

Chapter 11: Town of Collingwood

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11 Town of Collingwood

11.1 Introduction

This chapter contains information on one drinking water system for the Town of Collingwood.

~~Various consultants have completed the work presented, which has also been reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group or the Source Protection Committee. Various consultants have completed the work presented, all of which was reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group.~~

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 (Ministry of Environment (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 C) for a more in-depth description of the methods used, as well as the Glossary for any unfamiliar terms.

11.2 Drinking Water Systems

The Town of Collingwood operates surface water-based supplies in one (1) community and does not have any groundwater-based water supplies. As shown in Figure 11-1, the surface

water supply is within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR). While operating and servicing the Town of Collingwood, some water is pumped to parts of Alliston and the Township of New Tecumseth.

Collingwood municipal water supplies within the Nottawasaga Valley Source Protection Authority are:

- Collingwood (Raymond A. Barker) Water Treatment Plant

In addition, the Wellhead Protected Area (WHPA) from the Buckingham Woods Well supply slightly extends across from the Township of Clearview into the Town of Collingwood (Table 11-1). Information on this system can be found in Chapter 10 of this Assessment Report.

Table 11-1: WHPA that cross into the Town of Collingwood in the SGBLS SPR

Local Municipality that WHPA extends into	Municipality where wellhead is located	Name of Water Supply	Source Protection Region/Lead and Source Protection Authority (SPA)	Location where entire Assessment can be obtained
Town of Collingwood	Township of Clearview	Buckingham Woods	SGBLS SPR and Nottawasaga Valley SPA	This report (Chapter 10)

11.3 Collingwood Water Treatment Plant

The Collingwood (Raymond A. Barker Ultrafiltration Plant) Water Treatment Plant is located in Nottawasaga Bay, near the southern end of Georgian Bay, which is part of Lake Huron. The intake is located approximately 715 m offshore from the eastern part of the Town of Collingwood in a water depth of approximately 8.9 m. The intake structure is elevated approximately 3.0 m from the top of the pipe and capped at the top in order to create a horizontal inflow path. This horizontal inflow is desirable as it does not draw surface water down into the intake or bottom water upward and provides for fish protection. The pipe itself is 1,067 mm in diameter. The water treatment plant (WTP) has a rated capacity of 31,140 cubic metres per day (m³/d). The Collingwood Water Treatment Plant supplies the water needs of the Town of Collingwood and parts of Alliston and the Township of New Tecumseth.

A zebra mussel control system has been designed and will be constructed as part of the next water treatment plant upgrade and expansion. The treatment process includes microfiltration, ultrafiltration, and gas chlorination to maintain a chlorine residual in the treated water. A plant expansion is planned to add ultraviolet disinfection with the capability of adding oxidation to the treatment process.

Although the intake is located within Nottawasaga Bay, it is exposed to waves and currents generated over the full length of Georgian Bay (almost 200 km to the NNW). Winds from this direction can cause significant wave action, mixing in the water column, strong currents along the shore and over the shallows to the northwest (e.g. the Mary Ward Ledges). These conditions were also noted by the Chief Operator at the water treatment plant who has observed frazil ice conditions (a sign of turbulent mixing with very cold surface water reaching the intake) and periodic turbidity (following storms and spring runoff). The WTP is also under the influence of the Nottawasaga River, Pretty River, Batteaux River, and Black Ash Creek.

Ice conditions at the intake are quite dynamic and normally range from almost open water conditions until early February when a complete ice cover is often present until late March. There are some years, however, when the ice cover does not form completely at the intake and other years when there is no cover, or when cover is only in place for a week or two.

Intake Protection Zone (IPZ) IPZ-1 delineation for the Collingwood WTP was undertaken by the SGBLS SPR; the IPZ-2 delineation was completed by SNC-Lavalin, 2009, while the Vulnerability Scoring and Uncertainty Analysis were done by Baird (2010h). The Issues and Threats Assessment is based on the Genivar 2010a report.

IPZ-3 delineation and potential significant threats identification was undertaken by Genivar (identification of threats and spill scenarios), Baird (2011b) (event selection, tributary spill and final reporting), and SNC Lavalin (2011) (hydrodynamic and spill modelling).

11.3.1 Methods and Uncertainties

11.3.1.1 Surface Water Vulnerability

The Collingwood intake is classified as a Type A surface water intake (Rule 55; MOE, 2008a). For Type A intakes, three Intake Protection Zones (IPZ) can be delineated: the IPZ-1 is based on a fixed radius around the intake crib; the IPZ-2 acts as a secondary protection zone around the IPZ-1. If modelling demonstrates that a contaminant released during an extreme event is transported to the intake, and will lead to a deterioration of water for the use as a source of drinking water, then an IPZ-3 may also need to be delineated.

As the process of delineating and assessing Significant Threats for IPZ-1 and -2s, is very different from that for IPZ-3s, they are presented in two distinct subsections of this chapter.

11.3.1.2 Delineating IPZ-1 and IPZ-2

IPZ-1 was delineated by the SGBLS SPR according to the Technical Rules and as outlined in Chapter 5. The IPZ-1 was based on the 1 km radius and where the IPZ-1 intersects land, a setback on the land that is the greater of the Conservation Authority Regulation Limit or a 120 m setback measured from the high-water mark (HWM) [Rule 62 (1); MOE, 2009b].

It must be noted however that the definition of HWM used in this assessment differs to that provided by the Ministry of the Environment, [Conservation and Parks](#) (MECP) (MOE, 2009b). MOE (2009b) defines the HWM for water bodies where a long-term water level record exists, as the 80th percentile for the month within which the highest water level occurs, or where a long-term record of water levels does not exist, the level at which flood plains are flooded and leave a mark where natural vegetation changes from predominantly aquatic vegetation to terrestrial vegetation. The HWM in this study was based on the Ministry of Natural Resources and [Forestry](#) – Land Information Ontario (MNRF LIO) water polygon data layer, as insufficient data exists to define HWM according to the proposed MECP method. Analysis of shoreline properties within the IPZ-1 showed that the approach used to delineate HWM (i.e. MECP recommended, or that used in this study), would have little or no effect on the properties identified as being partially or wholly within the IPZ-1. For this reason, the method applied is considered equal to or better than the MECP recommended approach. Further information on the rationale for this approach is provided in Appendix E of the Baird (2010) report.

The IPZ-2 is defined based on the area that may contribute water to the intake where the time of travel to the intake is equal to or less than the time that is sufficient to allow the operator of the system to respond to an adverse condition in the quality of the surface water (Rule 65; MOE, 2008a). The two hour minimum response time was used for the Collingwood WTP, as the operator response time to shut-down the intake was 30 minutes upon receiving notification.

The IPZ-2 is comprised of four areas:

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

11.3.1.2.1 In-Lake IPZ-2 Delineation

In-Lake IPZ-2 delineation was completed by SNC-Lavalin, 2009. Delineation of a source water protection zone requires a rigorous analysis which includes the withdrawal zone for the intake itself and the regional circulation patterns. Circulation in a region is a complex function of bathymetry, meteorological conditions, river discharges, intake operations, and other similar factors. The process which was followed to study the combined effect of these aspects first involved the analysis of the currents at the intake point. Speeds and directions at that point were used to provide a preliminary estimate of the withdrawal zone and, hence, an estimate of the probable region of interest for more detailed modelling. This larger region was then simulated in the transient three-dimensional hydrodynamic model (GEMSS-SPM) to give a much more refined delineation of the source water protection zones.

Due to the typical extent of the region of interest at each intake and the high model grid resolutions, the Lagrangian method was adopted to increase computational efficiency. The time of travel for any contaminant to the intake was set at two hours and the target dilution of 1000 was adopted for defining contact with the intake. A cluster of 1000 particles were released at each individual model cell lying within the region of interest and a target number of one or more particles reaching the intake in two hours was defined as a potential threat for contamination. The flow in Georgian Bay is mostly wind driven which leads to surface velocities being higher than the layers below it. Because of this, the modeled particles were only released at the surface. Releasing the particles at the surface with higher velocities will result in a larger withdrawal zone (Intake Protection Zone) making the study conservative.

The near-field hydrodynamic and transport model suggested that the flow is mostly wind driven and affected by the local bathymetry. Near the shallow shoreline regions, the combined effect of wind and bathymetry normally results in along shore currents which are typically in the range of 5 to 20 centimeters per second (cm/s). The velocity attributable to the intake at Collingwood is small due to its shape, size, and flow rate (and would be ~2 cm/s at the immediate intake point based on average flow rate of 24,082 m³/d). The incremental velocities caused by inflow into the intake decrease very rapidly within metres of the intake structure and are, therefore, much smaller than the wind driven circulation very close to the intake. The wind driven flow thus overrides any withdrawal zone developed by the intake alone.

The preliminary analysis suggested that the critical extent of the withdrawal zone for a two-hour travel time is within 600 m of the intake, with the probability of contamination at the intake decreasing beyond this zone. The preliminary analysis also suggested that the zone will be elongated along the shore (northwest and southeast) when surface velocities are considered.

Direct Particle Modelling (DPM)

Using these estimates, the [DS](#)PM module was set up with a region of interest defined as an area extending about 2,000 m in northwest and southeast directions from the intake and about 500 m in the northeast and southwest directions. The time of travel criterion was set at two hours and the target number of particles to indicate travel time to the intake was chosen as greater than or equal to one (1) particle in 1000. The simulation was run for a period of four months to obtain the probability contour of the intake withdrawal zone.

Several other simulations were undertaken to determine the effect that strong offshore winds or strong winds from the west might have on the IPZ-2. The results are provided in Lavalin, 2009 and generally show that periodic storms have only a minor effect on the shape of the IPZ-2 at Collingwood.

Overall, the probability contour for target contamination of 0.1% is within the two-hour time of travel criterion. The withdrawal zone within approximately 500 m of the intake to the northwest and approximately 200 m to the southeast has a 25% probability of reaching the intake within two hours. Similarly, the lowest level of probability (0.1 % or 1 in 1000) extends over a distance of about 3 km (approximately 2 km to the west northwest and 1 km to the east southeast). Beyond these areas, it is not likely (< 0.1% chance) that lake water will contaminate the intake at a level of 0.1% (1 in 1000) within two hours based on the regional currents. It also suggests that the contamination level, if any, by the lake water beyond 3 km within two hours will be less than 0.1 % (1 in 1000). The high probability region (> 75% probability of intake

contamination) extends only about 100 m from the intake and it is oriented in all directions (with only a moderate alongshore bias to the northwest).

