

Chapter 7: Town of Midland

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7 Town of Midland

7.1 Introduction

This chapter contains information on one drinking water system for the Town of Midland. Golder Associates Ltd has completed the work presented, which has also been reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group or the Source Protection Committee.

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

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

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

7.2 Drinking Water Systems

The Town of Midland operates groundwater based water supplies in one (1) community and has no surface water intakes. As shown in Table 7-1 and Figure 7-1 the groundwater supply is within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). Table 7-1 also indicates the Source Protection Region and corresponding lead Source Protection Authority (SPA) for the municipal water supplies.

Table 7-1: Municipal Groundwater Supplies in the Town of Midland.

Local Municipality	Community Water Supply	Source Protection Region & Source Protection Authority (SPA)
Town of Midland	Midland Well Supply	SGBLS SPR & Severn Sound SPA

Also, the Midland WHPAs extend out of the Town into the Township of Tiny. No WHPAs from other municipalities cross into the Town of Midland (Table 7-2).

Table 7-2: WHPA that cross into and out of the Town of Midland in the SGBLS SPR.

Local Municipality that WHPA extends into	Municipality where wellhead is located	Name of Water Supply	Source Protection Region & Source Protection Authority (SPA)	Location where entire Assessment can be obtained
Township of Tiny	Town of Midland	Midland	SGBLS SPR & Severn Sound SPA	This Chapter

7.3 Midland Well Supply

The Town well system consists of 9 operating production wells located at four well fields (Figure 7a-1). The municipal wells systems take water under MECP¹ Permit To Take Water (PTTW) Number 76846-6ZPKPK. The PTTW was issued on April 18, 2007 and expires on March 31, 2017.

The Vindin well field (also commonly referred to as the Flume or Reservoir well field) is comprised of five wells (Wells 6, 11, , 14, 16 and 17) located on Vindin Street in the northern portion of the Town. The Heritage Drive well field consists of two wells (7A and 7B) and is located on the southern end of the Town along Highway 12. Wells 9 and 15 also referred to as the Dominion Avenue and Russell Street wells, are single wells located in the west and central portions of the Town, respectively. Well 1A, commonly referred to as the Fourth Street well is also a single well located in the northern portion of Town, in close proximity to Midland Bay. Although the Fourth Street well (Well 1A) has been inactive for many years, the Town of Midland plans to bring the well back into service once the necessary rehabilitation work has been completed. As of 2022, Well 1A is scheduled to be decommissioned. A summary of the municipal wells is provided in Table 7-3.

Four additional wells previously located on Sunnyside Drive in the north part of Town have been decommissioned and no longer form part of the municipal supply network. As the Town has completed all of the necessary steps (as prescribed by Ontario Regulation 287/07) to exempt the decommissioned wells from the Clean Water Act, the wells have been removed from the Assessment Report.

Well 12 and 1A are to be decommissioned and removed from the Assessment Report.

Table 7-3: Town of Midland Municipal Systems.

Well Field	Well Name	DWIS #	Aquifer	Model Pumping Rate (m ³ /day)	PTTW Max (m ³ /day)
Vindin	Well 6	5707106	A3	Combined 4,193	1,642
Vindin	Well 11	5715187	A3	Combined 4,193	1,961
Vindin	Well 14	5716078	A3	Combined 4,193	985
Vindin	Well 16	5722487	A3	Combined 4,193	1,313
Vindin	Well 17	5722489	A3	Combined 4,193	1,227
Heritage	Well 7A	5709697	A3	Combined 5,391	4,925
	Well 7B	-----	A3	Combined 5,391	4,234
Dominion	Well 9	5714014	A3	1,155	1,964
Russell	Well 15	-----	A3	770	1,309

¹ Previously, the MOE (Ministry of the Environment)

The hydrogeology and groundwater resources of the Town are described in detail in the North Simcoe Groundwater Study (NSGS) report prepared by Golder (2005).

The major aquifer unit in the study area, which has historically been referred to as the Lower Aquifer, is generally found in the elevation range of 120 metres above sea level (masl) to 200 masl. This corresponds to the saturated granular materials between the top of the bedrock to the water table. This aquifer is regionally equivalent to Aquifer A3 (Golder, 2005). Aquifer A3 is quite variable in composition, ranging from fine sand to coarse gravel. The thickness of the unit is variable depending on location, but generally ranges from 15 to 50 m. This unit is the source of groundwater for the major municipal well fields, whose yields range from 7.6 L/s to 57 L/s. The aquifer is continuous across most of the study area and appears to be thickest (up to 50 m) to the west of the Town and south of the Payette Drive well field (Town of Penetanguishene – Chapter 8). An upper aquifer is present across almost the entire study area that correlates to Aquifer A2 (Golder, 2005). Aquifers A2 and A3 are combined, in some areas, into one aquifer unit. Aquifer A2 is a discrete unit in the central Midland area, as well as in the highlands to the west. The thickness of Aquifer A2 ranges up to 40 metres or more to the west and 20 metres under the Town. Aquifer A2 is interpreted to discharge directly to Midland Bay, however detailed data to demonstrate this connection are not available in the water well records. In areas where Aquifers A2 and A3 are not combined, the confining layer separating the two aquifers is on the order of 2 to 8 metres thick in this area. This confining layer appears to pinch out under the peninsula to the north and to the south at Midland Bay.

Aquifer A3 is the only water bearing unit in the immediate vicinity of Vindin Street. Wells within this well field indicate the presence of an approximately 5 to 10 m thick confining unit overlying the aquifer. Where confined, aquifer A3 is under artesian pressure and the wells flow under static conditions.

The Russell Street well (Well 15) is interpreted to be constructed in the upper part of Aquifer A3, at the same elevation as the Sunnyside wells. This aquifer is confined by up to 15 m of confining material to the north of the well, but thins to as little as 5 m in the immediate vicinity of the well.

Wells 9 and 7A/7B are constructed in Aquifer A3, at a similar elevation to the Vindin Street Wells. Thin confining units overlie the aquifer in the vicinity of Well 9 and extend towards Wells 7A/7B, where one log also indicates a thin (2.5 m) layer at an elevation of approximately 180 masl.

Groundwater flow in Aquifer A3 originates from recharge areas in the uplands to the west of the Town and south of Penetanguishene and from the central part of the Tay Peninsula, discharging to Penetanguishene Harbour and Midland Bay. St. Andrews Lake and Little Lake and possibly, but to a lesser extent, Lalligan Lake, are recharge areas. The former two lakes have no outlets, and therefore any water flowing into them either evaporates or infiltrates into the underlying aquifers. The discharge areas surrounding Penetanguishene Harbour and in the vicinity of the Vindin Street (Midland) wells are under flowing artesian conditions.

7.3.1 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 Town of Midland water supply has been delineated following the process recommended in the Technical Rules (MOE, 2008a). The areas that contribute groundwater to the wells were delineated as WHPA. The Groundwater Vulnerability Assessment was carried out as follows:

- Review of the WHPA-A to -D delineation for all wellfields;
- Delineation of WHPA-E for the Heritage and Vindin well fields;
- Assess Groundwater Vulnerability (AVI Method);
- Assign a Vulnerability Score prior to modifiers (Transport Pathways);
- Consider modifications to the Vulnerability Score based on Transport Pathways;
- Assign the final Vulnerability Score; and,
- Determine the level of uncertainty in Vulnerability Assessment.

Detailed methods describing the Vulnerability Analysis completed by Golder (2010a and Golder 2014b) are provided in Appendix M. Note that the methods used to assign vulnerability scores in the Golder reports differ slightly than those within this Assessment Report. The Golder report includes a modification to vulnerability based on water quality. While Directors approval to use this alternate approach was requested under Technical Rule 15.1, approval was only given to increase vulnerability from low to medium, and not to increase vulnerability to high. As permission to only partially increase the vulnerability score was approved, it was recommended not to increase vulnerability due to water quality. An explanation from MECP detailing the reason why the alternate method could not be used is provided in Appendix M.

7.3.1.1 Wellhead Protection Area (WHPA) Delineation

The NSGS included the delineation of the WHPAs for all of the municipal wells in the Town. In 2014, the delineation of the WHPAs was updated due to the decommissioning of the Sunnyside system, and the reintroduction of the Fourth Street well (Well 1A). A detailed description of the original groundwater flow modeling undertaken for the municipal wells can be found in the NSGS report (Golder, 2005), while information regarding the modeling undertaken to revise the WHPA delineation can be found in the WHPA and Vulnerability Update Technical Memorandum (Golder, 2014b). An industry standard groundwater modeling software package, MODFLOW, was used to develop the capture zones for the wells in the Town. Further details can be found in Golder, 2005, 2010a and 2014b.

Since the time of the original assessment, additional information primarily consisting of supplementary water well information system (WWIS) data (i.e., well records) and updated survey information regarding municipal well locations was reviewed and considered. Upon review of the updated well location information it was recognized that the updated well coordinates were all within 20 m of the location used for the modeling conducted in the earlier studies. Recognizing the variability and relative accuracy associated with the data used to develop the models (for example hydraulic conductivity and recharge) and other uncertainties associated with the modeling process, re-evaluation of the WHPAs, due to updated well location information was not considered necessary. The previous results were applied, through minor (i.e. greater than 20 m) shifts in capture zones at the Heritage and Russell WHPAs to reflect new co-ordinate information. No adjustments were made to the remaining WHPAs.

As mentioned above, changes to the municipal well system (including the decommissioning of the Sunnyside wells, and introduction of the Fourth Street well) also prompted the review of the original WHPA boundaries that were delineated based on earlier modeling for the Vindin, Dominion Avenue, and Sunnyside well fields. It should be noted the current WHPA updates completed for the Vindin Street, Fourth Street, and, Dominion Avenue systems use the same methodology and same 3D numerical (MODFLOW) groundwater model as earlier work. Since the original capture zones for the Town were delineated prior to April 30th, 2005, the Ministry of Environment allowed for the use of the 10 year WHPA- C1 boundary. For consistency with the other existing WHPAs in the Towns of Midland, the updated WHPA delineations also make use of the WHPA-C1 boundary. A detailed description of the model and methods used for the updated WHPA assessment can be found in Chapter 5 (Methods Overview), Section 5.3.2., as well as Golder 2005, Golder 2010a, and Golder 2014b.

