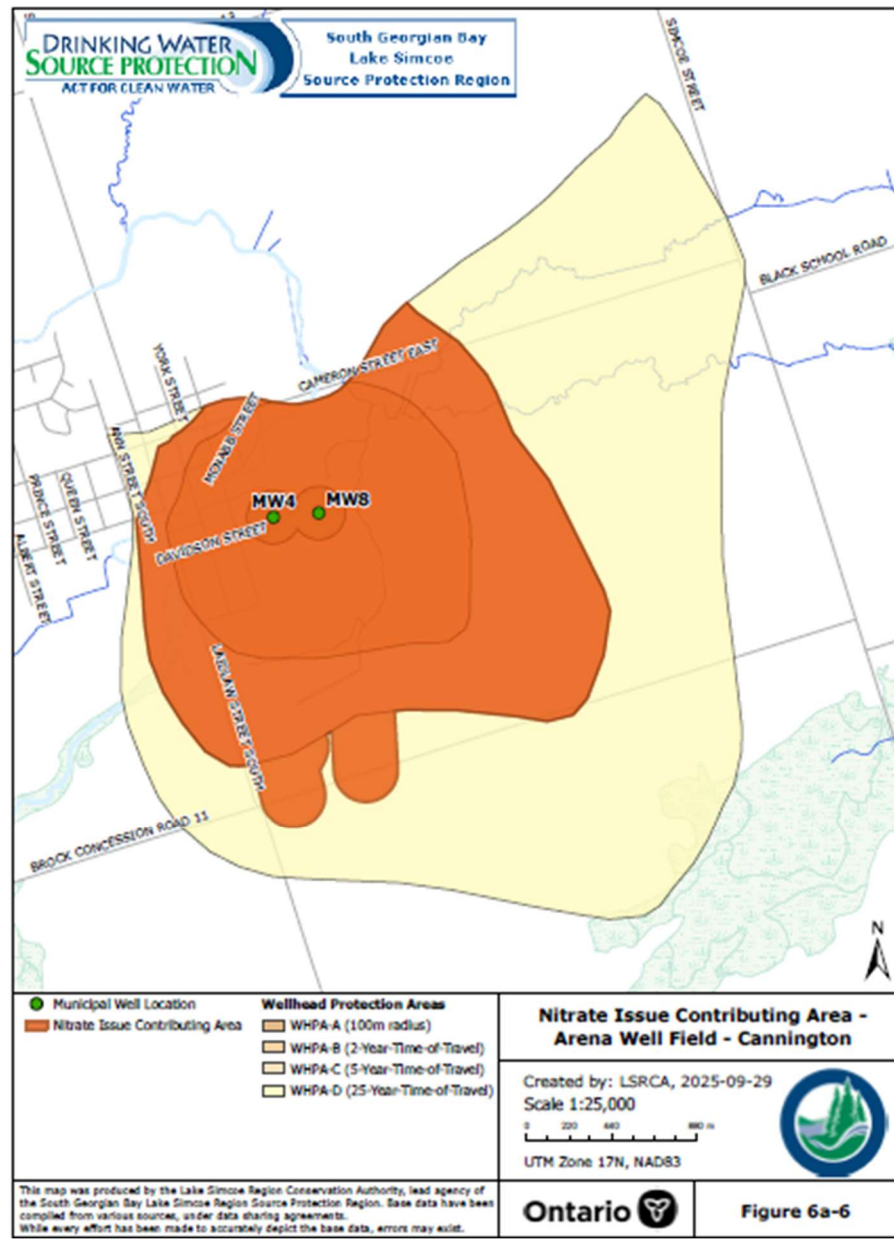


Figure 6a-7: Nitrate Issues Contributing Area – Gravel Pit Wellfield, Cannington.

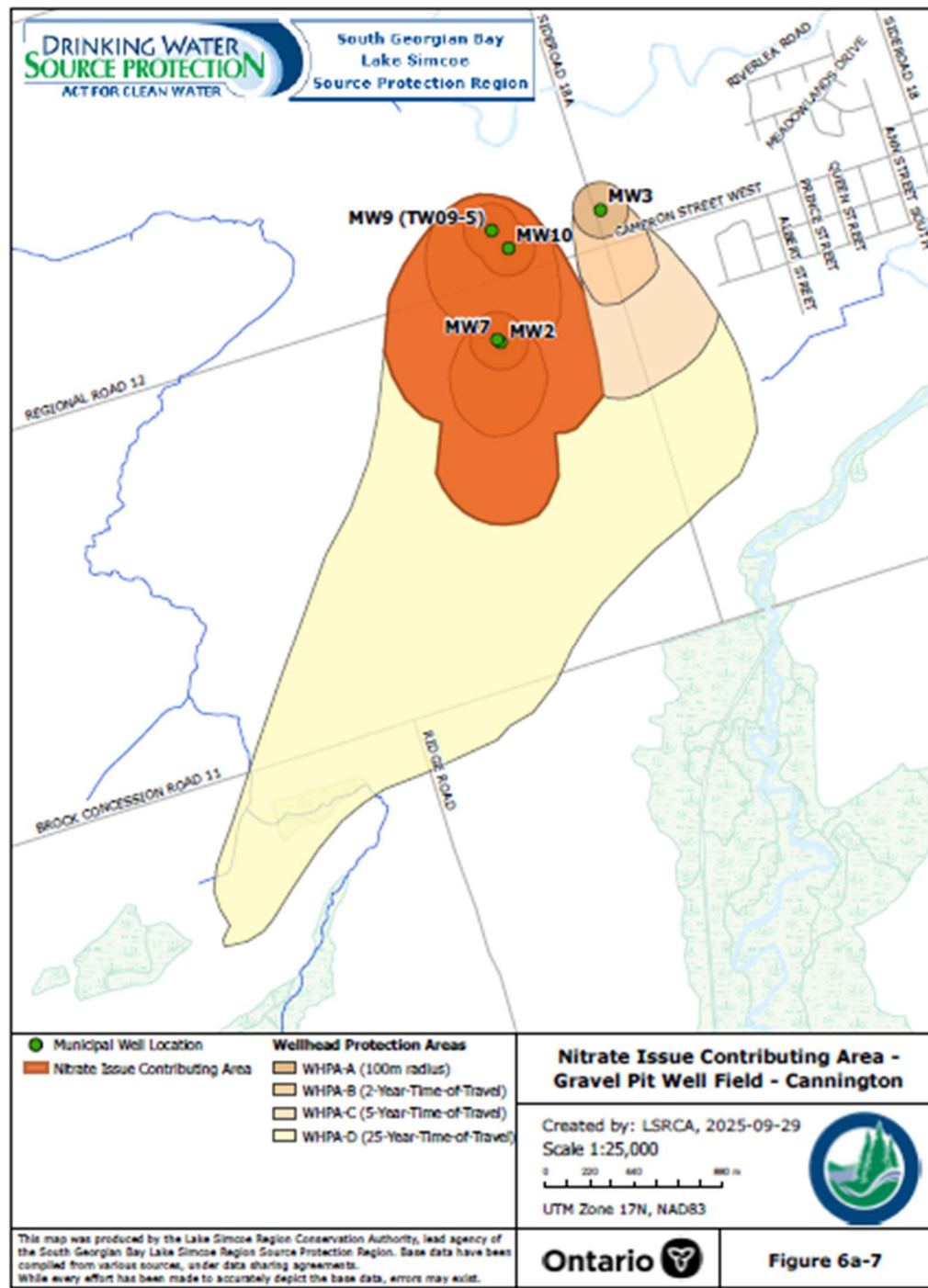
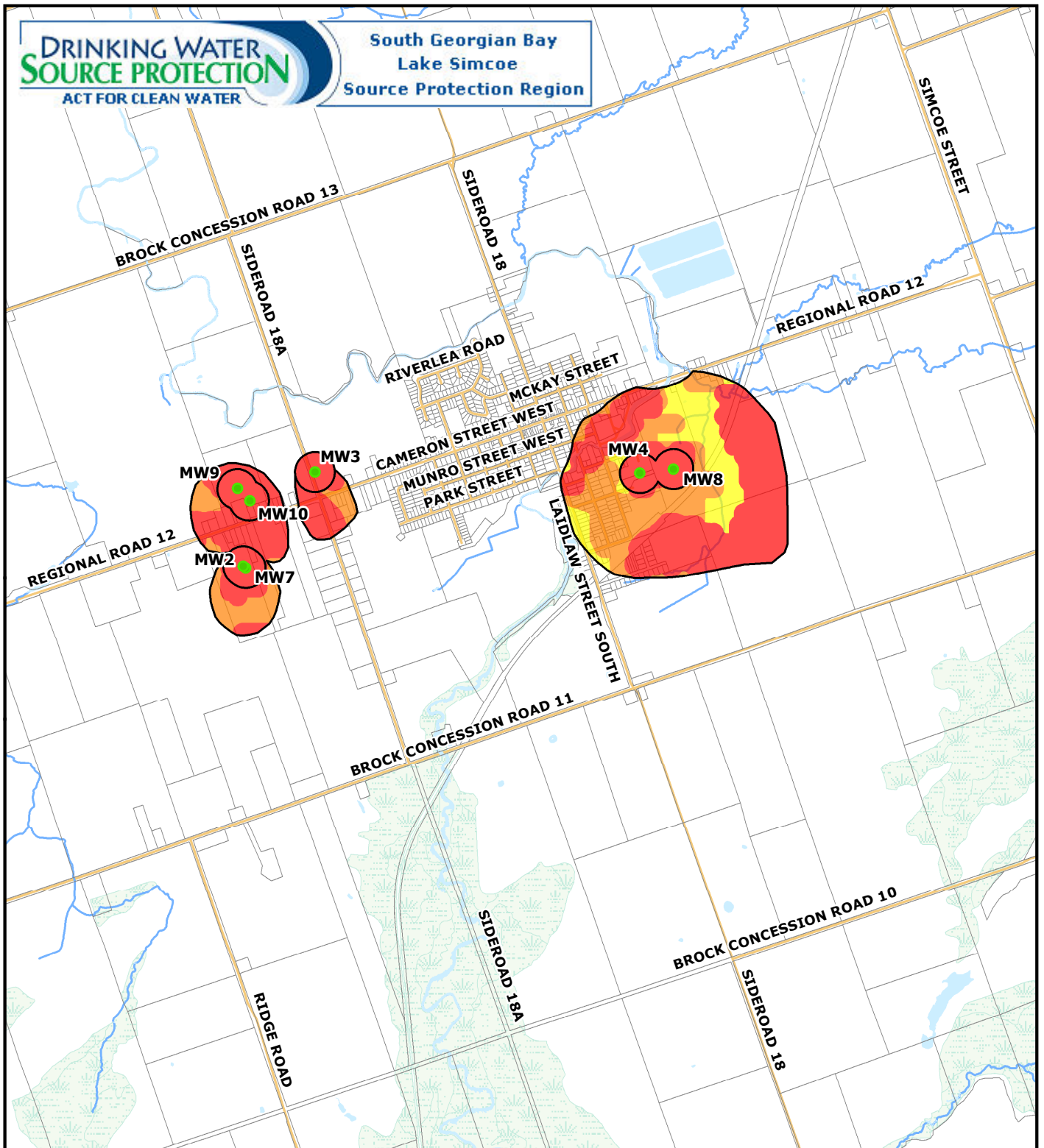


Figure 6a-8: Areas where Pathogens are or would be Significant, Moderate, or Low Threats - Cannington.



DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

South Georgian Bay
Lake Simcoe
Source Protection Region

- Municipal Supply Wells in Cannington
- Vulnerability Scoring**
- 10
 - 8
 - 6

Areas Where Pathogens Are or Would Be Significant, Moderate, or Low Threats - Cannington

Created by: LSRCA, 2021-12-06

Scale 1:28,000
0 200 400 600 800 1000m
UTM Zone 17N, NAD83

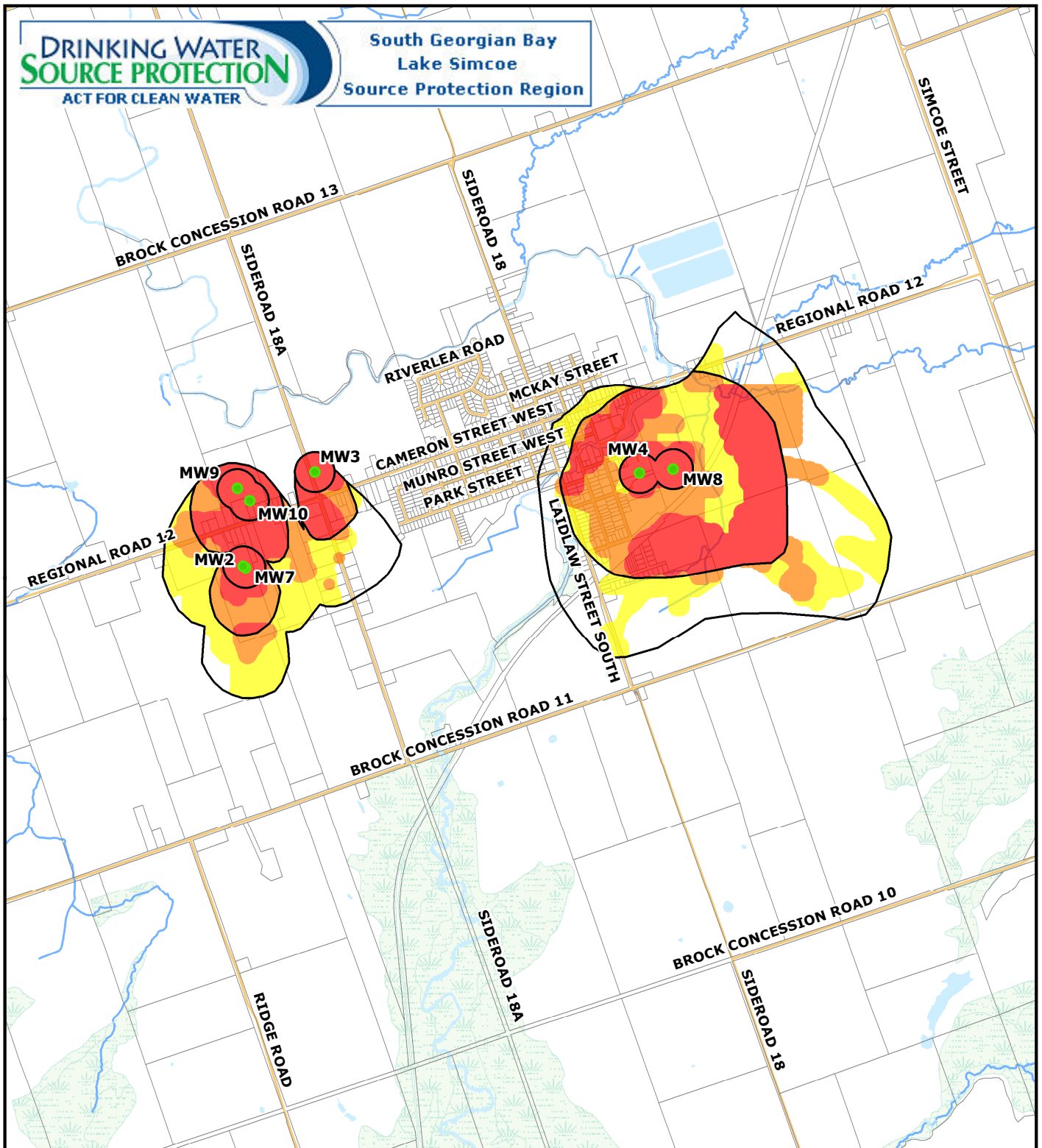


This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data,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



Figure 6a-8

Figure 6a-9: Areas where Chemicals are or would be Significant, Moderate or Low Threats - Cannington.



- Municipal Supply Wells in Cannington
- Vulnerability Scoring**
- 10
 - 8
 - 6

Areas Where Chemicals Are or Would Be Significant, Moderate, or Low Threats - Cannington

Created by: LSRCA, 2021-12-06

Scale 1:28,000
 0 200 400 600 800 1000m
 UTM Zone 17N, NAD83

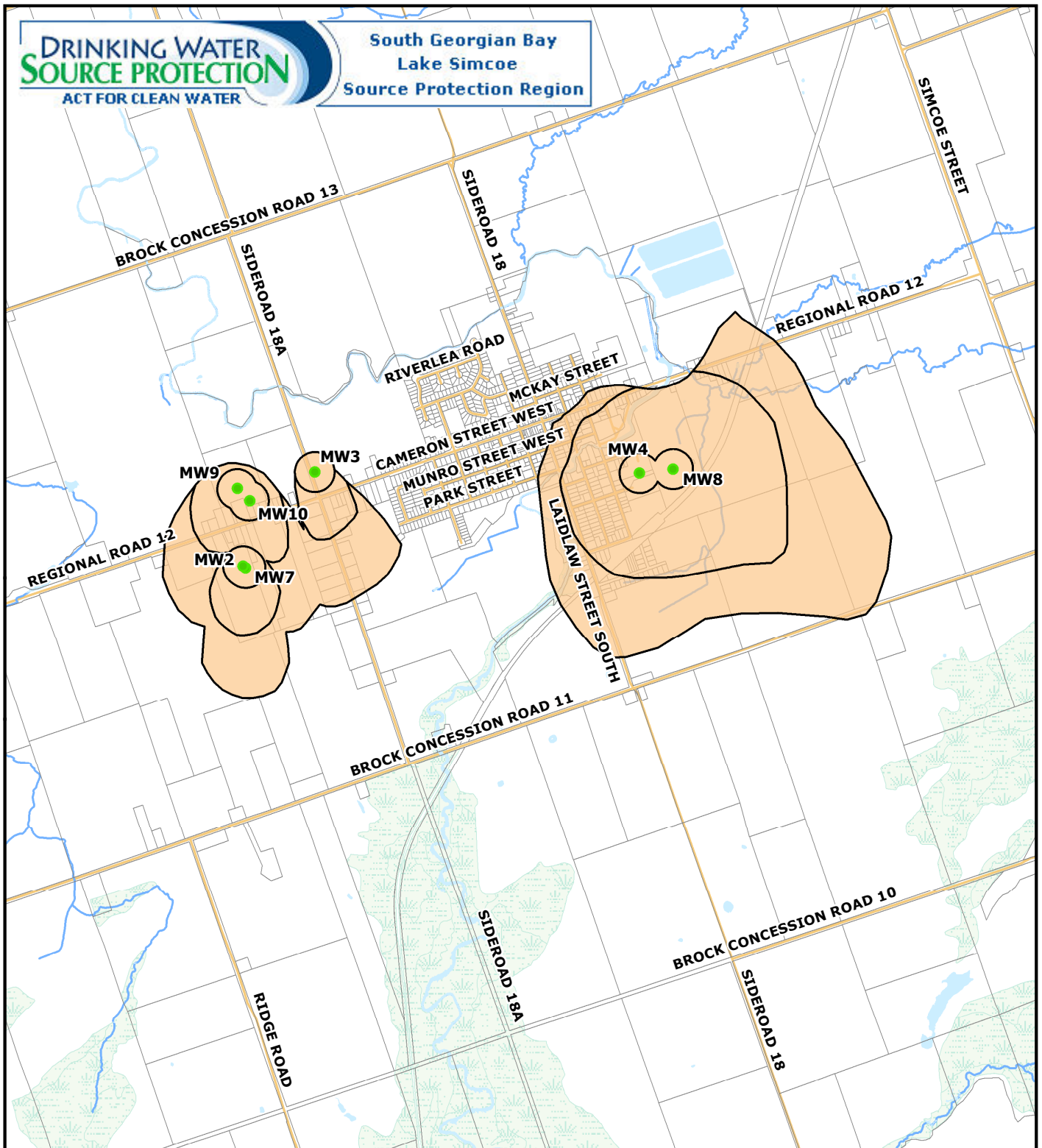


This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data,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



Figure 6a-9

Figure 6a-10: Areas where DNAPLs are or would be Significant, Moderate or Low Threats - Cannington.



- Municipal Supply Wells in Cannington
- WHPA-C (5 years time of travel)

Areas Where DNAPLs Are or Would Be Significant, Moderate, or Low Threats - Cannington

Created by: LSRCA, 2021-12-06

Scale 1:28,000
 0 200 400 600 800 1000m
 UTM Zone 17N, NAD83

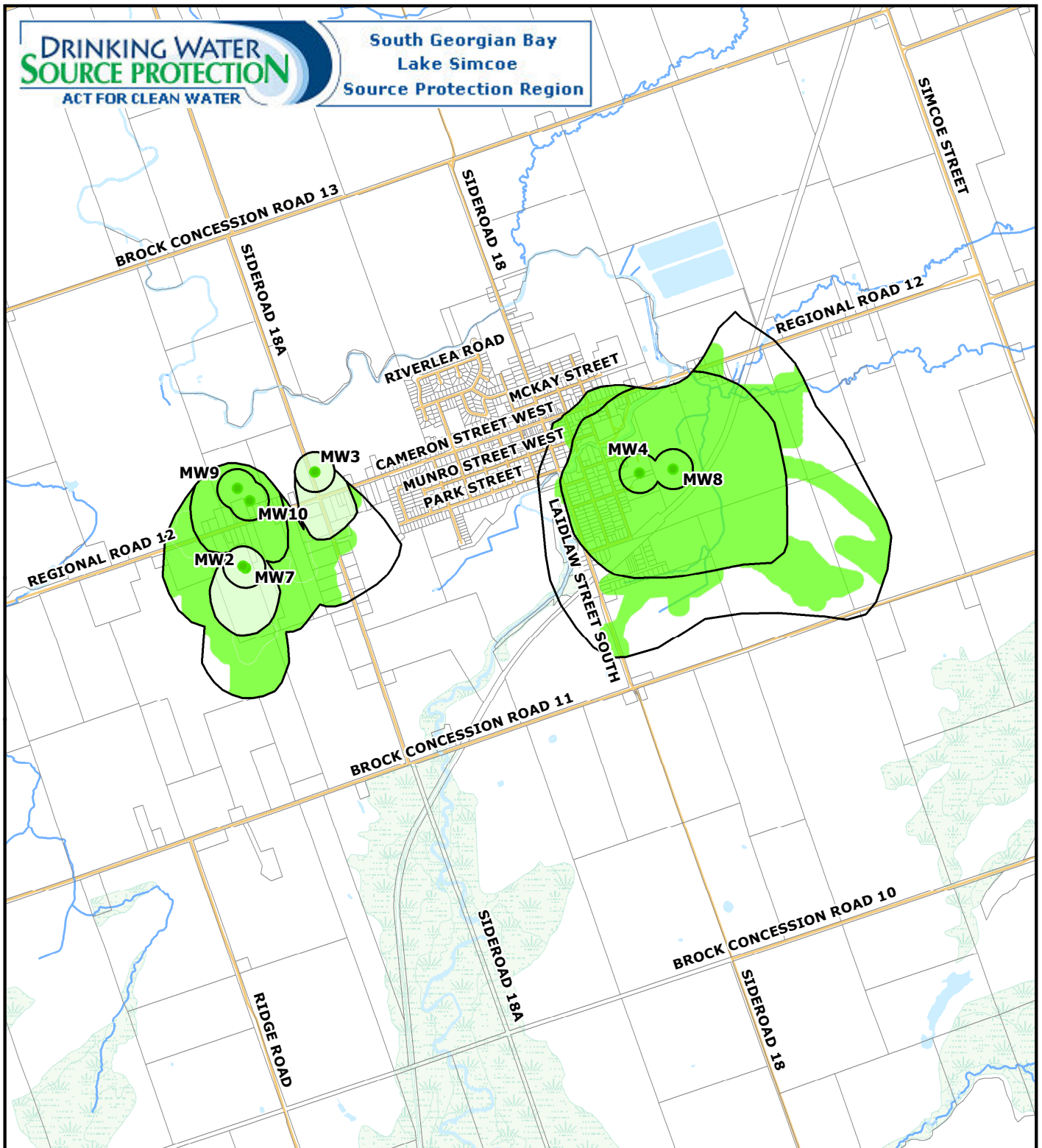


This map was produced by the Lake Simcoe Region Conservation Authority, lead agency of the South Georgian Bay Lake Simcoe Region Source Protection Region. Base data have been compiled from various sources, under data sharing agreements. While every effort has been made to accurately depict the base data,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



Figure 6a-10

Figure 6a-11: Managed Lands - Cannington.



● Municipal Supply Wells in Cannington

MANAGED LANDS

- < 40%
- 40% - 80%
- > 80%

Managed Lands - Cannington

Created by: LSRCA, 2021-12-06

Scale 1:28,000

0 200 400 600 800 1000m

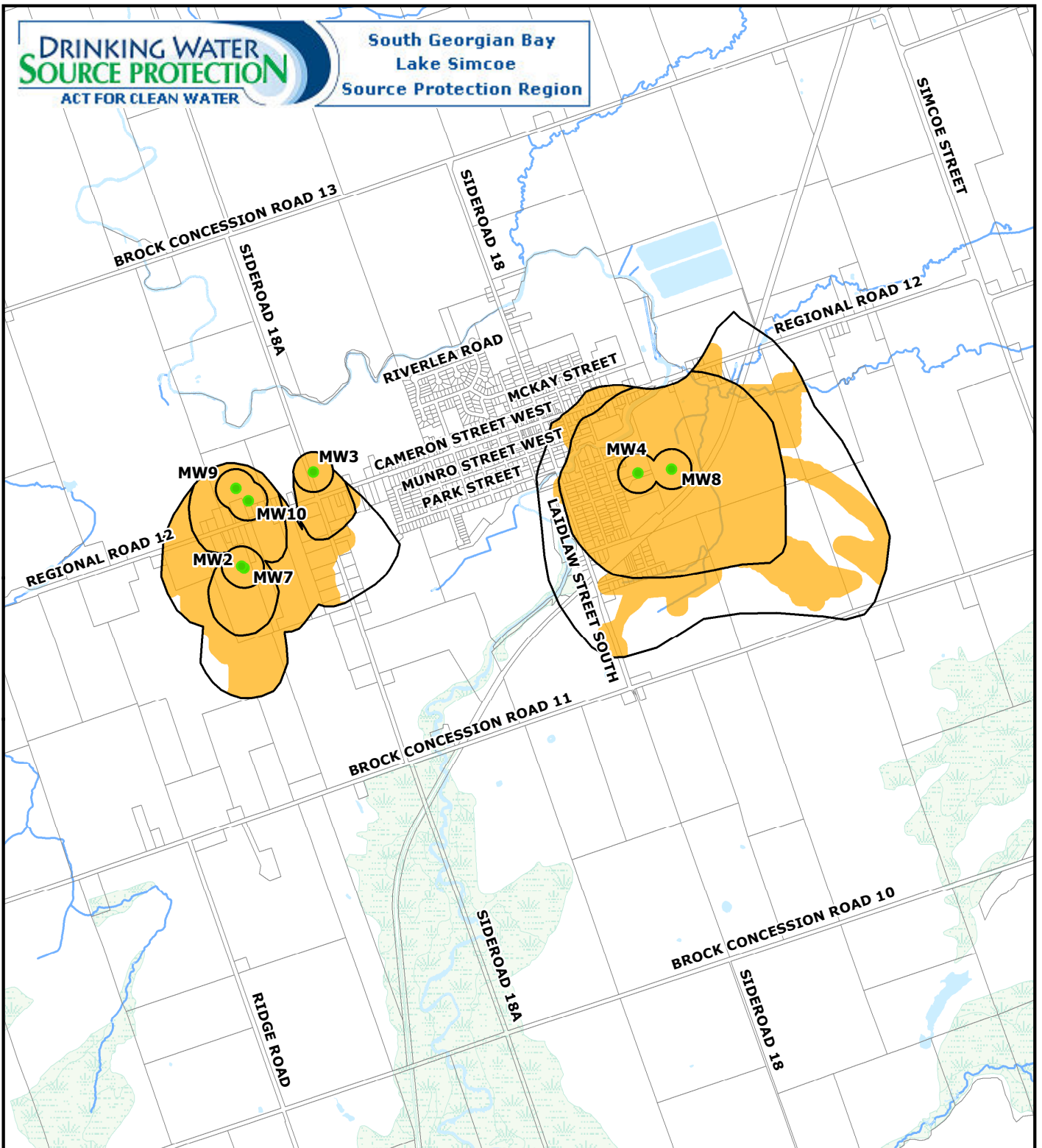
UTM Zone 17N, NAD83

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



Figure 6a-11

Figure 6a-12: Livestock Density - Cannington.