Reverse Particle Modelling

The same hydrodynamic modelling results were used in the reverse particle tracking modelling approach to define the lake portion of the IPZ-2. It should be noted that this reverse particle tracking modelling (RPM) is best suited for showing the likely outermost limits of particle/spill locations that may reach the intake. This approach also shows the time-of-travel to the intake from those locations.

Also, the RPM approach has been used to define the IPZ-2 in other Lake Simcoe Region studies (LSRCA) and has one advantage over the DPM approach. The advantage is that it produces simple time-of-travel (TOT) contours as compared to probability contours within a given time period (e.g. two hours). This contour mapping of the in-water TOT then enables one to extend the IPZ-2 into on-shore areas when the RPM contours include part of the shoreline before a two-hour travel time is reached.

The two-hour IPZ-2 withdraw zone from the RPM also shows that the IPZ-2 does not contact the shoreline. The IPZ-2 extends over a distance of approximately 2.6 km to the west northwest and 1.4 km to the east southeast. The area also extends approximately 1.0 km offshore from the intake and 550 m toward the shore. There is no contact with the shore in the two-hour IPZ-2. The results are similar to the direct particle modeling (DPM) in that the two-hour IPZ-2 for Collingwood does not include the mouths of the Pretty or Bateaux Rivers.

11.3.1.3 IPZ-1 and IPZ-2 Vulnerability Scores

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

$$B \times C$$

where,

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

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

The range of possible Vulnerability Scores can be found in Table 5-4, Section 5.3.2 of Chapter 5: Methods Overview.

11.3.1.3.1 Area Vulnerability Factor

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

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

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

The IPZ-2 base Area Vulnerability Factor, modifiers, and final Area Vulnerability Factor for the Collingwood WTP intake are listed in Table 11-2.

Table 11-2: Derivation of IPZ-2 Area Vulnerability Factor (B) for Collingwood WTP

Sub Watershed Closest to Intake	Base Area Vulnerability Factor	IPZ 2 Land-Water % modifier MOE Criteria Rule 92(1)	Drainage Density Modifier MOE Criteria Rule 92(1)	SCS Curve Number Modifier MOE Criteria Rule 92(2) & 92(3)	Land Use Modifier MOE Criteria Rule 92(2) & 92(3)	Relief/Length Ratio Modifier MOE Criteria Rule 92(2) & 92(3)	IPZ 2 Final Area Vulnerability Factor (B)
Blue Mountains	8	-1	-1	1	1	0	9

Notes to the table above:

1. The IPZ-2 Land Modifier and Drainage Density Modifier both reflect the ratio of water to land. The sum of these two modifiers cannot change the Area Vulnerability Factor by more than +/- 1
2. Drainage density = (Total Length of Streams) / (Subwatershed Area) Modifier: Within +/- 1 S.D. of mean = 0: >+1 S.D. of mean = +1: <-1 S.D. of mean = -1
3. Land-water modifier = Ratio of Land to Open water and Wetlands in Sub-zone. Within +/- 1 S.D. of mean = 0: >+1 S.D. of mean = +1: <-1 S.D. of mean = -1
4. Adjusted SCS Curve Number. Modifier: Within +/- 1 S.D. of mean = 0: >+1 S.D. of mean = +1: <-1 S.D. of mean = -1. Lake Couchiching CN is average of all other subwatersheds since no data was available
5. Land use: Natural/Forested = -1: Agricultural = 0: Urban/Developed = +1, coarsely interpreted from 1999 LandSat Imagery
6. Relief-Length Ratio = (Relief) / (Subwatershed Length). Modifier: Within +/- 1 S.D. of mean = 0: >+1 S.D. of mean = +1: <-1 S.D. of mean = -1
7. Combined modifier in group 92(1) cannot exceed +/-1; combined modifier in group 92(2) and 92(3) cannot exceed +/-2

11.3.1.3.2 Source Vulnerability Factor

A Source Vulnerability Factor (C) is assigned to each surface water intake (Rule 94; MOE, 2008a). Source Vulnerability for intakes within the SGBLS Source Protection Region was based on that developed by the Michigan Department of Environmental Quality (MDEQ). The first

three rows in Table 11-3 were taken directly from MDEQ (2004), while the bottom row lists the corresponding MOE Source Vulnerability Factors proposed for the Collingwood WTP. Source Vulnerability also needs to take into consideration any historical water quality concerns (Rule 95 (3)). A water quality concern for the purpose of this assessment was considered to be whether a Drinking Water Issue has been identified. If a drinking water issue is identified then the Source Vulnerability score could be increased up to 1.0 depending on the severity of the Issue. No Drinking Water Issues were identified for this intake, and therefore no further modification to the Source Vulnerability factor was applied.

Table 11--3: Intake Vulnerability Criteria based on Intake Distance from Shore and Depth (adapted from MDEQ, 2004)

Category	Nearshore- Shallow Water	Nearshore- Deep Water	Offshore- Shallow Water	Offshore- Deep Water
Parameters	< 300 m offshore < 6 m depth	< 300 m offshore > 6 m depth	> 300 m offshore < 6 m depth	> 300 m offshore > 6 m depth
Vulnerability (MDEQ)	High	High to Moderate	High to Moderate	Moderate
Recommended Factor (C) for Type A Intakes	0.7	0.6	0.6	0.5

Note to the table above:

1. Category, Parameters and Vulnerability are based on MDEQ (2004)

The Collingwood WTP intake is located approximately 715 m from shore at a water depth of 4.8m. A Source Vulnerability Factor (C) of 0.6 was therefore assigned based on the values presented in Table 11--3 (MDEQ, 2004).

11.3.1.4 IPZ-1 and IPZ-2 Uncertainty Assessment

This section summarizes some of the uncertainty identified by Baird (2010h) for the work they completed (assigning Vulnerability Scores). The entire discussion of uncertainties is presented in Baird 2010h, Appendix CW. This assessment was used by Baird (2010h) to assign Uncertainty Ratings of either “High” or “Low” for the Vulnerability Scores.

11.3.1.4.1 Data Quality and Gaps

Data gaps and data quality issues identified during the Vulnerability study (Baird, 2010h) included: intake locations and depths were provided by SGBLS SPR and are assumed to have been confirmed through review of all available data. Complete list of data quality and gaps listed in Baird, 2010h (Appendix CW). Further details on the data quality and gaps listed for the Collingwood intake are in Appendix CW, Baird 2010h.

11.3.1.4.2 Quality Assurance/Quality Control (QA/QC)

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

11.3.1.4.3 Area and Source Vulnerability Factors

The factors considered in assigning the area Vulnerability values include: the percentage of the area of the IPZ-2 that is composed of land; the land cover, soil type, and permeability of the land, and the slope of any setbacks; and the hydrological and hydrogeological conditions in the area that contributes water to the area through Transport Pathways. The only subwatershed characteristic that is relatively uncertain is the Soil Conservation Service (SCS) Curve No., which was estimated from datasets provided by the SGBLS SPR. The uncertainty arises from the fact that the SCS Curve No. is a relativistic estimate of the capability of an area for surface runoff generation, based primarily on land cover and soil hydrologic characterization. There is less uncertainty with the other sub-watershed characteristics (area, length, sum of stream lengths, land use, and relief) as they were measured directly from Geographic Information System (GIS) layers.

While there is a relatively low level of uncertainty associated with the datasets used to evaluate the Area Vulnerability Factor, there is a high degree of uncertainty in the methodology used to develop the Area Vulnerability Factor. The methodology developed by Baird is based on assigning a relative rating for each criterion in the rules. Other consultants have derived similar methodologies independently of Baird, but their exact choice of criteria, and the divisions between these, may vary.

The parameters considered in assigning the Source Vulnerability Factors were the distance of the intake from shore and the depth of water that it is located in. It is the consultants' (Baird)

understanding that these values have been confirmed based on engineering drawings and the client has indicated a Low level of Uncertainty for these values. A Threats and Issues Analysis was undertaken by Genivar, 2010a and based on the data reviewed, no Issues were identified. A Low level of Uncertainty has therefore been assigned to the Source Vulnerability Factors.

11.3.1.5 Modeled Threats and IPZ-3 Delineation

The methodology used for IPZ-3 delineation is consistent with the Technical Rules: Assessment Report, Clean Water Act, 2006, amended on November 16, 2009 (MOE, 2009a) and follows the general approach outlined in MOE's Technical Bulletin: Delineation of Intake Protection Zone 3 Using the Event Based Approach (EBA) dated July 2009 (MOE, 2009b). The steps used to identify potential Significant Threats and delineate IPZ-3 are:

- **Step 1 – Selection of extreme events for threat identification and IPZ-3 delineation:** Analysis of wind speeds and river flows is undertaken to develop an extreme event scenario with a joint probability (considering both wind and flow), of approximately a 1 in 100-year event (Section 11.3.1.5.1)
- **Step 2 – Identifying potential Significant Threats and assigning spill scenarios:** Identification of specific activities that may result in a contaminant being transported to the intake and deterioration of the water as a drinking water source. If an activity was considered to be a potential Significant Threat then spill scenarios were developed for the purposes of modelling transport to the intake (Section 11.3.1.5.2)
- **Step 3 – Lake and Tributary Spill Modelling:** Calculate the dilution and reduction in spill concentrations in tributaries between the spill location and the tributary mouth by analytical means. Calculation of the dilution and reduction in spill concentrations between the spill location or tributary mouths and the Collingwood intake (Section 11.3.1.5.3)
- **Step 4 – Significant Threat identification and IPZ-3 delineation:** Determining whether the spill constitutes a threat to the drinking water at the intake through comparison of modeled concentrations at the intake, with the Ontario Drinking Water Quality Standard (ODWQS). In this case, concentrations exceeding the ODQWS were typically considered to be a deterioration of the drinking water. If the identified activity is not within an existing IPZ (IPZ-1 or 2), then an IPZ-3 is delineated based on location of the Significant Threat activities (Section 11.3.1.5.4).

Identifying the extent of the IPZ-3 and the associated Significant Threats is an iterative process. Upon review of step 3 and 4 results, we revisited step 1 to ensure additional activities, which were excluded in the first round because they were unlikely to be a threat, were still not likely

to be a threat. If the new modeling results indicated that an additional activity should be considered, then we would proceed with steps 3 and 4.