Figure 7a-1 illustrates the current WHPAs for the Town of Midland water supplies. The WHPAs for the Dominion, Vindin Street and Fourth Street wells are merged to form one large capture zone. The WHPA for Wells 7A/7B extends north-northwest towards and beneath Little Lake. Little Lake provides some recharge to these water supply wells, although there is a relatively long travel time between the Lake and the supply wells. The Well 15 WHPA extends westward towards Little Lake. The model indicates that Little Lake does not provide significant recharge to Well 15.

In 2022, the delineation of the WHPAs was updated once again, due to plans to decommission Wells 1A (Fourth Street) and 12 (Vindin). The modeling to update the WHPA boundaries was completed by Golder now WSP, using the same methodology and 3D numerical (MODFLOW) groundwater model, that was used in the North Simcoe Groundwater Study.

7.3.1.2 WHPA-E

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

A GUDI evaluation was completed by MacViro Consultants Inc. in 2002 for the Town Wells. The conclusions of the report resulted in the identification of the Heritage wells and the Vindin Street wells as GUDI, with effective in-situ filtration.

The Vindin Street wells (6, 11, 12, 14, 16 and 17) were identified as GUDI wells within the MacViro report based on the reversal of gradients under pumping from upward to downward conditions, the 50-day travel time encompassing the adjacent Vindin Creek and the overall assessment indicating that the wells have a high potential to be under the direct influence of surface water.

The MacViro report states that although Heritage wells (7A and 7B) are located a significant distance from major surface water features (i.e., Little Lake), the wells are located within the 50 day horizontal travel time of a pond and drainage ditches. The report notes that considering the hydrogeology and increases in chloride and sodium levels, indicating surficial impacts, the wells are potentially GUDI and the GUDI designation was applied on a cautionary basis. The MacViro report notes that Little Lake is separated from the deep aquifer based on hydrogeologic interpretation and is supported by water level differences in the Lake and lower aquifer. The NSGS concluded that Little Lake may provide some recharge to the wells, although there is a relatively long travel time between the Lake and the supply wells. Based on these interpretations Little Lake was not included in the WHPA-E assessment.

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

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

A tracer study was designed to evaluate the two hour time-of-travel along Vindin Creek for the WHPA-E delineation of the Vindin Street wells. An initial assessment of the wetland features upstream of Well 11 was conducted in August, 2009. The tracer study was performed in September, 2009, upstream of Well 11, the most upstream well along Vindin Creek. Based on the two-hour time-of-travel, the tracer study indicated that the WHPA-E boundary should extend from Well 17 to approximately 630 m (including a 40% safety factor) upstream of Well 11. The northern boundary encompasses the small subdivision along Everton Drive and the southern boundary extends to Vindin Street including the eastern-most stormwater catchment area along Vindin Street. The downstream extent is defined by the two year groundwater capture zone since the exact location of the groundwater-surface water interaction is not known at this location. Further details on the WHPA-E modeling and results can be found in Golder, 2009.

Figure 7a-2 illustrates the WHPA-E for the Heritage Drive and Vindin Street wells. As indicated, the WHPA-E for the Vindin wells extends from the eastern edge of the WHPA-B downstream of Well 17 on Vindin Creek to approximately 630 m upstream of Well 11. The WHPA-E boundary for the Heritage wells corresponds to the watershed boundary in this area.

7.3.1.3 Groundwater Vulnerability

The Groundwater Vulnerability within the WHPAs of the 9 operational municipal wells in Midland is shown in Figure 7a-3 and Figure 7a-4.

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

To account for the added protection that the confining units may provide and thus decrease the calculated Vulnerability of the aquifer, the Vulnerability was re-calculated using the Aquifer Vulnerability Index (AVI) method based on the materials and depth to the top of the municipal aquifer for each well. As many wells in the area do not penetrate the entire depth of aquifer units, it was not possible to use the geologic logs of individual well records to calculate the Vulnerability. The layers from the calibrated numerical model developed as part of Golder (2005) were therefore utilized to calculate the Vulnerability to the municipal aquifer.

As illustrated in Figure 7a-4, in the immediate vicinity of the Vindin Street, and Fourth Street wells, the Vulnerability is scored as Medium (i.e., within the WHPA-A and WHPA-B). The remainder of the capture areas for these wells (i.e. WHPA-C1 and WHPA-D) are characterized by areas of Low Vulnerability. As further illustrated in Figure 7a-4, the WHPAs for the Dominion Avenue and Heritage Drive wells are predominantly within an area characterized by Low Vulnerability (i.e. AVI greater than 80). The WHPA for Well 15 is also largely in an area scored as

Low Vulnerability, with the exception of a small area of Medium Vulnerability in the immediate vicinity of the well, which intersects WHPA-A, B and C1.

7.3.1.4 Transport Pathway Increase

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

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

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

A sand and gravel operation was identified within the Heritage WHPA. A portion of the WHPA-B and C1 intersect the property where this operation is undertaken. A small portion of the upper overburden unit has been removed in the area. Assessment of the increased Vulnerability due to the removal of the overburden at the operation is difficult to interpret, and therefore a conservative approach to increase the Vulnerability one level where the sand and gravel operation intersects the WHPA zones was considered.

A second sand and gravel operation was noted at the most western portion of the Heritage WHPA. The depth of this operation was not considered sufficient to warrant an increase in the Vulnerability scoring.

Constructed Transport Pathways to an aquifer, for example water wells, can have a locally significant impact on the Vulnerability of an aquifer. The SSEA surveys were aimed at identifying and locating wells within the WHPAs and included a categorization of those wells which pose the highest risk to the aquifer. The wells were classified based on: (1) the physical condition of the well (i.e., Class A, B or C), based on height of the casing above grade and likely condition of the well cap; and (2) increasing risk (category 1, 2, and 3) based on the aquifer they were completed in. Wells with a risk rating of 3C were included as Transport Pathways as they are considered to have the highest risk as this comprises the wells completed to the municipal aquifer which have below standard well casing height. The high risk rating does not imply that these wells necessarily represent a Transport Pathway that is or could cause impact to the municipal aquifer. It implies that, based on the physical condition and depth of the well, there is an increased risk associated with these locations. These are the only wells (3C) that have been used to modify the Vulnerability Scoring, based on the rationale provided in Golder, 2010a. 3C wells were identified in the combined Vindin and Dominion WHPA (five locations) and in the Heritage wells WHPA (two locations). The Vulnerability at these well locations was increased one level within a 30 m buffer of the well.

The location of Transport Pathways and the resulting increase to Vulnerability Scores are presented in Figure 7a-5.

7.3.1.5 Vulnerability Score

The WHPA zones for the Midland Water Supply, as shown in Figure 7a-1, the Groundwater Vulnerability, as shown in Figure 7a-3 and Figure 7a-4, and the increases due to Transport Pathways (Section 7.3.1.4) were used to assign a Vulnerability Score using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 7a-5 illustrates the Vulnerability Scores for the Midland Water Supply. The vulnerability scoring in Figure 7a-5 will also be used to assess Drinking Water Threats in Section 7.3.3.

7.3.1.6 Vulnerability Score for WHPA-E

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

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

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

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

Table 7-4 summarizes the Area and Source Vulnerability Factors and overall Vulnerability Scores. Justification of the score is provided in Golder, 2009.

Table 7-4: Vulnerability Scoring for WHPA-E Catchment Areas.

Well Field	Area Vulnerability Factor	Source Vulnerability Factor	Vulnerability Score
Heritage Drive	8	0.8	6.4
Vindin Street	8	0.8	6.4

7.3.1.7 Uncertainty Rating

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

The independent peer review of WHPA delineation was undertaken by Dillon Consulting using a standard scoring matrix (Table 1, Appendix MO). The Uncertainty Rating assigned for the Midland WHPAs is High. The full results of the WHPA delineation Peer Review process, for Midland is available in Appendix M and discussed in Chapter 5 (Methods Overview). Based on the rationale provided for the Vulnerability Assessment (see below), Golder 2010a, characterized uncertainty of the WHPA delineation as Low. As this differs from that provided by the peer review, the most conservative, 'High' Uncertainty ranking will currently apply.

The uncertainty and assumptions made in the modeling process are documented in Golder (2005). The uncertainty associated with the Vulnerability Assessment was evaluated using a qualitative process outlined in Golder, 2010a. The Uncertainty Assessment methodology considers the type, quantity and quality of available data, the methods used to determine the Vulnerability Assessment components, and the nature of the groundwater flow system.

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

7.3.2 Drinking Water Issues Evaluation

The intent of the Issues Evaluation is to identify parameters (e.g. chemicals or pathogen) in the raw drinking water that will limit the ability of the water to serve as a drinking water source either now, or in the future. To be considered a Drinking Water Issue, a parameter needs to be at a concentration that may result in the deterioration of the quality of the water for use as a source of drinking water or if there is a trend of increasing concentrations of the parameter and a continuation of that trend that would result in the deterioration of the quality of the water as

a source of drinking water (Technical Rule 114.(1)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

The Town of Midland Drinking Water Issues evaluation was based on a review of water quality data from Golder (2005) and annual drinking water quality reports from 2002 to 2007. Additionally, raw water quality samples were collected by Golder from the Town wells in March 2009 (Golder, 2010a) as part of the Issues Evaluation.

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

No Drinking Water Issues were identified for the Town of Midland Well Supply.

The trends of chloride and sodium concentrations are increasing trends at all of the well systems with the exception of the Sunnyside wells. The origins of chloride and sodium are considered to be anthropogenic in this area and likely the result of non-point source inputs such as road salt. The trend in chloride and sodium concentration was not interpreted to exceed the ODWQS within 50 years based on linear regression analysis. An exception to this is noted for Well 9 (Dominion Avenue).

Recent chloride concentrations at the Vindin Street wells ranged from 40 to 67 mg/L, whereas sodium concentrations ranged from 15 to 34 mg/L. At the Heritage wells chloride concentrations ranged from 43 to 94 mg/L with accompanying sodium concentrations of 18 to 39 mg/L. Well 15 exhibits recent chloride and sodium concentrations of 49 and 15 mg/L, respectively.

The most recent chloride and sodium concentrations at Well 9 were 100 mg/L and 31 mg/L, respectively. Trending of these parameters based on linear regression indicates projected chloride levels of greater than 300 mg/L and 67 mg/L, respectively, which represents an exceedance of the ODWQS for chloride.