● Municipal Supply Wells in Cannington

Livestock Density

- <0.5 Nutrient Units
- 0.5-1.0 Nutrient Units
- >1.0 Nutrient Units

Livestock Density - Cannington

Created by: LSRCA, 2021-12-06

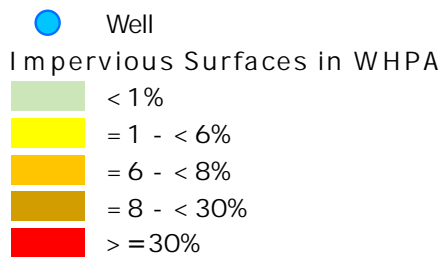
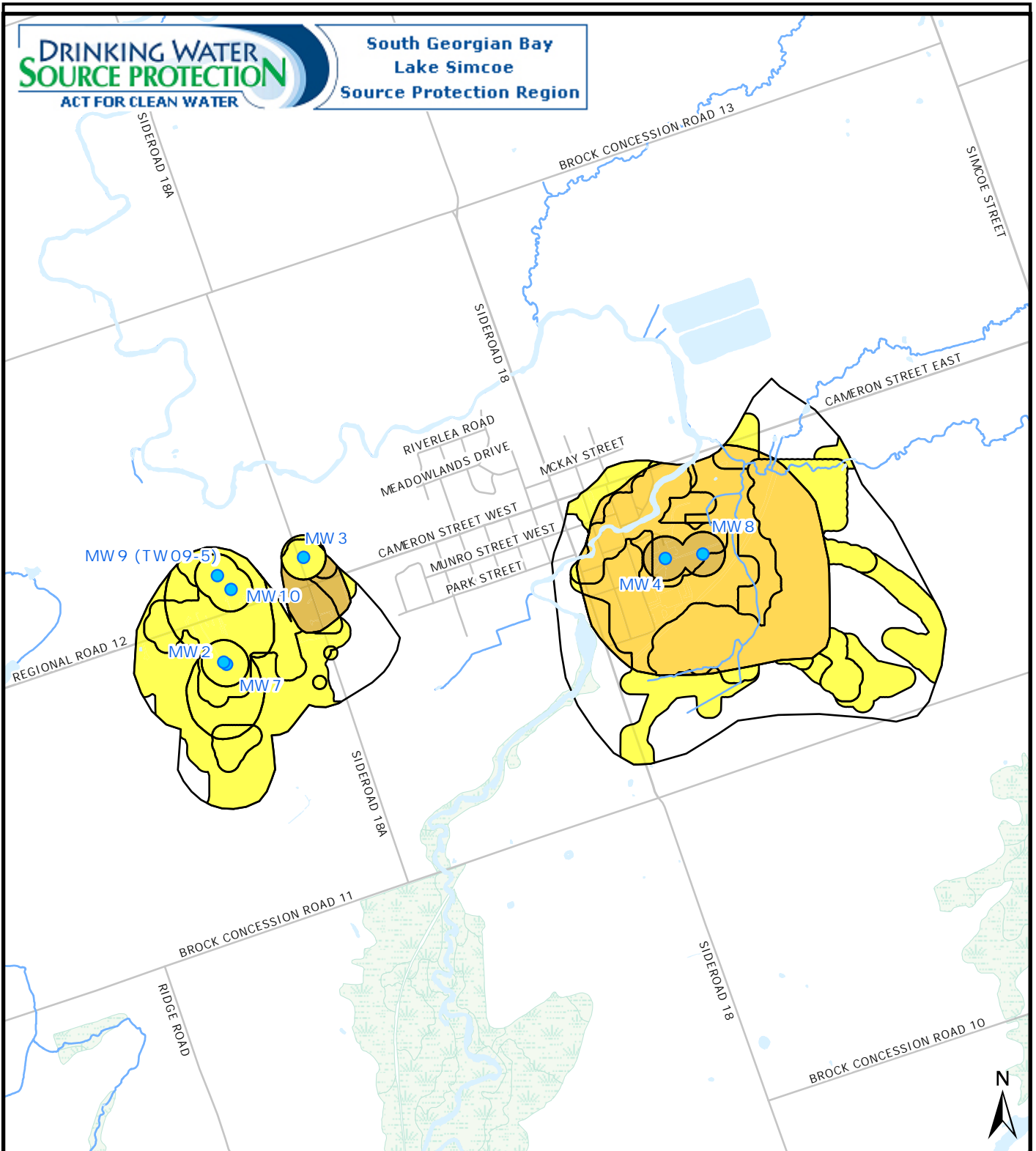
Scale 1:28,000
 0 200 400 600 800 1000m
 UTM Zone 17N, NAD83



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



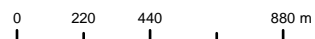
Figure 6a-12



**Impervious Surfaces - Cannington
WHPA**

Created by: LSRCA, 2025-08-05

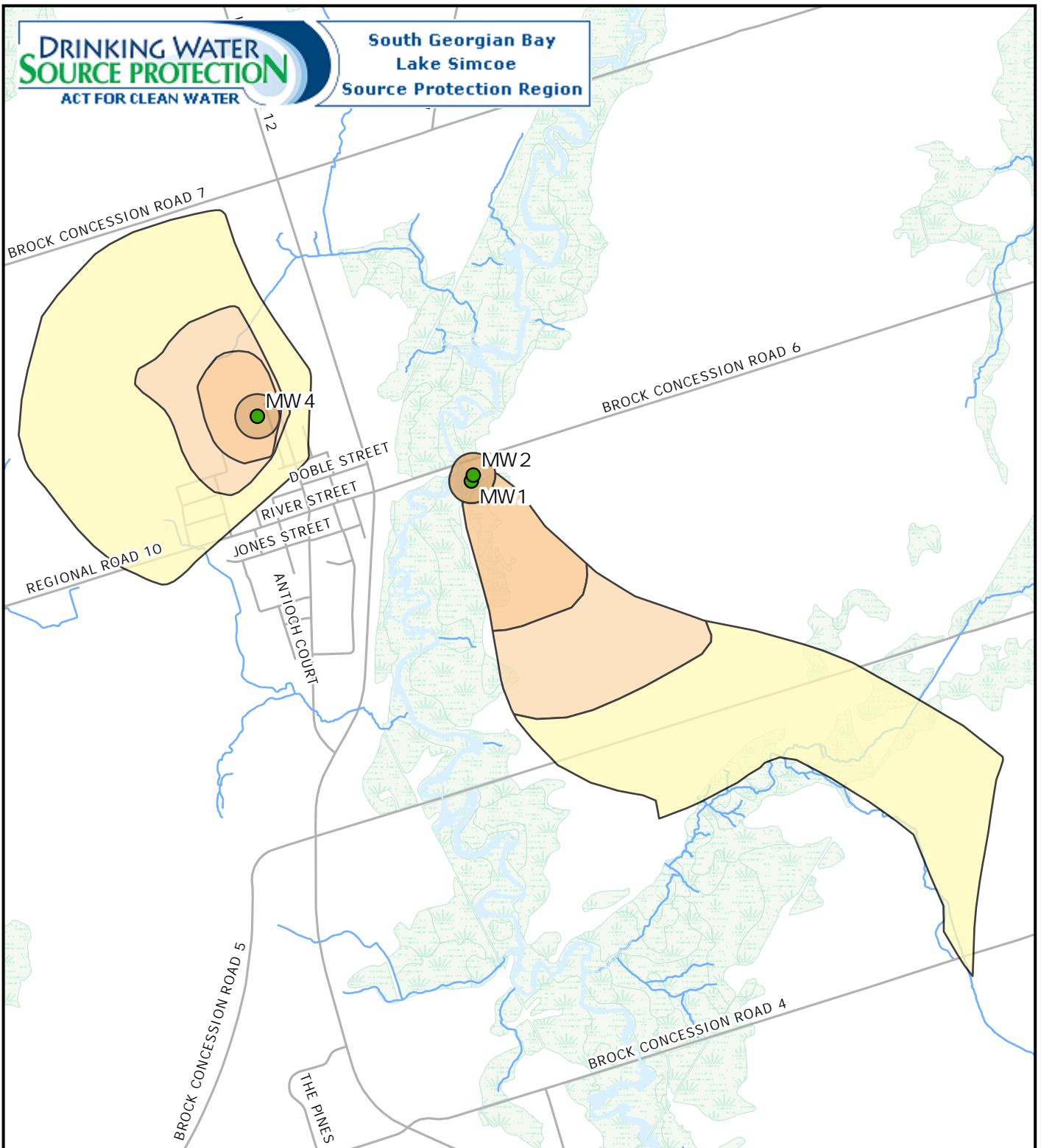
Scale 1: 25,000



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.

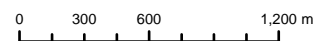


- Municipal Well Location
- Wellhead Protection Areas**
- WHPA-A (100m radius)
- WHPA-B (2-Year-Time-of-Travel)
- WHPA-C (5-Year-Time-of-Travel)
- WHPA-D (25-Year-Time-of-Travel)

**Wellhead Protection Areas -
Sunderland**

Created by: LSRCA, 2025-09-29

Scale 1: 35,000



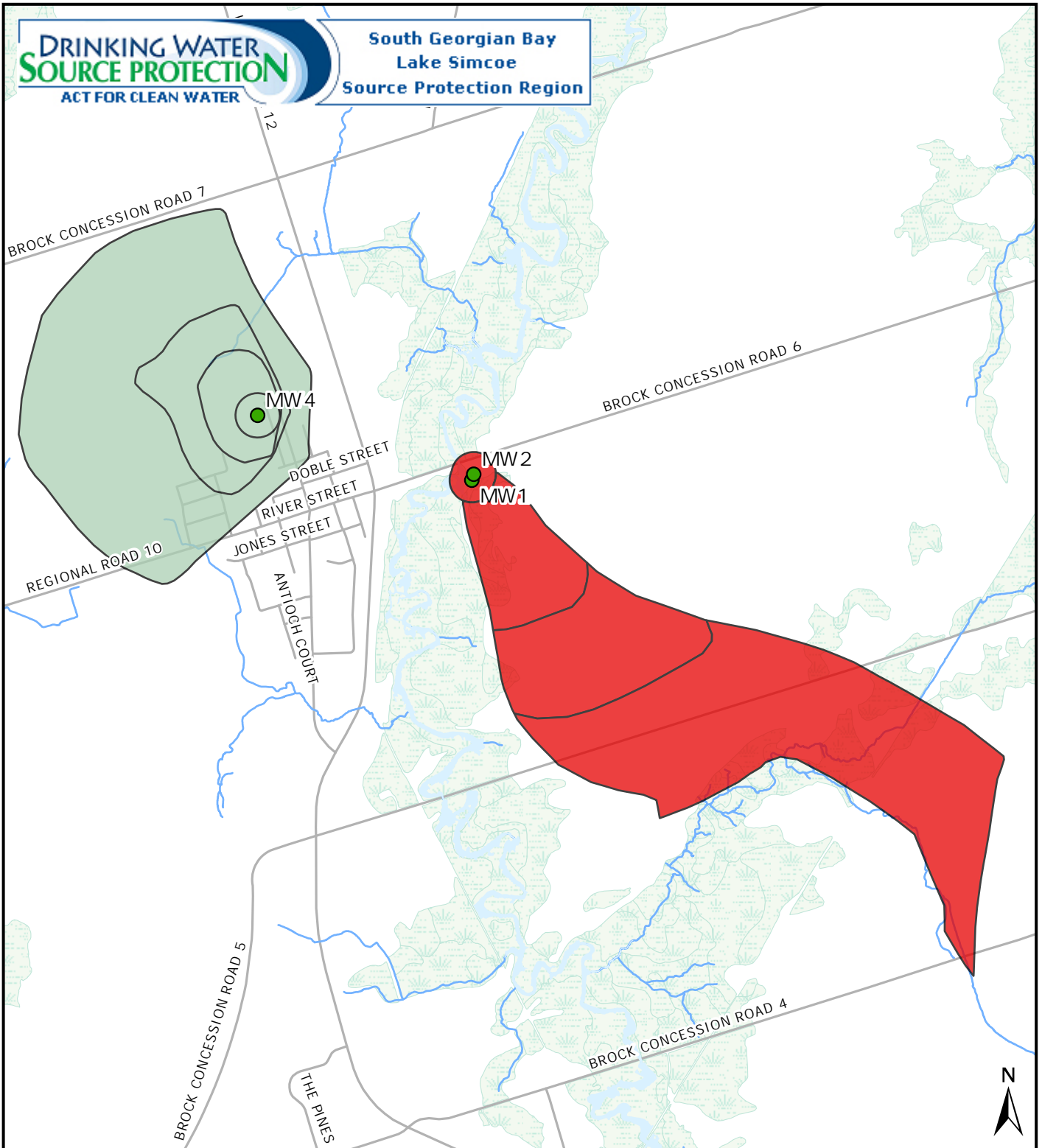
UTM Zone 17N, NAD83



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



Figure 6b-1



● Municipal Well Location

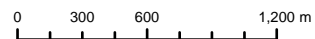
Aquifer Vulnerability Index

- High
- Medium
- Low

**Groundwater Vulnerability -
Sunderland**

Created by: LSRCA, 2025-09-29

Scale 1: 35,000



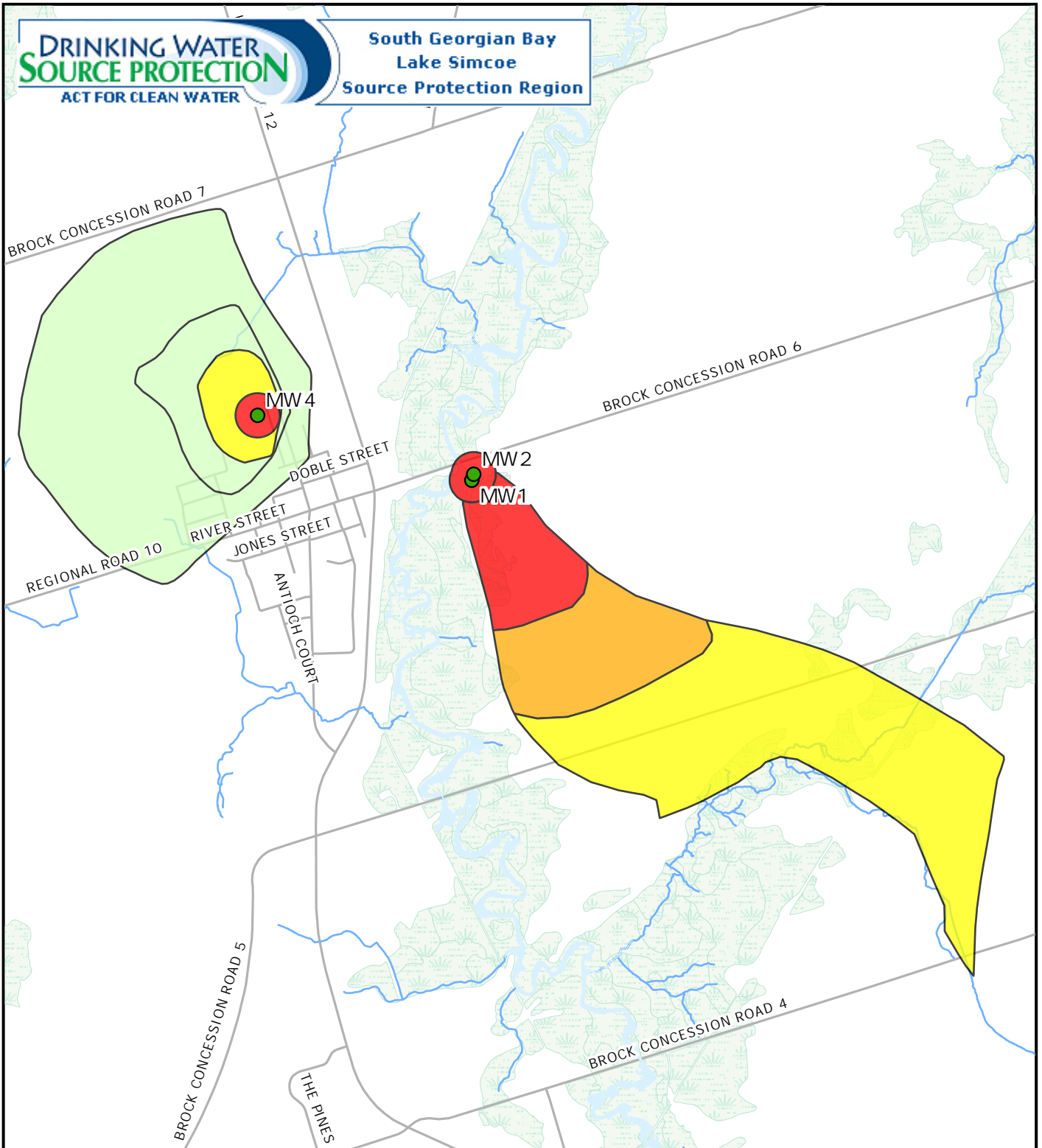
UTM Zone 17N, NAD83



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



Figure 6b-2



● Municipal Well Location

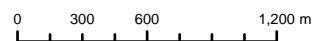
Vulnerability Score

- 10
- 8
- 6
- 4
- 2

Vulnerability Score - Sunderland

Created by: LSRCA, 2025-09-29

Scale: 1: 35,000



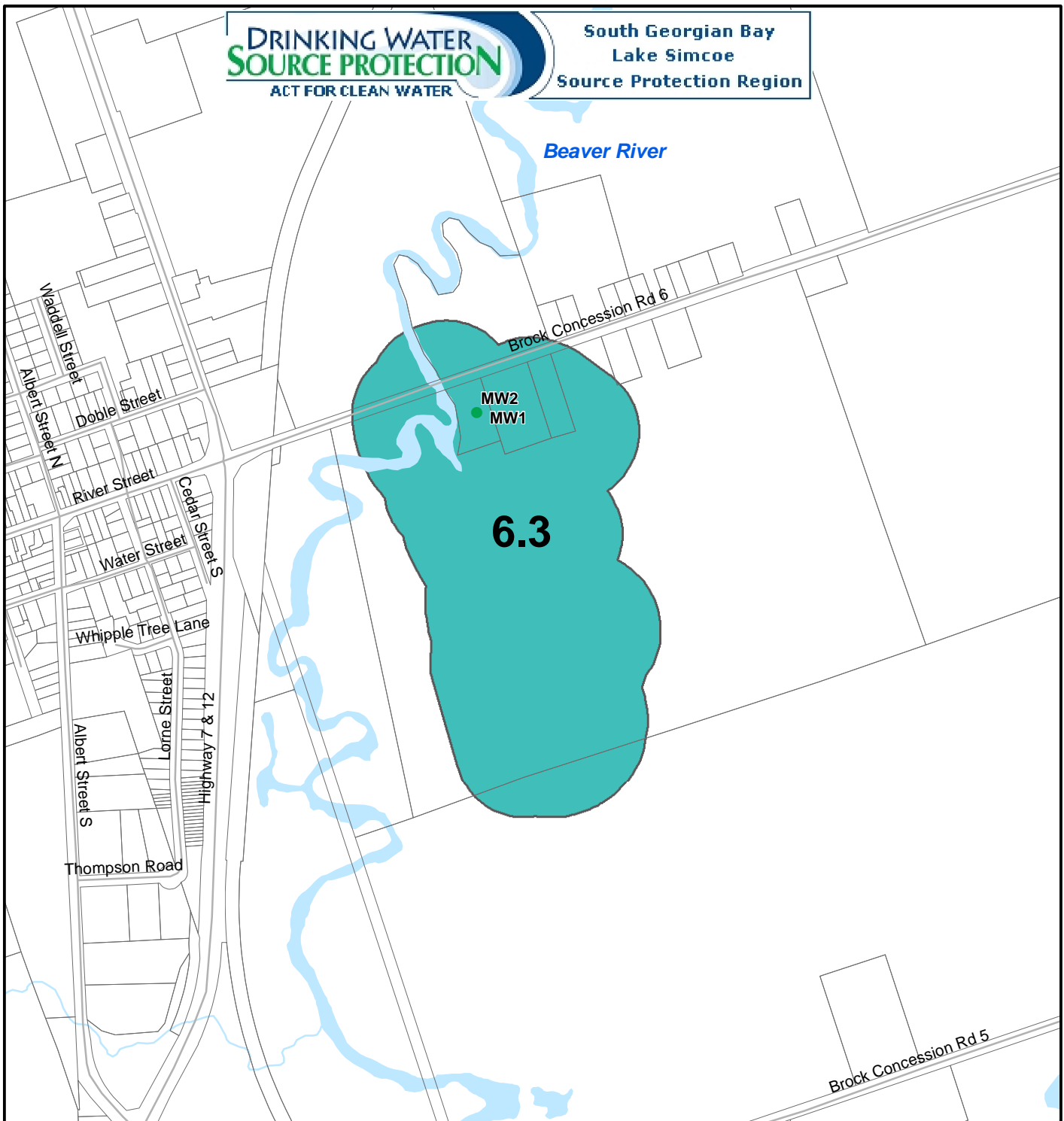
UTM Zone 17N, NAD83



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



Figure 6b-3



Legend

- MUNICIPAL WELL LOCATION
- ROADS
- WATERLINE
- WATERBODY
- WHPA-E
- 6.3 VULNERABILITY SCORE



WHPA-E - SUNDERLAND

ASSESSMENT OF DRINKING WATER THREATS -
SUNDERLAND
The Regional Municipality of Durham

DATE: JUNE 2010

SCALE: 1:10000

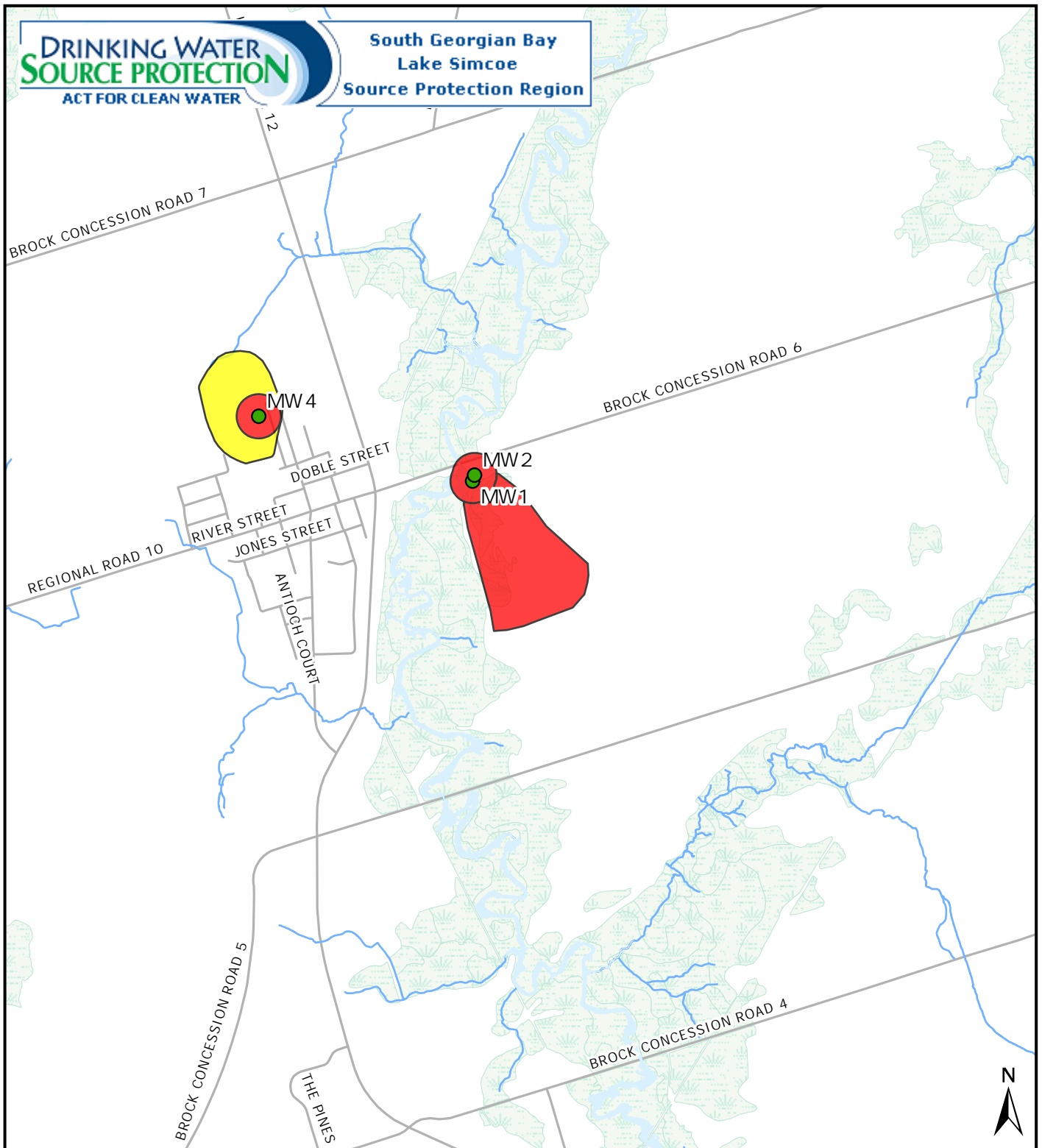
PROJECT: 0-001204.08

FILE. NO.:0-00120408F4-4

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FIGURE
6b-4



● Municipal Well Location

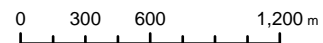
Vulnerability Score

- 10
- 8
- 6

Areas Where Pathogens Are or Would be Significant, Moderate, or Low Threats - Sunderland

Created by: LSRCA, 2025-09-29

Scale 1: 35,000



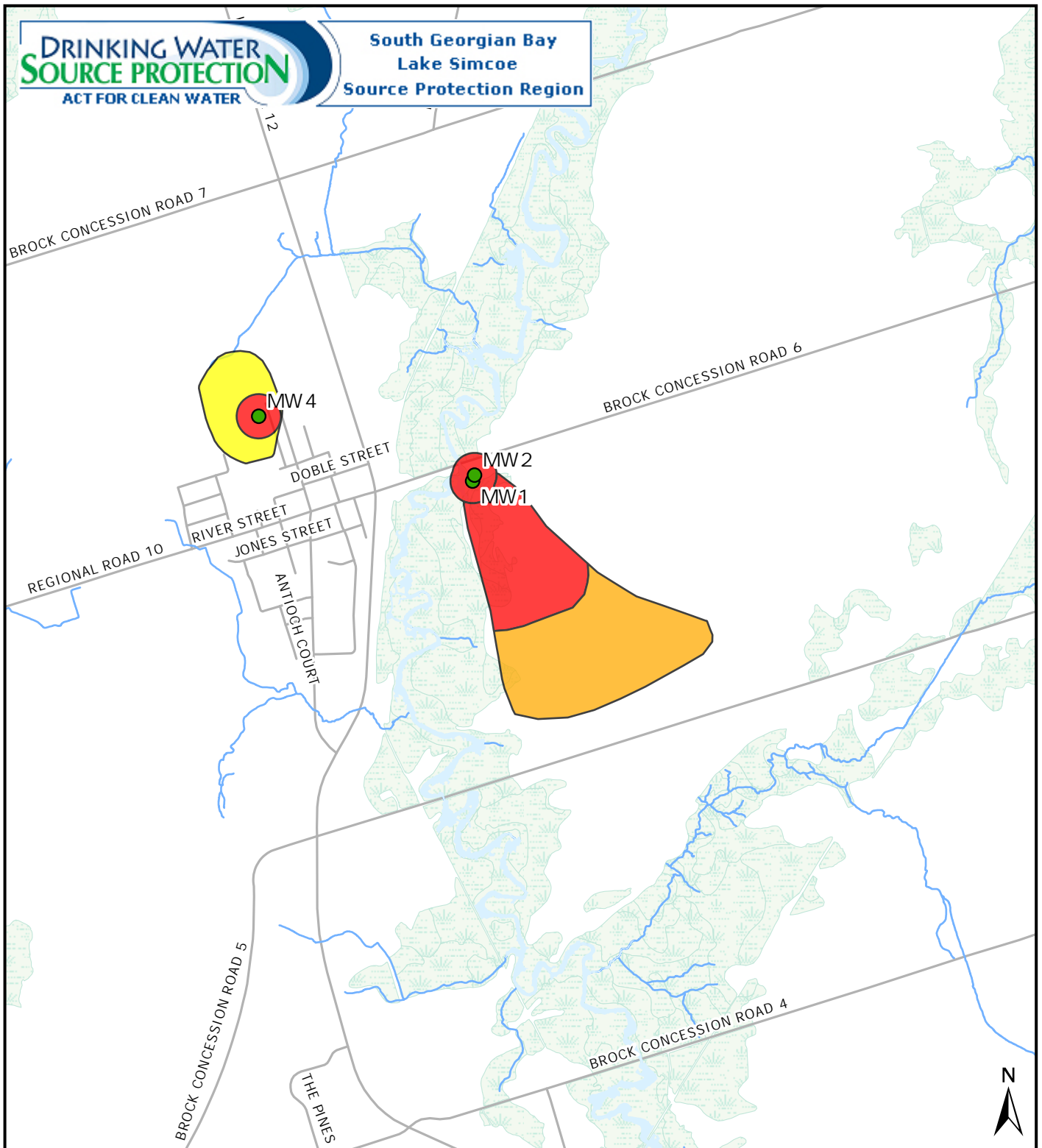
UTM Zone 17N, NAD83



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Figure 6b-5



● Municipal Well Location

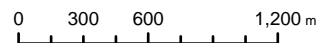
Vulnerability Score

- 10
- 8
- 6

Areas Where Chemicals Are or Would be Significant, Moderate, or Low Threats - Sunderland