11.3.1.5.1 Selection of Extreme Events for Model Runs

The Technical Rules define an extreme event to be used for the delineation of an IPZ-3 as a period of heavy precipitation or up to a 100-year storm event (wind); or a freshet.

The driving forces that would potentially transport a contaminant to the Collingwood intake are:

- wind on Georgian Bay – wind is the main force driving the circulation in the lake
- tributary flows –tributaries transport contaminants from the watershed and upstream to the lake, where they may then be transported to the intakes

A joint probability analysis (JPA) was undertaken to define the combined 100-year return period event considering the wind on Georgian Bay and flow in the tributaries.

Hourly wind speed data from Collingwood Airport from 1994 to 2010 and daily flow records at the Clarksburg gauge in the Beaver River from 1957 to 2008 were used for the JPA. The Beaver River was used for the JPA only, as it has been gauged since 1957 whereas the Pretty River has only been gauged since 2006 and the Batteaux River is not gauged. The data was analyzed to determine the mean, standard deviation, and extreme values for varying return periods. The logarithm of the discharge flow in the Beaver River was used in the analysis since a normal distribution of each variable is generally required for a joint probability analysis. A separate statistical analysis was completed on the Collingwood wind data to determine directional extreme wind speeds.

Using the statistical data, a joint probability analysis was performed to define the combinations of wind and tributary flow with a given return period. Many (infinite) combinations of wind and flow could be found for a given exceedance probability or return period. For this study, a surface which represents 100-year return period scenarios using the joint probability was produced.

Considering the mechanism by which a spill may be transported to the Collingwood intake, wind is the key factor. A spill occurring inland may be transported down a tributary to the lake under the full range of tributary flow conditions. Once it enters the lake, dilution increases due to the size of the water body. If there is not sufficient wind to drive the currents in the lake, the contaminant will not be transported to the intake. Baird 2011b (Appendix CW) provides detail of the wind-tributary flow event used for each spill scenario.

The following outlines the specific events used for the spills outlined in Section 11.3.1.5.2 and Table 11-4.

Scenarios 1 and 2 are spills in the Pretty River and Batteaux River. Mean daily flow, 1 year and 5-year return period flows were considered in the initial analysis (longitudinal dilution in tributaries) described in Baird, 2011b. The mean daily flow was selected for modeling with the GEMSS model in Georgian Bay (as described in 11.3.1.5.3), and a number of wind events were modeled. The peak wind speeds used in the analysis are all between the mean wind speed and a 1.5-year return period event. All of the events modeled have a combined return period of less than 1 in 100 years.

Scenario 3 is an overflow from the Waste Water Treatment Plant (WWTP) located in Collingwood Harbour. Currents must transport the spill to the harbour mouth and then in an easterly direction to reach the intake. A wind speed and direction return period of less than 0.5 years was used. A 20-year return period flow was used for all tributaries including Black Ash Creek, which empties into Collingwood Harbour, giving a combined return period of 100 years. The discharge from the WWTP was 63,000 m³/day (peak flow). The bypass (spill) volume and rate are listed in the following section. The results of Scenario 3 were used to estimate concentrations for Scenario 5, which is described in Section 11.3.1.5.2.

Scenario 4 is a spill from a marina located in White's Bay, northwest of Collingwood Harbour and the Collingwood intake. Wind is the driving force that would transport a spill to the intake in this case. An 85-year return period wind from the north was combined with average monthly flows in the tributaries. Four selected storms from the modeling period (May to August 2006) were factored to the 85-year return period wind speed from the northwest. The combined probability of these events is 1 in 100 years.

11.3.1.5.2 Assessment of Activities for Spill Modeling

For consistency, the process of identifying activities that may be a Significant Threat followed a similar process as that used for identifying threats in the IPZ-1. Available land use databases and map information were reviewed to identify locations within the catchment that may potentially release contaminants that could reach the intake. As a first step in this process, each land parcel within the contributing area around the intakes was assigned a "LandUseActivityName" consistent with the MOE Look-Up Table Database. A list of potential locations and activities was compiled and prioritized from this exercise. The first priority was to identify land use activities based on a hypothetical risk score. Each activity was assigned a hypothetical vulnerability score of ten (10) and this was multiplied by a hazard rating that was based on the factors such as the quantity and type of chemical present and how it is being

stored (above/below grade). Those activities with a risk score greater than 80 were further included in the initial list of potential threats.

(Note: the hypothetical vulnerability score of 10 was only used as a tool to assist in identification of potential Significant Threats to model. Following the Technical Rules, Vulnerability Scores cannot be used in process of assigning threats levels for Type A intake IPZ-3s).

Once an initial list of potential threats was established, a process of eliminating activities that were unlikely to be a Significant Threat was undertaken. Firstly, land parcels and activities were selected based on the relative distance from the surface water features. Activities within the Conservation Area Regulation Limit or 120 m of the surface water feature were given a higher priority. This list of land use activities was subsequently reviewed to assess the potential that a significant release of the identified chemical parameters could occur. As part of this review, staff from the Nottawasaga Valley Conservation Authority provided assistance through visual inspections and obtaining additional information on the presence of chemicals and the likelihood of release.

Through this process, fuel storage at marinas on Georgian Bay and the potential for a sewer bypass from the Collingwood Sewage Treatment Plant were identified as having the greatest likelihood of being a significant threat to the drinking water sources. These activities were proposed for further analysis using the modelling tools. Industrial land uses within the watershed were not considered to have potential to be a significant threat for release of contaminants to the surface water courses. These land uses were not considered further in the IPZ-3 analysis. A list of all activities considered and a justification as to why the activity was, or was not, considered for further investigation through modelling is provided in Baird 2011 (see Appendix CW).

It must also be noted that a fuel spill at intersections between major roadways and Pretty River and Batteaux River was also investigated as a potential threat. The results of this work are presented in Baird 2011b. While it was found that a fuel spill could be a potential Significant Threat to the intake, the Source Protection Committee has previously ruled that threats associated with transport corridors will not be included in the Assessment Report until a defensible consistent approach can be applied across the entire Source Protection Region. Until then, then SPC recommends engaging emergency management / first responders in communication efforts in locations where transport corridors may be a Significant Threat.

11.3.1.5.2.1 Spill Scenarios

Scenarios 1 and 2 are a tanker truck spill at road crossings with the Pretty and Batteaux Rivers. These spills occur on transport corridors and Director's approval would be required to consider them for IPZ-3 delineation. In each case, a 34,000 L truck carrying fuel (2% benzene) was evaluated. It was assumed that the tank was full and the entire load would spill. A spill was modeled where highway 124 crosses the Pretty River and where Side Road 36 crosses the Batteaux River. A spill scenario of a 6 cubic metre salt truck from a road crossing of the Pretty and Batteaux Rivers was also considered, however the analysis showed exceedances were unlikely and further analysis was discontinued.

Scenario 3 is a bypass at the Collingwood WWTP in Collingwood Harbour. The spill scenario was developed based on discussions with the WWTP operator. The discharge rate at the WWTP was 63,000 m³/day. The bypass spill consisted of 500 m³ of water with an *E. coli* concentration of 130,000 colony forming units per 100 millilitres (CFUs/100 mL). The spill occurred over a ten-minute period. The *E. coli* was treated as a conservative substance having no decay.

Scenario 4 is a release from a marina fuel tank in White's Bay. The contaminant of concern was benzene and the fuel contained 2% benzene, with maximum solubility in water of 10 milligrams per litre (mg/L). It was assumed that one third of the 25,000 L tank (8,300 L) would enter the water. The basis for using one third of the tank in the analysis is as follows:

1. the team was unable to confirm the tank size as the Technical Standards and Safety Authority (TSSA) database is sometimes not accurate and we were unable to confirm that tank size with the land owner during the winter, therefore a lesser amount was selected as a precaution since a lesser amount may be stored
2. it was considered unlikely that the full tank would spill prior to intervention
3. by using this lesser amount, smaller tanks may also be designated as Significant Threats, and the full tank size is automatically included. The simulated release occurred over a three-hour period

Scenario 5 is a release from a marina fuel tank in Collingwood Harbour. The contaminant of concern was benzene and the fuel contained 2% benzene, with maximum solubility in water of 10 mg/L. It was assumed that one third of the 25,000 L tank (8,300 L) would enter the water, for the same reasons listed under Scenario 4. This scenario was not modeled, but rather, concentrations at the intake were approximated based on the results from Scenario 3.

A summary of spill scenarios is provided in Table 11-4.

Table 11-4: Spill scenarios used to identify potential Significant Threats, and delineate IPZ-3

Scenario Number	Spill Scenario	Spill	Contaminant	Release Volume(m ³)	Contaminant Concentration	ODWQS (mg/L)
1	Tanker truck at Hwy 124 and Pretty River	Gasoline	Benzene	35	2% Benzene	0.005
2	Tanker truck at Side Rd. 36 and Batteaux River	Gasoline	Benzene	35	2% Benzene	0.005
3	Sewage by-pass at WWTP	Waste water	E. coli	500	1.3 x 10 ⁶ Counts/L	0 Counts/L
4	Marina 1 fuel tank rupture	Gasoline	Benzene	35	2% Benzene	0.005
5	Marina 2 fuel tank rupture	Gasoline	Benzene	35	2% Benzene	0.005

11.3.1.5.3 Lake and Tributary Spill Modelling

Tributary Modelling

Spill Scenarios 1 and 2 (see Table 11-5) are spills in tributaries that flow into Georgian Bay. An analytical approach using the methodologies outlined in MOE (2009b) was used to evaluate longitudinal dispersion as the spill was transported from the source to the mouth of the tributary. Concentrations were calculated for a range of flow conditions including mean daily flow, the 1-year flow and the 5-year flow. Results from mean daily flow resulted in the highest concentrations at the mouths of the tributaries, and these values were used for the lake spill modelling described below.

Lake Modelling

Assessing whether a spill scenario reached the intake at concentrations leading to deterioration in water quality was completed using the GEMSS 3-dimensional hydrodynamic model – this is the same model used for delineating the Collingwood IPZ-2. The modeling, completed by SNC-

Lavalin (2011) is summarized in Section 11.3.1.2.1. Additional information describing the model setup, calibration and validation is provided in SNC-Lavalin (2009) (Appendix CW). The spills defined in Section 11.3.1.5.2 were used as input to the GEMSS model. The model was run for event conditions described in Section 11.3.1.5.1.