However, more recent data, indicate decreased and stable concentrations as compared to the highest concentrations formerly observed in 2001 (129 mg/L) and subsequent concentrations of 100 mg/L (2002), 110 mg/L (2003) and 100 mg/L (2009). As the latter data points do not support the long term trend line, chloride was not considered to be a Drinking Water Issue at this wellfield.

7.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Town of Midland Water Supply was completed in accordance with the detailed methodology presented in Golder, 2010a (Appendix M). 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 Midland Water Supply includes preparation of:

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

7.3.3.1 List of Drinking Water Threats – Activities

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

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

- MOE Look Up Tables (LUT) Database (2009);
- Municipal Property Assessment Corporation (MPAC) (2007) assessment information;
- North Simcoe Groundwater Study (NSGS) Contaminant Source Inventories;
- Hazardous Waste Information Network (HWIN) (2009);
- MOE Records Database (2009);
- Mapping provided by SSEA including landuse (November 2009), storm water and sanitary serviced areas;
- SSEA Livestock Survey (2001) and Biosolids (2007) Database; and,
- SSEA Pre-Screening Report (2007)

- SSEA Threats Verification Work (2014)

Section 7.3.3.5 describes how these datasets were used to identify and enumerate potential Significant Threat Activities for the Midland drinking water system.

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

7.3.3.2 List of Drinking Water Threats – Conditions

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

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

7.3.3.3 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 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/>.

7.3.3.3.1 Pathogen Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 7a-6 to identify the areas where Activities associated with pathogen Threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Town of Midland Water Supply Areas within the WHPA-A and WHPA-B with a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

7.3.3.3.2 Chemical Parameters

The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 7a-7 to identify the areas where activities associated with chemical threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Town of Midland Water Supply, Areas within the WHPA that have a Vulnerability Score of less than six are not illustrated as they do not contain Circumstances (high enough Hazard Score) for an Activity Threat to be considered Significant, Moderate or Low.

7.3.3.3.3 DNAPL Chemical Parameters

Figure 7a-8 illustrates the area within the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of 6, where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Midland Water Supply. Moderate and Low Threats are only considered in WHPA-D if the Vulnerability Score is 6. The Technical Rules can be used in conjunction with the Vulnerability Scores on Figure 7a-8 to identify the circumstances in which these Activities would be Significant, or Moderate, or Low Drinking Water Threats. The circumstances can be found at: <https://threats.swpip.ca/>.

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

Further to Section 7.3.3.2, no Conditions have been confirmed within the WHPA for the Midland Water Supply as per 2021 Directors Technical Rule 126.

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). 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 7a-5 illustrates the Vulnerability Score map for Midland Water Supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

7.3.3.5 Enumerating Drinking Water Threats

7.3.3.4.17.3.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 7.3.2 and 7.3.3.2, respectively. This section describes the identification and enumeration of Significant Drinking Water Threat Activities. Identification of Activities requires determining where they are located in terms of vulnerable areas and their associated Risk Score based on the type of Activity. Detailed methodology can be found in Golder, 2010a. It should be noted that in 2013 a threats enumeration refinement exercise was undertaken across the Source Protection Region. In the Severn Sound watershed this exercise was completed by Severn Sound Source Protection Authority staff. The methods used to refine the Significant Drinking Water Threat enumeration are detailed in Chapter 5 of this Assessment Report.

For the Significant Drinking Water Threat enumeration exercise undertaken by Golder 2010a, a number of data sources were utilized as part of the Activity Threat Assessment. The data sources used to obtain Threat information for the GIS based algorithm developed for the project are described in Golder 2010a and summarized in section 7.3.3.1. In most cases, the detailed information required to document the MOE Circumstances was not readily available. The approach was designed to represent typical Activities occurring at different property types. The approach is considered conservative and, in many cases, likely results in a higher Threat ranking than may otherwise actually be present in many cases. The assumed Circumstances and MOE Hazard Scores are described in Golder, 2010a, and were based on MPAC property codes (and MOE LUT Activities). It is noted that the assessment has not involved field verification or site visits to validate information.

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

The input data lead the algorithm to relevant reference IDs in the MOE Drinking Water Threats Tables (now, the MECP Threat Lookup Tool) that reflect the Circumstances identified on the property. A lookup table is used to link the selected Circumstance to an MECP Hazard Score which, when multiplied by the Vulnerability Score, provides the resultant Risk Score for the Threat in question. When multiple chemical parameter Circumstances are present for a given Threat, Risk Scores are calculated for each parameter and the highest score is tabulated for the Threat. It is noted that the Vulnerability Score used to rank a property is based on the maximum Vulnerability Score intersected by the parcel for the WHPA being evaluated. Finally, if the calculated Risk Score for a Threat is greater than or equal to 80, the Threat is ranked as Significant.

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

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

7.3.3.4.1-17.3.3.5.1.1 *Managed Lands*

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

Non-agricultural managed lands includes golf courses, sports fields and residential lawns and other built up grassed areas that may receive nutrients (primarily commercial fertilizers).

Technical Rule 16(9) 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 Midland WHPA as outlined in Golder, 2010a.

The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 7.3.3.5). Figure 7a-9 illustrates the location and proportion of Managed Lands within the delineated WHPA zones for the Midland Water. The Managed Land within all of the Midland WHPA is within the lowest threshold of 0 to 40%.

7.3.3.4.1.27.3.3.5.1.2 *Livestock Density*

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

Technical Rule 16(10) 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 Midland WHPA as outlined in Golder, 2010a. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 7.3.3.5). Figure 7a-10 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Midland Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D. The Livestock Density figure reflects the distribution of Agricultural Managed Lands. As expected, the livestock density calculations result in <0.5 NU/acres within all of Midland WHPAs where densities were calculated (i.e. greater than a Vulnerability Score of 6).

7.3.3.4.1.37.3.3.5.1.3 *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 Midland WHPA was determined in accordance with the Severn Sound Environmental Association “Impervious Surface Mapping – Midland Vindin, Fourth Street, and Dominion April 2023 methodology using the 2021 Technical Rules. Each impervious area percentage was calculated separately for each WHPA within the Midland Well Supply. The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 7.3.3.5). The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 7a-11 illustrates the distribution of Impervious Surfaces within the delineated WHPA zones for the Midland Water Supply where Vulnerability Scores were greater than 6 for WHPA-A to WHPA-D and greater than 4.5 for WHPA-E.

7.3.3.4.27.3.3.5.2 Enumerating Significant Drinking Water Threats – Results

The number of Significant Drinking Water Threats for the Town of Midland Groundwater Supply has been determined using the methodology presented in Golder, 2010a (Appendix M) and refined using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

There are a total of 31 Significant Drinking Water Threats for Activities in the Midland WHPAs. The number of parcels in the WHPAs with identified Significant Drinking Water Threats is 27. The total number of Significant Threats is higher than the total number of parcels with Significant Threats because there are parcels that have multiple Threats identified. Table 7-5, Table 7-6, and Table 7-7, document the refined enumeration of Significant Drinking Water Threats for the Vindin and Dominion, Russell, Heritage Drive, and Fourth St. WHPAs that make up the Midland Groundwater Supply. No Threats related to Conditions or Drinking Water Issues have been identified in the Town WHPAs.

In the combined Vindin and Dominion Street WHPA a total of 19 parcels with 23 Significant Drinking Water Threat activities were identified. The Significant Threats are related to sanitary sewers and related pipes (3, one for each wellfield), handling and storage of Dense Non-Aqueous Phase Liquids (DNAPLs) (15), handling and storage of organic solvents (3) and handling and storage of fuel (2).

Two (2) parcels with Significant Drinking Water Threat activities were identified within the Russell Street WHPA. These threats are related to sanitary sewers and related pipes (1) and handling and storage of DNAPLs (1).

A total of six (6) parcels with Significant Drinking Water Threat activities were identified in the Heritage Drive WHPA. The Significant Threats identified are related to sanitary sewers and related pipes (1), discharge of untreated water from a stormwater retention pond (1), and handling and storage of DNAPLs (4).

Table 7-5: Number of Significant Threat Activities for the Town of Midland Vindin and Dominion WHPA.

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.	39
2.	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.	3
3.	The application of agricultural source material to land.	0
4.	The storage of agricultural source material to land.	0
5.	The management of agricultural source material.	0
6.	The application of non-agricultural source material to land.	0
7.	The handling and storage of non-agricultural source material.	0
8.	The application of commercial fertilizer to land.	0
9.	The handling and storage of commercial fertilizer to land.	0
10.	The application of pesticide to land.	0
11.	The handling and storage of pesticide.	0
12.	The application of road salt.	0
13.	The handling and storage of road salt.	0
14.	The storage of snow.	0
15.	The handling and storage of fuel.	2
16.	The handling and storage of dense non-aqueous phase liquid.	15

Threat Number	Threat	Significant threat counts Number of threats
17.	The handling and storage of an organic solvent.	3
18.	The management of runoff that contains chemicals used in the de-icing of aircraft.	0
19.	An activity that takes water from an aquifer or a surface water body without returning the water taken to the safe aquifer or surface water body.	0
20.	Any activity that reduces the recharge of an aquifer.	0
21.	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard.	0
22.	The establishment and operation of a liquid hydrocarbon pipeline	0
-	Totals:	3123* significant threats (on 2619 properties)

*4 verified existing Threats and 19 potential Threats that require further investigation (2015)

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

Table 7-6: Number of Significant Threat Activities for the Town of Midland Russell WHPA.