Created by: LSRCA, 2025-09-29

Scale 1: 35,000



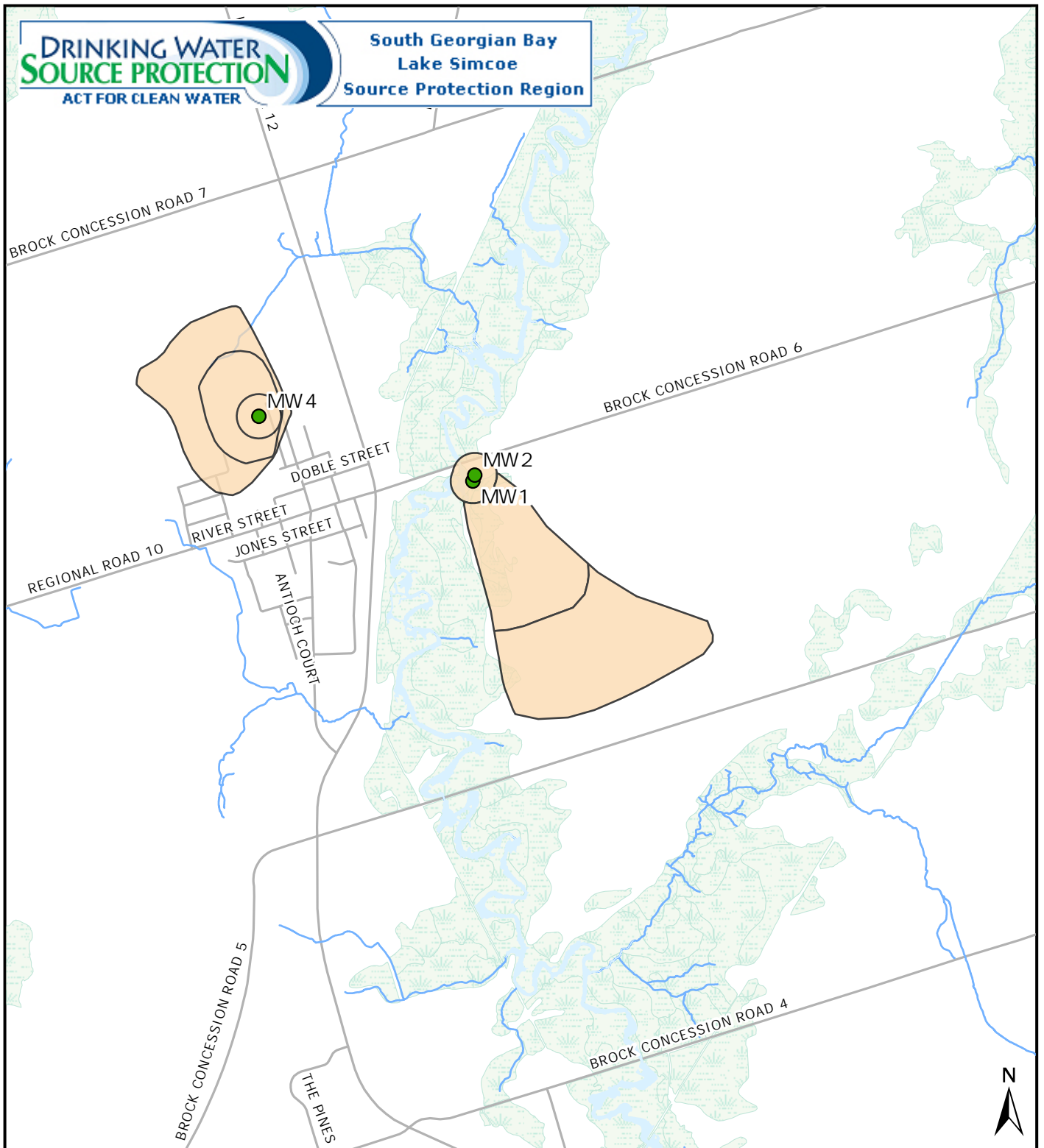
UTM Zone 17N, NAD83



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



Figure 6b-6

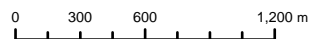


- Municipal Well Location
- WHPA-C (5-Year-Time-of-Travel)
- Vulnerability Score = 6

Areas Where DNAPLs Are or Would be Significant, Moderate, or Low Threats - Sunderland

Created by: LSRCA, 2025-09-29

Scale: 1: 35,000



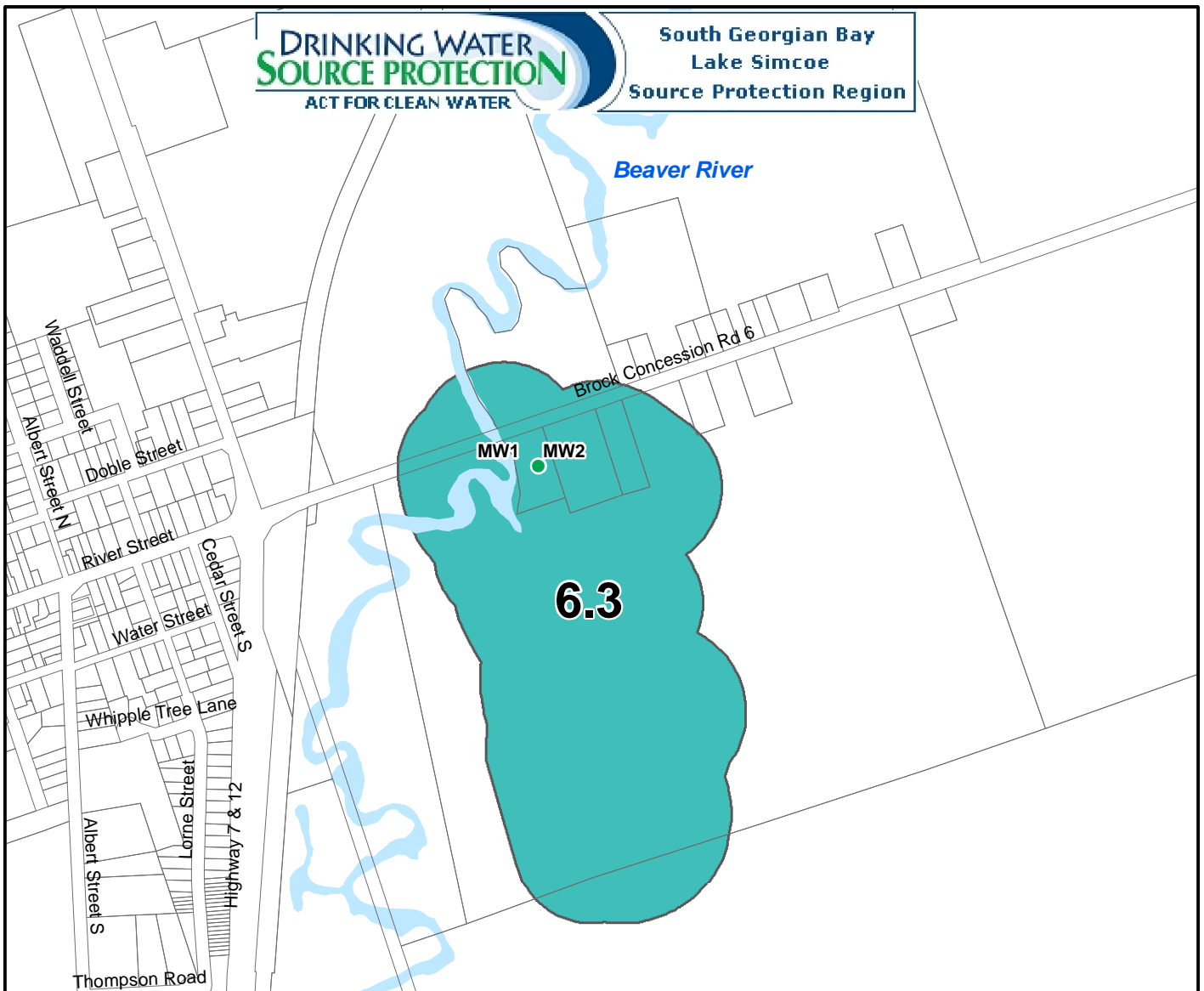
UTM Zone 17N, NAD83



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



Figure 6b-7



Vulnerability Score ¹	Number of circumstances in Table of Drinking Water Threats ²		
	Significant	Moderate	Low
6.3 (Chemicals)	0	13 (CIPZWE6.3M ³)	1193 (CIPZWE6.3L)
6.3 (Pathogens)	0	12 (PIPZWE6.3M)	15 (PIPZWE6.3L)

¹ Areas with vulnerability scores less than 4 can not have significant, moderate or low threats. ² The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). ³ Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: <http://www.ens.gov.on.ca/en/water/cleanwater/provincialTables.php>).

WHPA-E

Legend

- MUNICIPAL WELL LOCATION
- WATERLINE
- WATERBODY
- WHPA-E
- 6.3 VULNERABILITY SCORE

AREAS OF MODERATE AND LOW THREATS - PATHOGENS AND CHEMICALS (WHPA-E)

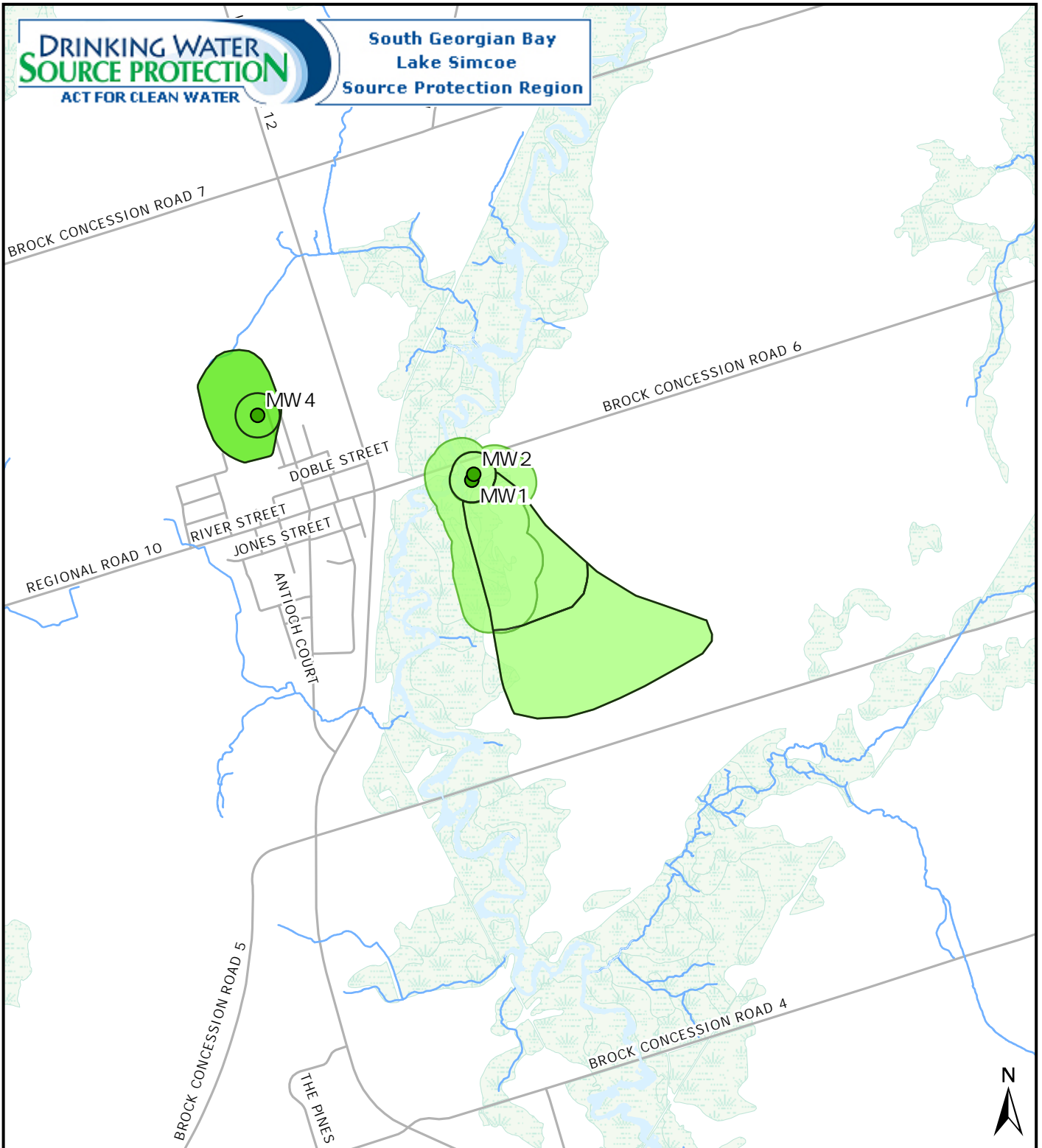
ASSESSMENT OF DRINKING WATER THREATS - SUNDERLAND
The Regional Municipality of Durham

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: AUGUST 2010	SCALE: 1:10000
PROJECT: 0-001204.08	FILE. NO.:0-00120408F4-8

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

FIGURE 6b-8



● Municipal Well Location

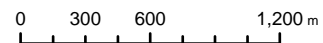
Managed Lands

- < 40%
- 40-80%
- > 80%

Managed Lands - Sunderland

Created by: LSRCA, 2025-09-29

Scale 1: 35,000



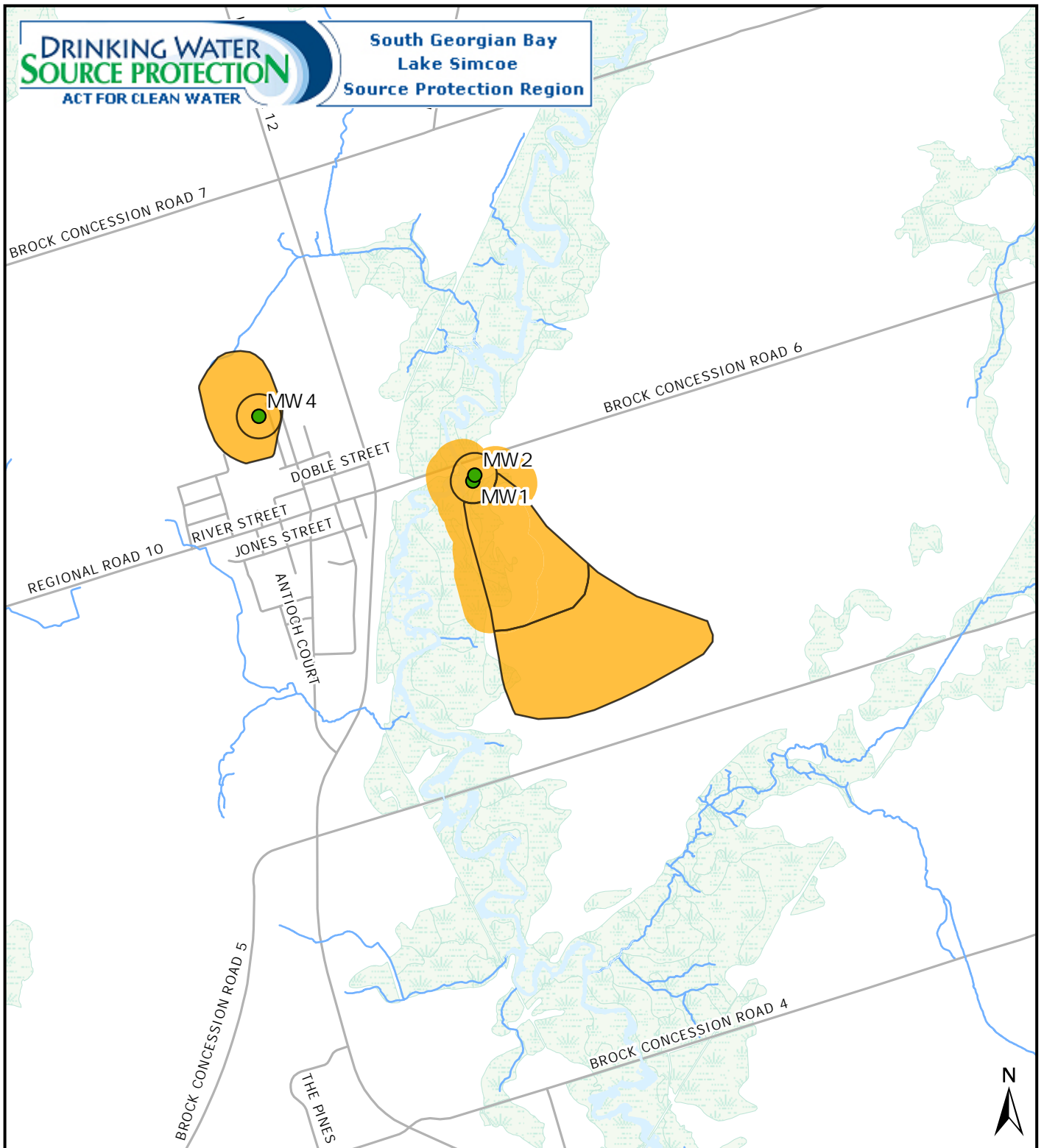
UTM Zone 17N, NAD83



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



Figure 6b-9



● Municipal Well Location

Livestock Density

Orange box: < 0.5 Nutrient Units

Blue box: 0.5-1.0 Nutrient Units

Green box: > 1.0 Nutrient Units

Livestock Density - Sunderland

Created by: LSRCA, 2025-09-29

Scale 1: 35,000

0 300 600 1,200 m

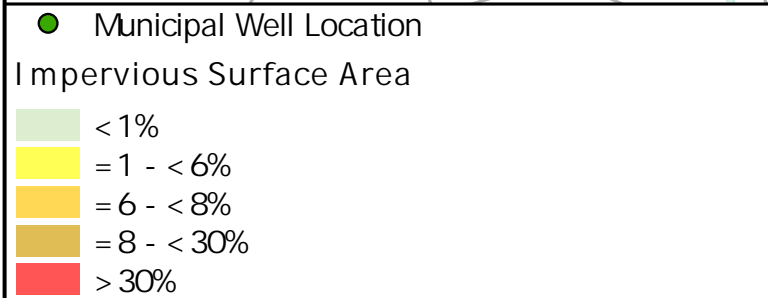
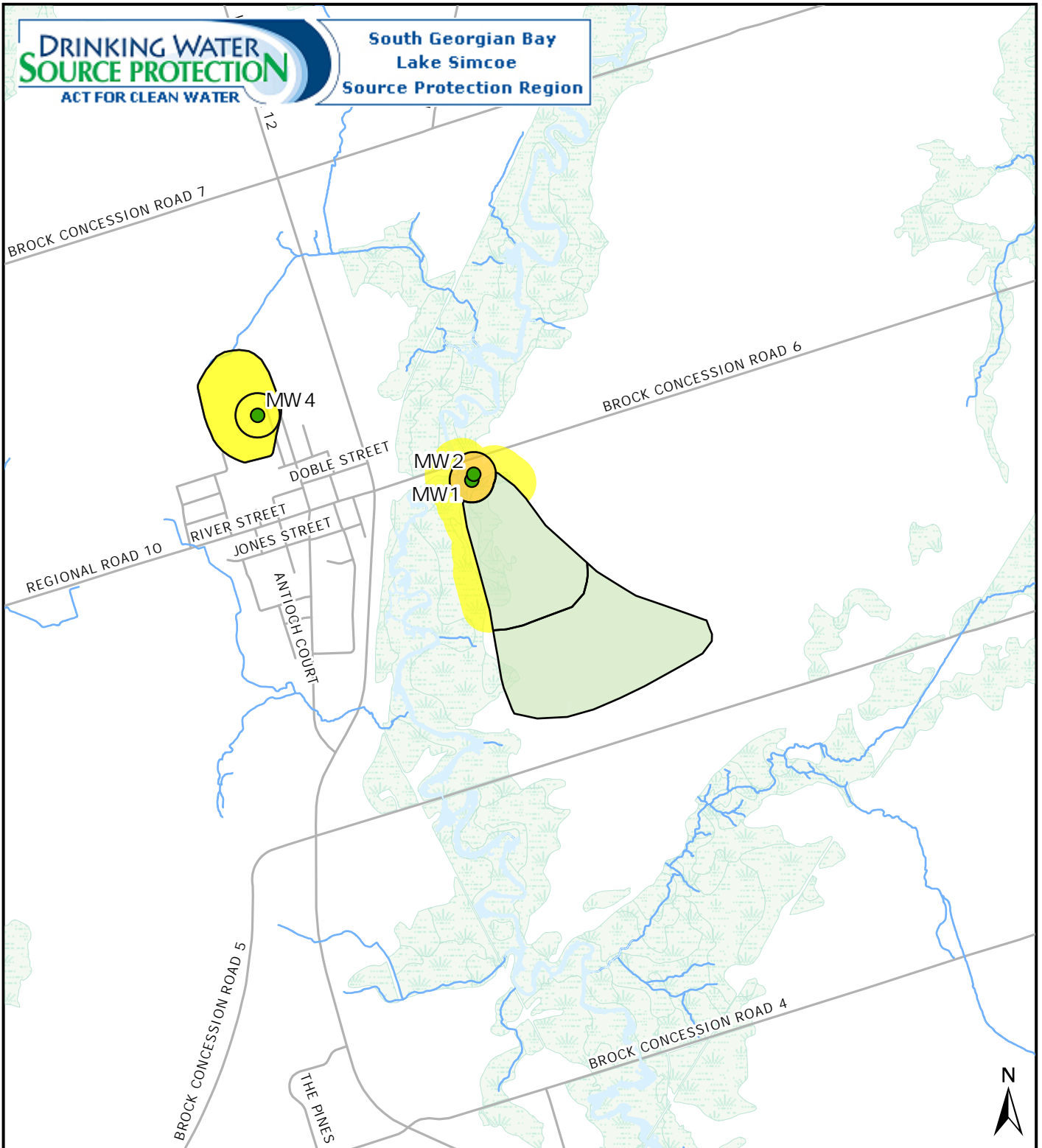
UTM Zone 17N, NAD83



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.




Figure 6b-10



**Total Impervious Surface Area -
Sunderland**

Created by: LSRCA, 2025-09-29
 Scale: 1: 35,000

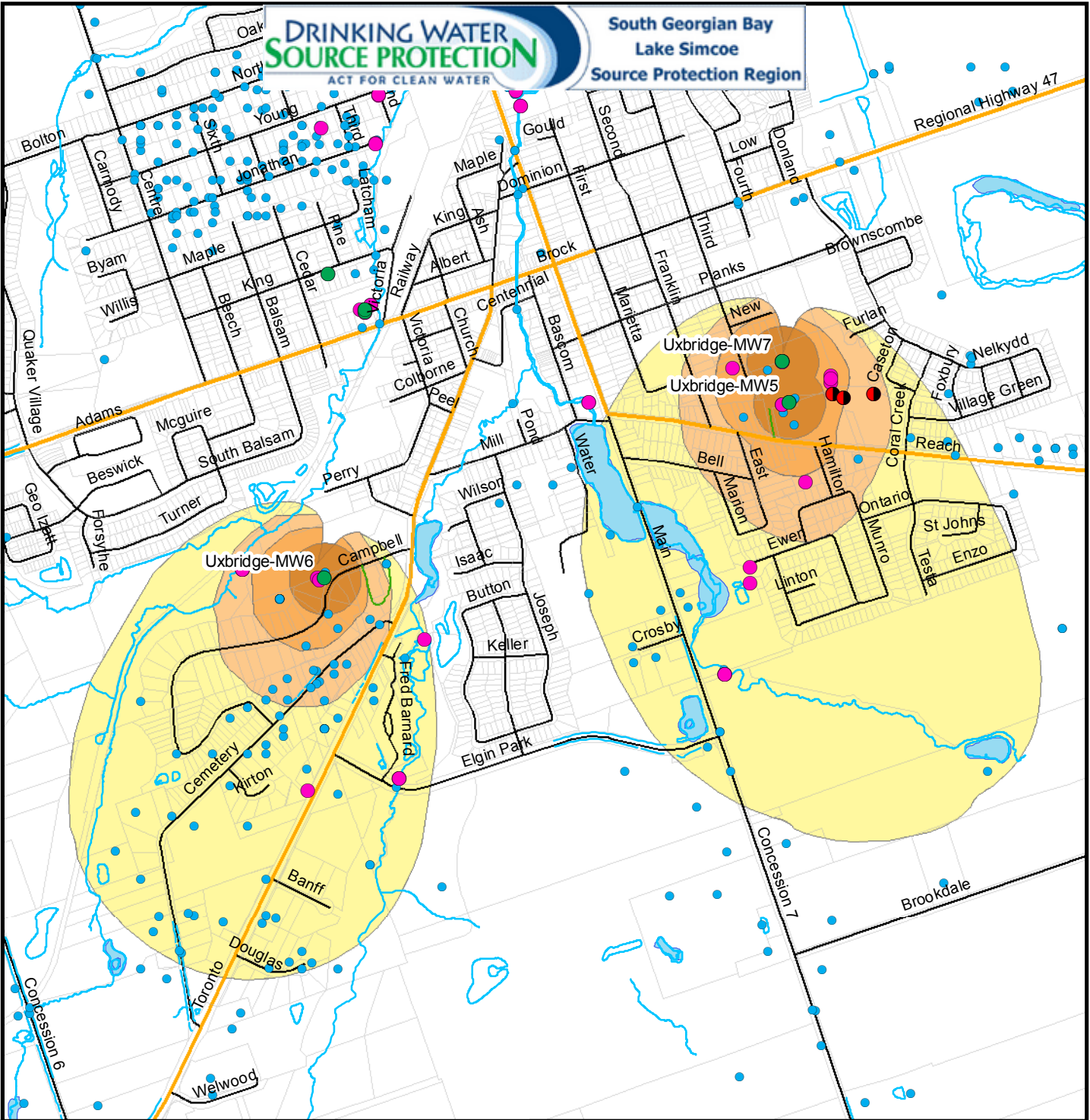
 UTM Zone 17N, NAD83



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



Figure 6b-11



LEGEND

- MONITORING WELLS
- MUNICIPAL WELLS
- OTHER WELLS
- PRIVATE WATER WELLS
- ▭ PARCEL FABRIC

WHPA-2009

Capture Zones

- WHPA-A: 100 METRE BUFFER
- WHPA-B: 2 YEAR TIME-OF-TRAVEL
- WHPA-C: 5 YEAR TIME-OF-TRAVEL
- WHPA-D: 25 YEAR TIME-OF-TRAVEL

0 100 200 400 600 Meters

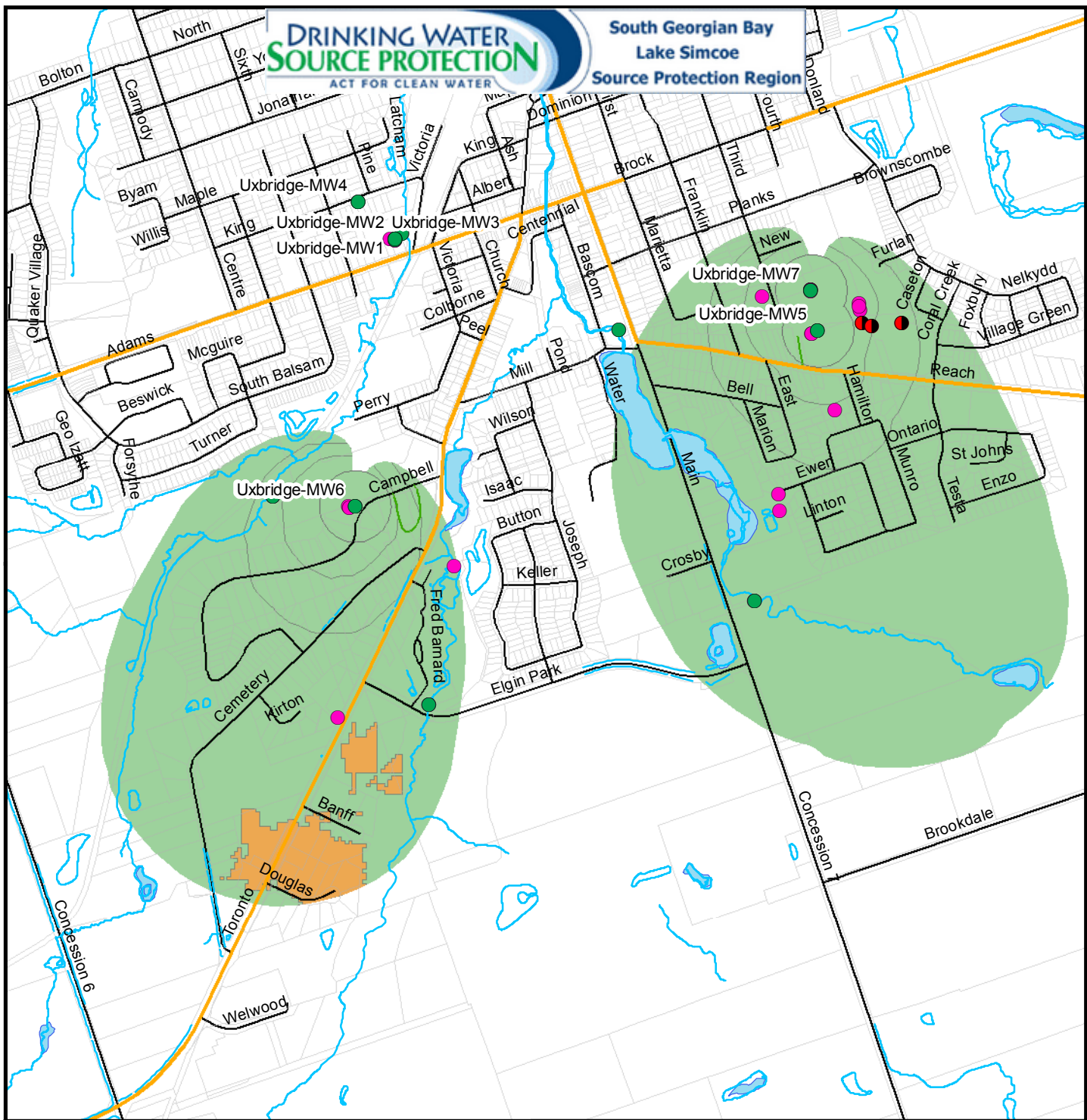
WELLHEAD PROTECTION AREAS - UXBRIDGE

ASSESSMENT OF DRINKING WATER THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010	SCALE: 1:16,000
PROJECT: WG-246-07	