Results of the lake spill modeling are summarized in Table 11-5.

Table 11-5: Peak Concentrations at Collingwood Intake for Spill Scenarios

Scenario Number	Spill Scenario	Contaminant	Spill Size (m ³)	Maximum Concentration at Intake Surface	Maximum Concentration at Intake Lakebed	ODWQS
1	Tanker truck at Hwy 124 and Pretty River	2% Benzene	35	0.004 mg/L	0.094 mg/L	0.005 mg/L
2	Tanker truck at Side Rd. 36 and Batteaux River	2% Benzene	35	0.071 mg/L	0.024 mg/L	0.005 mg/L
3	Sewage by-pass at WWTP	E. coli	500	3 CFU/100 mL	1.2 CFU /100 mL	0 CFU/100 mL
4	Marina in White's Bay fuel tank rupture	2% Benzene	8.3	0.003 mg/L	0.002 mg/L	0.005 mg/L
5	Marina in Collingwood Harbour fuel tank rupture	2% Benzene	8.3	> 0.005 mg/L	0.005 mg/L	0.005 mg/L

Note to Table Above:

1. Calculation of Scenario 5 "Maximum Concentration at Intake" (Surface and Lakebed) are based on model results from Scenario 3-

11.3.1.5.4 Significant Threat Identification and IPZ-3 Delineation

The analysis indicated that a fuel tank rupture at the marina in Collingwood Harbour (Scenario 5) would result in exceedances of the ODWQS for benzene at the intake. Similarly, the modeling predicted benzene concentrations close to the ODWQS as a result of the fuel tank rupture in White's Bay (Scenario 4). Considering the limited number of scenarios modeled and the level of uncertainty associated with the analysis (see Section 11.3.2.3 for Uncertainty Assessment), it is likely that a fuel spill could result in an exceedance of the ODWQS.

While the WWTP bypass scenario did result in levels of *E. coli* above the ODWQS (0 CFU/100 mL) it was not considered a potential Significant Threat. This is based on the following factors:

1. very low levels of *E. coli* modeled to reach the intake as a result of the bypass scenario
2. ambient levels of *E. coli* within Georgian Bay from a variety of sources already exceeding the ODWQS
3. the capacity of drinking water treatment plant to effectively remove high levels of *E. coli*

Although modeling was undertaken to evaluate spills from transport corridors (Spill Scenarios 1a and 2a), the SPC ruled out including transport corridors in the updated Assessment Report (defeated motion at September 2009 SPC meeting). Extension of the IPZ-3 to include transport corridors may be considered in the future.

The MOE memorandum (Nov. 15, 2010) directs that an IPZ-3 is to be delineated if a spill can be shown to result in deterioration of the water supply. For this purpose and in accordance with other aspects of the Technical Rules (i.e. Issues Evaluation), deterioration of the water supply is typically considered to be an exceedance of the ODWQS.

The final number of potential Significant Threats resulting from the spill modeling and the resulting IPZ-3 is presented in the following results Section (11.3.2).

11.3.1.6 IPZ-3 Uncertainty Assessment

An analysis of the uncertainty, characterized by “high” or “low” is required in respect of the delineation of surface water intake protection zones Rule 13 (MOE, 2009a). The factors to be considered in this analysis are listed in Rule 14 (MOE, 2009a):

1. Distribution, variability, quality and relevance of data
2. Ability of models to predict the processes
3. Quality assurance and quality control procedures applied
4. Extent and level of calibration and validation achieved for model used

Baird (2011b) details the main limitations and uncertainties associated with the work undertaken IPZ-3 delineation and threats identification for the Collingwood intake. Here we summarize a few key limitations identified in the Baird (2011b) report.

Data Quality and Gaps

- the MPAC and TSSA data were found to be not consistently up to date. These data bases were used to identify threats for spill modeling, as required for the IPZ-3 delineation. Ground truthing was undertaken to help improve the certainty of some activities
- tributary flow data were available for the Pretty River. The Batteaux River is not gauged and flows were developed from the Pretty River data. Flow return periods were based on a peak over threshold (POT) analysis of Environment Canada [and Climate Change](#) gauge data. Cross-section data were taken from the HEC-RAS model
- the in-water extent of the IPZ-3 was estimated based on the modeling. The precise route that a spill would take to reach the intake would vary with the events modeled

Model Limitations - Longitudinal Dispersion Analysis in Tributaries

The longitudinal dispersion analysis (LDA) provides a first-order estimate of the likely dispersion of a spill of a contaminant into a tributary channel, for the purposes of delineating the IPZ-3.

There are several sources of uncertainty associated with this approach including:

- the LDA assumes an instantaneous spill that is fully-mixed with the flow in the river
- the cross-section of the river is assumed to be constant throughout its course (a weighted mean approach was used in this analysis)
- the LDA uses the empirical equations outlined in the Technical Bulletin. These equations were developed for different regions with different watershed characteristics than the study area, and they are uncalibrated to the study area
- physical and chemical changes to the contaminant as it moves downstream were not considered
- the saturation concentration of benzene was assumed to be 10 mg/l where this value will vary in reality

Model Limitations - GEMSS

- a limited number of events (defined as up to the 100-year return period) were simulated based on time and budget. The selected events may not cover the full range of spills and plume dispersion that may occur in the lake. If different events were selected, the concentrations at the intakes would be different
- decay due to physical and chemical processes has not been considered in this analysis. This is a conservative approach
- it is important to recognize that modeling is a tool that has been used in this study to improve our understanding of the vulnerability of the intakes to specific activities

11.3.2 Results Collingwood Water Treatment Plant

11.3.2.1 Intake Protection Zones (IPZ)

The Intake Protection Zones for the Collingwood WTP are shown in Figure 11-1. IPZ-1 consists of a 1 km radius centered on the crib of the intake. The IPZ-2, shown in Figure 11a-1, extends over a distance of about 4 km (approximately 2.6 km to the west northwest and 1.4 km to the east southeast from the intake). The IPZ-2 does not extend to the shoreline or include the discharge of shoreline streams or rivers.

The IPZ-3 includes the area within Collingwood Harbour, White's Bay and Georgian Bay through which contaminants may be transported to the intake as required by Rule 68(1). According to Technical Rule 68(2) where the water body abuts land a setback on land is to extend to the greater of 120 m or the Conservation Authority Regulation Limit. However, rather than use the entire Conservation Authority Regulation Limit, only the wave uprush component of the Regulation Limit was applied. Restricting the IPZ-3 to the uprush is considered a more accurate representation of the IPZ-3 for the following reasons:

1. modeling was only completed for the lake only; no modeling was completed for the tributaries or Regulated Area
2. all activities within the larger regulated area and 120 m setback were considered to have spill scenarios (e.g. contaminant type and volume) that are not a potential significant threat to the quality of water at the intake

In other words, if the entire regulated limit was used, the on-land extent of the IPZ-3 would be much larger, including tributaries and their flood plains, where modeling has not demonstrated that a spill from these areas would result in an exceedance of the ODWQS at the intake. This modification of the IPZ-3 was undertaken in accordance with Technical Rule 15.1 with Directors approval provided in Appendix CW.

11.3.2.2 Intake Protection Zone (IPZ) Vulnerability Scores

The Vulnerability Factors and Scores for the IPZ-1 and IPZ-2 are summarized below in Table 11-6 and Figure 11a-1. IPZ-3s, using the event-based approach are not assigned a Vulnerability Score.

Table 11-6: Summary of Vulnerability Factors and Scores for Collingwood WTP Intake

IPZ	Area Vulnerability Factor (B)	Source Vulnerability Factor (C)	Vulnerability Score (V)
IPZ-1	10	0.6	6.0
IPZ-2	9	0.6	5.4

11.3.2.3 Uncertainty for IPZ Delineation and Vulnerability

The Technical Rules require that an Uncertainty Rating of either High or Low be assigned with each Vulnerable Area as outlined in Technical Rules 13-15 (Part I.4 – Uncertainty Analysis – Water Quality (MOE, 2008a)).

IPZ-1 and IPZ-2 Uncertainty

Based on the factors discussed above, Baird (2010h) recommended an IPZ delineation Uncertainty Rating for the IPZ-1 of Low. IPZ-2 delineation uncertainty as assigned by SNC Lavalin 2009, is Low. The Uncertainty Rating for the IPZ-1 and -2 Vulnerability Scores are all High (Table 11-7).

The IPZ-1 delineation was completed by others and reviewed by Baird. The SGBLS SPR has stated that there is a low level of uncertainty in the location of the intake and in the QA/QC. It is noted that the shoreline used in the delineation differs from the HWM defined in MOE (2009d). This is not expected to have a large impact on the IPZ-1 delineation. No modeling was required and the overall Uncertainty Rating for IPZ-1 delineation is therefore Low.

The Uncertainty Rating for the data used to define the Source Vulnerability Factor (offset from shore, depth, and history of water quality concerns) is High due to the limited data available to determine a history of water quality concerns. The Source Vulnerability Factor applies to both the IPZ-1 and the IPZ-2. The level of uncertainty for the Area Vulnerability Factor for the IPZ-1 is low, as it is defined in MOE (2009b) as 10. The level of uncertainty for the Area Vulnerability for the IPZ-2 is high. Although the IPZ-2 does not contact the shore, the Area Vulnerability Factor was derived using the characteristics of the nearest subwatershed. This is a conservative approach and alternative approaches could have been used. There is a High degree of uncertainty in the methodology used to develop the Area Vulnerability Factor. The Area Vulnerability Factor has therefore been assigned a High level of Uncertainty. The overall Uncertainty Rating for the Vulnerability Score is therefore High.

IPZ-3 Uncertainty

An assessment of the IPZ-3 delineation uncertainty was completed by Baird (2011b) (Appendix CW). Because of the multidisciplinary nature of the work being undertaken, uncertainty of other consultant tasks was also considered, this included threat identification by Genivar, and hydrodynamic modelling by SNC Lavalin (2011). Uncertainty analysis considered factors such as data quality and gaps, model limitations, QA/QC and model calibration/validation.

The overall Uncertainty for the IPZ-3 delineation was rated as High (see Table 11-7).