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

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

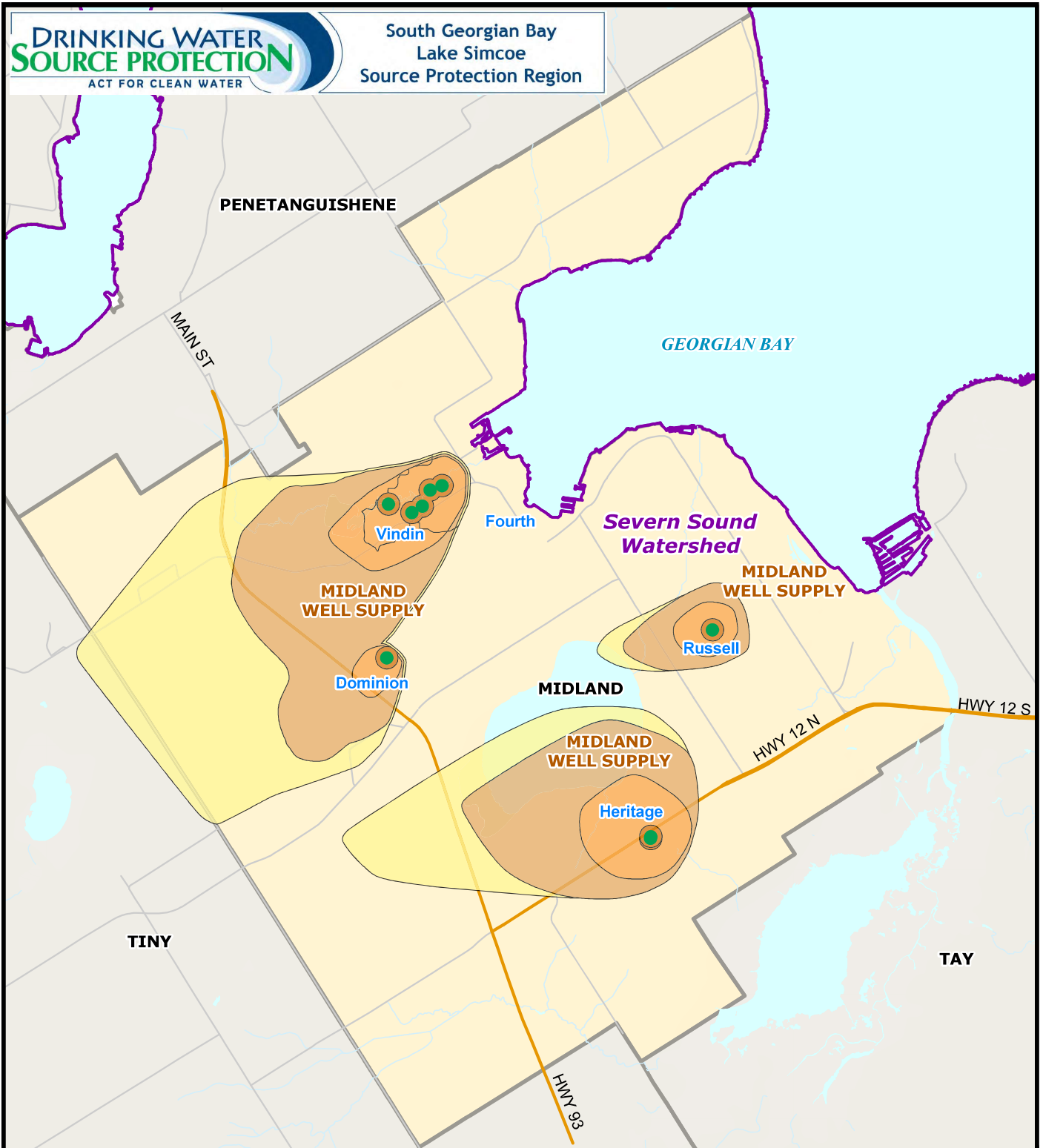
*2 potential Threats that require further investigation (2015)

Table 7-7: Number of Significant Threat Activities for the Town of Midland Heritage Drive WHPA.

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

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

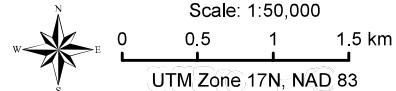
*6 potential Threats that require further investigation (2015)



- Municipal Supply Well in Town of Midland
- WHPA-A (100 m)
- WHPA-B (2 years time of travel)
- WHPA-C1 (10 years time of travel)
- WHPA-D (25 years time of travel)
- SWP Watershed Region
- Municipal Boundary

**Drinking Water System
Vulnerable Area in
Town of Midland**

Created by: LSRCA
Amendments By: SSEA
Date: 2024-09-20



This map was produced for the Town of Midland for the purpose of updating the South Georgian Bay Lake Simcoe Assessment Report Supplement. Base data have been compiled from various sharing agreements. While every effort has been made to accurately depict the base data, errors may exist.



Figure 7-1

DRINKING WATER SOURCE PROTECTION

ACT FOR CLEAN WATER

South Georgian Bay Lake Simcoe Source Protection Region

WELLHEAD PROTECTION AREAS TOWN OF MIDLAND

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

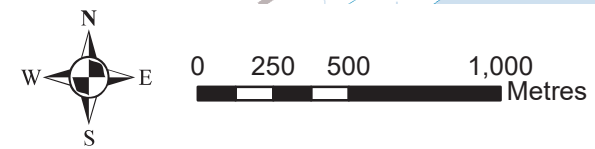
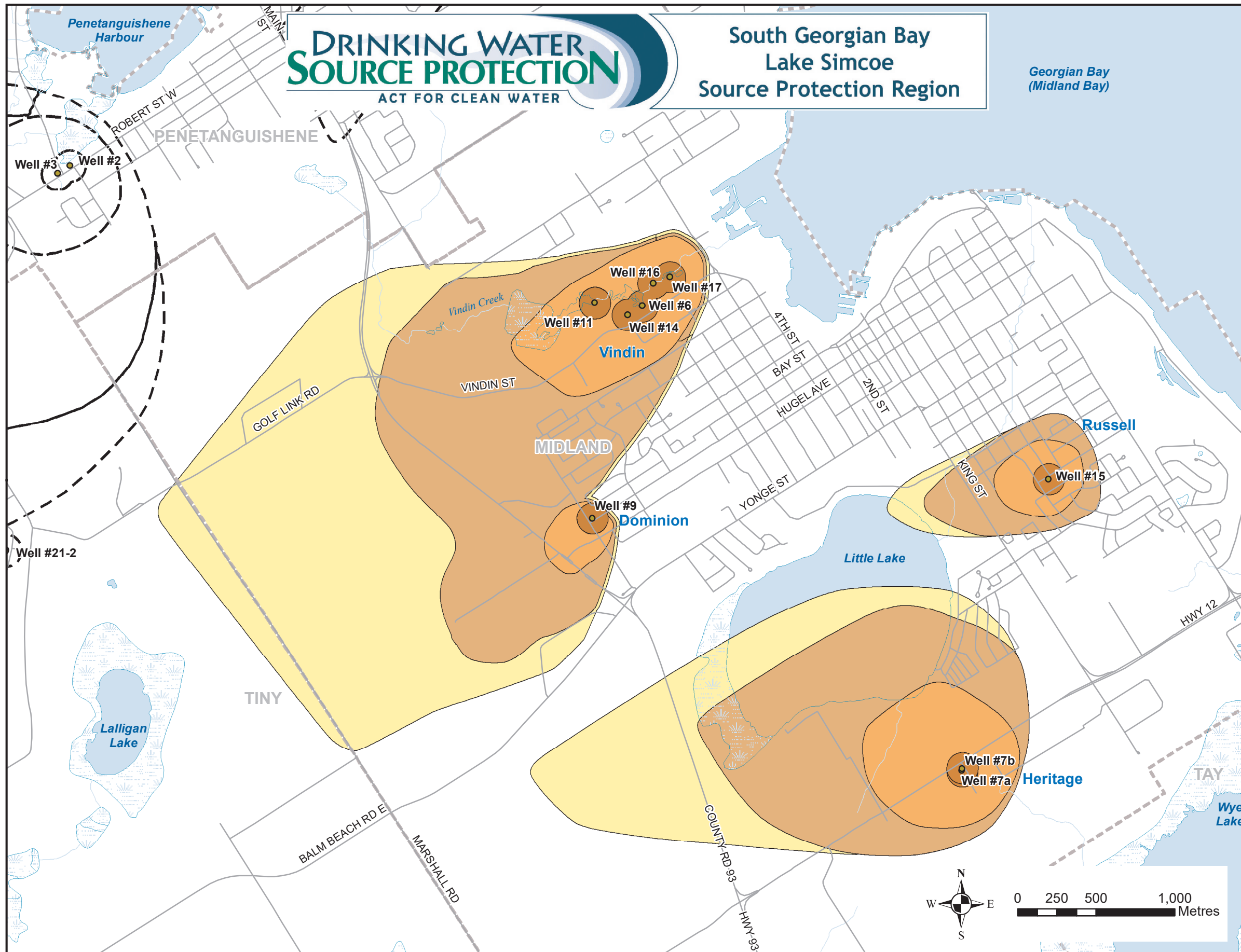
South Georgian Bay Lake Simcoe
Source Protection Region

LEGEND

- Municipal Wells
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

WELLHEAD PROTECTION AREA

- WHPA-A: 100 m RADIUS
- WHPA-B: 2-YEAR TIME-OF-TRAVEL
- WHPA-C1: 10-YEAR TIME-OF-TRAVEL
- WHPA-D: 25-YEAR TIME-OF-TRAVEL
- Adjacent Well Field WHPA



WSP GOLDER

DATE: DECEMBER 2022

SCALE: 1:25,000

Ontario

FIGURE
7a-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.

**WELLHEAD PROTECTION AREAS
TOWN OF MIDLAND
FINAL VULNERABILITY SCORING
(WHPA-E)**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