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		FIGURE 6c-1
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LEGEND

- MONITORING WELLS
- MUNICIPAL WELLS
- OTHER WELLS
- PARCEL FABRIC

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

0 100 200 400 600 Meters

GROUNDWATER VULNERABILITY - UXBRIDGE

ASSESSMENT OF DRINKING WATER THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010

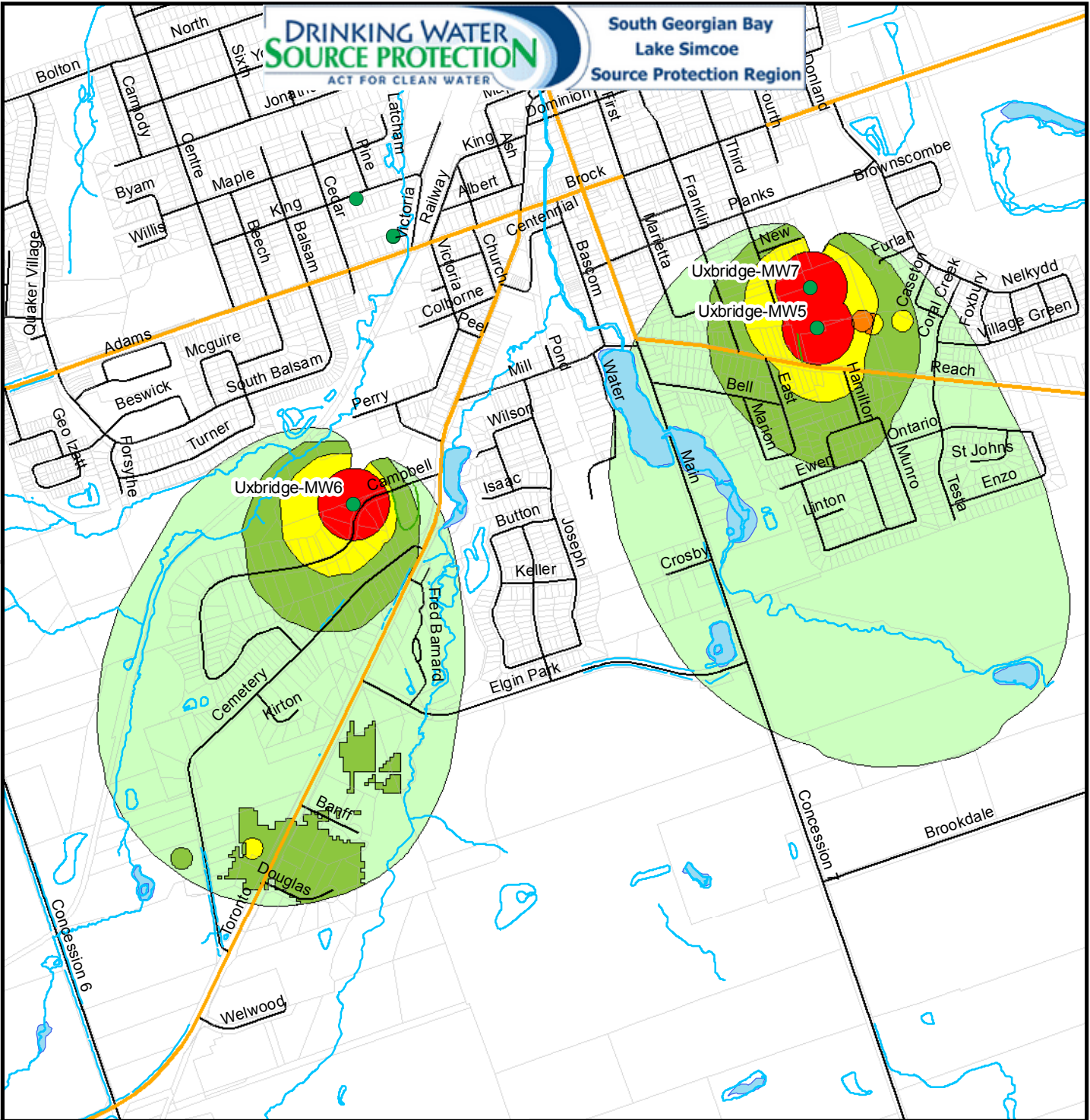
SCALE: 1:16,000

PROJECT: WG-246-07

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FIGURE
6c-2



LEGEND

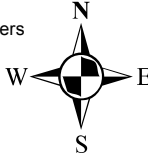
- MUNICIPAL WELLS
- ▭ PARCEL FABRIC

Vulnerability Scoring

Final Score

- 10
- 8
- 6
- 4
- 2

0 100 200 400 600 Meters



VULNERABILITY SCORE - UXBRIDGE

ASSESSMENT OF DRINKING WATER THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010

SCALE: 1:16,000

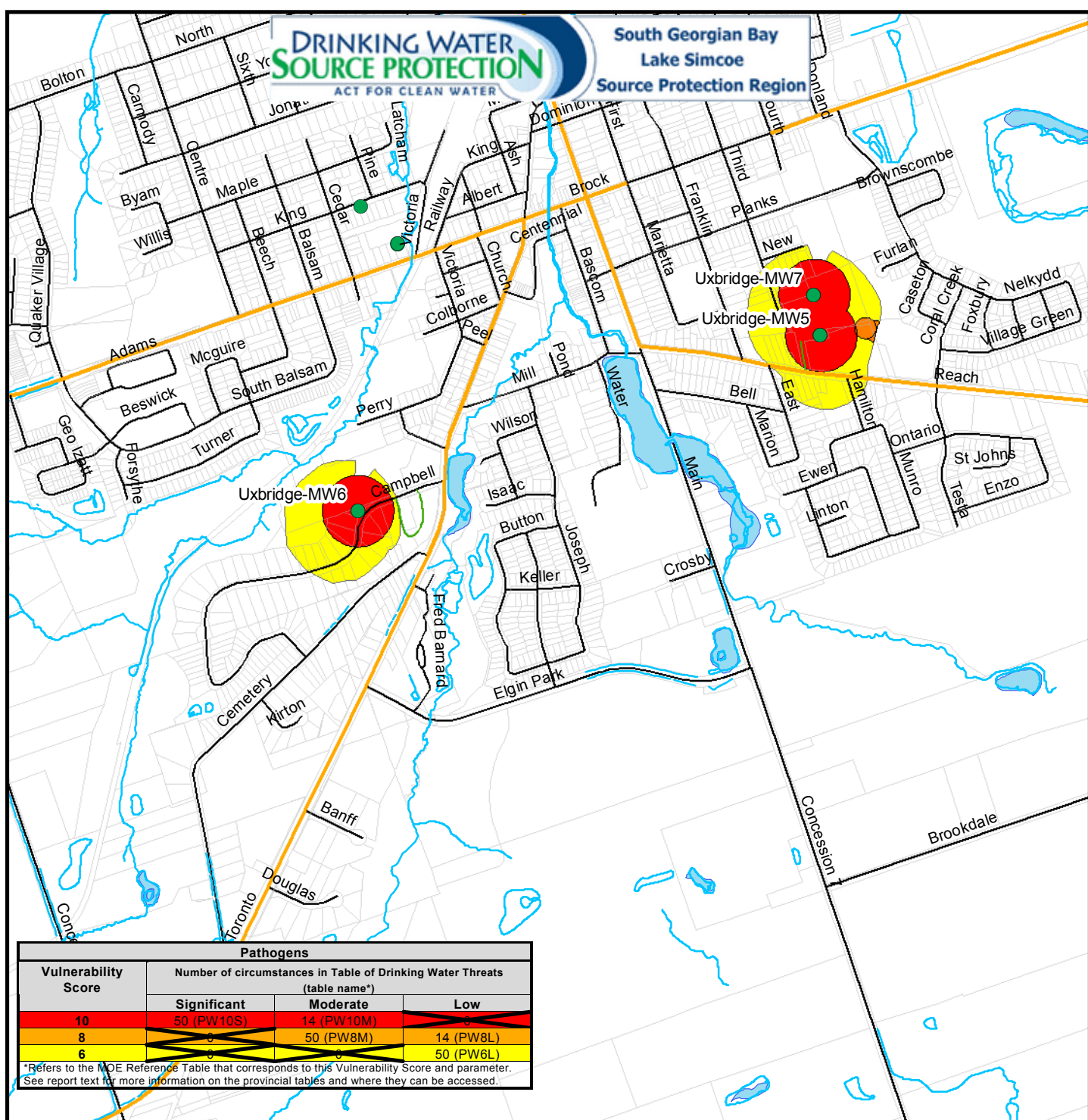
PROJECT: WG-246-07

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FIGURE

6c-3



Vulnerability Score	Number of circumstances in Table of Drinking Water Threats (table name*)		
	Significant	Moderate	Low
10	50 (PW10S)	14 (PW10M)	14 (PW10L)
8	50 (PW8S)	50 (PW8M)	14 (PW8L)
6	50 (PW6S)	50 (PW6M)	50 (PW6L)

*Refers to the MOE Reference Table that corresponds to this Vulnerability Score and parameter. See report text for more information on the provincial tables and where they can be accessed.

LEGEND

- MUNICIPAL WELLS
- PARCEL FABRIC

Vulnerability Scoring

- 10
- 8
- 6
- 4
- 2

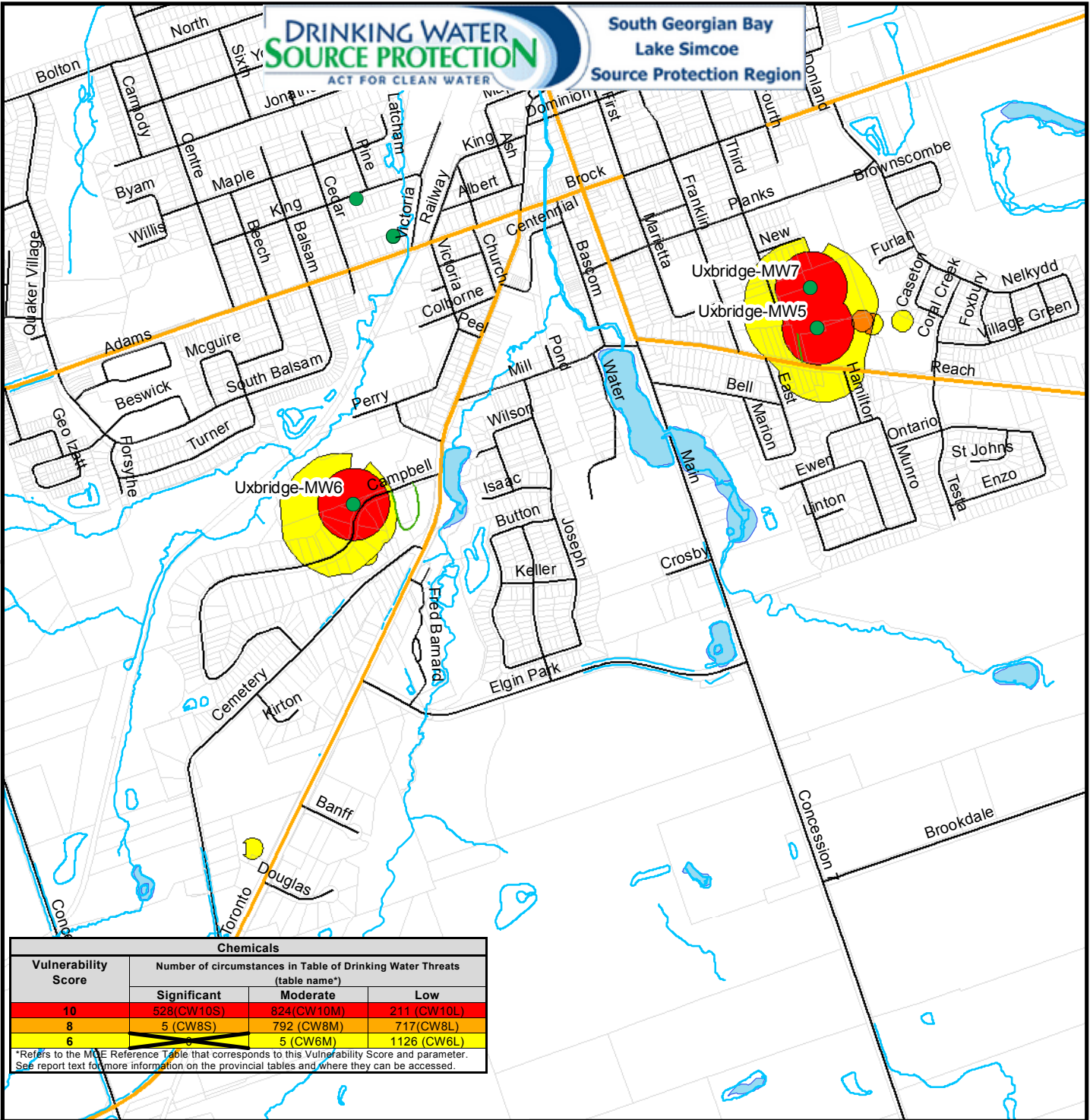
0 100 200 400 600 Meters

AREAS OF SIGNIFICANT, MODERATE OR LOW THREAT - PATHOGENS

ASSESSMENT OF DRINKING WATER THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010 SCALE: 1:16,000
PROJECT: WG-246-07

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LEGEND

- MUNICIPAL WELLS
- PARCEL FABRIC

Vulnerability Scoring

FinalScore

- 10
- 8
- 6
- 4
- 2

0 100 200 400 600 Meters

AREAS OF SIGNIFICANT, MODERATE OR LOW THREAT - CHEMICALS

ASSESSMENT OF DRINKING WATER THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010 SCALE: 1:16,000
PROJECT: WG-246-07

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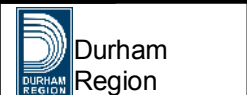
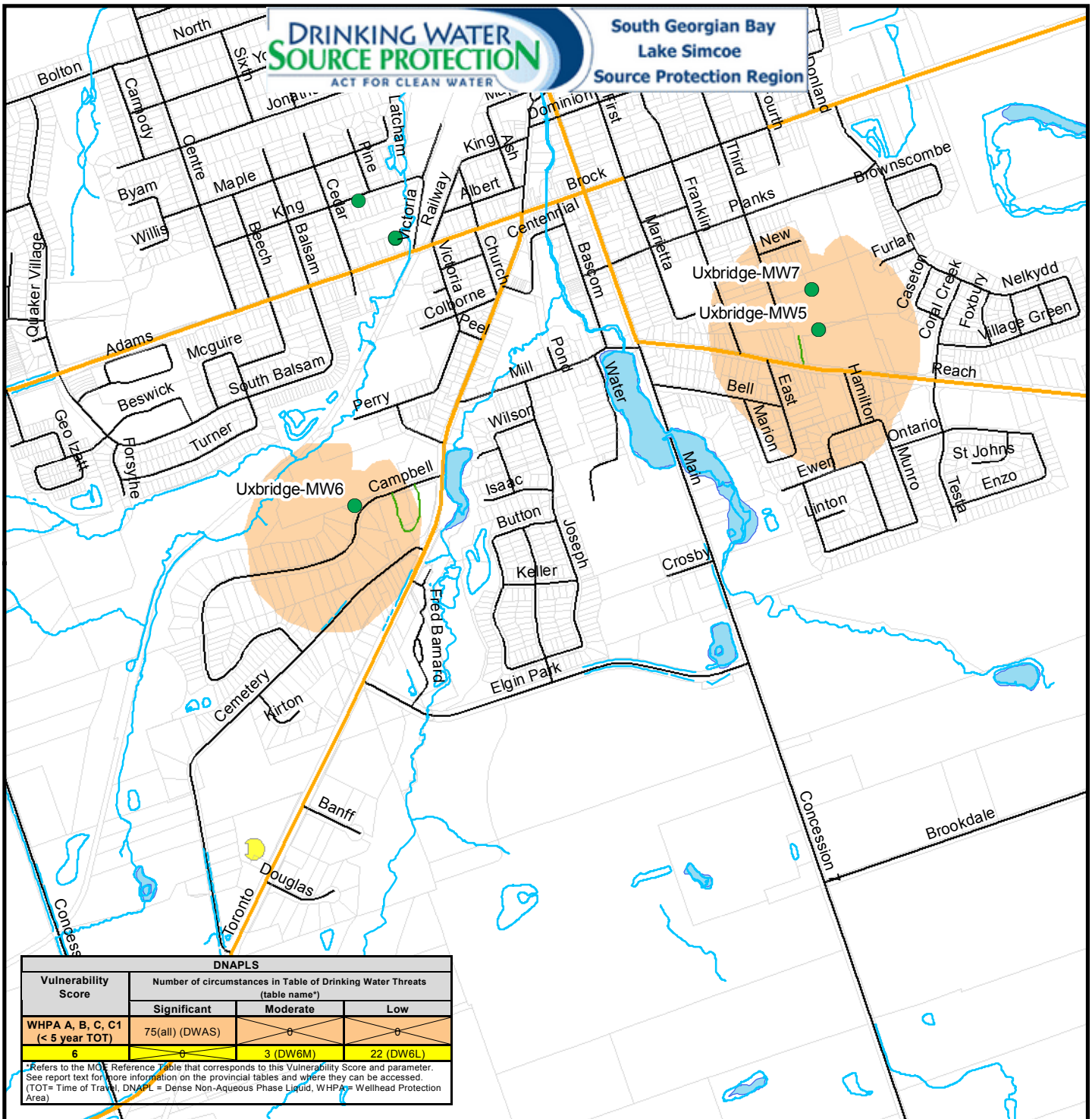


FIGURE
6c-5



Vulnerability Score	Number of circumstances in Table of Drinking Water Threats (table name*)		
	Significant	Moderate	Low
WHPA A, B, C, C1 (< 5 year TOT)	75(all) (DWAS)	0	0
6	0	3 (DW6M)	22 (DW6L)

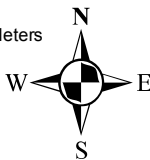
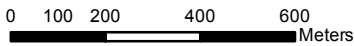
*Refers to the MOE Reference Table that corresponds to this Vulnerability Score and parameter. See report text for more information on the provincial tables and where they can be accessed. (TOT= Time of Travel, DNAPL = Dense Non-Aqueous Phase Liquid, WHPA = Wellhead Protection Area)

LEGEND

- MUNICIPAL WELLS
- PARCEL FABRIC

VULNERABILITY SCORING

- SIGNIFICANT DNAPL THREAT
- MODERATE DNAPL THREAT



AREAS OF SIGNIFICANT, MODERATE, OR LOW THREATS - DNAPLS

ASSESSMENT OF DRINKING WATER THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010

SCALE: 1:16,000

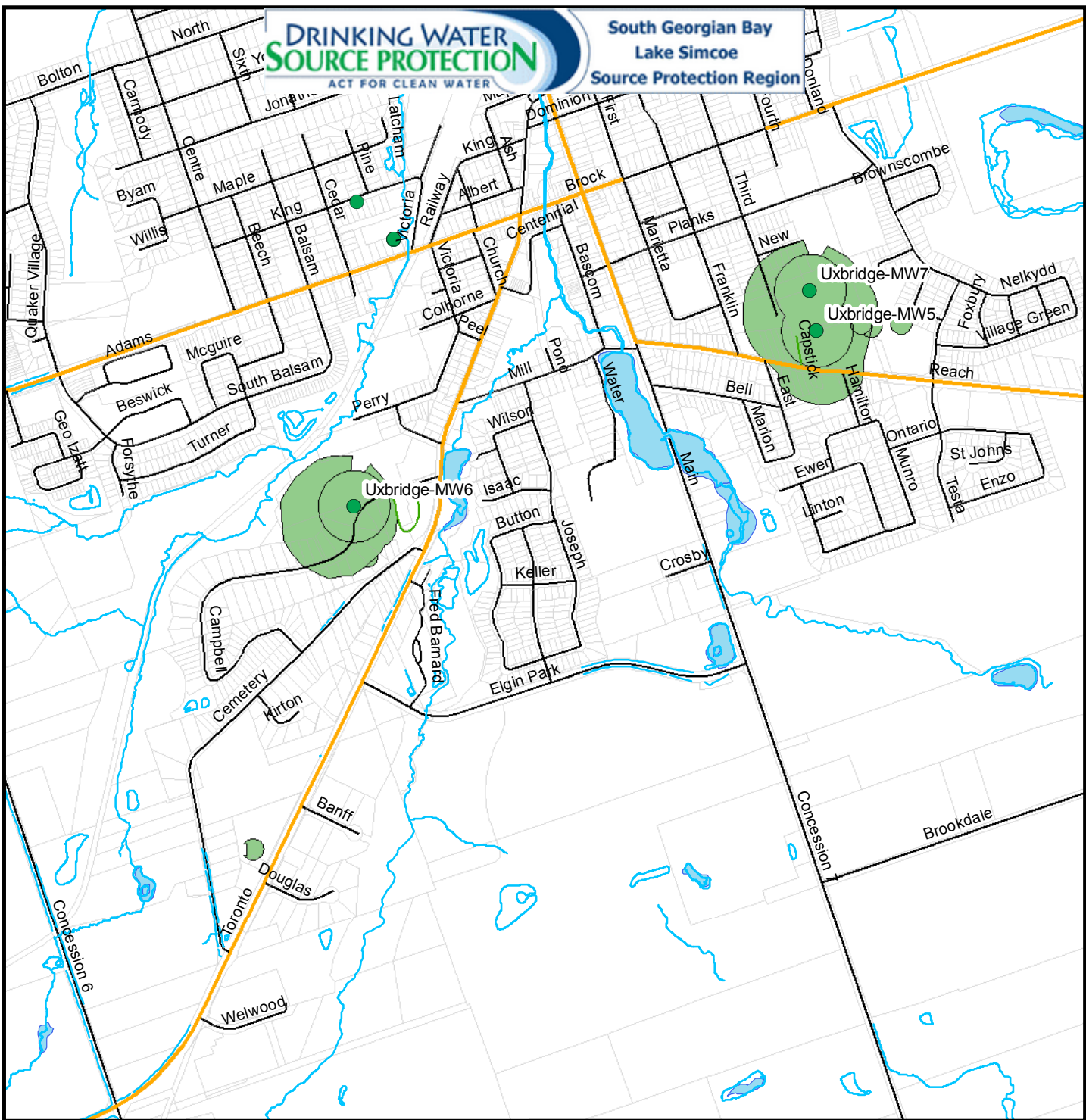
PROJECT: WG-246-07

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FIGURE

6c-6



LEGEND

- MUNICIPAL WELLS
- PARCEL FABRIC
- MANAGED LANDS (40-80%)

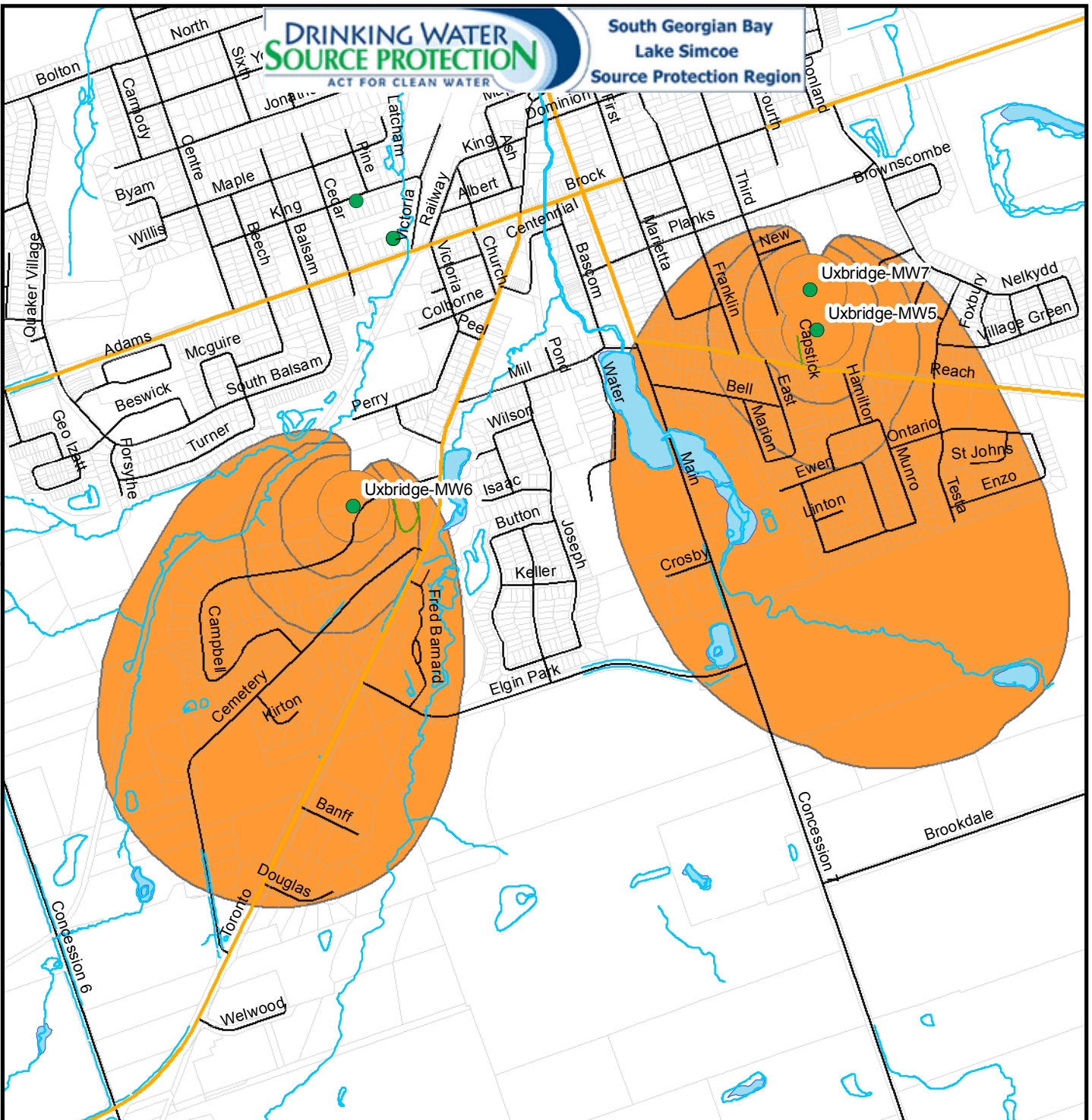
0 100 200 400 600 Meters

MANAGED LANDS - UXBRIDGE

ASSESSMENT OF DRINKING WATER
THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010	SCALE: 1:16,000
PROJECT: WG-246-07	

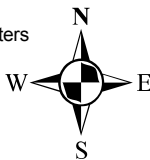
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LEGEND

- MUNICIPAL WELLS
- PARCEL FABRIC
- < 0.5 NU/ACRE

0 100 200 400 600 Meters



LIVESTOCK DENSITY - UXBRIDGE

ASSESSMENT OF DRINKING WATER
THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010