Although the IPZ-3 delineation received an overall High Uncertainty Rating, the methodologies used are consistent with the Technical Rules. The high rating reflects data limitations, as well as limitations of the modeling undertaken. It is noted that the modeling approach is consistent with the Technical Rules and the level of effort permitted based on schedule and budget. The intent of this work is to provide a better understanding of the vulnerability of the intake and this has been accomplished.

Table 11--7: Summary of Uncertainty Ratings for Collingwood WTP Intake IPZs and Vulnerability Scores

IPZ	Uncertainty for IPZ Delineation	Uncertainty for Vulnerability Scores
IPZ 1	Low	High
IPZ 2	Low	High
IPZ 3	High	n/a

11.3.3 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)(a-b)). However, a parameter may not be considered an Issue in cases where it is naturally occurring or effective treatment is in place.

Available data describing raw water quality and treated water quality for the Collingwood WTP has been reviewed to identify Drinking Water Issues that are considered likely to result in a deterioration of the quality of water for use as a source of drinking water. Details of the Drinking Water Issues Evaluation for the Town of Collingwood are provided in Technical Memorandum F1 – Drinking Water Issues Evaluation – Collingwood (Appendix CW).

No Drinking Water Issues were identified for the Collingwood Water Treatment Plant.

The occasional presence of coliform and *E. coli* bacteria in raw water from Georgian Bay is not considered to represent a specific Drinking Water Issue as these parameters are being treated effectively and in accordance with Safe Drinking Water Act regulations. Aesthetic/operational parameters that exceed guidelines include hardness which is likely to be naturally-occurring. Various organic parameters, some of which are related to pesticides/herbicides or industrial uses, are present in trace concentrations that are well below Ontario Drinking Water Quality Standards (ODWQS) values and do not display increasing trends. Trihalomethanes and other related organic parameters are present in trace concentrations as byproducts of disinfection by chlorination. Concentrations are typically well below ODWQS values and do not display increasing trends.

11.3.4 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Collingwood WTP was completed in accordance with the detailed methodology presented in Technical Memo – A5 (Appendix MO) and using the event-based modeling approach specified in Technical Rule 130. 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 Collingwood WTP builds on the information from the Vulnerability Analysis and Issues Evaluation and includes the 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
- an enumeration of Drinking Water Threats

11.3.4.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for Collingwood WTP 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.

11.3.4.2 List of Drinking Water Threats – Conditions

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

- 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 IPZs
- 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 with staff from the Town of Collingwood to identify potential Conditions within the identified IPZs for the drinking water supply

No confirmed Conditions have been identified for the Collingwood WTP. No potential Conditions have been identified for consideration at this time.

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

The areas where Activities are or would be Drinking Water Threats within IPZ-1 and IPZ-3 are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps [combined with the table of Drinking Water Threats Technical Rules threat circumstances can be used to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores.](#) ~~include references to a series of tables prepared by MOE to correlate activities that are or would be Drinking Water Threats with the Vulnerability Scores.~~

The ~~circumstances tables~~ can be found at ~~the~~ <https://threats.swpip.ca/> ~~https://swpip.ca/~~ <https://swpip.ca/> ~~Government of Ontario's Drinking Water Threats and Circumstances.~~

11.3.4.3.1 Pathogen Parameters

The ~~MECP table of Drinking Water Threats Technical Rules Key Table on Figure 11a-2~~ can be used in conjunction with the Vulnerability Scores to identify the areas where Activities associated with pathogen Threats are or would be Moderate or Low Drinking Water Threats for the water supply to the Collingwood WTP (~~Figure 11a-2~~). Activities cannot be classified as Significant Drinking Threats where the Vulnerability Score of the IPZ is equal to or less than six (6).

11.3.4.3.2 Chemical Parameters

The ~~MECP table of Drinking Water Threats Technical Rules Key Table on Figure 11a-3~~ can be used in conjunction with the Vulnerability Scores to identify the areas where Activities associated with chemical Threats are or would be Moderate or Low Drinking Water Threats for the water supply to the Collingwood WTP (~~Figure 11a-3~~). Activities cannot be classified as Significant Drinking Threats where the Vulnerability Score of the IPZ is equal to or less than 6.

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

Further to Section 11.3.4.2, no Conditions have been confirmed within the WHPA for the Collingwood WTP. Any Conditions that may be present would not be considered to be Significant Drinking Water Threats due to the assigned Vulnerability Score.

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 11a-1 illustrates the Vulnerability Score map for Collingwood WTP that can be used to determine where a Condition is or would be a Significant, Moderate, or Low Threat to Drinking Water.

11.3.4.5 Identifying threats and circumstances that could be a Significant Threat within the IPZ-3

According to the Technical Rules, activities with circumstances the same as those used to delineate the IPZ-3 need to be identified in the Assessment Report. The purpose of this table is to highlight what future potential activities may be a Significant Threat to the quality of drinking water based on the delineated IPZ-3 and the associated modelling. Table 11-8-The Technical Rules lists the threats and circumstances that are or would be identified as a Significant Threat within the IPZ-3, such as the handling and storage of fuel. (Note that the Circumstance numbers were determined from information provided within the MOE Table of Drinking Water Threats (November 2009)).

Table 11-8: Circumstances that are or could be a potential significant threat for the handling and storage of fuel within the Collingwood IPZ-3

Circumstance Numbers in MOE Table of Drinking Water Threats
172-173
175-178
180-183
185-188
190-191

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Circumstance Numbers in MOE Table of Drinking Water Threats
1379-1380
1382-1385
1387-1390
1392-1395
1397-1400
1402-1405
1407-1408

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Note to the table above:

1. The circumstance numbers correspond with information contained within the MOE Table of Drinking Water Threats (November 2009). Numbers in table refer to the circumstances found in the Table of Drinking Water Threats (MOE 2009).

11.3.4.6 Enumerating Drinking Water Threats

11.3.4.6

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Threats associated with IPZ-1 and IPZ-2

The number of Significant Drinking Water Threats for the Collingwood WTP has been determined using the methodology outlined in Technical Memorandum A5 (Appendix MO).

There are no Significant Threats associated with Conditions or Drinking Water Issues.

No activities that are potential Significant Drinking Water Threats were identified for the Collingwood WTP within the IPPZ-1 and IPZ-2. Potential Significant Threats to Drinking Water are only assigned where Vulnerability Scores are 8 or greater.

Threats associated with IPZ-3 (modeled threats)

Two (2) potential Significant Threat activities were identified on two (2) properties through modelling approaches. These activities were identified as being a potential Significant Threat for the handling and storage of fuel. No Conditions were identified in the IPZ-3. Number of

threats for Collingwood Surface Water intake is summarized in Table 11-9. Location of the potential significant threats is presented in Figure 11a-7.

Table 11-89: Number of Significant Drinking Water Threats for the Collingwood WTP

Threat Number	Threat	Significant Threat Counts	
		IPZ1, IPZ2	Modelled (IPZ3)
1	The establishment, operation or maintenance of a waste disposal site within the meaning of Part V or the Environmental Protection Act	0	0
2	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage	0	0
3	The application of agricultural source material to land	0	0
4	The storage of agricultural source material to land	0	0
5	The management of agricultural source material	0	0
6	The application of non-agricultural source material to land	0	0
7	The handling and storage of non-agricultural source material	0	0
8	The application of commercial fertilizer to land	0	0
9	The handling and storage of commercial fertilizer to land	0	0
10	The application of pesticide to land	0	0
11	The handling and storage of pesticide	0	0
12	The application of road salt	0	0

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Threat Number	Threat	Significant Threat Counts IPZ1, IPZ2	Significant Threat Counts Modelled (IPZ3)
13	The handling and storage of road salt	0	0
14	The storage of snow	0	0
15	The handling and storage of fuel	0	2
16	The handling and storage of dense non-aqueous phase liquid	0	0
17	The handling and storage of an organic solvent	0	0
18	The management of runoff that contains chemicals used in the de-icing of aircraft	0	0
21	The use of land as livestock grazing or pasturing land, and outdoor confinement area, or a farm-animal yard	0	0
22	The establishment and operation of a liquid hydrocarbon pipeline. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0	0
-	Total Number	0 significant threats	2 significant threats (on 2 properties)

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Note for the table above:

1. The number of parcels identified will typically be less than the number of significant threats as multiple threats can be observed per parcel

11.3.4.7 Managed Lands

Technical Rule 16(9) ~~(August 2009)~~ requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area,

including IPZ-1 and -2. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a threat in [Part XII of the Technical Rules \(December 2021\)](#), [the Table of Drinking Water Threats](#).

Managed Lands were identified and the Managed Lands proportions were determined for IPZ-1 for the Collingwood WTP as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.4.6). 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 11a-4 illustrates the proportion of Managed Lands within the delineated IPZ-1 for the Collingwood WTP. In accordance with the Technical Rules, maps of Managed Lands have not been generated for the IPZ-3 as there is no associated Vulnerability Score.

11.3.4.8 Livestock Density

Technical Rule 16(10) (~~August 2009~~) requires the Assessment Report to include maps showing the Livestock Density within including IPZ-1 and -2. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in [Part XII of the Technical Rules \(December 2021\)](#), [the Table of Drinking Water Threats](#).

The Livestock Density was determined for IPZ-1 for the Collingwood WTP as outlined in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.4.6). Nutrient Units per farm are used in the identification of Threat activities associated with the storage of Agricultural Source Material and the grazing and/or confinement of livestock.

Figure 11a-5 illustrates the Livestock Density within the delineated IPZ-1 for the Collingwood WTP. In accordance with the Technical Rules, Livestock Density has not been mapped within the IPZ-3 as there is no associated Vulnerability Score.