LEGEND

6.4 WHPA-E Vulnerability Score

• Municipal Wells

— Road

— Watercourse

Water Area, Permanent

Wetland, Permanent

Municipal Boundary

WELLHEAD PROTECTION AREA

WHPA-A: 100 m RADIUS

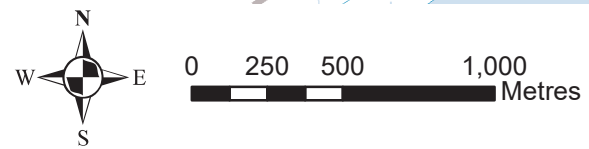
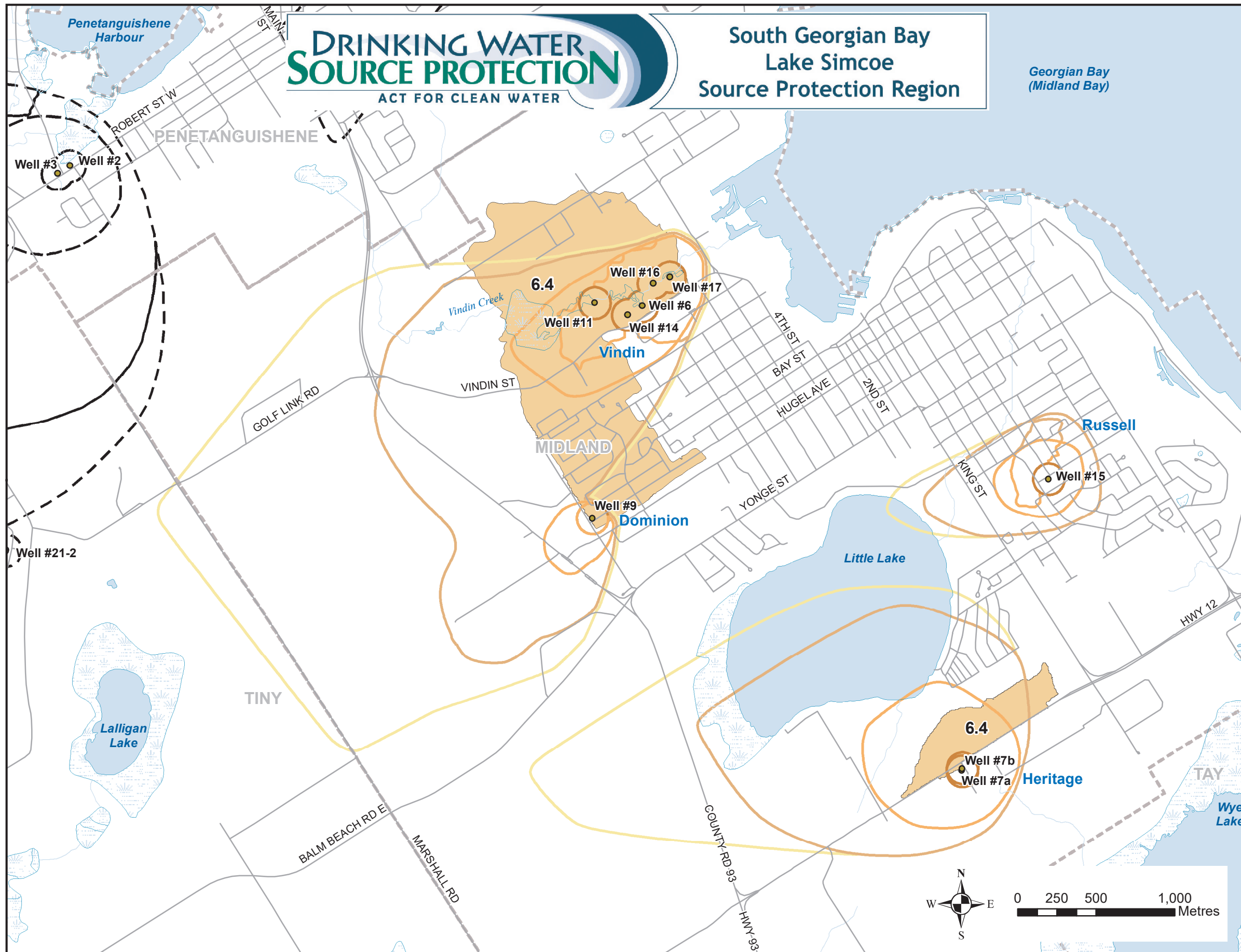
WHPA-B: 2-YEAR TIME-OF-TRAVEL

WHPA-C1: 10-YEAR TIME-OF-TRAVEL

WHPA-D: 25-YEAR TIME-OF-TRAVEL

WHPA-E:

Adjacent Well Field WHPA



DRINKING WATER SOURCE PROTECTION

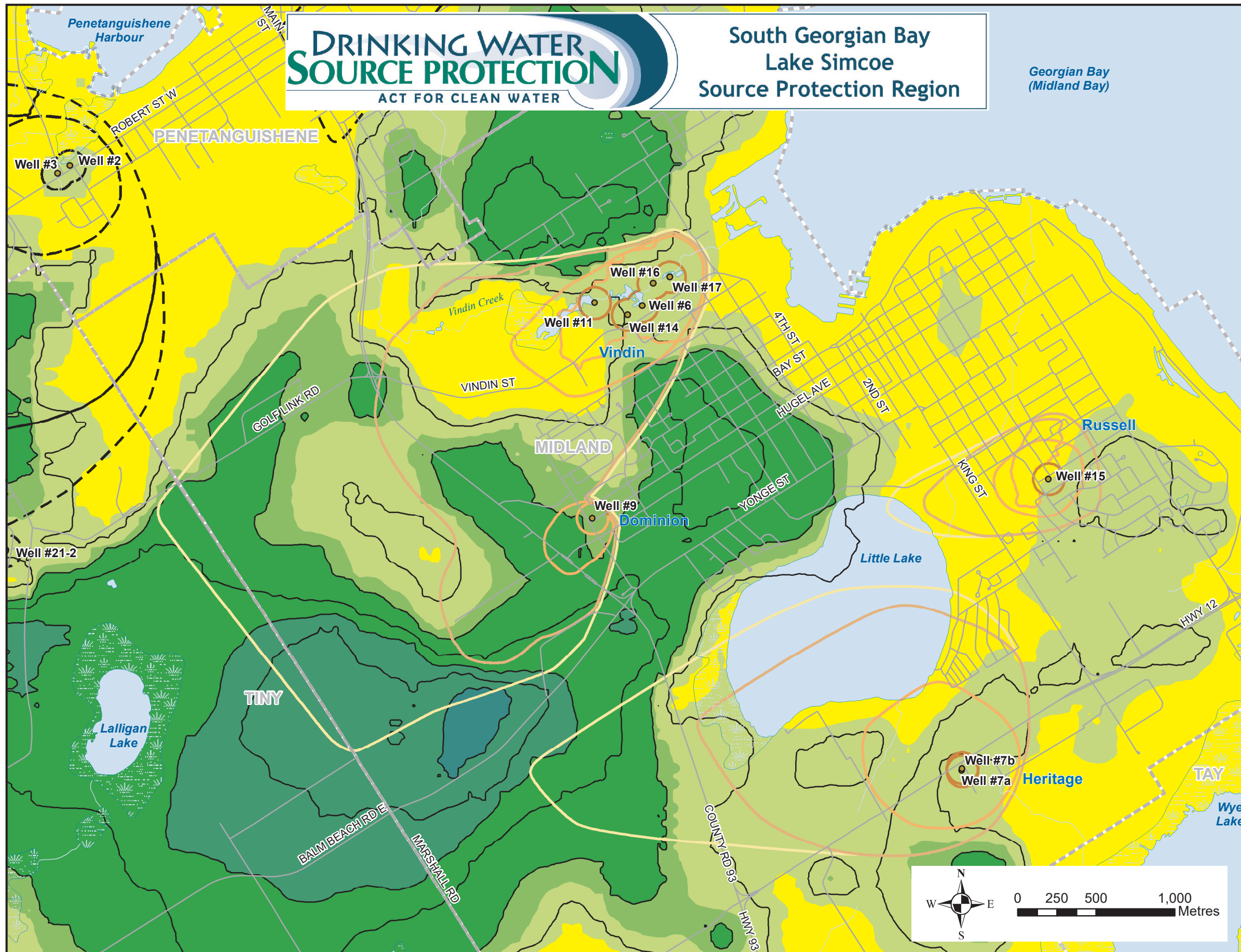
ACT FOR CLEAN WATER

South Georgian Bay Lake Simcoe Source Protection Region

TOWN OF MIDLAND MODEL CALCULATED AVI TO TOP OF AQUIFER A2

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region



LEGEND

- Municipal Wells
 - Road
 - Watercourse
 - Water Area, Permanent
 - Wetland, Permanent
 - Municipal Boundary
- | Model Calculated Aquifer Vulnerability Index (AVI) | |
|--|--|
| 0 - 30 | |
| 31 - 80 | |
| 81 - 100 | |
| 101 - 200 | |
| 201 - 300 | |
| 301 - 400 | |
| 401 - 500 | |
| 501 - 600 | |
| 601 - 700 | |
| 701 - 1300 | |
| Contour (50 AVI) | |
- WELLHEAD PROTECTION AREA**
- WHPA-A: 100 m RADIUS
 - WHPA-B: 2-YEAR TIME-OF-TRAVEL
 - WHPA-C1: 10-YEAR TIME-OF-TRAVEL
 - WHPA-D: 25-YEAR TIME-OF-TRAVEL
 - WHPA-E:
 - Adjacent Well
 - Field WHPA
- Notes:**
- Low Vulnerability (AVI > 80)
 - Medium Vulnerability (AVI 30 to 80)
 - High Vulnerability (AVI < 30)



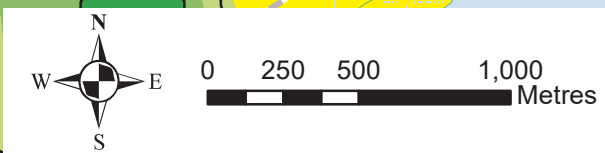
DATE: DECEMBER 2022

SCALE: 1:25,000



FIGURE
7a-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.