SCALE: 1:16,000

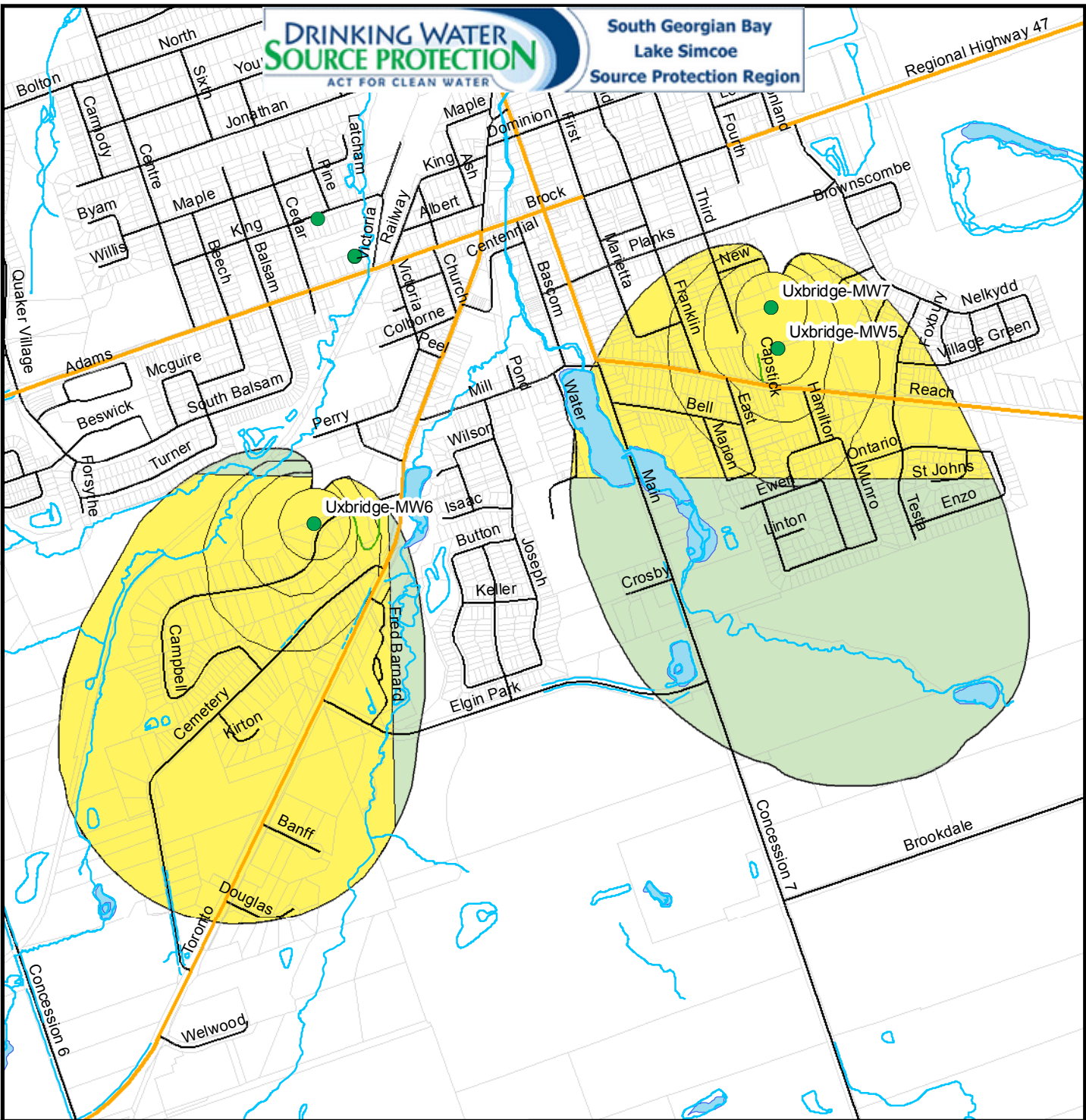
PROJECT: WG-246-07

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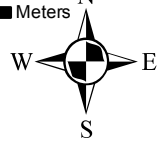
FIGURE

6c-8



LEGEND 0 105 210 420 630 Meters

- MUNICIPAL WELLS
- PARCEL FABRIC
- IMPERVIOUS SURFACES**
- 1- <8%
- <1%



IMPERVIOUS SURFACES - UXBRIDGE

ASSESSMENT OF DRINKING WATER THREATS- UXBRIDGE
The Regional Municipality of Durham

DATE: JUNE 2010

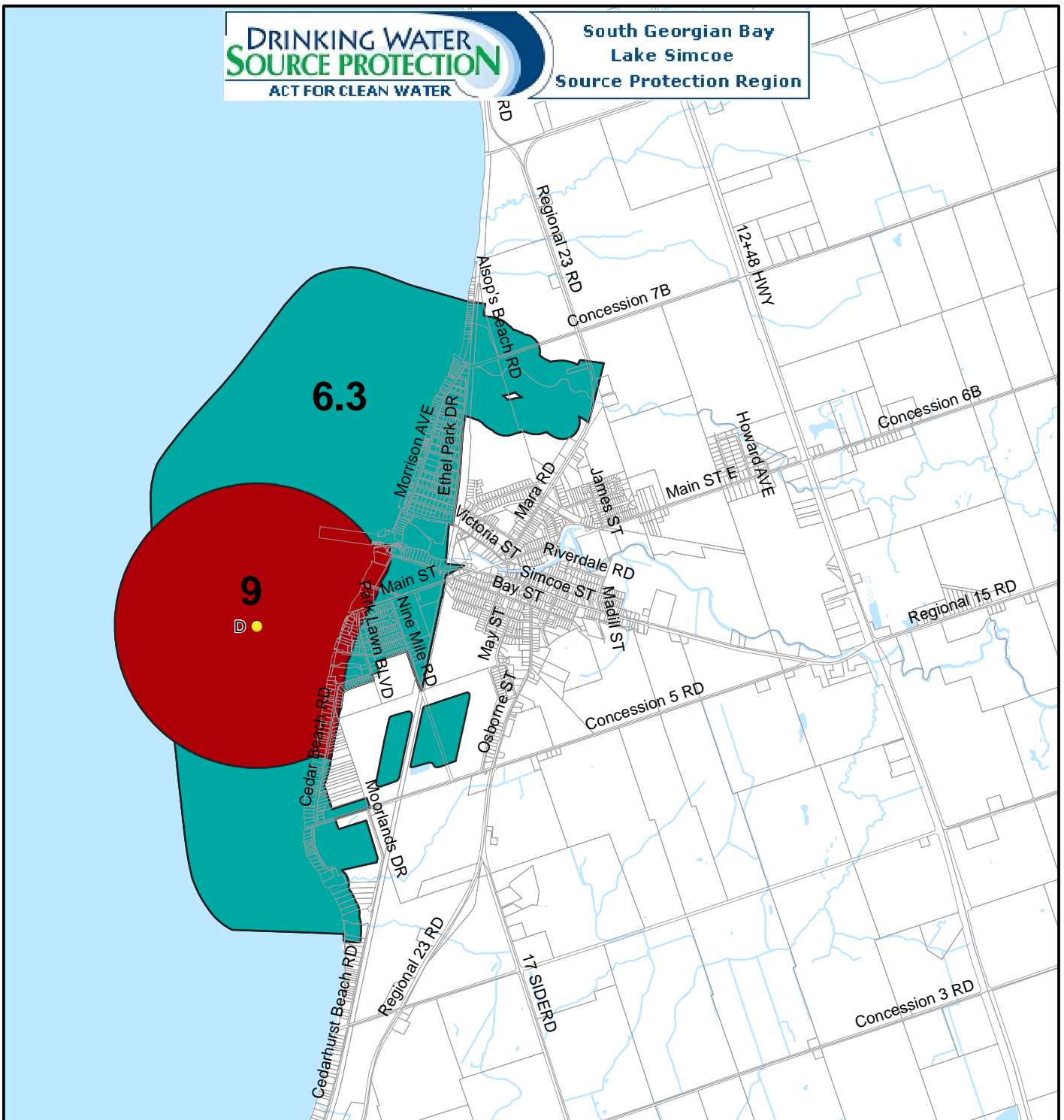
SCALE: 1:16,000

PROJECT: WG-246-07

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FIGURE
6c-9



Legend

- IPZ 1 AND VULNERABILITY SCORE 9
- IPZ 2 AND VULNERABILITY SCORE 6.3
- SURFACE WATER INTAKE (TYPE D)



**INTAKE PROTECTION ZONES AND
VULNERABILITY SCORES -
BEAVERTON, DURHAM REGION**

DATE: JUNE 2010

SCALE: 1:40000

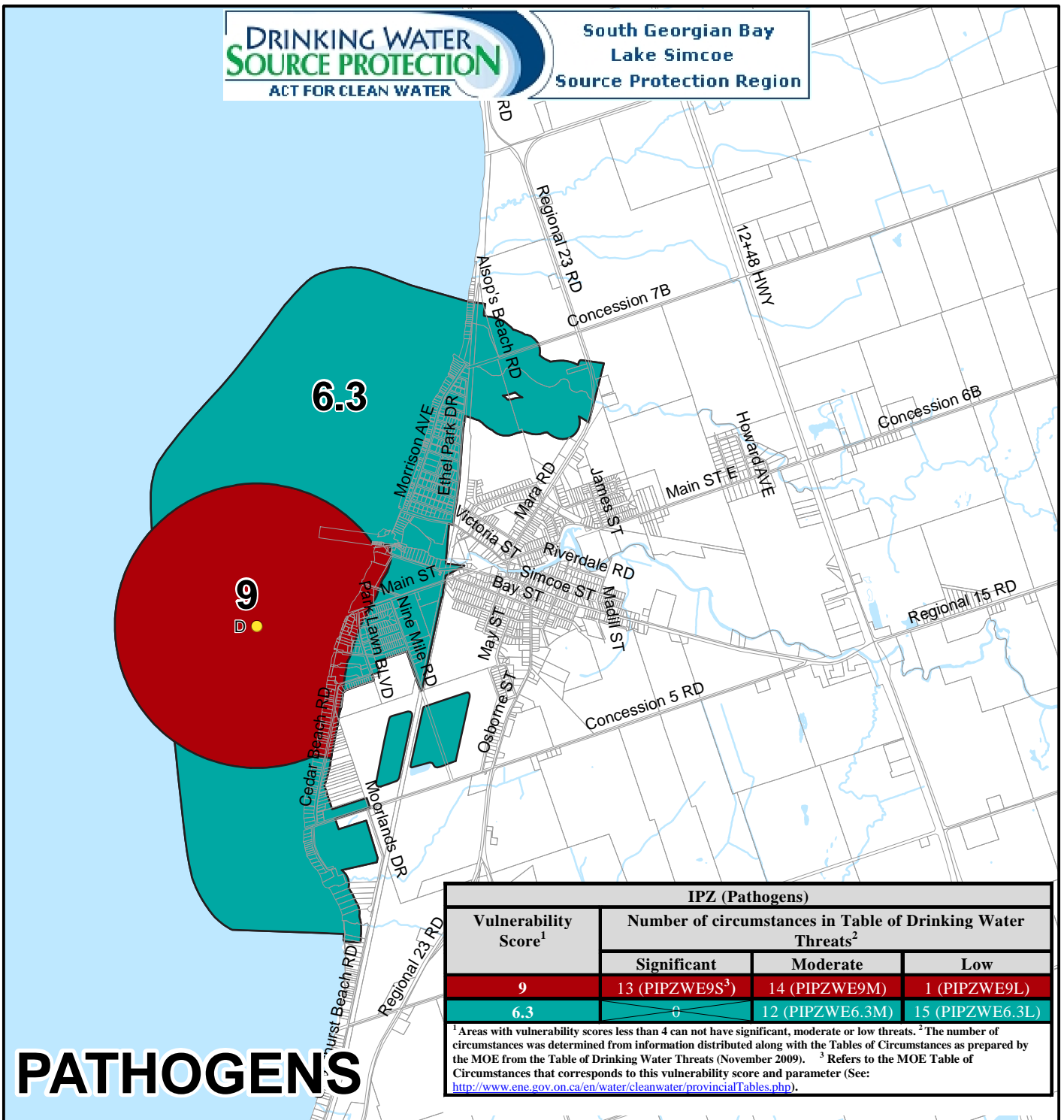
PROJECT: 0-071948.13

FILE. NO.:0-07194813F4-1

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



FIGURE
6d-1



PATHOGENS

IPZ (Pathogens)			
Vulnerability Score ¹	Number of circumstances in Table of Drinking Water Threats ²		
	Significant	Moderate	Low
9	13 (PIPZWE9S ³)	14 (PIPZWE9M)	1 (PIPZWE9L)
6.3	0	12 (PIPZWE6.3M)	15 (PIPZWE6.3L)

¹ Areas with vulnerability scores less than 4 can not have significant, moderate or low threats. ² The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). ³ Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: <http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php>).

Legend

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



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

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

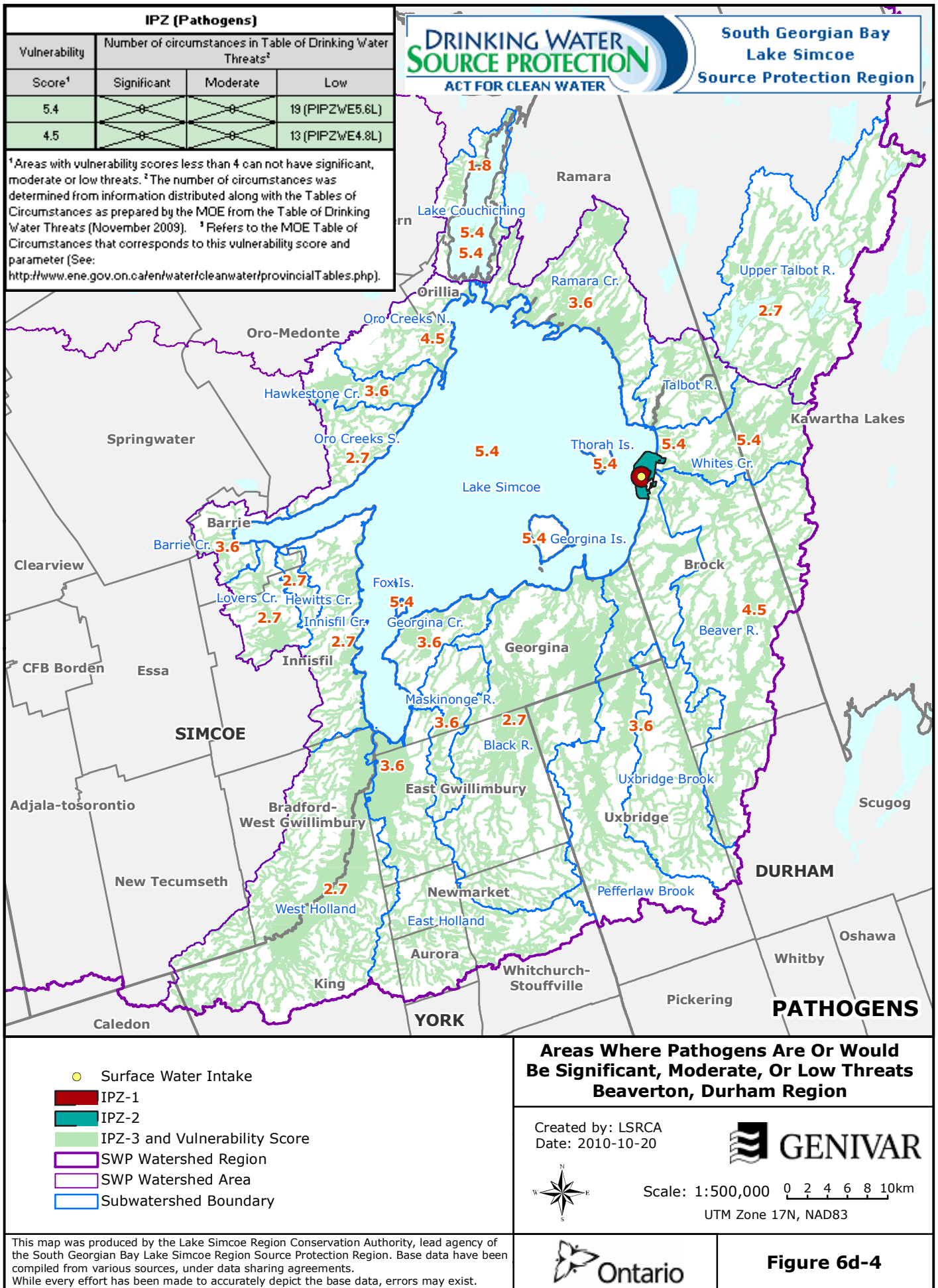
PROJECT: 0-071948.13

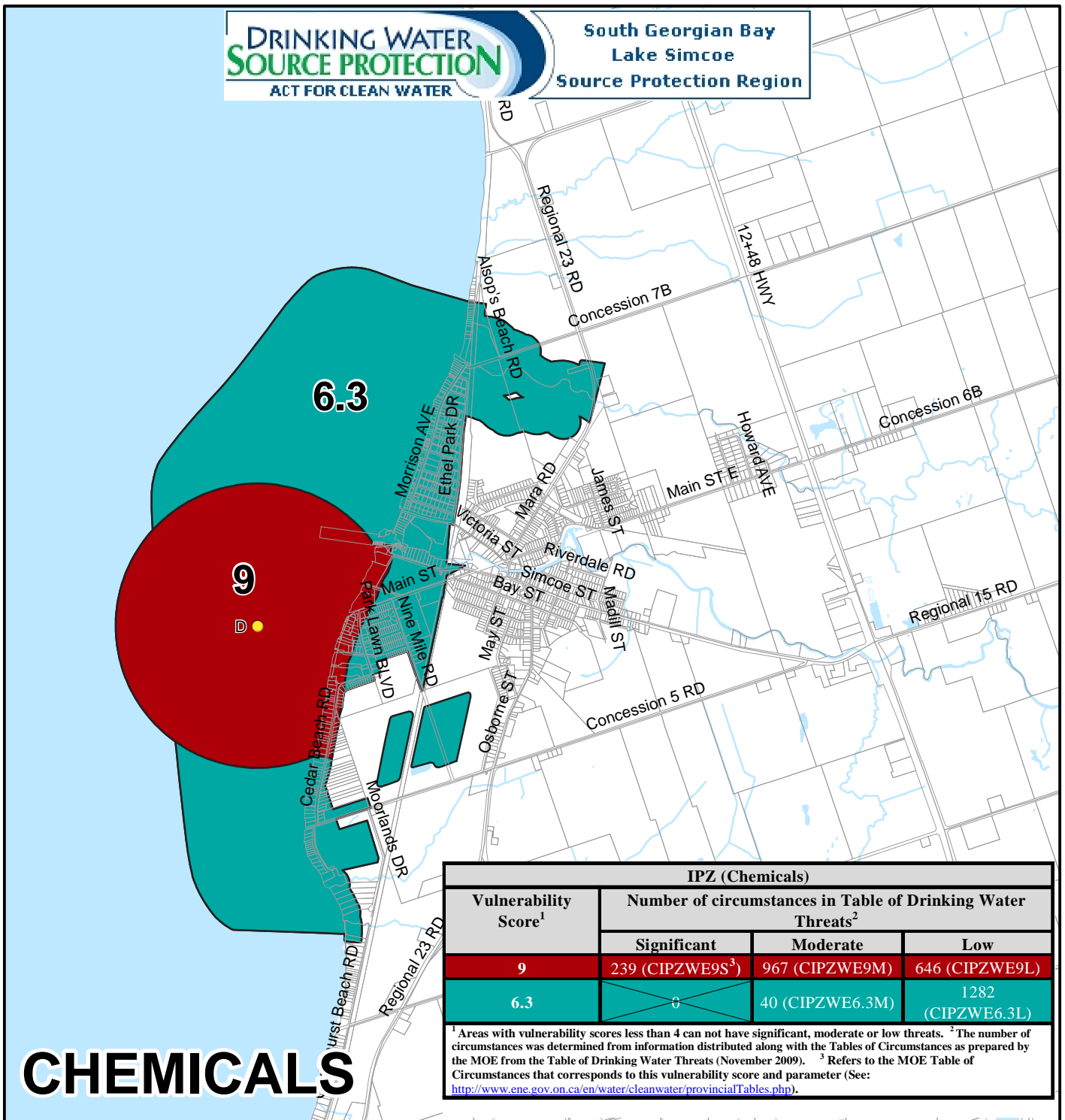
FILE. NO.:0-07194813F4-2

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.



FIGURE **6d-3**





CHEMICALS

IPZ (Chemicals)			
Vulnerability Score ¹	Number of circumstances in Table of Drinking Water Threats ²		
	Significant	Moderate	Low
9	239 (CIPZWE9S ³)	967 (CIPZWE9M)	646 (CIPZWE9L)
6.3	0	40 (CIPZWE6.3M)	1282 (CIPZWE6.3L)

¹ Areas with vulnerability scores less than 4 can not have significant, moderate or low threats. ² The number of circumstances was determined from information distributed along with the Tables of Circumstances as prepared by the MOE from the Table of Drinking Water Threats (November 2009). ³ Refers to the MOE Table of Circumstances that corresponds to this vulnerability score and parameter (See: <http://www.ene.gov.on.ca/en/water/cleanwater/provincialTables.php>).

Legend

- IPZ 1 AND VULNERABILITY SCORE
 - IPZ 2 AND VULNERABILITY SCORE
 - SURFACE WATER INTAKE (TYPE D)
- 500 250 0 500 Metres

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

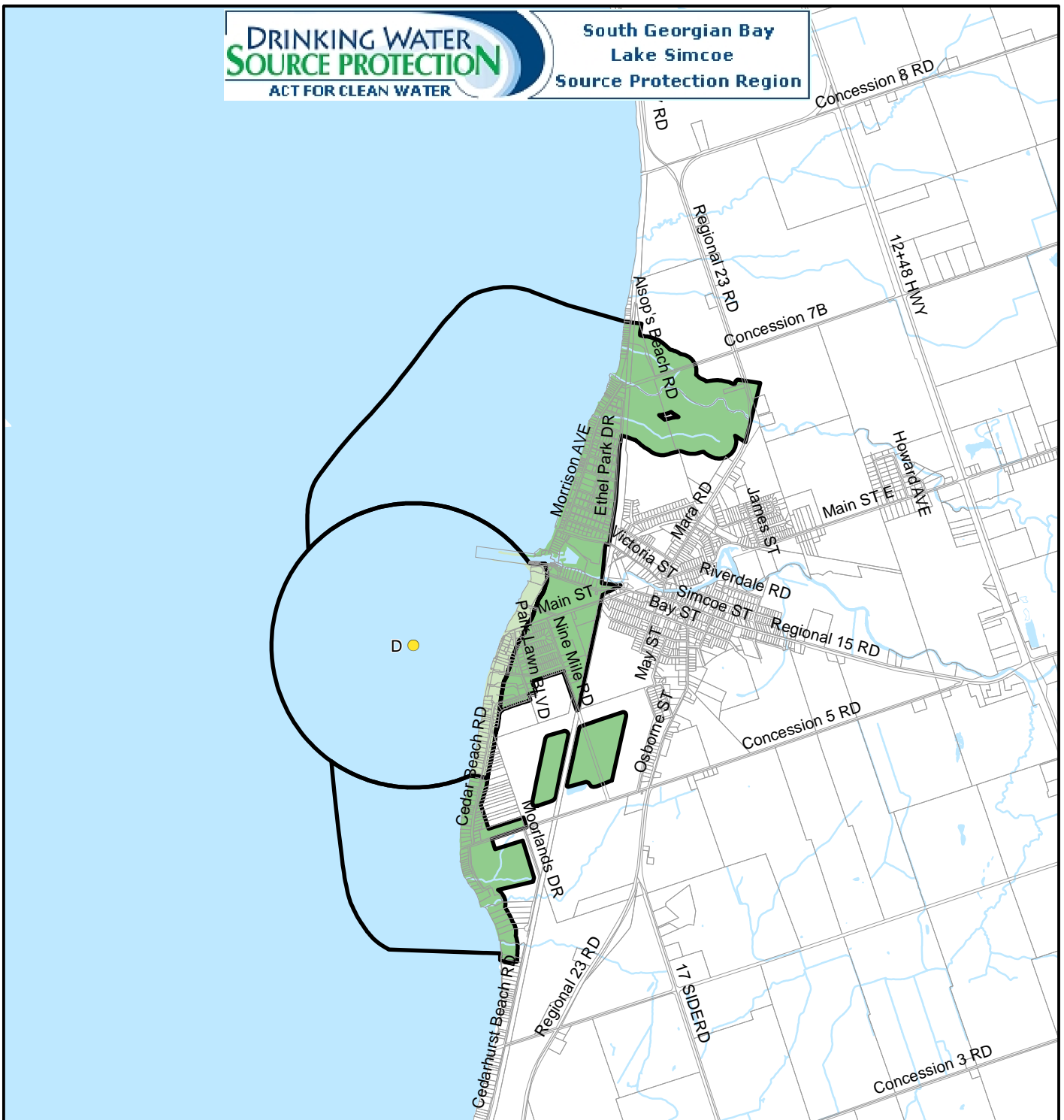
This figure is to be used to identify the areas where a landuse activity is or would be a drinking water threat based on the Technical Rules. The key table is intended to correlate the vulnerability score with circumstances that are significant, moderate, or low threats in the Table of Drinking Water 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: 0-071948.13 FILE. NO.:0-07194813F4-3

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

GENIVAR **FIGURE 6d-5**





Legend

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



500 250 0 500 Metres

MANAGED LANDS - BEAVERTON

The Managed Land 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: 0-071948.13