11.3.4.9 Impervious Surfaces

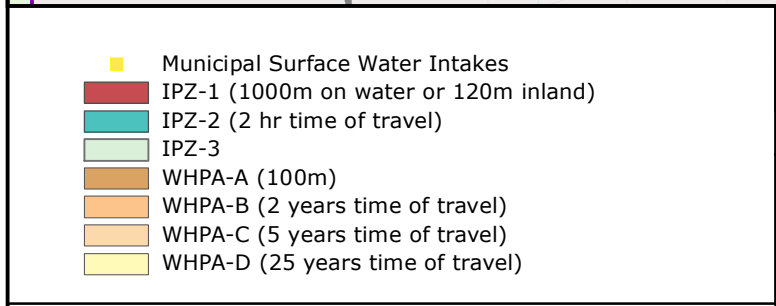
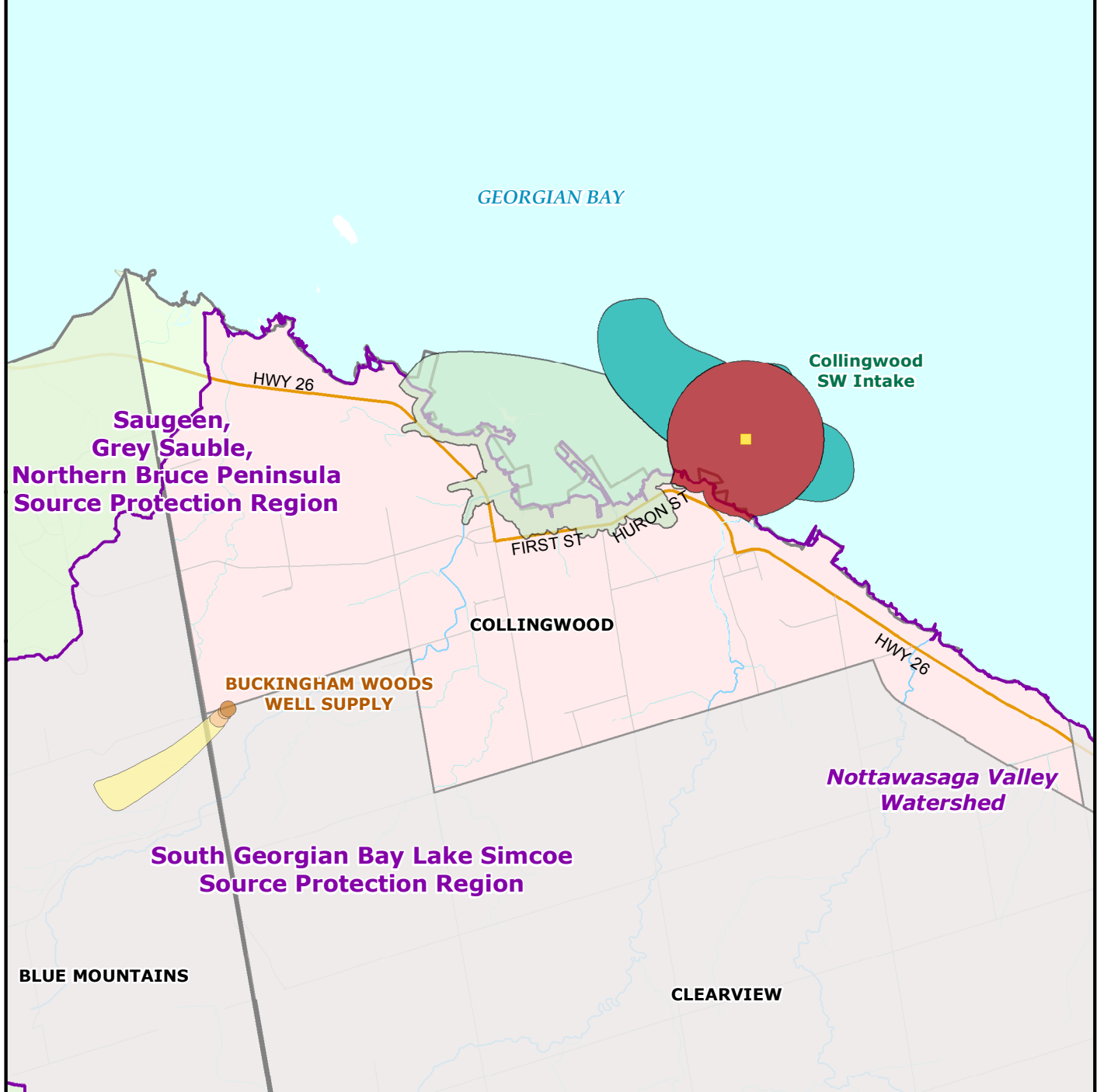
Technical Rule 16(11) (~~August 2009~~) requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within including IPZ-1 and -2. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in [Part XII of the Technical Rules \(December 2021\)](#), [the Table of Drinking Water Threats](#), [Methodology](#)

[in Technical Memorandum A5.1 \(Appendix MO\) was used in 2023 to update the proportion of Impervious Surfaces within the delineated Intake Protection Zones using the 2021 Technical Rules.](#)

The proportion of impervious surfaces within the delineated IPZ-1 for the Collingwood WTP was determined in accordance with the methodology in Technical Memorandum A5 (Appendix MO). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 11.3.4.6). The Impervious Surfaces are used in the identification of Threat Activities associated with the application of winter de-icing agents (salt).

In accordance with the Technical Rules, maps of Impervious Surfaces have not been generated for the IPZ-3 as there is no associated Vulnerability Score.

Figure 11a-6 illustrates the distribution of Impervious Surfaces within the delineated IPZ-1 for the Collingwood WTP.



**Drinking Water System
Vulnerable Areas in
Town of Collingwood**

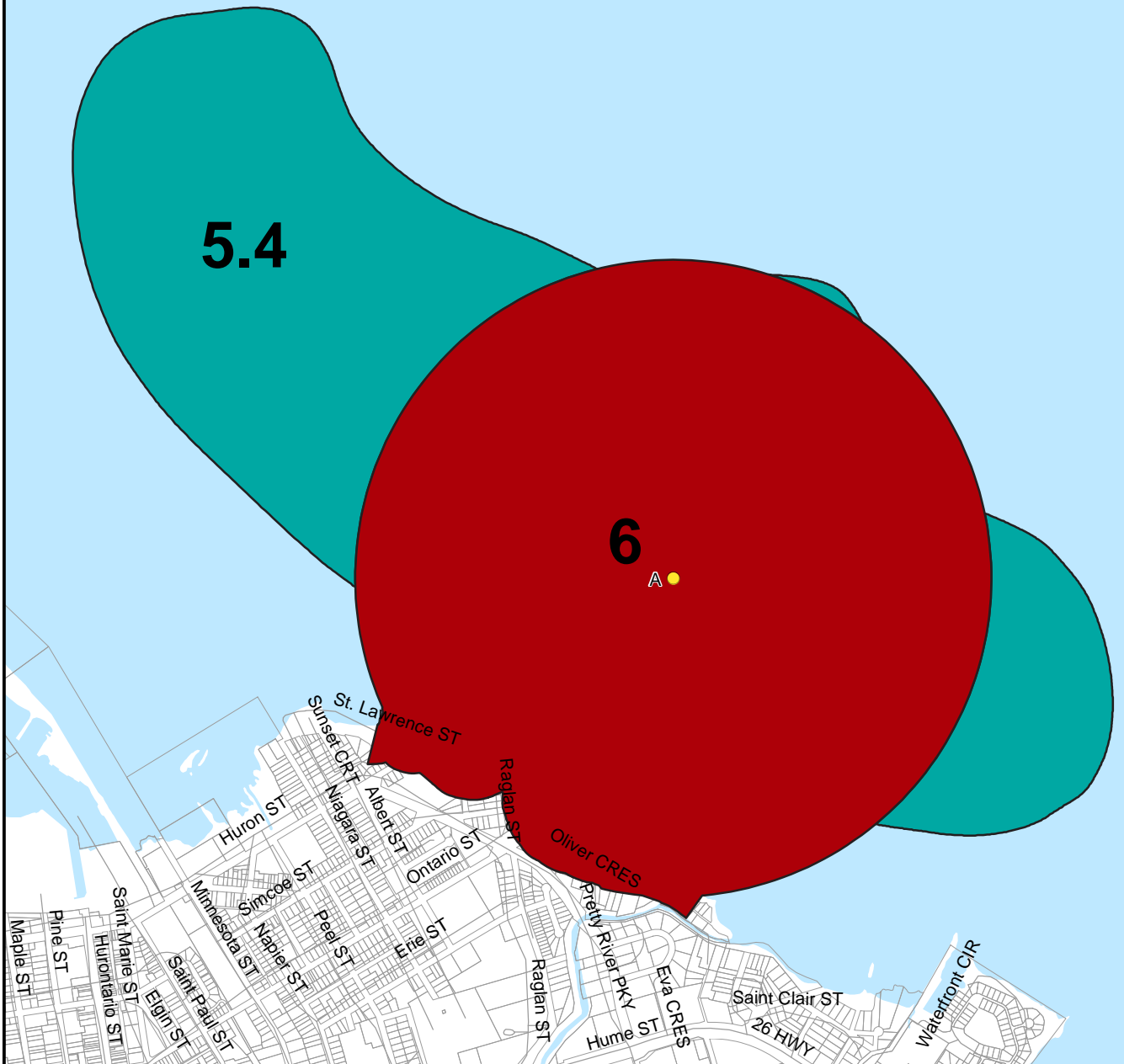
Created by: LSRCA
Date: 2011-05-10

Scale: 1:75,000
0 1 2km
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 11-1



Legend

- 6 IPZ 1 AND VULNERABILITY SCORE
- 5.4 IPZ 2 AND VULNERABILITY SCORE
- SURFACE WATER INTAKE (TYPE A)