DRINKING WATER SOURCE PROTECTION

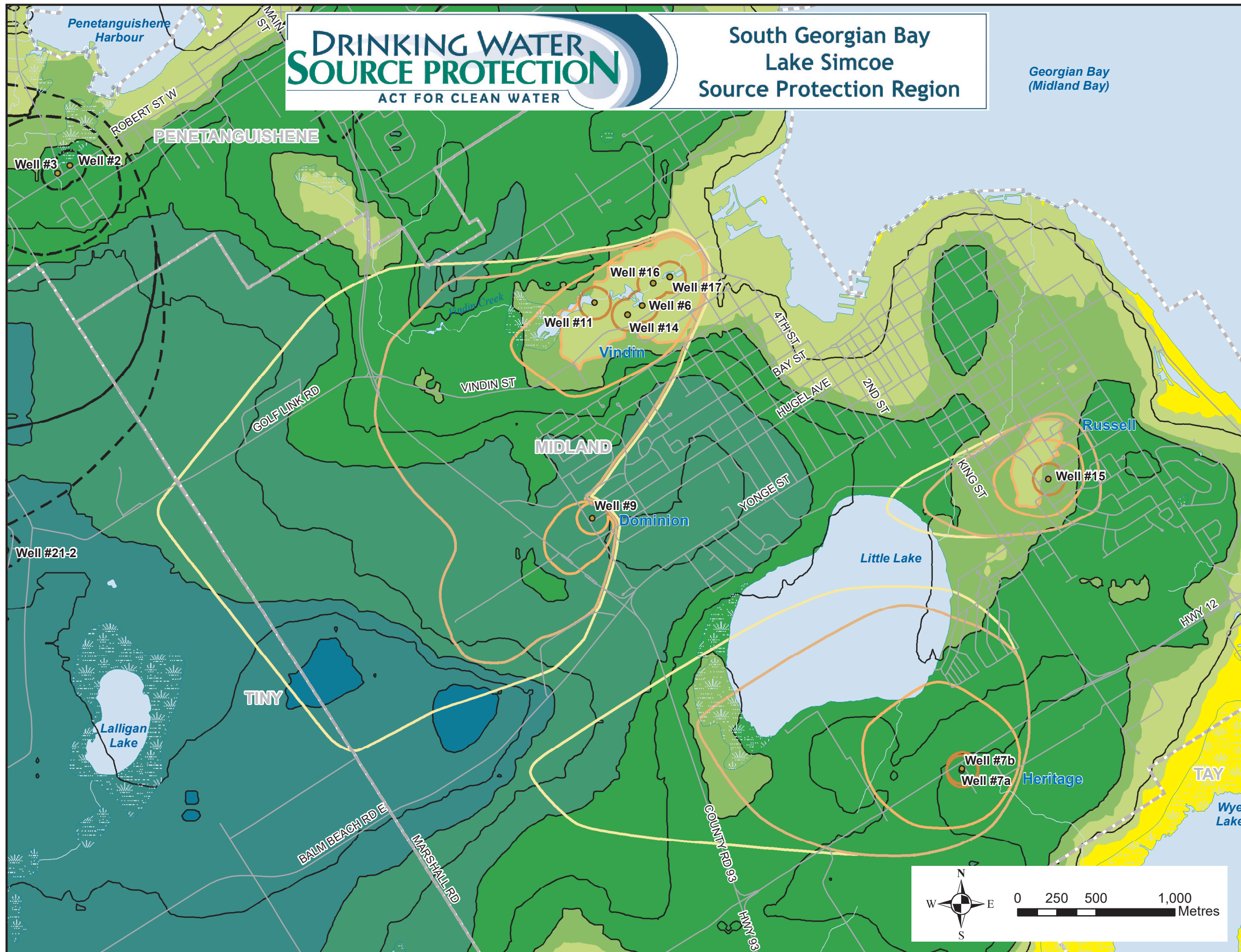
ACT FOR CLEAN WATER

South Georgian Bay Lake Simcoe Source Protection Region

TOWN OF MIDLAND MODEL CALCULATED AVI TO TOP OF AQUIFER A3

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region



LEGEND

- Municipal Wells
 - Road
 - Watercourse
 - Water Area, Permanent
 - Wetland, Permanent
 - Municipal Boundary
- WELLHEAD PROTECTION AREA**
- WHPA-A: 100 m RADIUS
 - WHPA-B: 2-YEAR TIME-OF-TRAVEL
 - WHPA-C1: 5-YEAR TIME-OF-TRAVEL
 - WHPA-D: 25-YEAR TIME-OF-TRAVEL
 - Adjacent Well Field WHPA
- Model Calculated Aquifer Vulnerability Index (AVI)**
- 0 - 30
 - 31 - 80
 - 81 - 100
 - 101 - 200
 - 201 - 300
 - 301 - 400
 - 401 - 500
 - 501 - 600
 - 601 - 700
 - 701 - 1300
 - Contour (50 AVI)
- Notes:
- Low Vulnerability (AVI > 80)
 - Medium Vulnerability (AVI 30 to 80)
 - High Vulnerability (AVI < 30)

WSP GOLDER

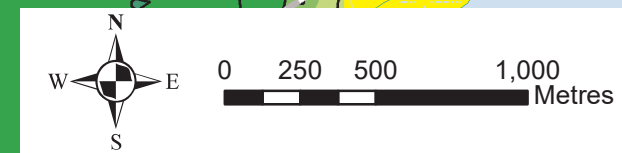
DATE: DECEMBER 2022

SCALE: 1:25,000

Ontario

FIGURE
7a-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.



**WELLHEAD PROTECTION AREAS
TOWN OF MIDLAND
FINAL VULNERABILITY SCORING**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

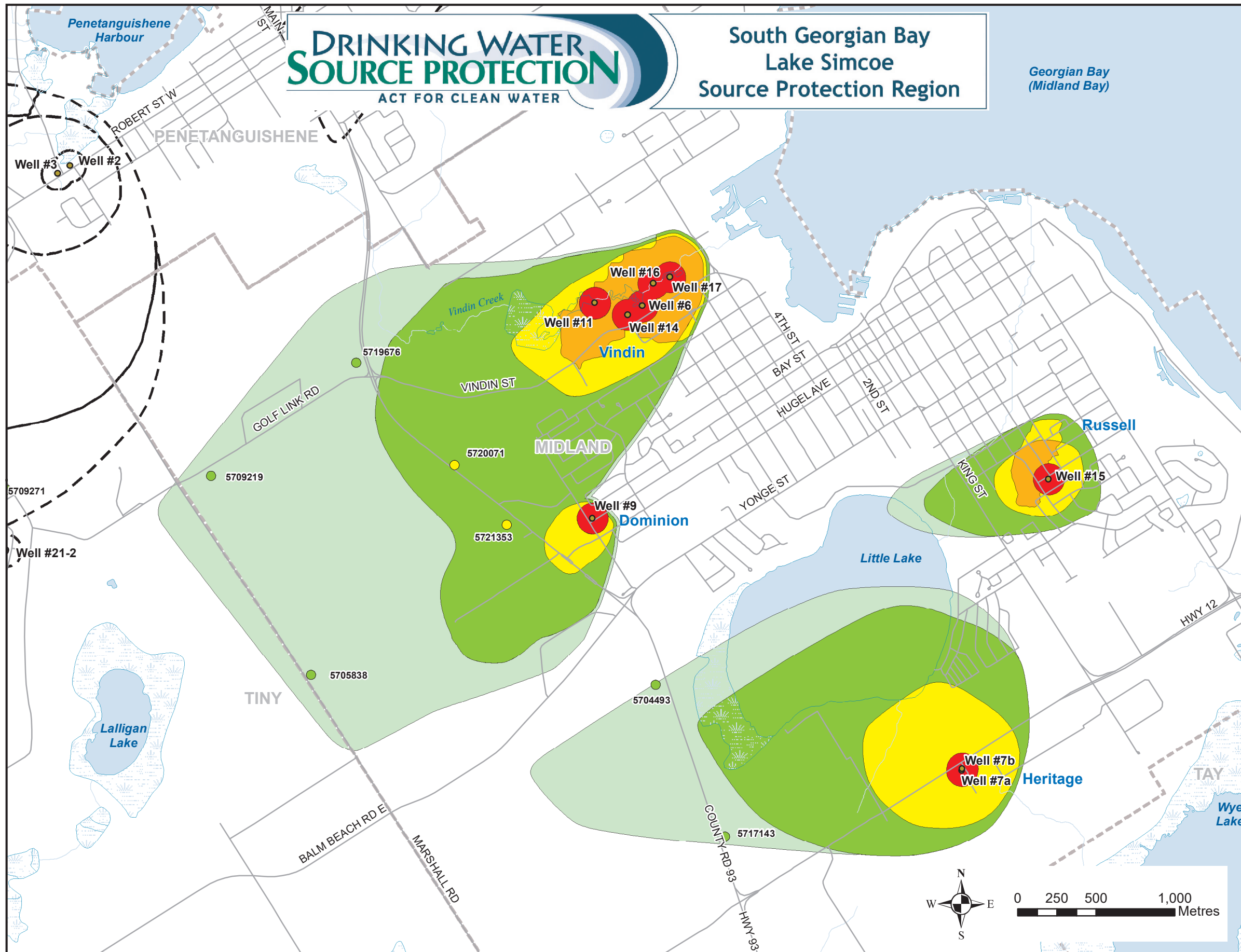
South Georgian Bay Lake Simcoe
Source Protection Region

LEGEND

- Municipal Wells
- 5705838 3C Well Pathway
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary

VULNERABILITY SCORE

- 10
- 8
- 6
- 4
- 2



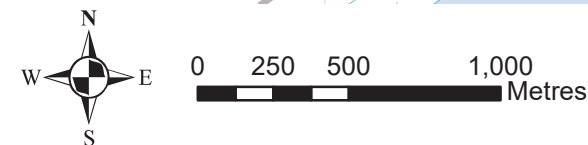
DATE: DECEMBER 2022

SCALE: 1:25,000



FIGURE
7a-5

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**TOWN OF MIDLAND
AREAS THAT ARE OR
WOULD BE SIGNIFICANT,
MODERATE OR LOW DRINKING
WATER THREATS:
ACTIVITIES PATHOGEN**