FILE. NO.:0-07194813F4-4

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



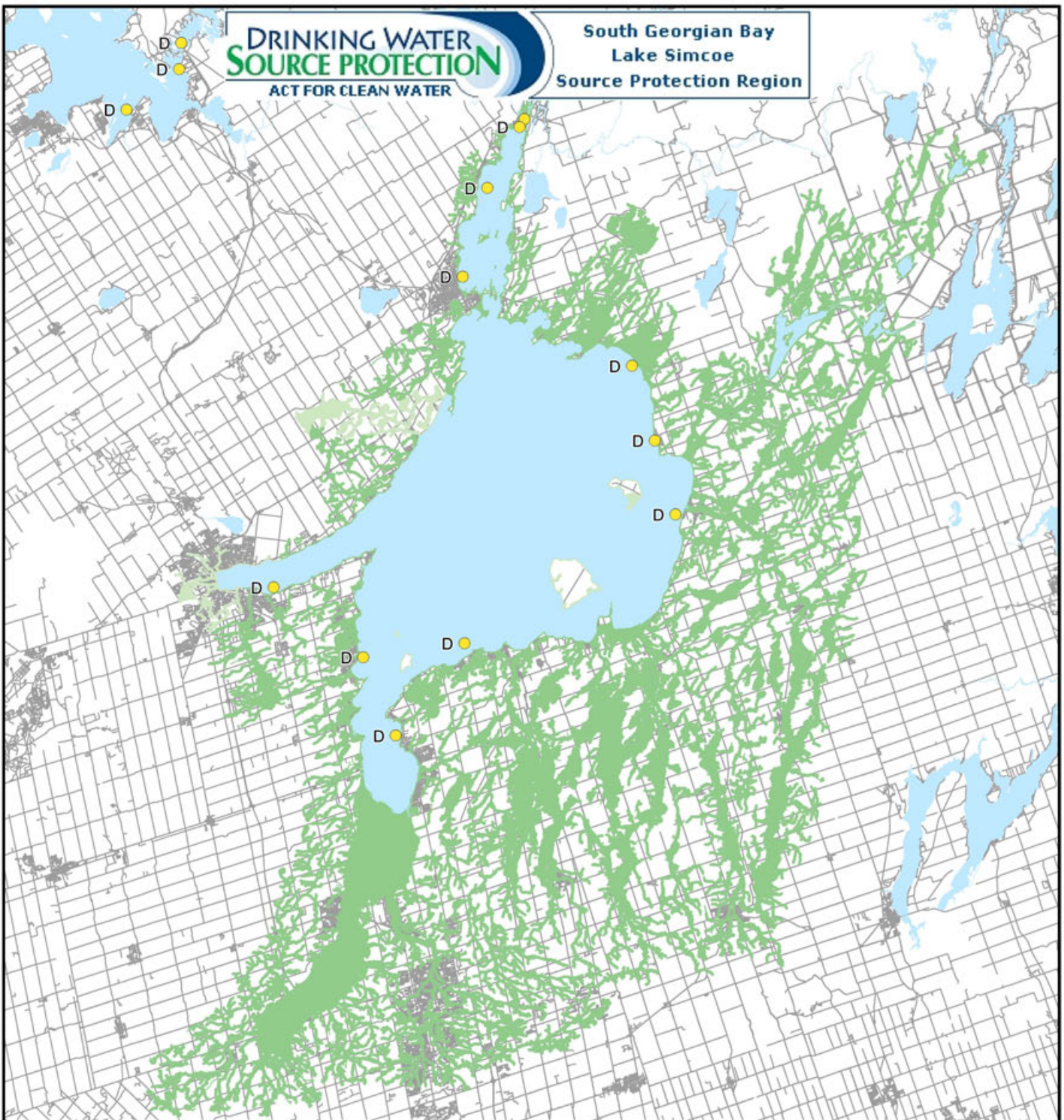
GENIVAR



Ontario

FIGURE

6d-7



Legend

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



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

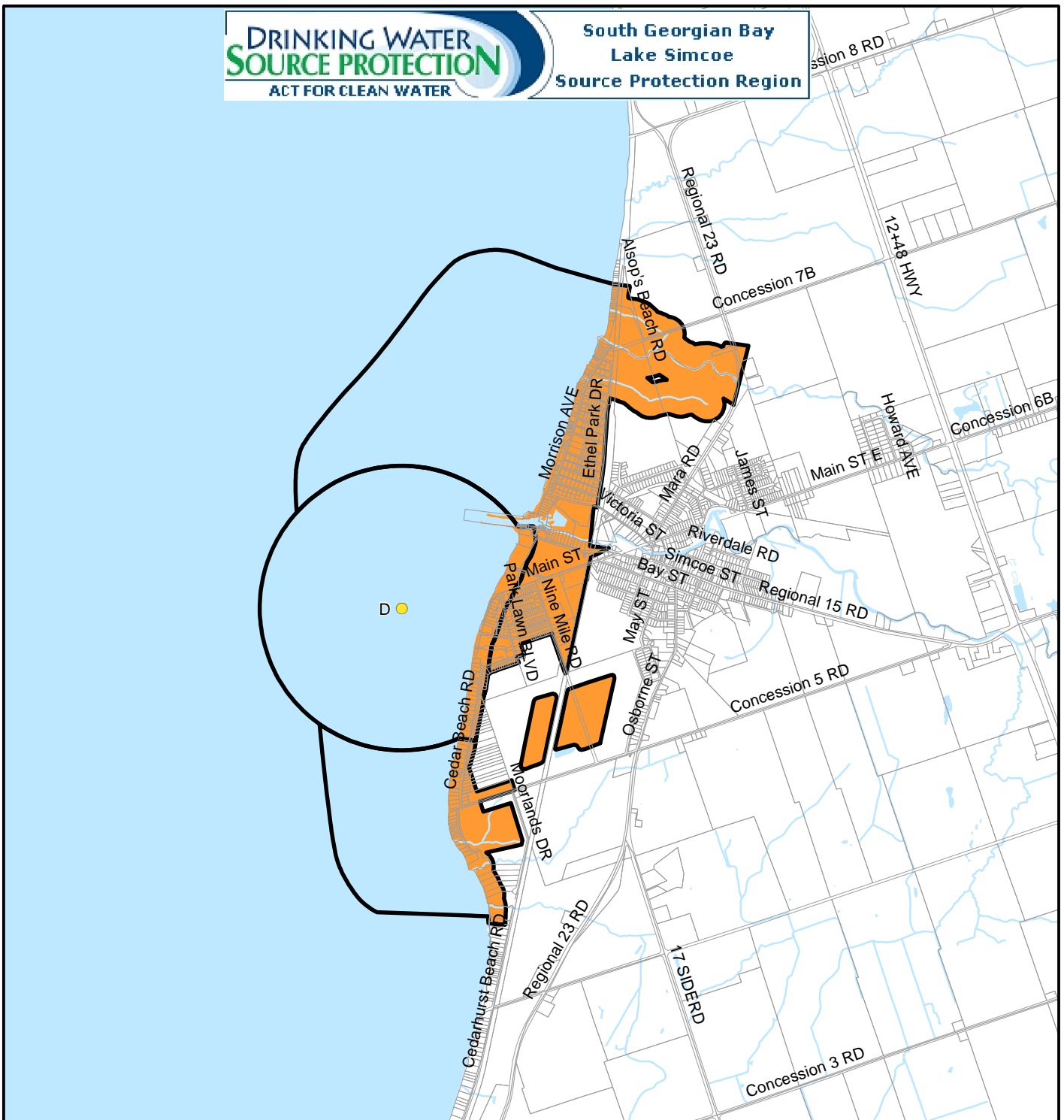
PROJECT: 0-071948.00

FILE. NO.: 0-07194800F3.3-4

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



FIGURE
6d-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)



**LIVESTOCK DENSITY -
BEAVERTON**

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: 0-071948.13

FILE. NO.:0-07194813F4-5

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.



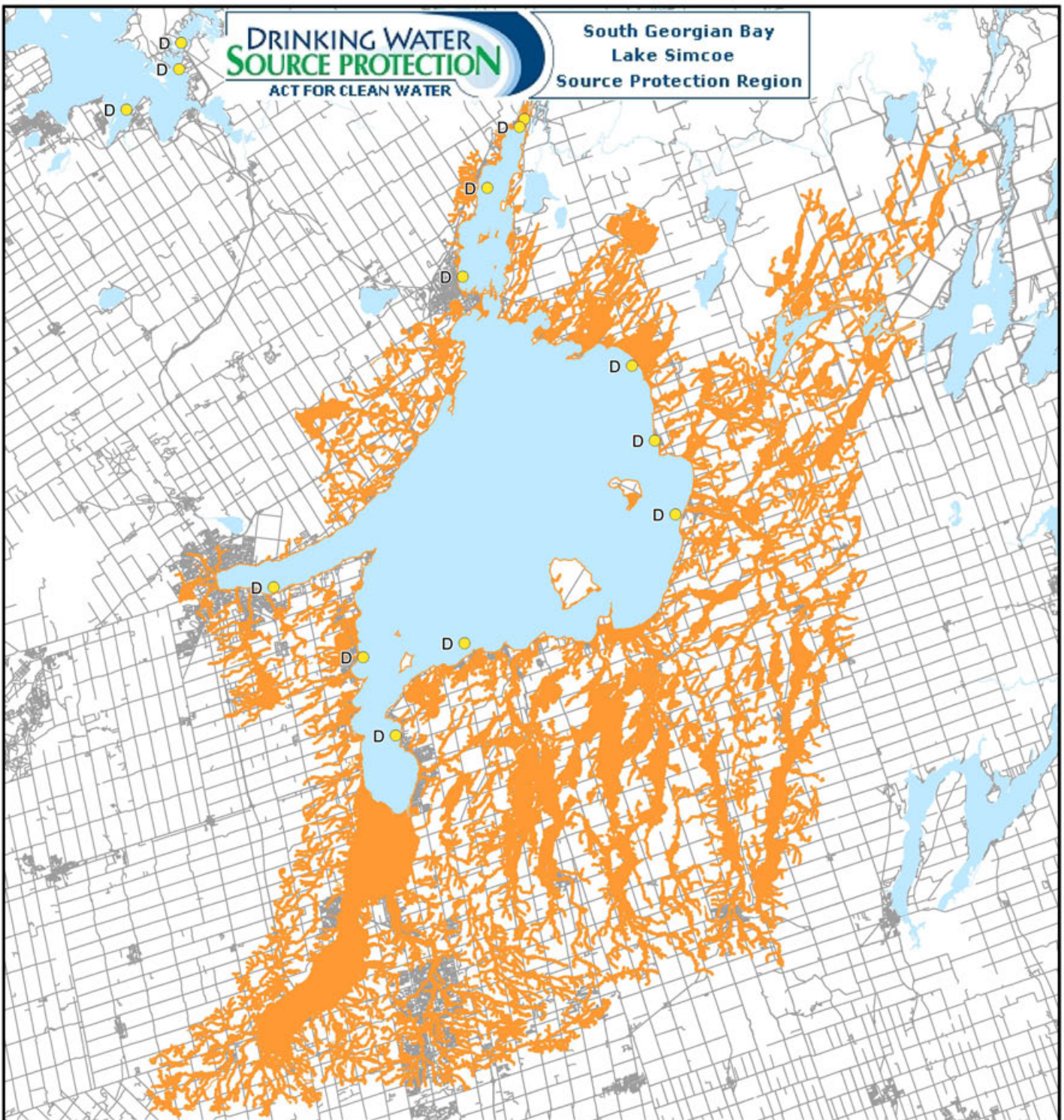
GENIVAR







Ontario

FIGURE

6d-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)



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

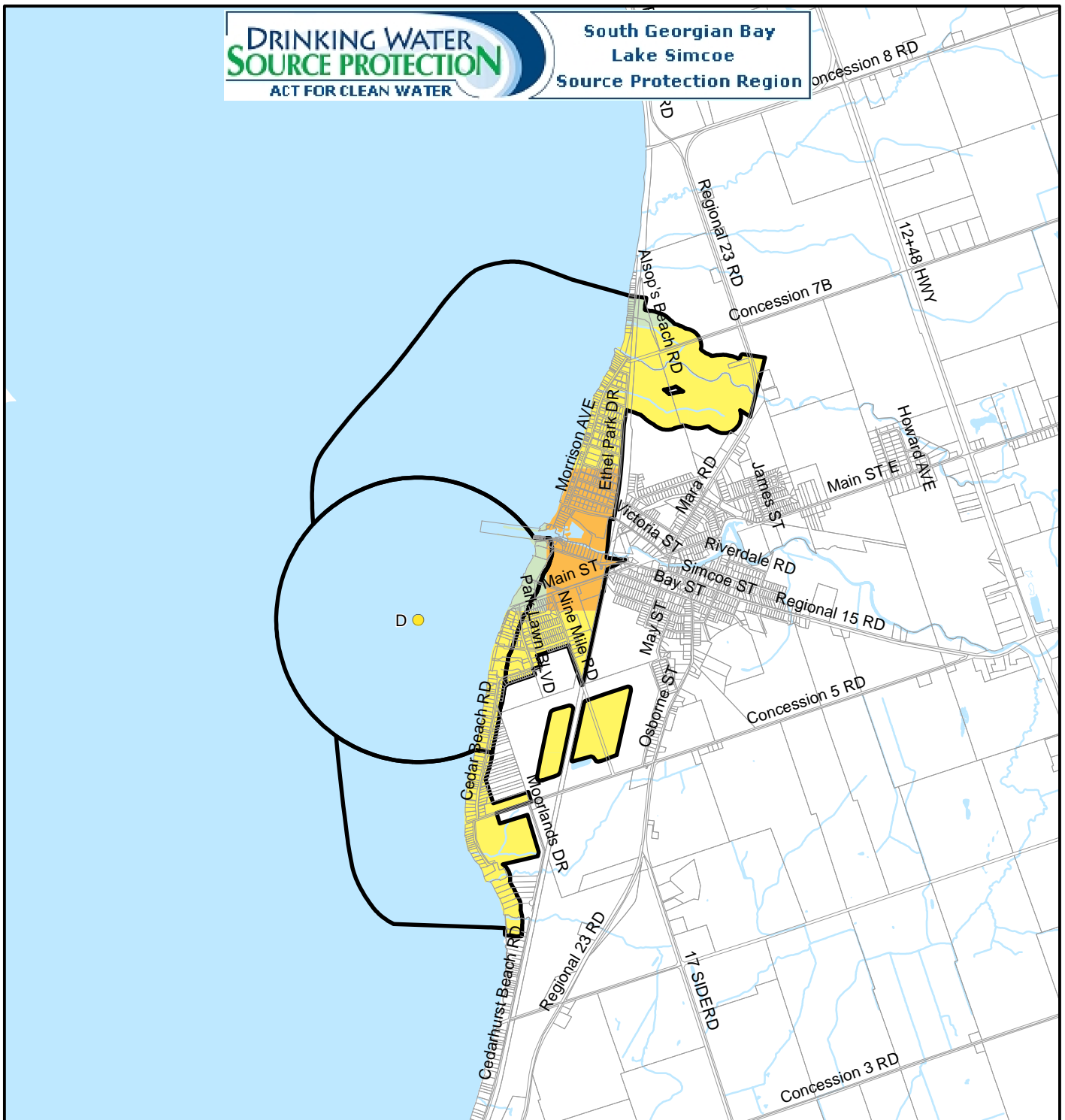
PROJECT: 0-071948.00

FILE. NO.: 0-07194800F3.3-5

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



FIGURE
6d-10



Legend

IMPERVIOUS SURFACE

- <1%
- >1% and <8%
- >8% and <80%

Surface Water Intake (Type D)



500 250 0 500 Metres

IMPERVIOUS SURFACES - BEAVERTON

The Impervious Surfaces 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: 0-071948.13

FILE. NO.:0-07194813F4-6

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



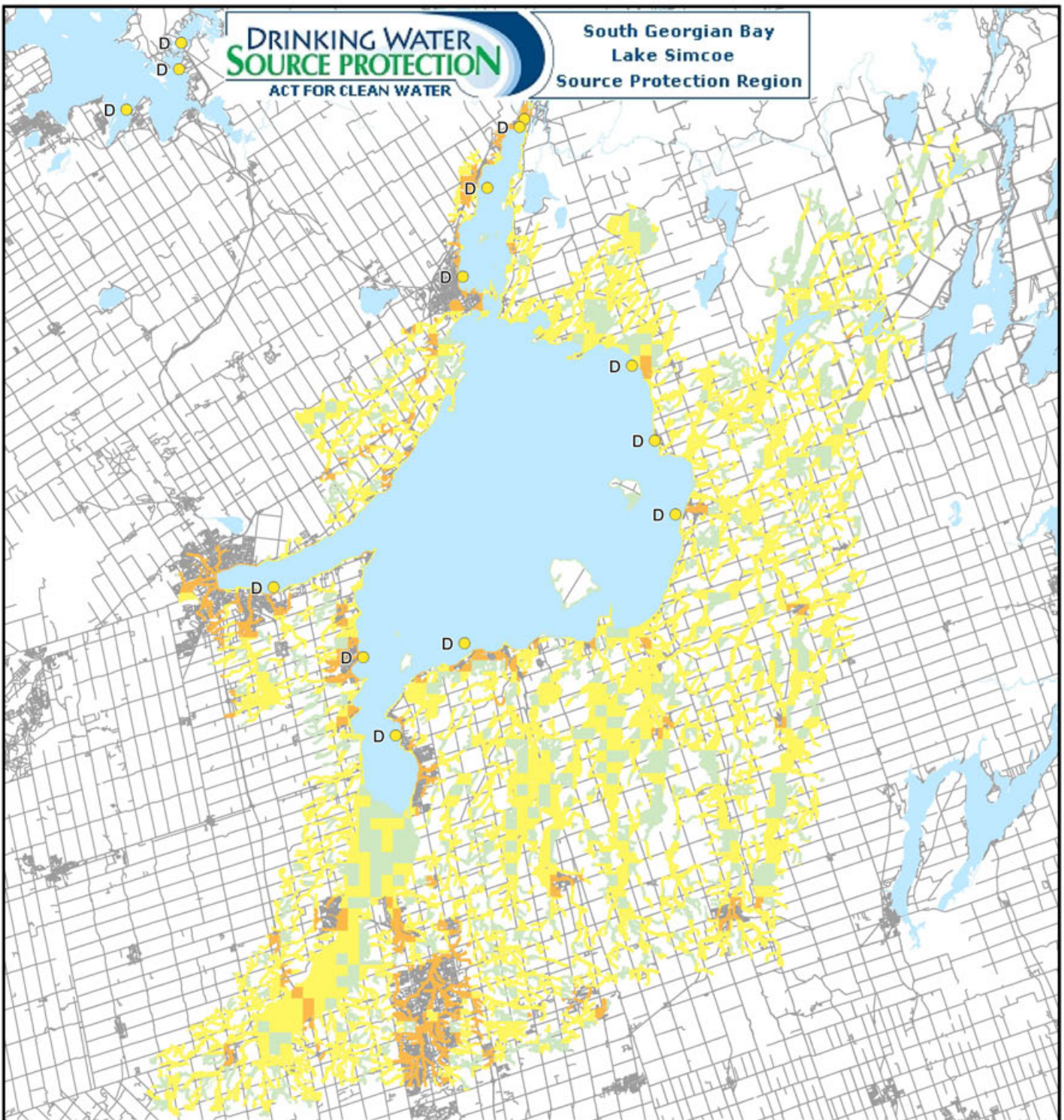
GENIVAR



Ontario

FIGURE

6d-11



Legend

IMPERVIOUS SURFACE

- <1%
- >1% and <8%
- >8% and <80%
- SURFACE WATER INTAKE (TYPE D)



5,400 2,700 0 5,400 Metres

**IMPERVIOUS SURFACES -
INTAKE PROTECTION ZONE 3**

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

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

DATE: JUNE 2010

SCALE: 1:505000

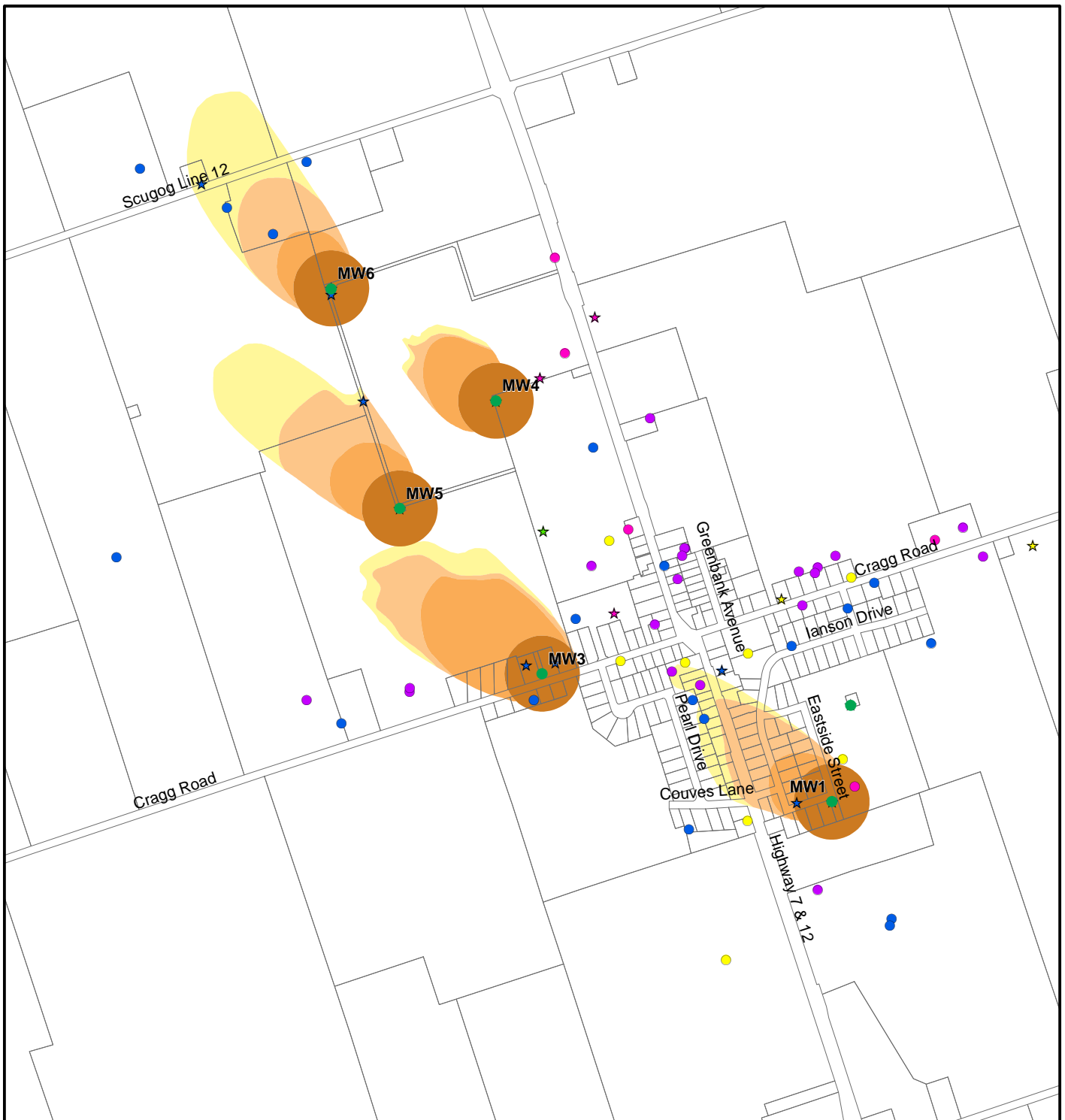
PROJECT: 0-071948.00

FILE. NO.: 0-07194803F3.3-6

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



FIGURE
6d-12



LEGEND

- MUNICIPAL WELLS
- WELLS ABOVE UPPER AQUIFER
- WELLS IN UPPER AQUIFER
- WELLS BETWEEN MUNICIPAL AQUIFERS
- WELLS IN INTERMEDIATE AQUIFER
- WELLS BELOW INTERMEDIATE AQUIFER
- ☆ HIGH QUALITY BOREHOLE INFORMATION
- BOREHOLE LOCATION (MOE WWIS INFORMATION)

WELLHEAD PROTECTION AREAS

- WHPA-A: 100 METRE RADIUS
- WHPA-B: 2 YEAR TIME-OF-TRAVEL
- WHPA-C: 5 YEAR TIME-OF-TRAVEL
- WHPA-D: 25 YEAR TIME-OF-TRAVEL

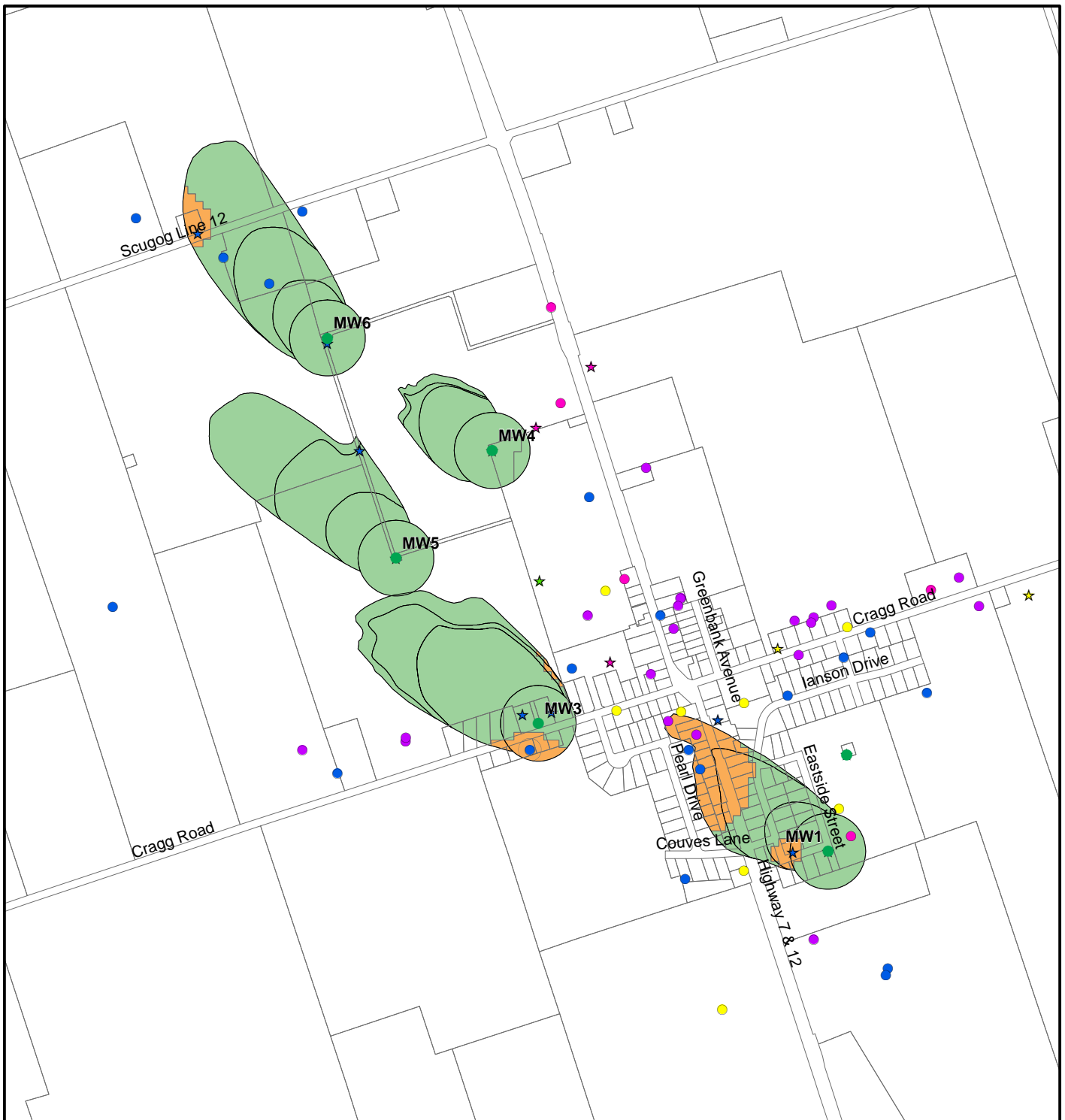
WELLHEAD PROTECTION AREAS - GREENBANK

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK

The Regional Municipality of Durham

DATE: AUGUST 2010	SCALE: 1:15000
PROJECT: 0-021345.02	FILE. NO.:0-02134502F7-1

FIGURE 6e-1



LEGEND

- MUNICIPAL WELLS
- WELLS ABOVE UPPER AQUIFER
- WELLS IN UPPER AQUIFER
- WELLS BETWEEN MUNICIPAL AQUIFERS
- WELLS IN INTERMEDIATE AQUIFER
- WELLS BELOW INTERMEDIATE AQUIFER
- ☆ HIGH QUALITY BOREHOLE INFORMATION
- BOREHOLE LOCATION (MOE WWIS INFORMATION)

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

150 75 0 150 Metres

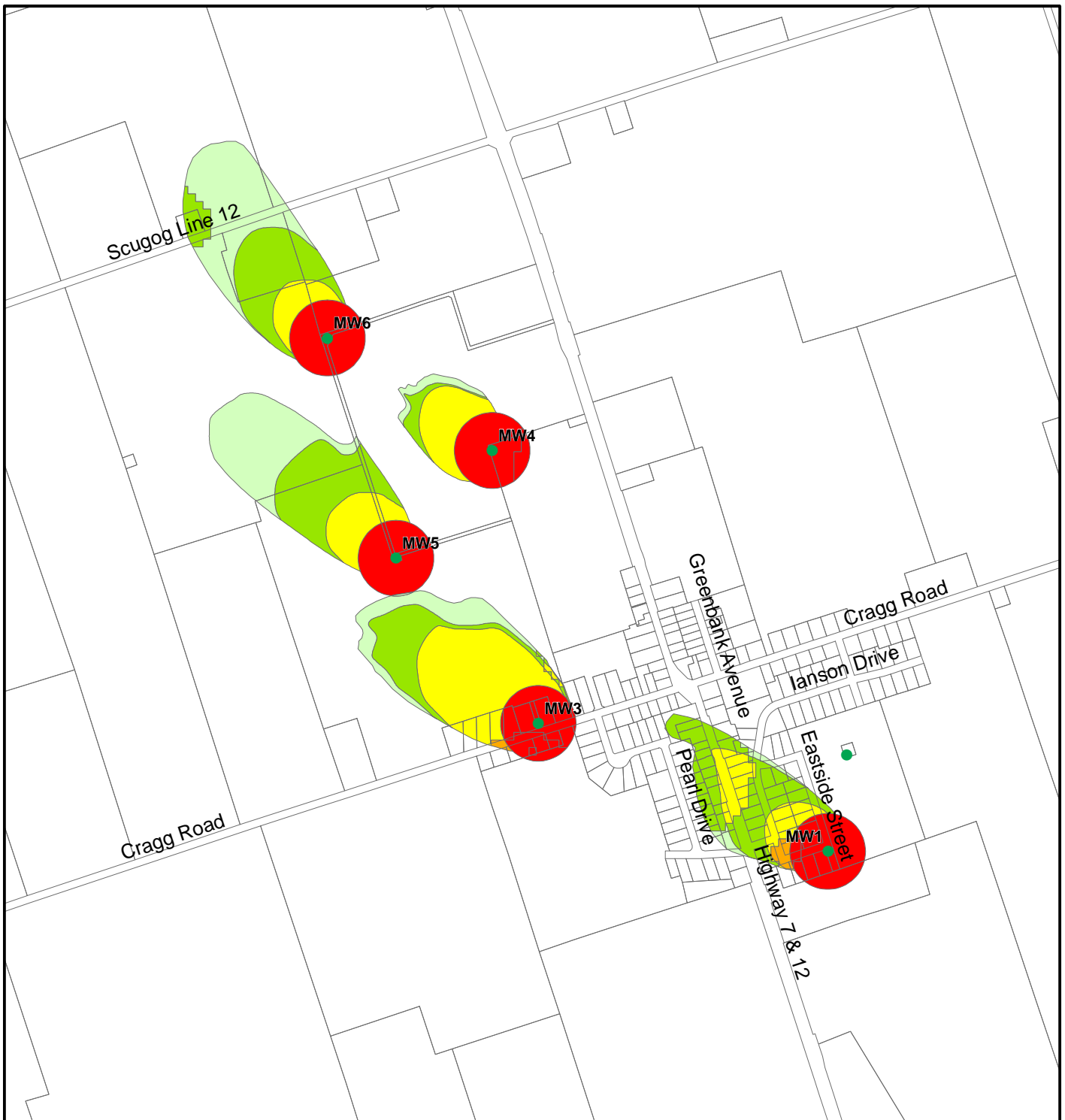
GROUNDWATER VULNERABILITY - GREENBANK

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK

The Regional Municipality of Durham

DATE: AUGUST 2010	SCALE: 1:15000
PROJECT: 0-021345.02	FILE. NO.:0-02134502F7-2

FIGURE 6e-2



LEGEND

● MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10
- 8
- 6
- 4
- 2



VULNERABILITY SCORE - GREENBANK

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK

The Regional Municipality of Durham

DATE: AUGUST 2010

SCALE: 1:15000

PROJECT: 0-021345.02

FILE. NO.:0-02134502F7-5



FIGURE **6e-3**



Pathogens			
Vulnerability Score ¹	Number of circumstances in Table of Drinking Water Threats ²		
	Significant	Moderate	Low
10	50 (PW10S ³)	14 (PW10M)	0
8	0	50 (PW8M)	14 (PW8L)
6	0	0	50 (PW6L)

¹ Areas with vulnerability scores less than 6 can not have significant, moderate or low threats. Pathogens are not a threat in WHPA C, C1 or D; ² The number of circumstances was calculated using the Upper Thames River Conservation Authority Threats Analysis Tool (<http://maps.thamesriver.on.ca/SWPThreats/>). More details and the official number of activities and circumstances that result in prescribed threats within the identified vulnerable areas are available within the Table of Drinking Water Threats. ³ Refers to the Provincial Table of Circumstances that corresponds to this vulnerability score and parameter (see Appendix; http://ourwatershed.ca/documents/assessment_report/threatslist.php).