200 100 0 200 Metres

INTAKE PROTECTION ZONES AND VULNERABILITY SCORES - COLLINGWOOD

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

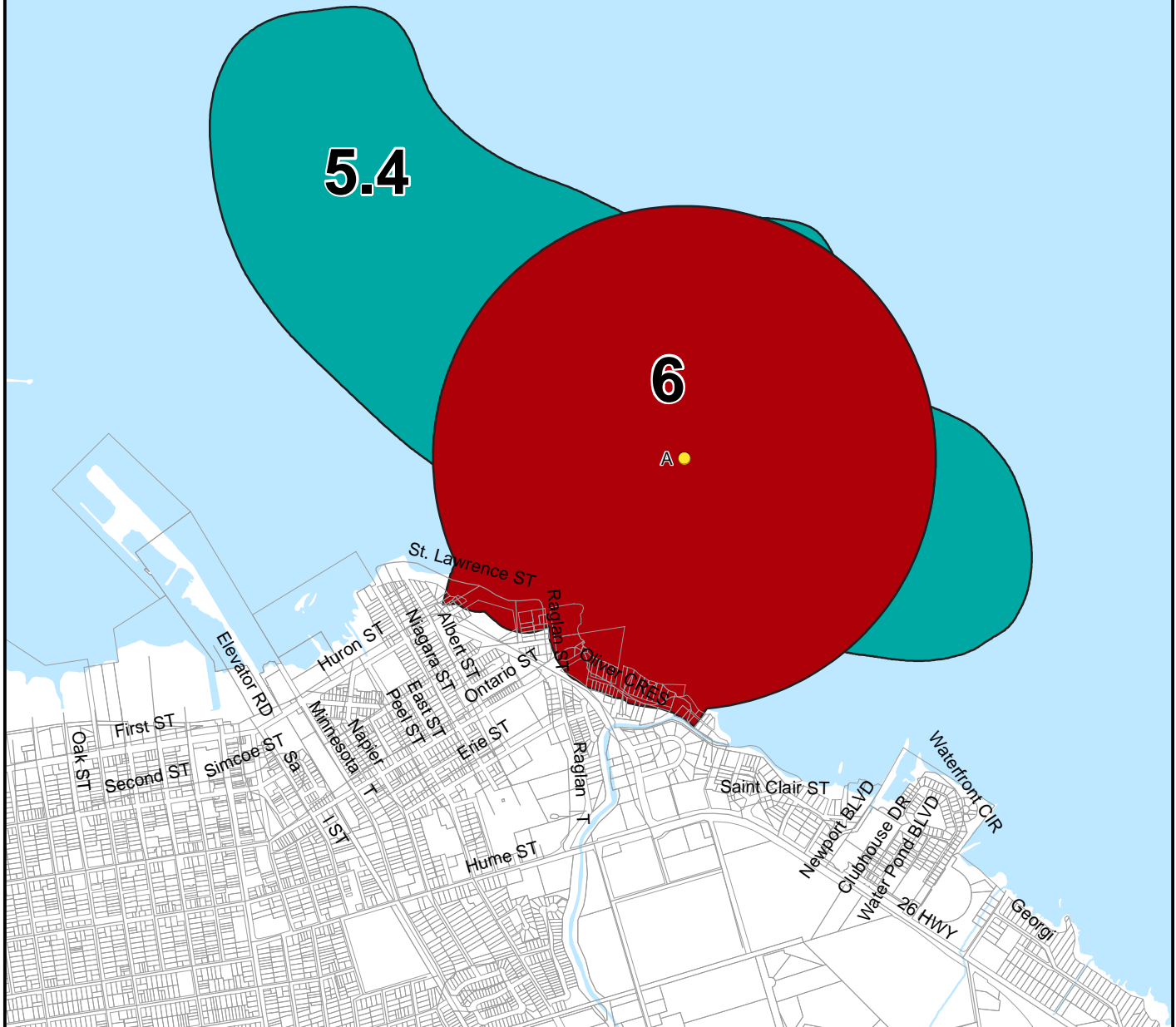
DATE: JUNE 2010

SCALE: 1:20000

PROJECT: 0-071948.02

FILE. NO.:0-07194802F7-1

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.



Legend

- IPZ 1 AND VULNERABILITY SCORE 6
- IPZ 2 AND VULNERABILITY SCORE 5.4
- SURFACE WATER INTAKE (TYPE A)



250 125 0 250 Metres

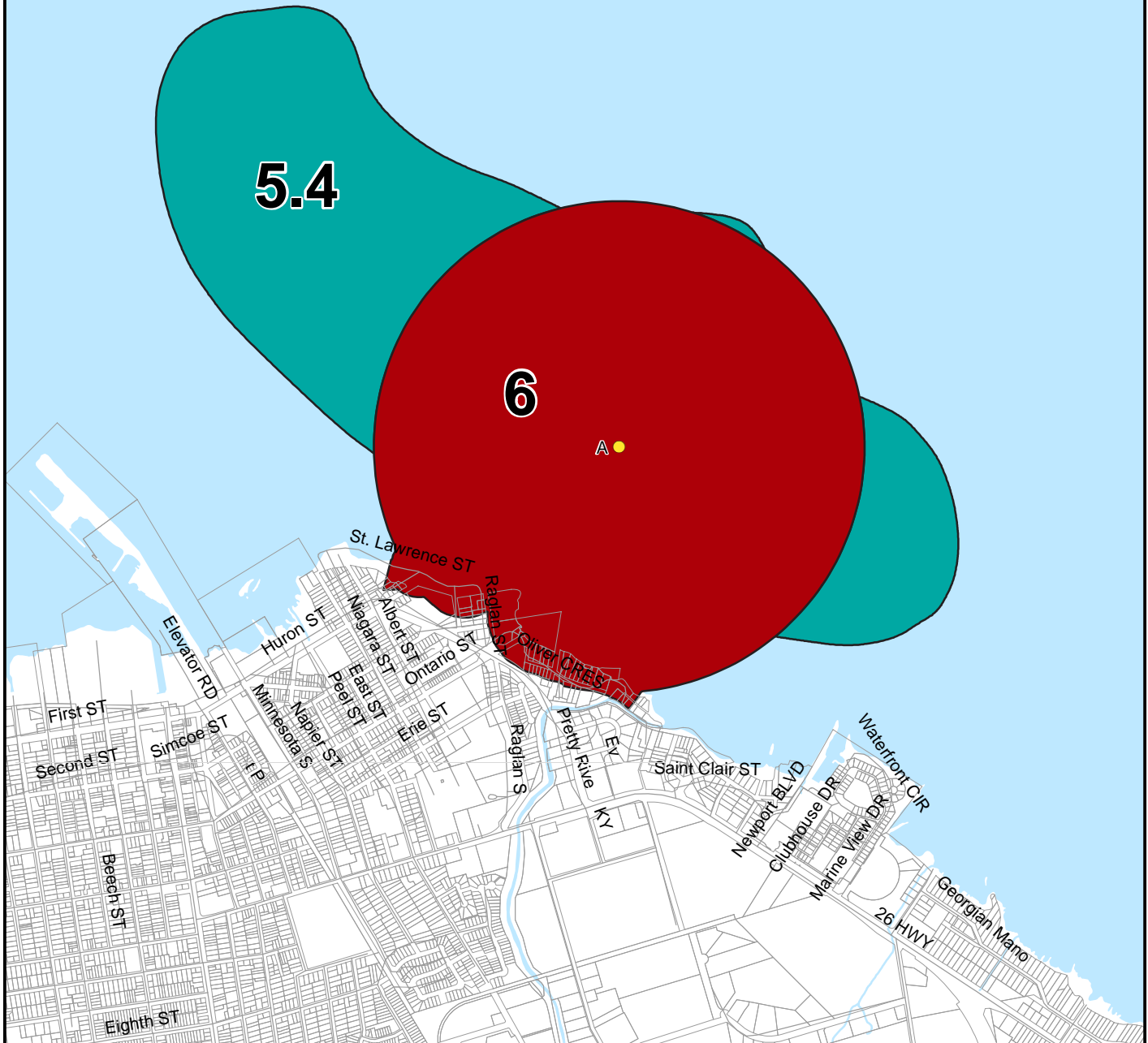
AREAS WHERE PATHOGENS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - COLLINGWOOD

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

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

DATE: JUNE 2010	SCALE: 1:25000
PROJECT: 0-071948.02	FILE. NO.:0-07194802F7-2

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.



Legend

- 6 IPZ 1 AND VULNERABILITY SCORE
- 5.4 IPZ 2 AND VULNERABILITY SCORE
- SURFACE WATER INTAKE (TYPE A)

250 125 0 250 Metres

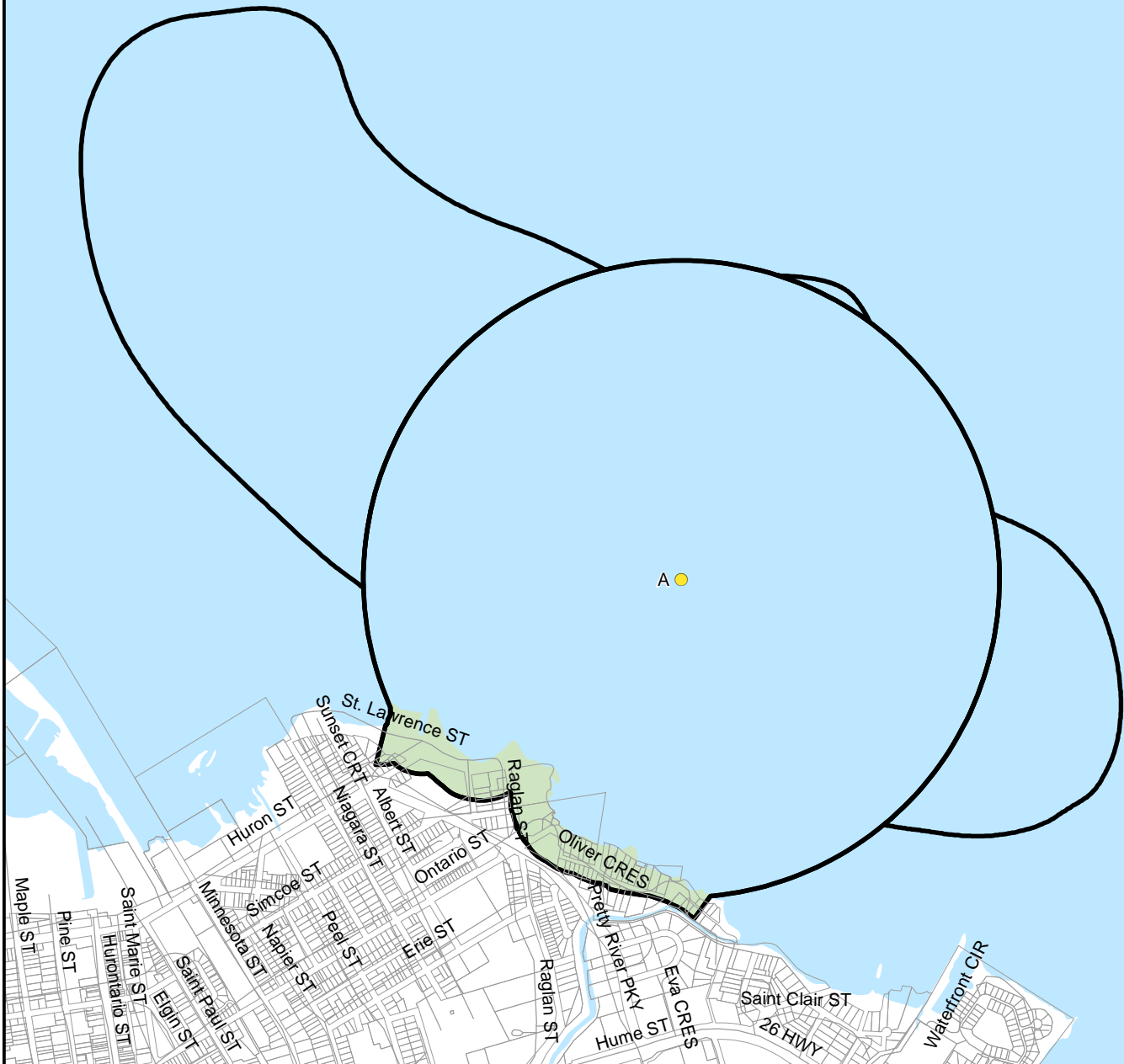
AREAS WHERE CHEMICALS ARE OR WOULD BE SIGNIFICANT, MODERATE, OR LOW THREATS - COLLINGWOOD

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

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

DATE: JUNE 2010	SCALE: 1:25000
PROJECT: 0-071948.02	FILE. NO.:0-07194802F7-3

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.