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

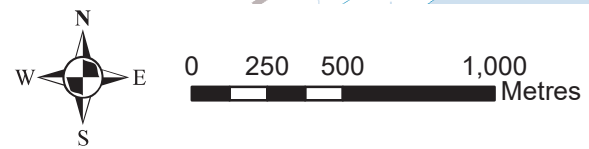
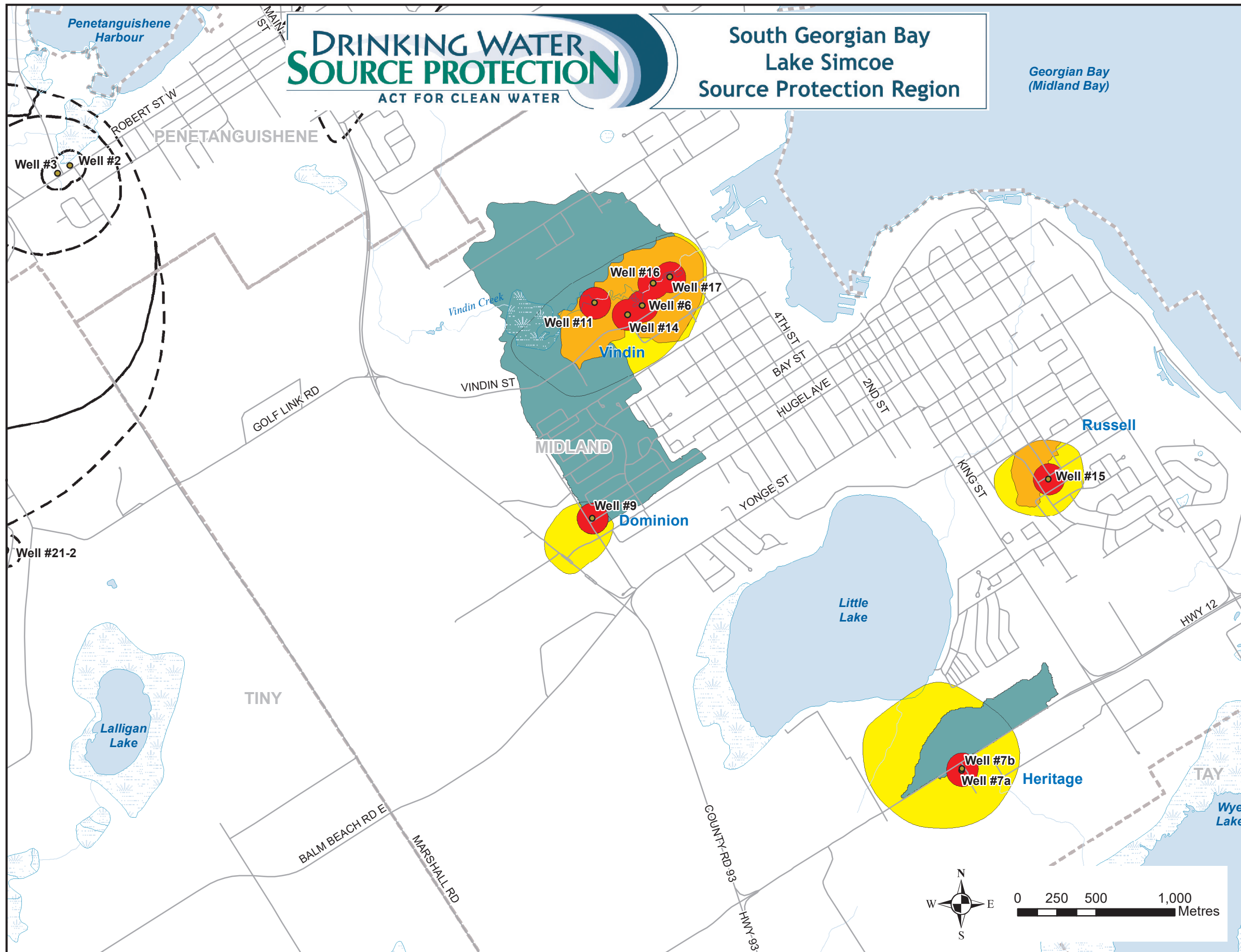
LEGEND

● Municipal Wells

VULNERABILITY SCORE

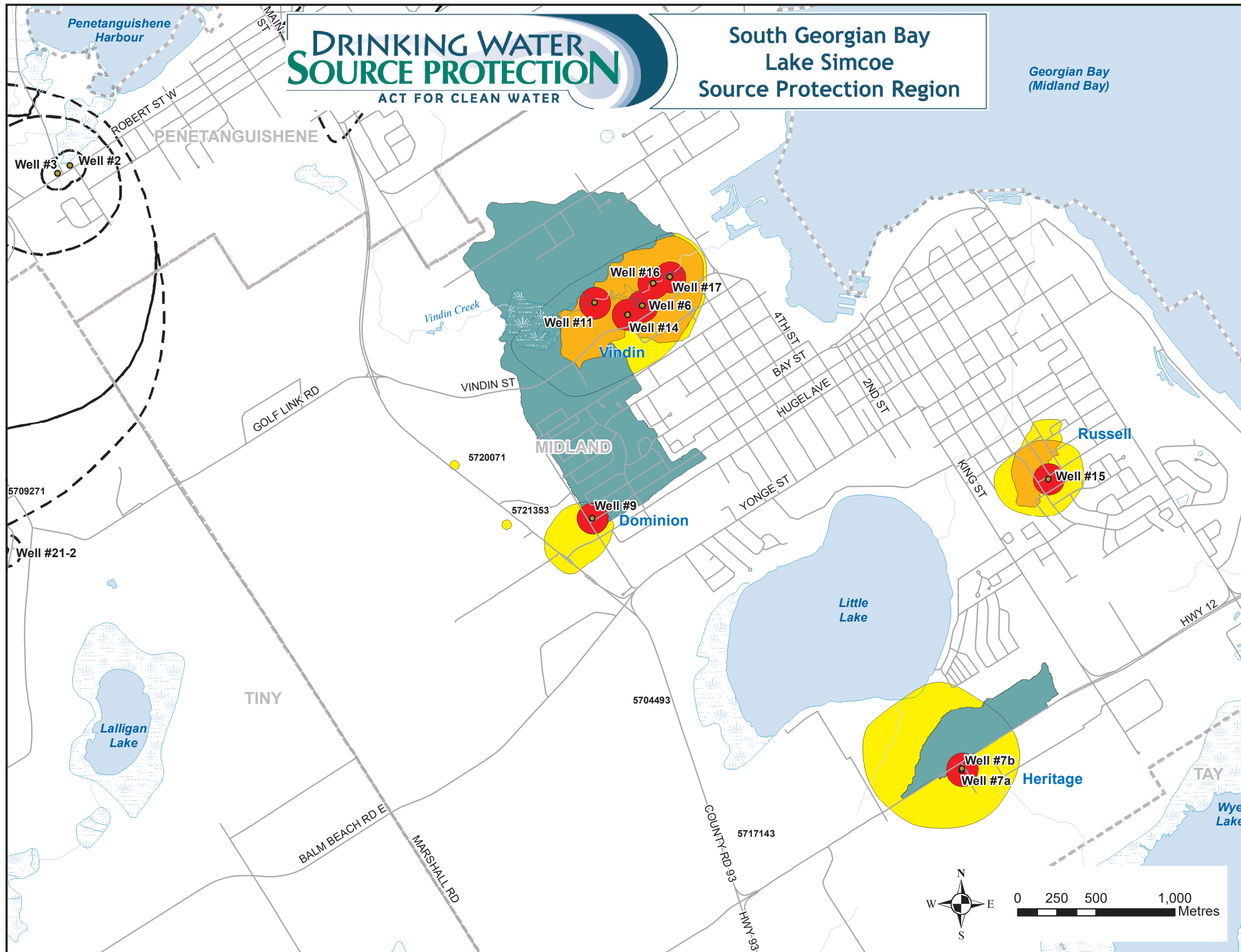
- 10
- 8
- 6.4
- 6

- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary
- Adjacent Well Field WHPA



**TOWN OF MIDLAND
AREAS THAT ARE OR
WOULD BE SIGNIFICANT,
MODERATE OR LOW DRINKING
WATER THREATS:
ACTIVITIES CHEMICAL**

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



LEGEND

● Municipal Wells

VULNERABILITY SCORE

- 10
- 8
- 6.4
- 6

— Road

— Watercourse

Water Area, Permanent

Wetland, Permanent

Municipal Boundary

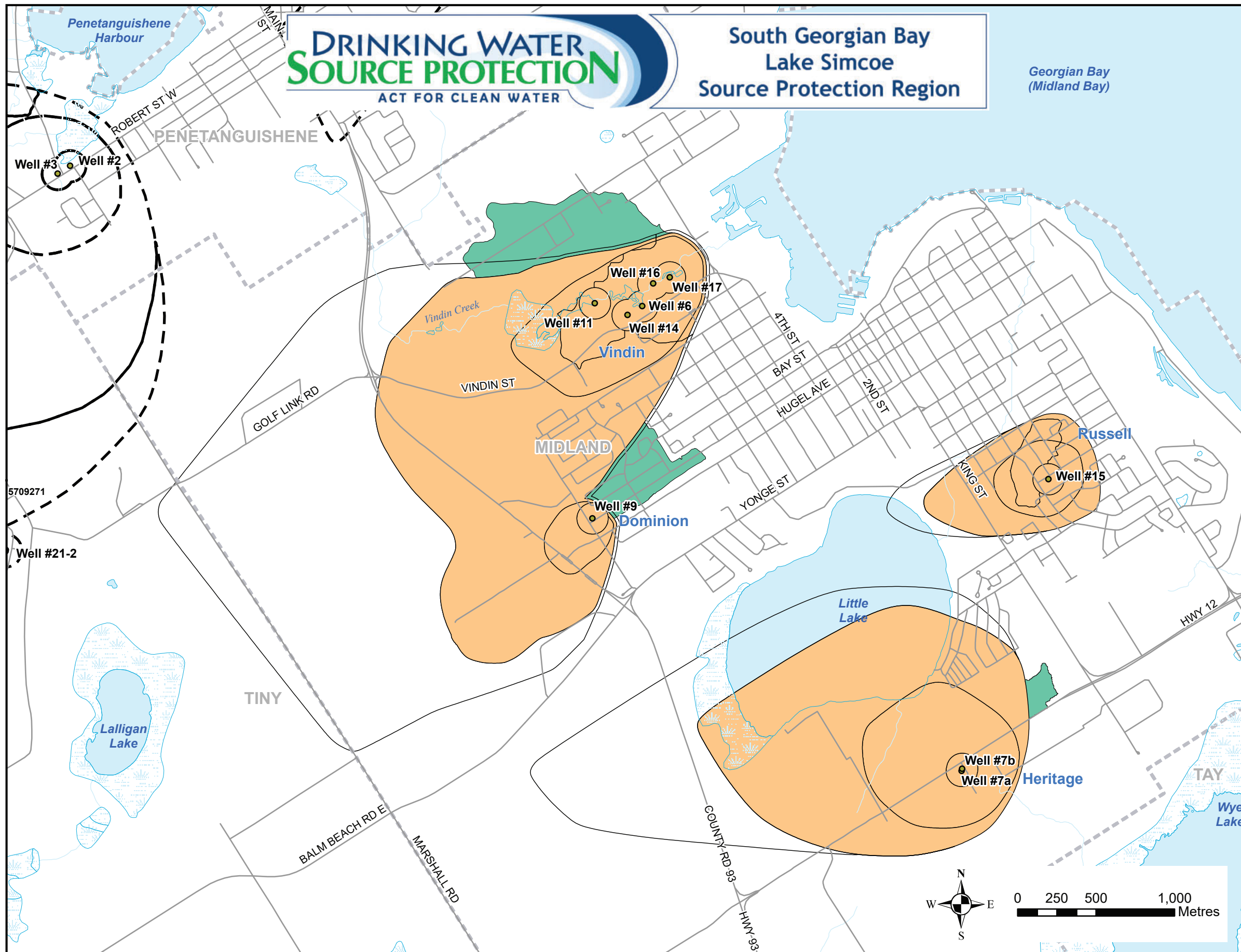
Adjacent Well Field WHPA



TOWN OF MIDLAND AREAS THAT ARE OR WOULD BE SIGNIFICANT, MODERATE OR LOW DRINKING WATER THREATS: ACTIVITIES DNAPLs

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe Source Protection Region



LEGEND

- Municipal Wells
- VULNERABILITY SCORE**
- WHPA A, B, C1
- WHPA D with Vulnerability ≥ 6
- WHPA E with Vulnerability ≥ 6.4
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- ⊖ Municipal Boundary
- ⊖ Adjacent Well Field WHPA