PATHOGENS

LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- 10 (Red)
- 8 (Orange)
- 6 (Yellow)

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

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK
The Regional Municipality of Durham

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: AUGUST 2010	SCALE: 1:15000
PROJECT: 0-021345.02	FILE. NO.:0-02134502F7-6

FIGURE 6e-4



Chemicals			
Vulnerability Score ¹	Number of circumstances in Table of Drinking Water Threats ²		
	Significant	Moderate	Low
10	528 (CW10S ³)	824 (CW10M)	211 (CW10L)
8	5 (CW8S)	792 (CW8M)	717 (CW8L)
6	0	5 (CW6M)	1126 (CW6L)

¹ Areas with vulnerability scores less than 6 can not have significant, moderate or low threats: ² The number of circumstances was calculated using the Upper Thames River Conservation Authority Threats Analysis Tool (<http://maps.thamesriver.on.ca/SWTthreats/>). More details and the official number of activities and circumstances that result in prescribed threats within the identified vulnerable areas are available within the Table of Drinking Water Threats. ³ Refers to the Provincial Table of Circumstances that corresponds to this vulnerability score and parameter (see Appendix: http://ourwatershed.ca/documents/assessment_report/threatslist.php).

CHEMICALS

LEGEND

- MUNICIPAL WELL LOCATION

VULNERABILITY SCORING

- Red: 10
- Orange: 8
- Yellow: 6

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

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK
The Regional Municipality of Durham

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: AUGUST 2010	SCALE: 1:15000
PROJECT: 0-021345.02	FILE. NO.:0-02134502F7-7
GENIVAR The Regional Municipality of Durham Works Department	Ontario

FIGURE 6e-5



DNAPLS			
Vulnerability Score/WHPA ¹	Number of circumstances in Table of Drinking Water Threats ²		
	Significant	Moderate	Low
WHPA A, B, C, C1 (< 5 year TOT)	75(all) (DWAS ³)	0	0

¹ Areas with vulnerability scores less than 6 can not have significant, moderate or low threats: ² The number of circumstances was calculated using the Upper Thames River Conservation Authority Threats Analysis Tool (<http://maps.thamesriver.on.ca/SWThreats/>). More details and the official number of activities and circumstances that result in prescribed threats within the identified vulnerable areas are available within the Table of Drinking Water Threats. ³ Refers to the Provincial Table of Circumstances that corresponds to this vulnerability score and parameter (see Appendix; http://ourwatershed.ca/documents/assessment_report/threatslist.php).

DNAPLS

LEGEND

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

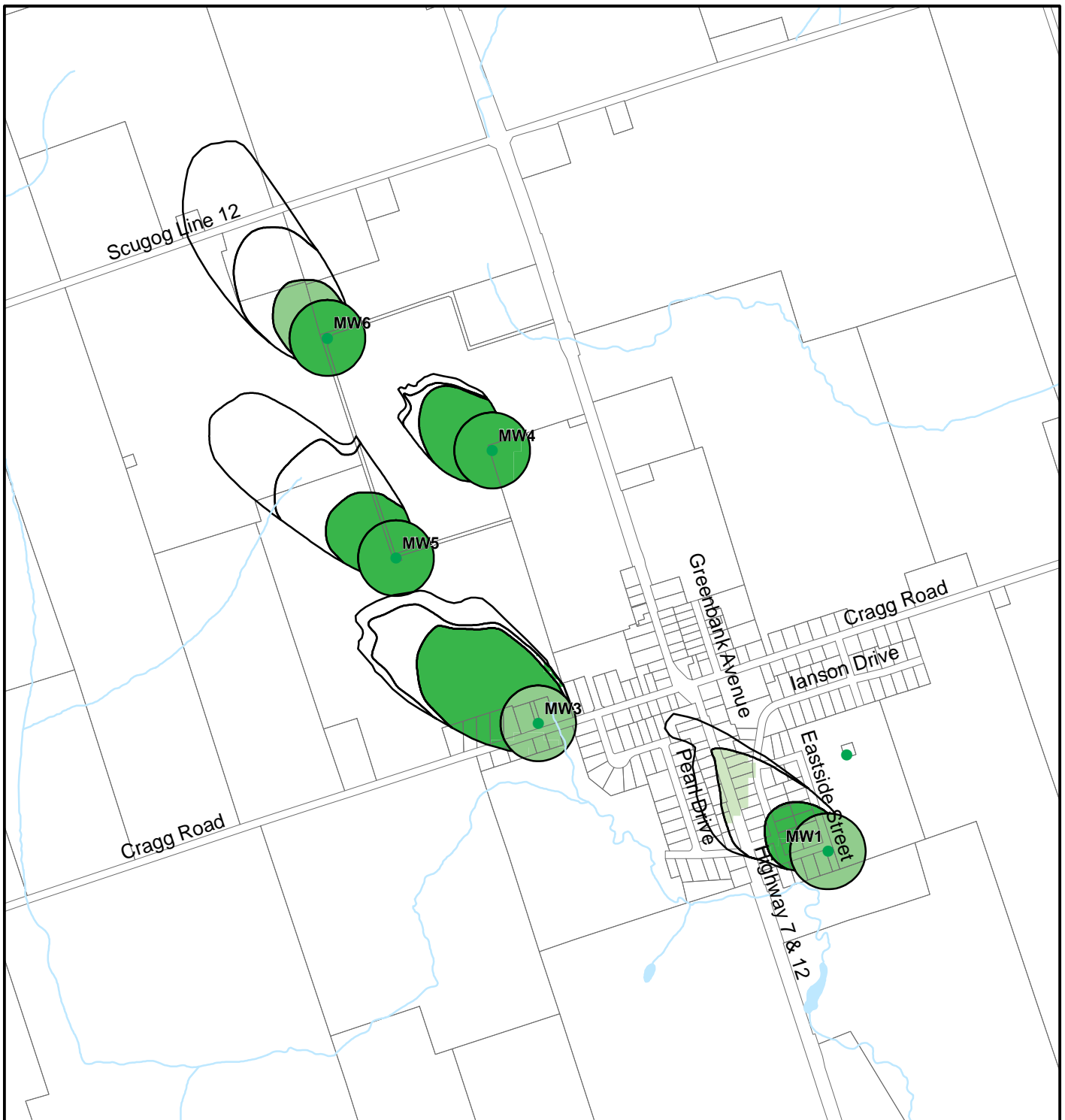
AREAS WHERE DNAPLS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - GREENBANK

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK
The Regional Municipality of Durham

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: AUGUST 2010	SCALE: 1:15000
PROJECT: 0-021345.02	FILE. NO.:0-02134502F7-8

FIGURE 6e-6



Legend

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



150 75 0 150 Metres

MANAGED LANDS - GREENBANK

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK
The Regional Municipality of Durham

DATE: AUGUST 2010

SCALE: 1:15000

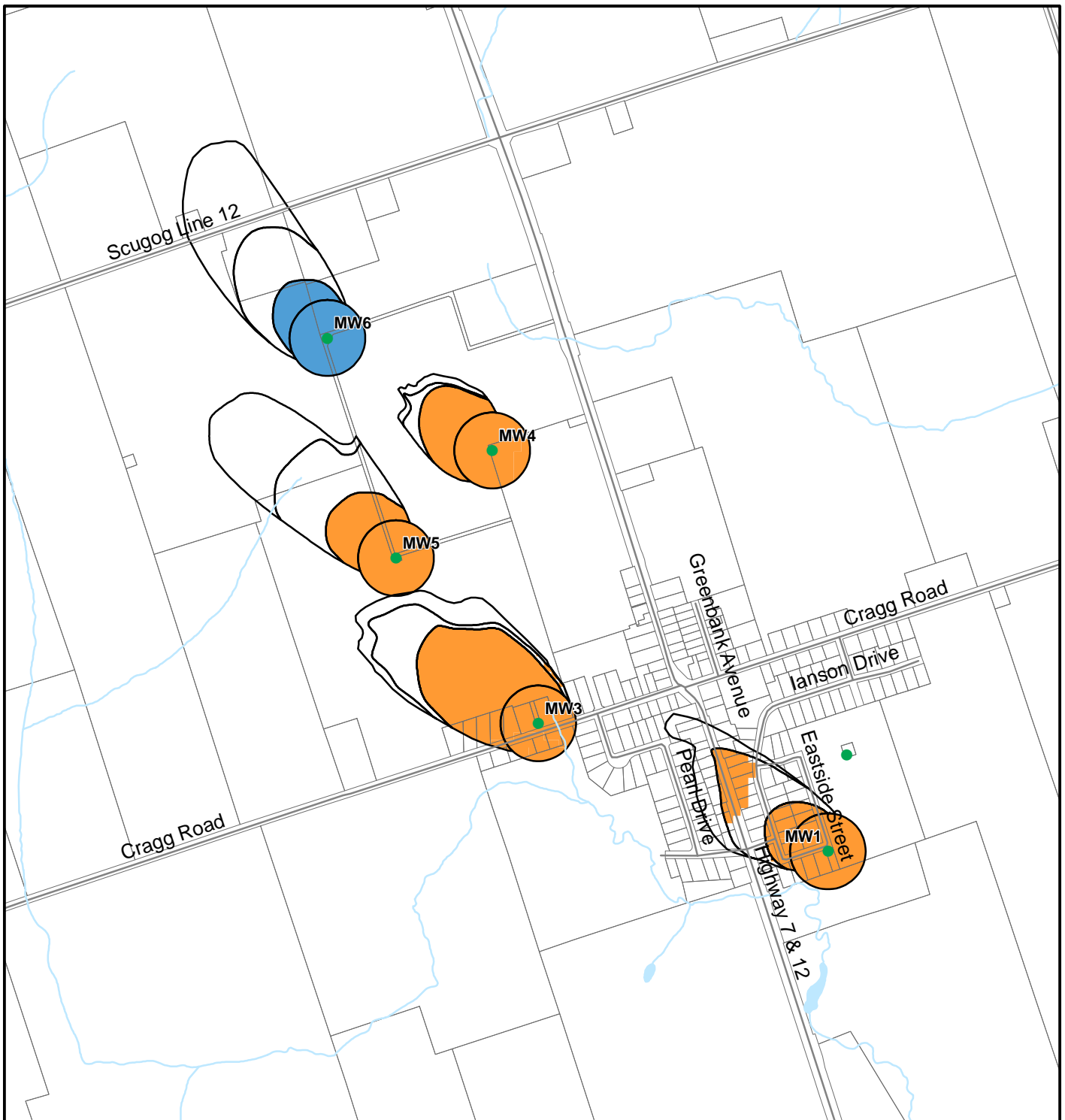
PROJECT: 0-021345.02

FILE. NO.:0-02134502F7-9

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



FIGURE **6e-7**



Legend

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



LIVESTOCK DENSITY - GREENBANK

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK
The Regional Municipality of Durham

DATE: AUGUST 2010

SCALE: 1:15000

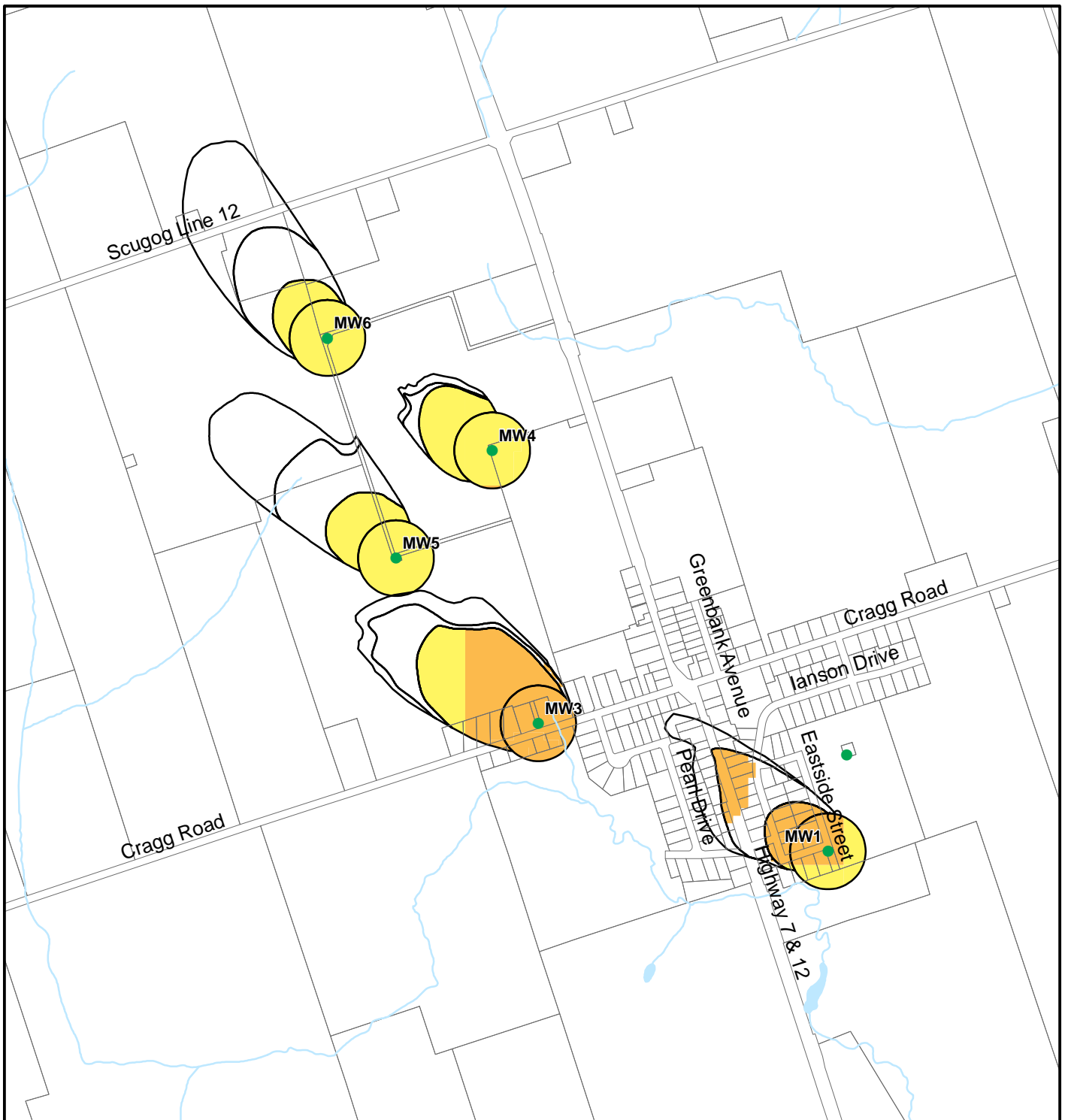
PROJECT: 0-021345.02

FILE. NO.:0-02134502F7-10

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



FIGURE
6e-8

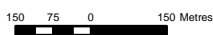


Legend

● MUNICIPAL WELL LOCATION

IMPERVIOUS SURFACE

- <1%
- >1% and <8%
- >8% and <80%



IMPERVIOUS SURFACES - GREENBANK

ASSESSMENT OF DRINKING WATER THREATS - GREENBANK
The Regional Municipality of Durham

DATE: AUGUST 2010

SCALE: 1:15000

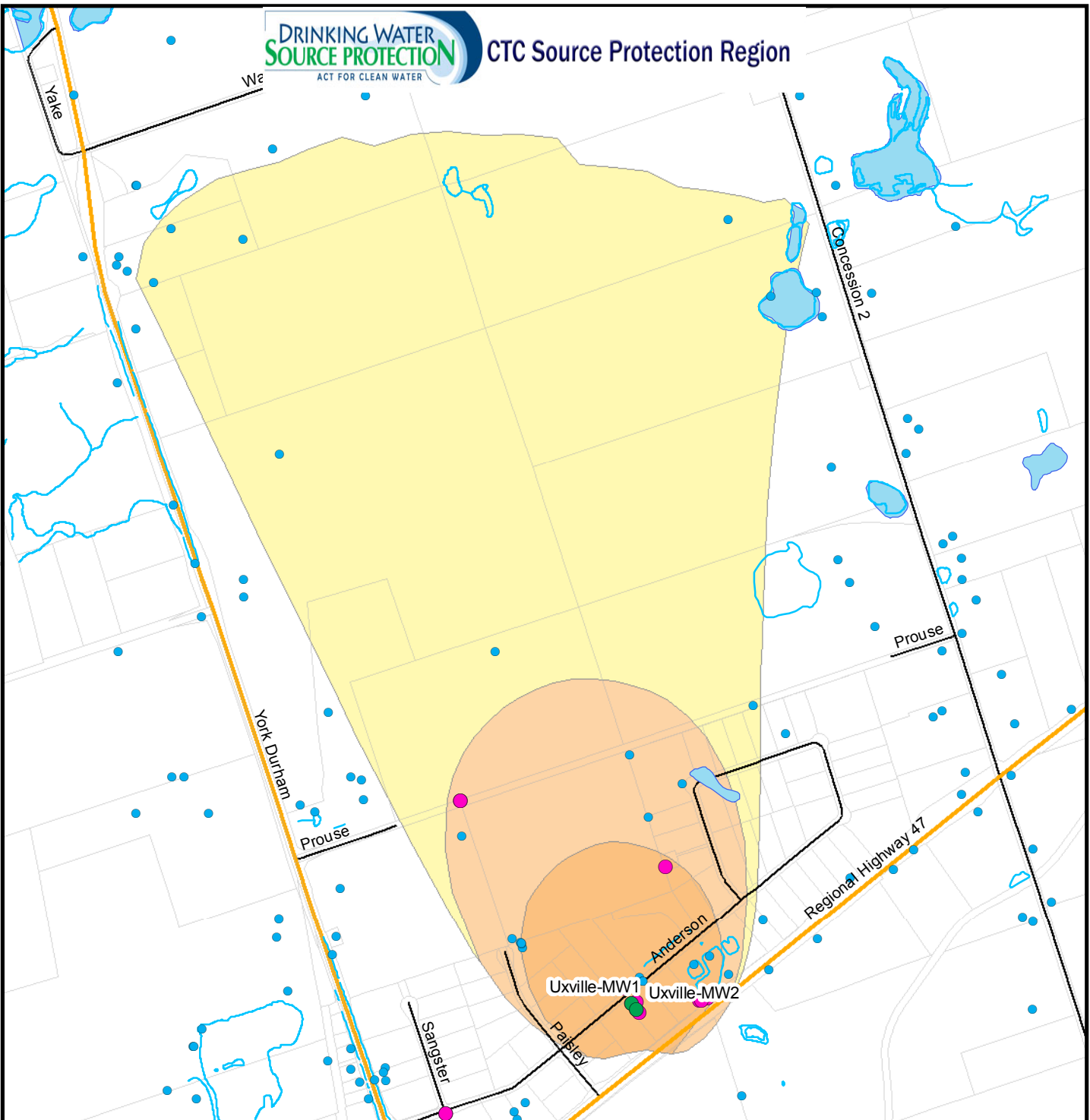
PROJECT: 0-021345.02

FILE. NO.:0-02134502F7-11

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



FIGURE **6e-9**



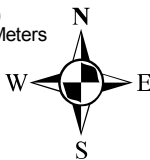
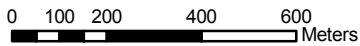
LEGEND

- MONITORING WELLS
- MUNICIPAL WELLS
- PRIVATE WATER WELL
- PARCEL FABRIC

WHPA-2009

Capture Zones

- WHPA-A: 100 METRE BUFFER
- WHPA-B: 2 YEAR TIME-OF-TRAVEL
- WHPA-C: 5 YEAR TIME-OF-TRAVEL
- WHPA-D: 25 YEAR TIME-OF-TRAVEL



WELLHEAD PROTECTION AREAS - UXVILLE

ASSESSMENT OF DRINKING WATER THREATS- UXVILLE

The Regional Municipality of Durham

DATE: JUNE 2010

SCALE: 1:16,000

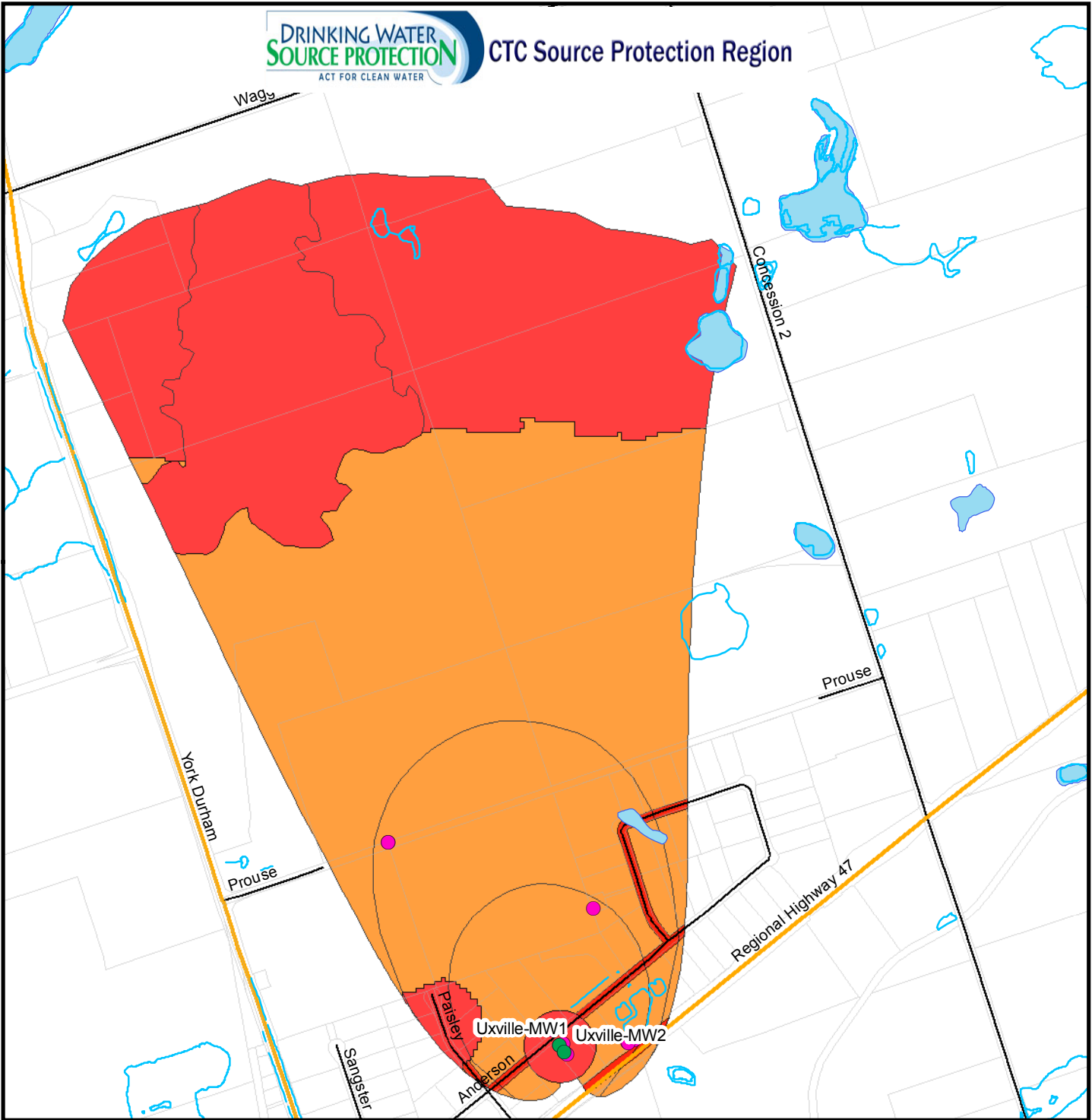
PROJECT: WG-246-07

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FIGURE

6f-1



LEGEND

- MONITORING WELLS
- MUNICIPAL WELLS
- PARCEL FABRIC

AQUIFER VULNERABILITY INDEX

- HIGH
- MEDIUM
- LOW

0 100 200 400 600 Meters

GROUNDWATER VULNERABILITY - UXVILLE

ASSESSMENT OF DRINKING WATER THREATS- UXVILLE
The Regional Municipality of Durham

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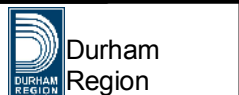
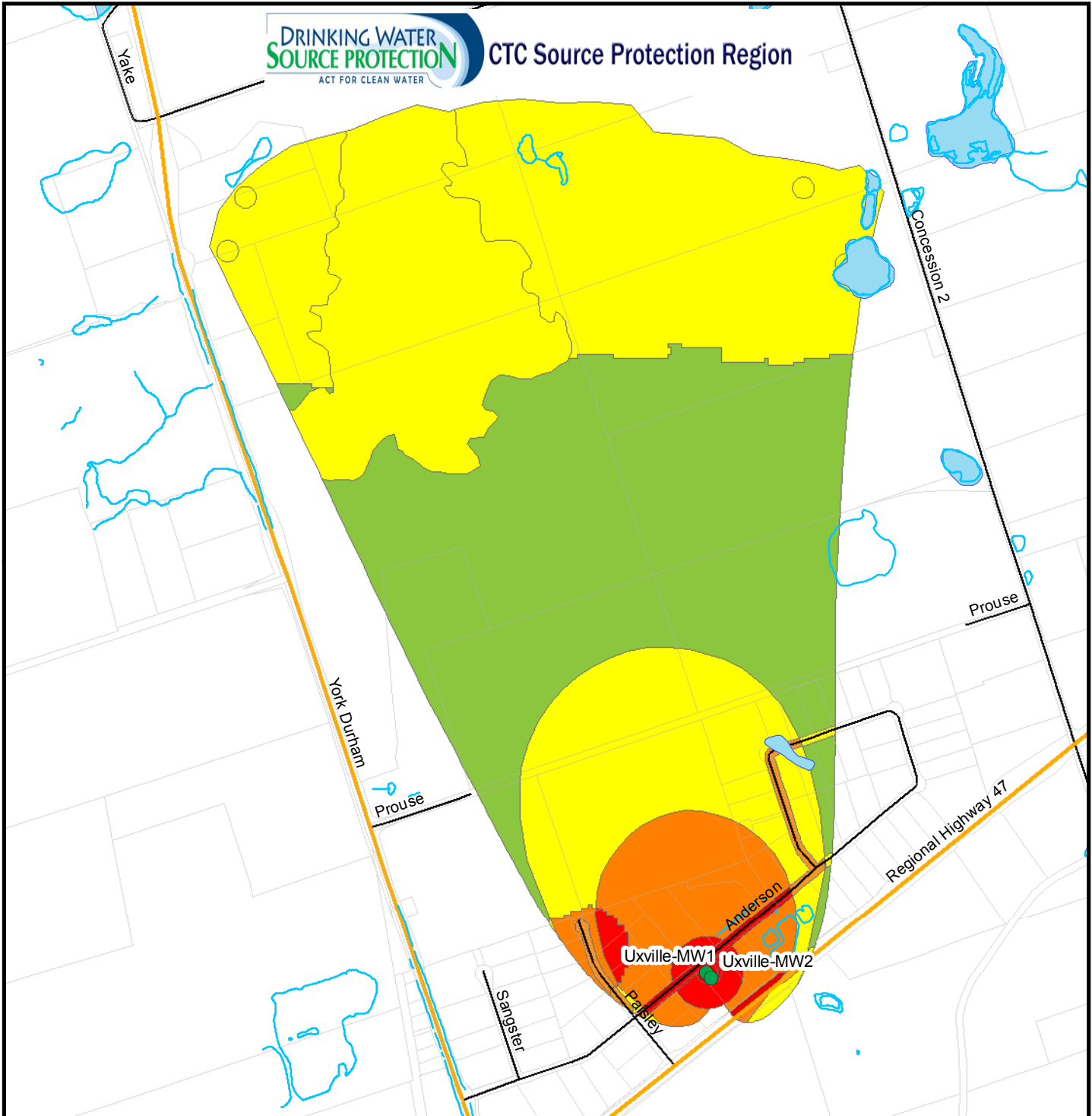