Legend

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



200 100 0 200 Metres

MANAGED LANDS - COLLINGWOOD

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

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

DATE: JUNE 2010

SCALE: 1:20000

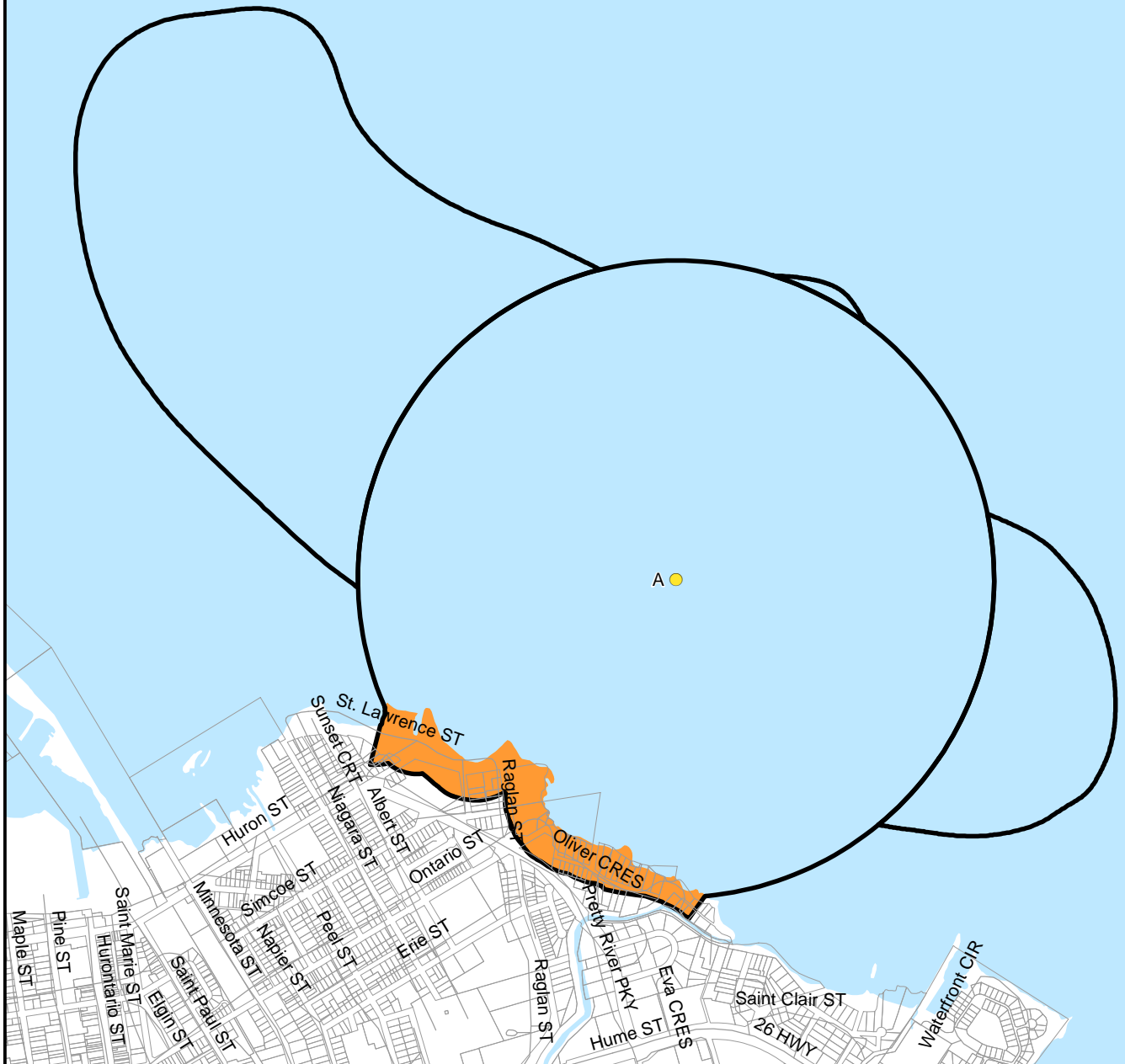
PROJECT: 0-071948.02

FILE. NO.:0-07194802F7-4

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.

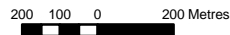


FIGURE
11a-4



Legend

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



**LIVESTOCK DENSITY -
COLLINGWOOD**

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

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

DATE: JUNE 2010	SCALE: 1:20000
PROJECT: 0-071948.02	FILE. NO.:0-07194802F7-5

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.



Legend

- Surface Water Intake (Type A)
- <1%
- =1 - <6%
- =6 - <8%
- =8 - <30%
- =>30%



**IMPERVIOUS SURFACES -
COLLINGWOOD**

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 1 and 2 where the vulnerability score is greater than 4.1.

This map was produced for the South Georgian Bay Lake Simcoe Protection Region for the purpose 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.

Created by: NVCA
Date: 2025-09

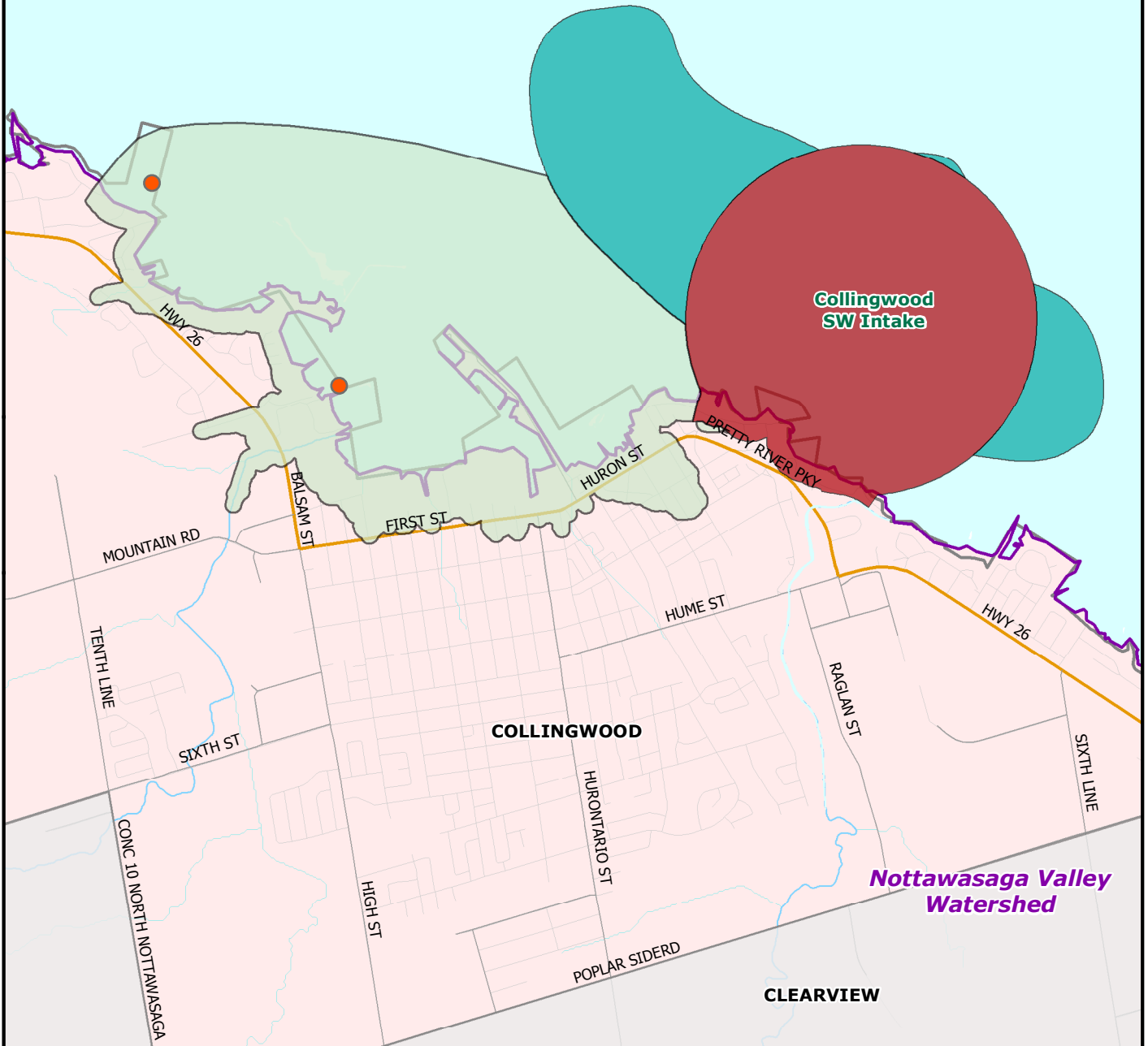
Scale: 1:20,000

UTM Zone 17N, NAD83



Ontario

Figure 11a-6



- Potential Significant Threat
- Intake Protection Zone 1 (IPZ-1)
- Intake Protection Zone 2 (IPZ-2)
- Intake Protection Zone 3 (IPZ-3)

**Potential Significant Threats to
Collingwood Surface Water Intake**

Created by: LSRCA
Date: 2011-05-10

Scale: 1:35,000
0 0.5 1km
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 11a-7