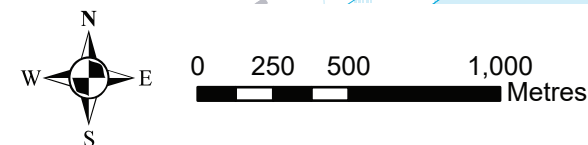
DATE: SEPTEMBER 2023

SCALE: 1:25,000



FIGURE
7a-8

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TOWN OF MIDLAND MANAGED LANDS

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

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

LEGEND

● Municipal Wells

PERCENT TOTAL MANAGED LANDS

Light Green = 40%

Medium Green = > 40% - 80%

Dark Green = 80%

— Road

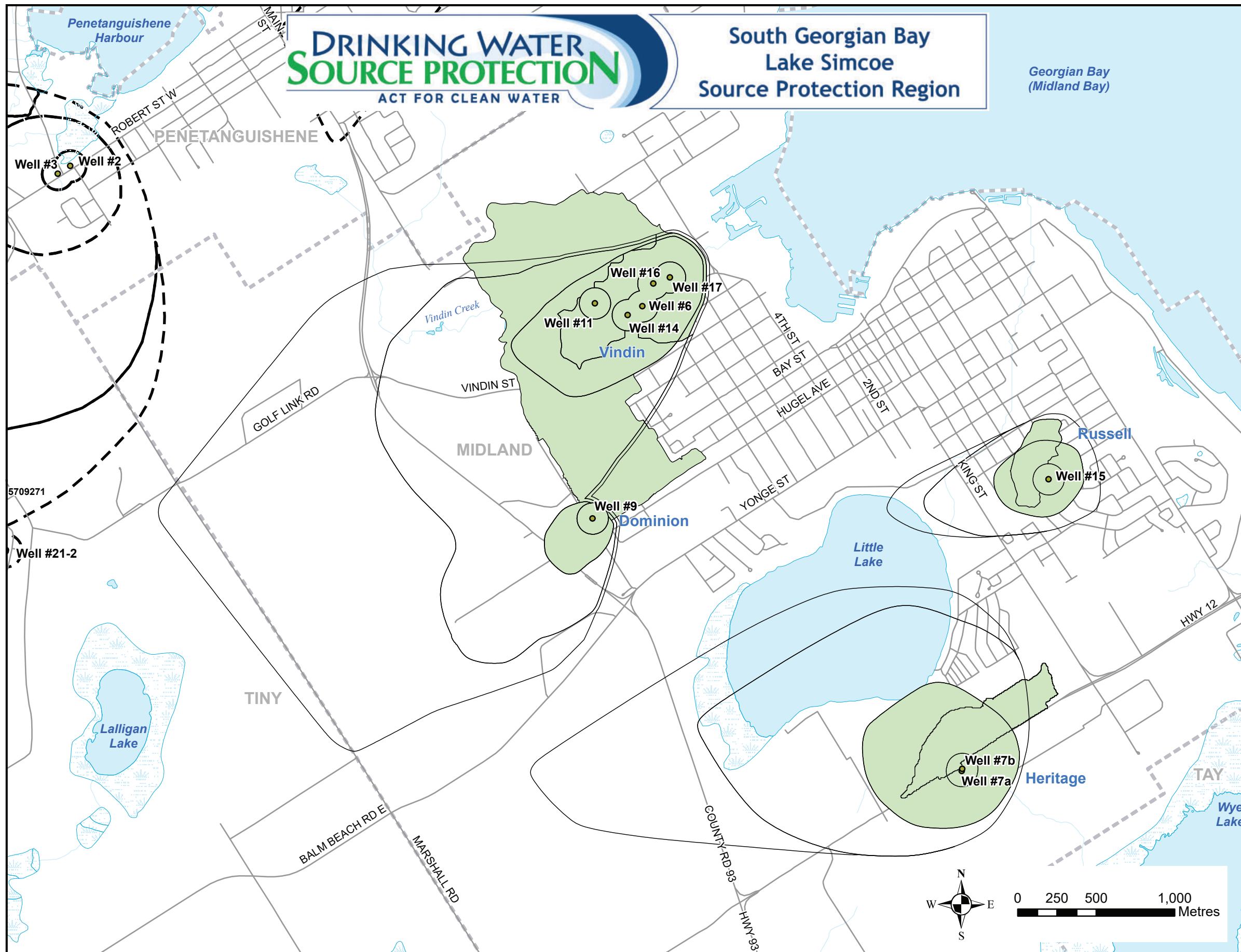
— Watercourse

Light Blue Area = Water Area, Permanent

Blue Area with Trees = Wetland, Permanent

Dashed Line = Municipal Boundary

Thick Dashed Line = Adjacent Well Field WHPA

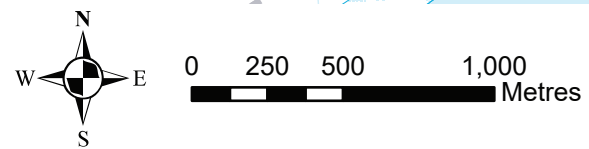


DATE: SEPTEMBER 2023

SCALE: 1:25,000



FIGURE
7a-9



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TOWN OF MIDLAND LIVESTOCK DENSITY

ASSESSMENT OF DRINKING WATER THREATS
SELECTED MUNICIPAL GROUNDWATER SUPPLIES

South Georgian Bay Lake Simcoe
Source Protection Region

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

LEGEND

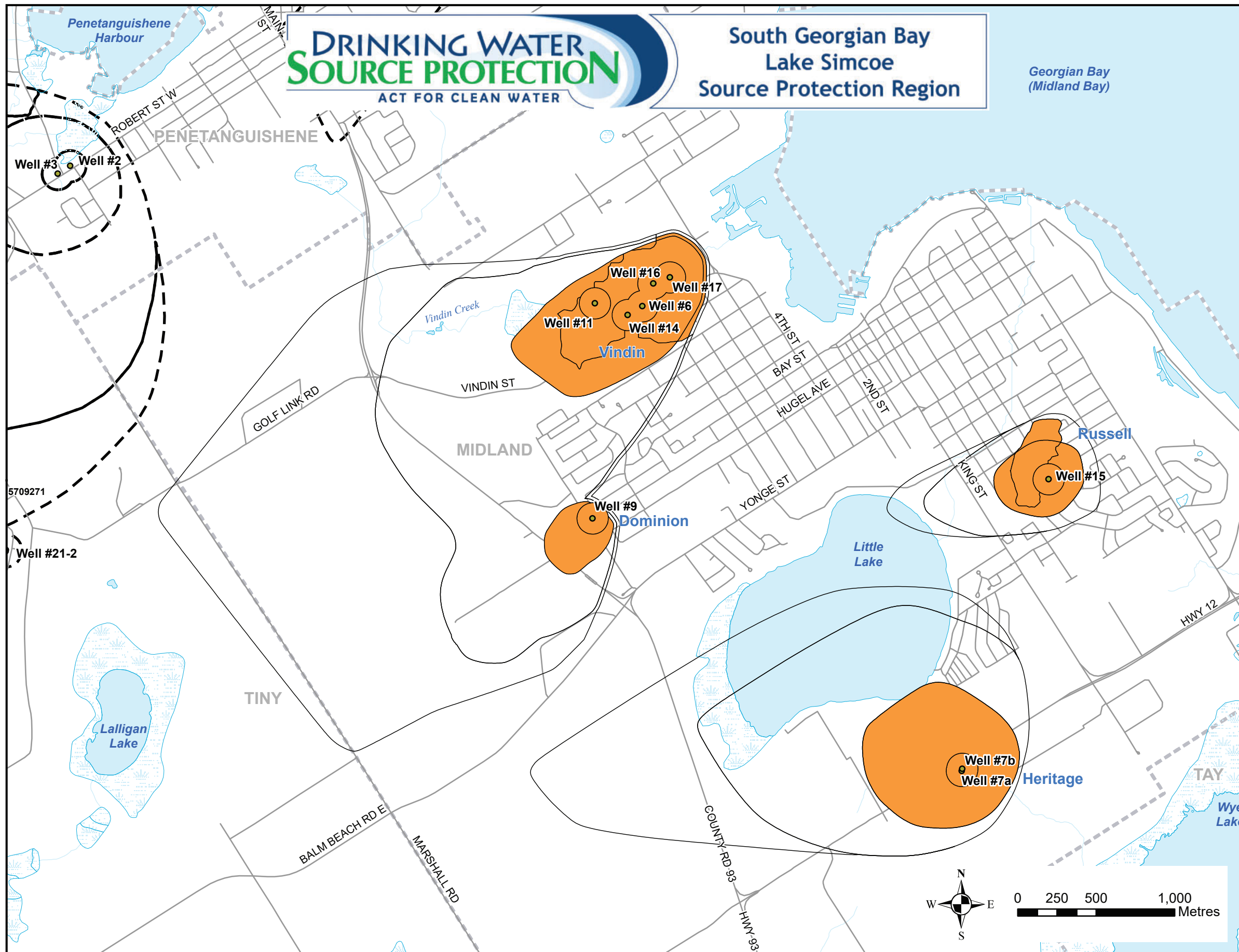
● Municipal Wells

LIVESTOCK DENSITY

Orange: ≤ 0.5 NU/AC*
Green: $> 0.5 - \leq 1.0$ NU/AC*
Blue: > 1.0 NU/AC*

*NUTRIENT UNITS/ ACRE

- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary
- Adjacent Well Field WHPA



TOWN OF MIDLAND IMPERVIOUS SURFACES

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

LEGEND

● Municipal Wells

IMPERVIOUS SURFACE

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

- WHPA Boundary
- Road
- Watercourse
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary
- Adjacent Well Field WHPA

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



DATE: AUGUST 2025

SCALE: 1:25,000



FIGURE
7a-11

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.