FIGURE
6f-2



LEGEND

0 115 230 460 690 Meters

● MUNICIPAL WELLS

▭ PARCEL FABRIC

Vulnerability Scoring

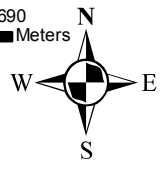
10

8

6

4

2



VULNERABILITY SCORE - UXVILLE

ASSESSMENT OF DRINKING WATER THREATS- UXVILLE
The Regional Municipality of Durham

DATE: JUNE 2010 SCALE: 1:16,000

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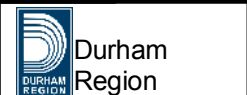
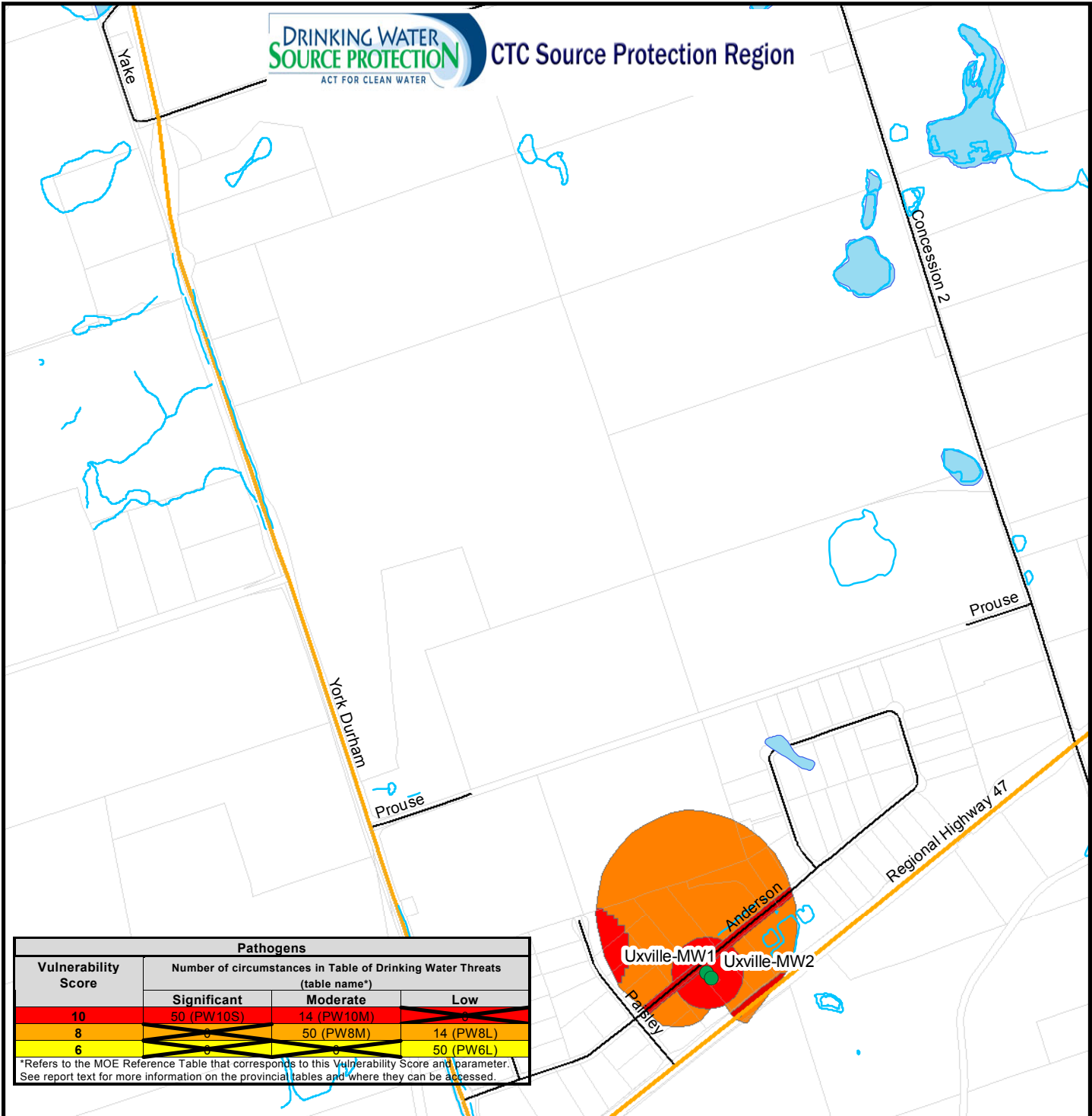


FIGURE **6f-3**



Pathogens			
Vulnerability Score	Number of circumstances in Table of Drinking Water Threats (table name*)		
	Significant	Moderate	Low
10	50 (PW10S)	14 (PW10M)	14 (PW10L)
8	50 (PW8S)	50 (PW8M)	14 (PW8L)
6	50 (PW6S)	50 (PW6M)	50 (PW6L)

*Refers to the MOE Reference Table that corresponds to this Vulnerability Score and parameter. See report text for more information on the provincial tables and where they can be accessed.

LEGEND

0 105 210 420 630 Meters

● MUNICIPAL WELLS
 □ PARCEL FABRIC

Vulnerability Scoring

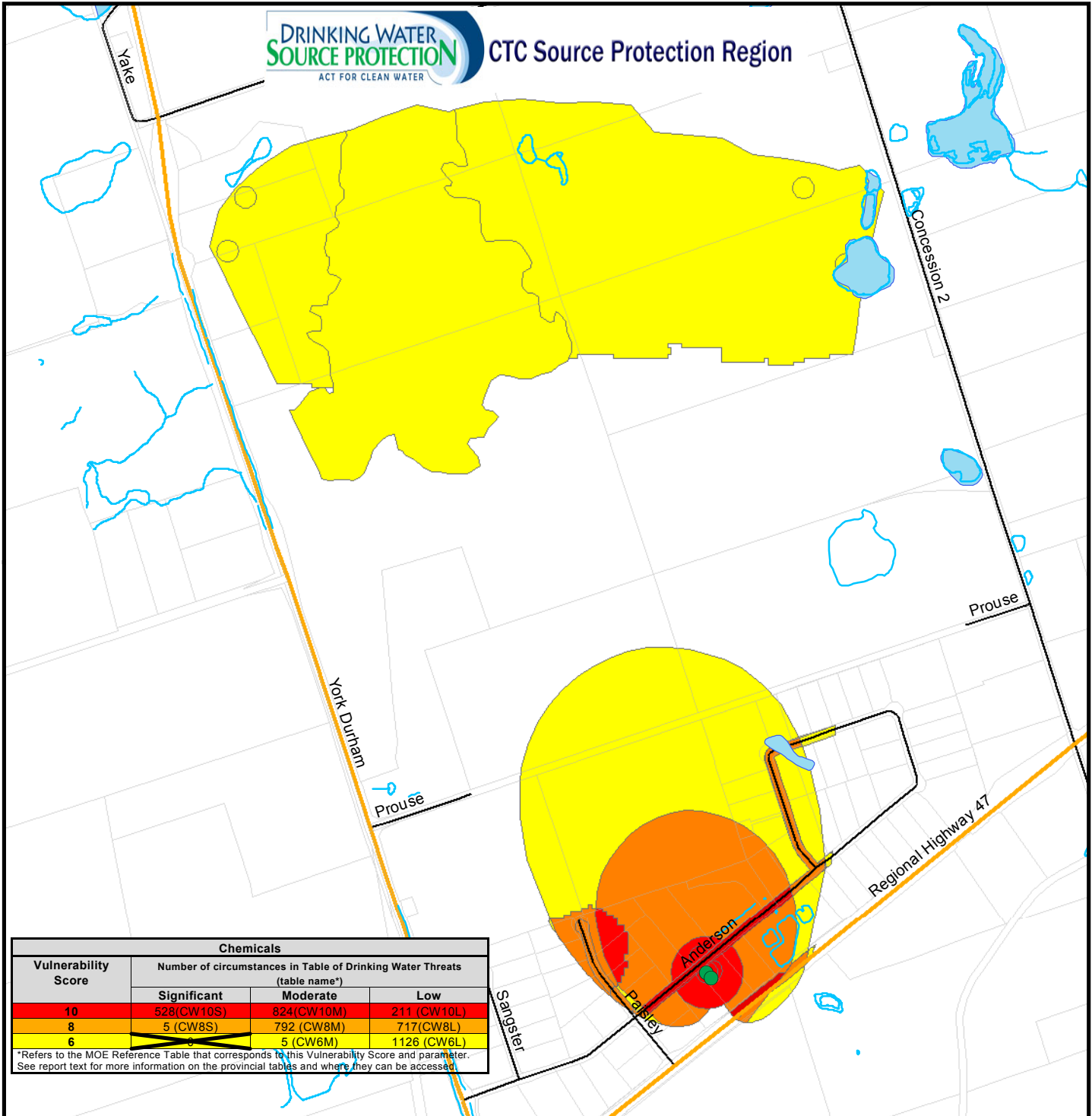
- 10
- 8
- 6
- 4
- 2

AREAS OF SIGNIFICANT, MODERATE OR LOW THREAT - PATHOGENS

ASSESSMENT OF DRINKING WATER THREATS- UXVILLE
 The Regional Municipality of Durham

DATE: JUNE 2010 SCALE: 1:16,000
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Vulnerability Score	Chemicals		
	Number of circumstances in Table of Drinking Water Threats (table name*)		
	Significant	Moderate	Low
10	528 (CW10S)	824 (CW10M)	211 (CW10L)
8	5 (CW8S)	792 (CW8M)	717 (CW8L)
6	5 (CW6S)	5 (CW6M)	1126 (CW6L)

*Refers to the MOE Reference Table that corresponds to this Vulnerability Score and parameter. See report text for more information on the provincial tables and where they can be accessed.

LEGEND

- MUNICIPAL WELLS
- PARCEL FABRIC

Vulnerability Scoring

FinalScore

- 10
- 8
- 6
- 4
- 2

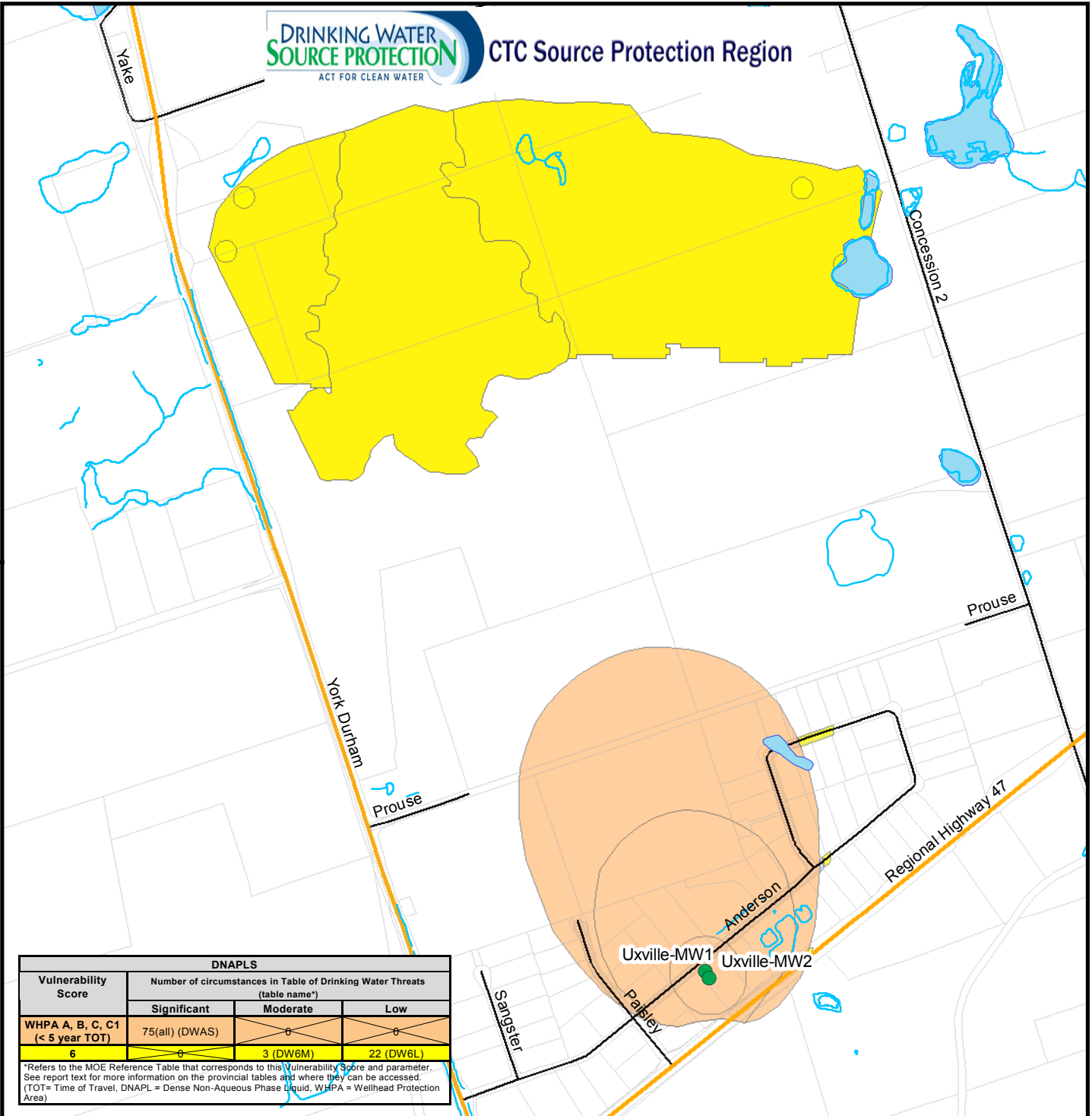
0 105 210 420 630 Meters

AREAS OF SIGNIFICANT, MODERATE OR LOW THREAT - CHEMICALS

ASSESSMENT OF DRINKING WATER THREATS- UXVILLE
The Regional Municipality of Durham

DATE: JUNE 2010 SCALE: 1:16,000
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Vulnerability Score	DNAPLS		
	Number of circumstances in Table of Drinking Water Threats (table name*)		
	Significant	Moderate	Low
WHPA A, B, C, C1 (< 5 year TOT)	75(all) (DWAS)	0	0
6	0	3 (DW6M)	22 (DW6L)

*Refers to the MOE Reference Table that corresponds to this Vulnerability Score and parameter. See report text for more information on the provincial tables and where they can be accessed. (TOT= Time of Travel, DNAPL = Dense Non-Aqueous Phase Liquid, WHPA = Wellhead Protection Area)

LEGEND

- MUNICIPAL WELLS
- PARCEL FABRIC

VULNERABILITY SCORING

- SIGNIFICANT DNAPL THREAT
- MODERATE DNAPL THREAT

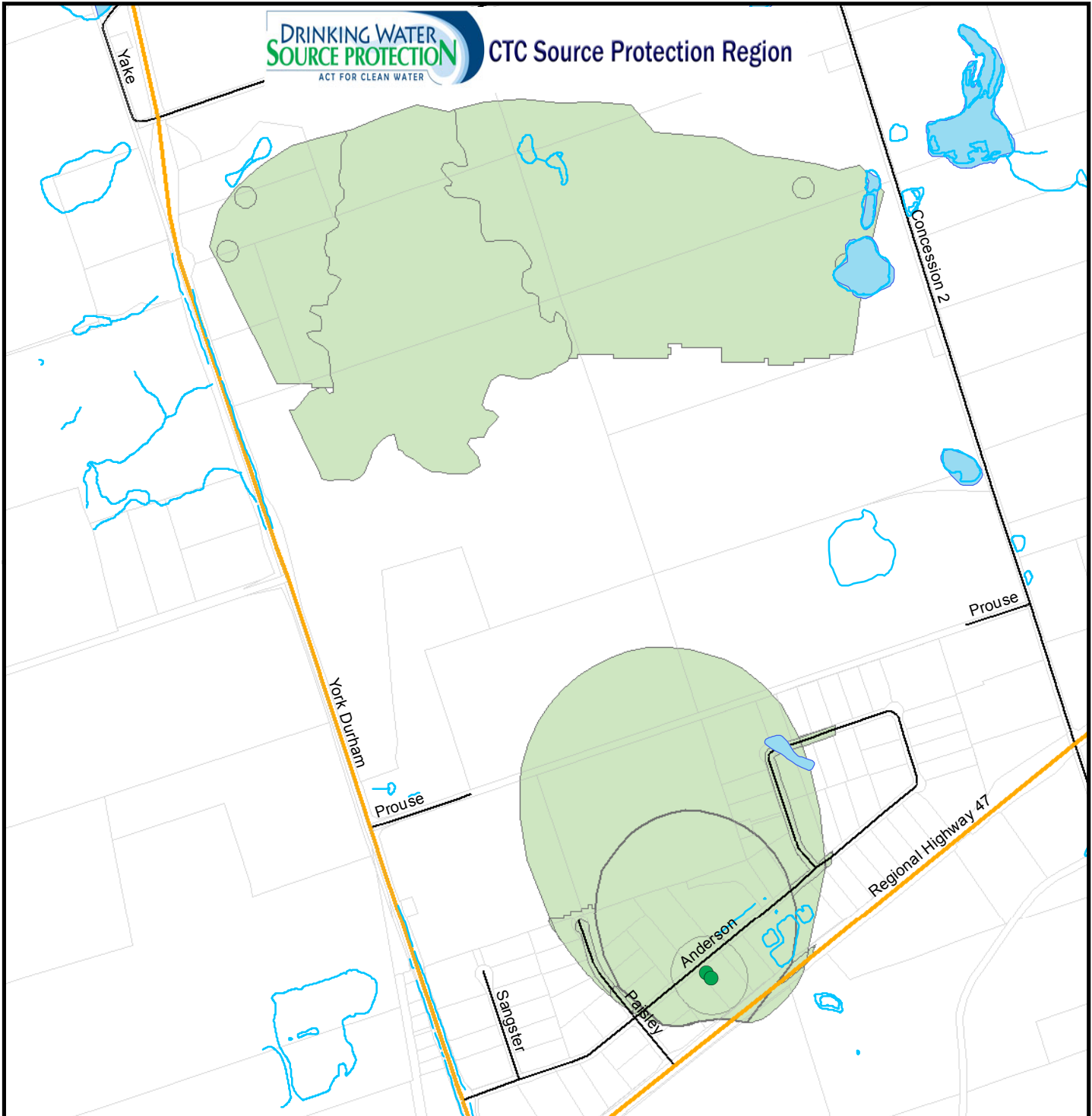
0 100 200 400 600 Meters

AREAS OF SIGNIFICANT, MODERATE, OR LOW THREATS - DNAPLS

ASSESSMENT OF DRINKING WATER THREATS- UXVILLE
The Regional Municipality of Durham

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LEGEND

- MUNICIPAL WELLS
- PARCEL FABRIC
- MANAGED LANDS (<40%)

0 100 200 400 600 Meters

MANAGED LANDS - UXVILLE

ASSESSMENT OF DRINKING WATER THREATS- UXVILLE

The Regional Municipality of Durham

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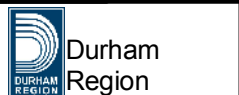
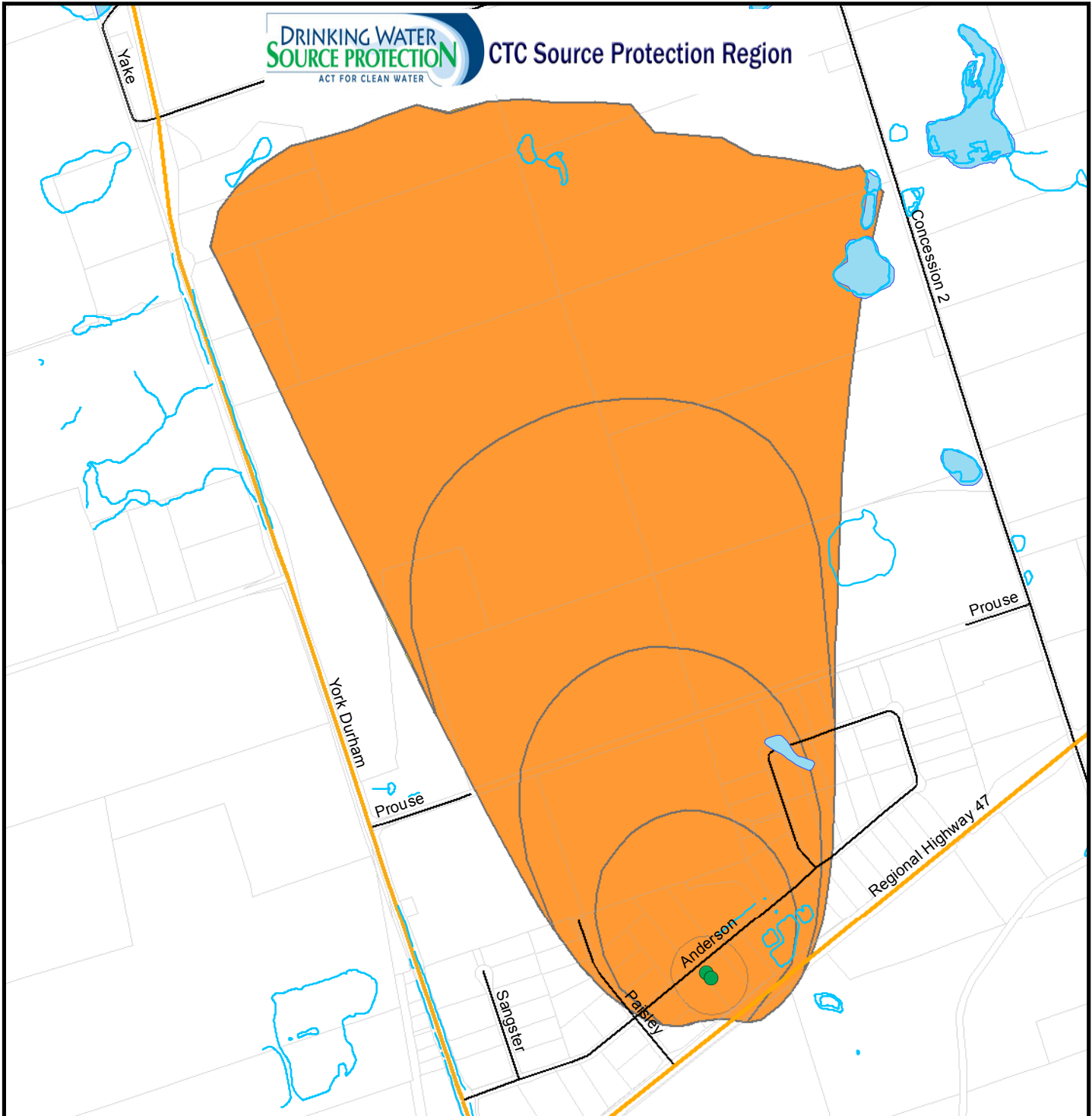
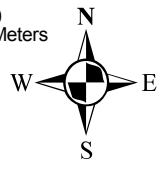


FIGURE
6f-7



LEGEND 0 105 210 420 630 Meters

- MUNICIPAL WELLS
- PARCEL FABRIC
- < 0.5 NU/ACRE



LIVESTOCK DENSITY - UXVILLE

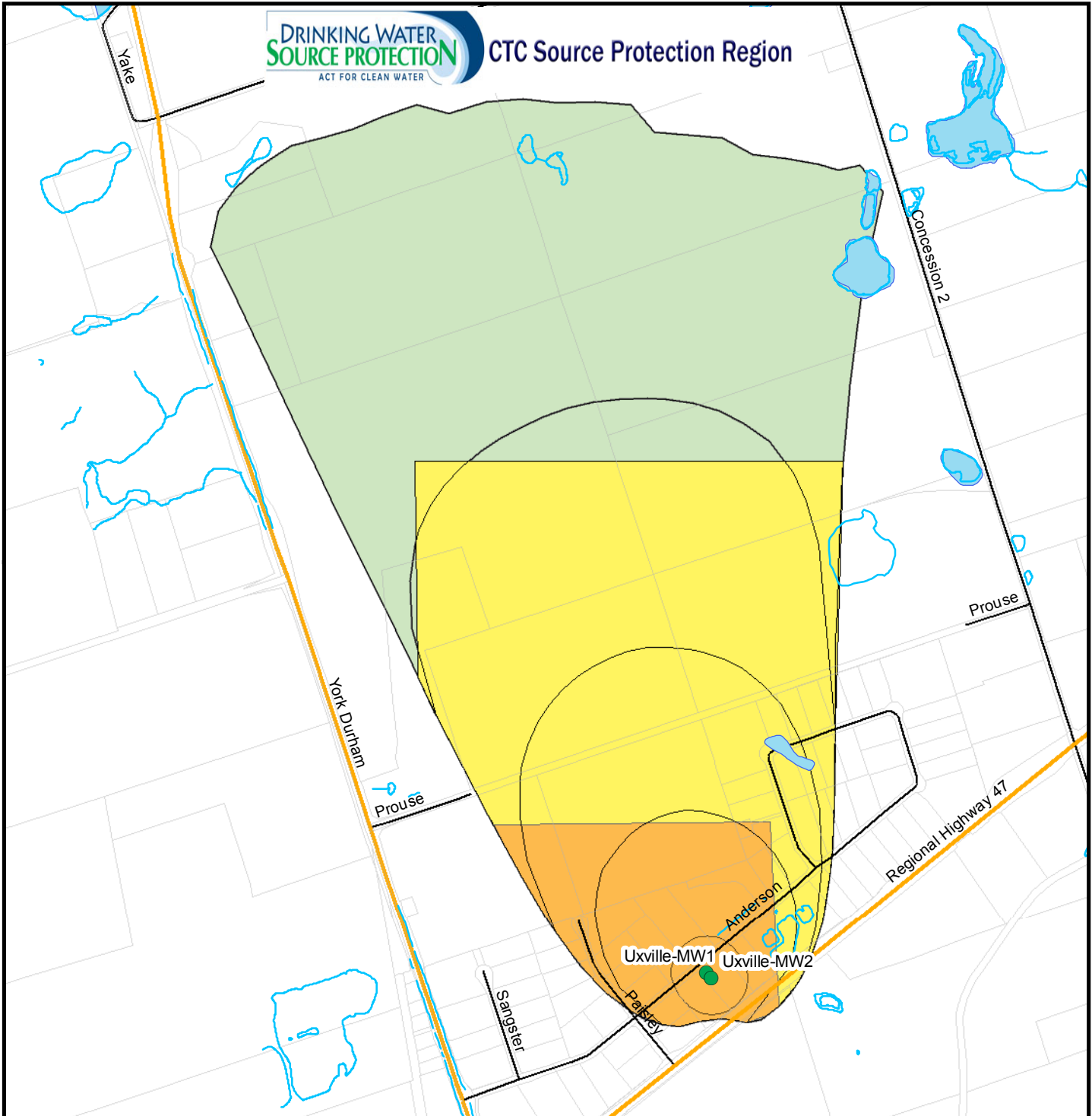
ASSESSMENT OF DRINKING WATER THREATS- UXVILLE
 The Regional Municipality of Durham

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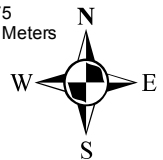
FIGURE
6f-8



LEGEND 0 112.5 225 450 675 Meters

- MUNICIPAL WELLS
- PARCEL FABRIC

- IMPERVIOUS SURFACES**
- 8- < 80%
 - 1- < 8%
 - < 1%



IMPERVIOUS SURFACES - UXVILLE

ASSESSMENT OF DRINKING WATER THREATS- UXVILLE
The Regional Municipality of Durham

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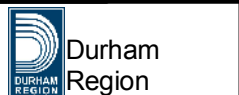


FIGURE **6f-9**