Chapter 19: The Town of Mono

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19.1 Introduction

This chapter contains information on one drinking water system for the Town of Mono. Various consultants have completed the work presented, which has also been reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group or the Source Protection Committee~~Various consultants have completed the work presented, all of which was reviewed by South Georgian Bay-Lake Simcoe Source Water Protection staff and members of the Technical Work Group~~. In this chapter, each of the groundwater systems and surface water systems is discussed separately for easier readability.

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

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

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

19.2 Drinking Water Systems

The Town of Mono operates groundwater based water supplies in three communities and does not have any surface water based supplies. As shown in Figure 19-1, one of the groundwater supplies is within the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (SPR).

Municipal Groundwater Supply in the Town of Mono within the Nottawasaga Valley Source Protection Authority SGBLS SPR included in this report:

- Cardinal Woods Subdivision

Municipal Groundwater Supplies in the Town of Mono within the Credit Valley, Toronto and Region, and Central Lake Ontario Source Protection Authority (CTC SPR) but not included in this report:

- Purple Hill Subdivision
- Island Lake Subdivision

Sections of the Hockley and Rosemount WHPAs (located in the Township of Adjala-Tosorontio) cross over the border into the Town of Mono (Table 19-1). Information on these two systems can be found in the Adjala-Tosorontio chapter (Chapter 8) of this report.

Table 19-1: WHPA that cross into the Town of Mono 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
Town of Mono	Township of Adjala-Tosorontio	Hockley	SGBLS SPR and Nottawasaga Valley SPA	This Report (Chapter 8)
Town of Mono	Township of Adjala-Tosorontio	Rosemount	SGBLS SPR and Nottawasaga Valley SPA	This Report (Chapter 8)

19.3 Cardinal Woods Subdivision Well Supply

The Town of Mono is situated at the headwaters of the Credit, Humber, Grand and Nottawasaga watersheds. It is approximately 30 km north of Brampton and adjoining the Town of Orangeville. Within the Town of Mono there are two water supply systems: the Cardinal Woods Water Supply System and the Coles and Island Lake Water Supply System. This section will only cover information pertaining to the Cardinal Woods Water System as it is the only one within the SGBLS SPR.

The Cardinal Woods Water Supply System consists of three wells located near Highway 10 and County Road 16. The original Cardinal Woods system, completed in 1987, provided water for the Cardinal Woods development, Phases I and II. In addition, the system has capacity for other miscellaneous uses including some institutional and commercial, the Brett Farm development which is currently being built and the proposed Maggisano residential development. The system provides water for approximately 190 residential customers (2008).

The existing system consists of three wells, a high lift pumping station and storage reservoir. The system is permitted to take water under the Ministry of the Environment, Conservation and Parks (MECP~~OE~~) Permit to Take Water (PTTW) 6306-6NSPG7 from wells MW1, MW3 (which is located within the NVCA watershed) and MW4. Well MW2 has been abandoned and is no longer a part of the system.

The Cardinal Woods wells are completed to depths up to 65 m in the bedrock aquifer. The bedrock in the area is limestone of the Amabel Formation which is overlain by approximately 25 m of ice contact sand and gravel.

MW-1 was drilled in 1978 as a 200 mm diameter well with an open bedrock hole from 16.5 m to a depth of 60 m. Limestone was encountered between 16.5 and 59.0 m, red shale was penetrated to a depth of 59.6 m (Burnside, 2001b).

MW-2 is a 150 mm diameter bedrock well that was drilled as one of the original test wells at this site. MW-2 was located in the driveway of an existing residence. The well was located in a pit that was equipped with a rubber gasket seal at the surface and a drain with back flow prevention. This well has since been abandoned and sealed in accordance with existing MECP~~OE~~ regulations and is no longer a part of the supply system (Burnside, 2001b).

MW-3 was drilled in 1990 as a 200 mm diameter bedrock well. The overburden encountered at this location consists of fine sand layered with gravel and clay streaks to 15.2 m. Limestone was encountered between 15.2 m and 65.8 m with the section between 15.2 and 29.9 m being particularly fractured and porous. Between 29.9 m and 42.7 m the limestone is reported as having shale layers and reverts to a massive limestone between 42.7 and 65.8 m. The records

indicate that a red shale was encountered between 65.8 m and 67.1 m (Burnside, 2001b). MW-3 has the highest specific capacity of the production wells and has been recognized as the lead well by the existing MECP~~OE~~ permit.

MW-4 was drilled as a 200 mm diameter bedrock well in 1999. Overburden sediments of sand and gravel were encountered from ground surface to 24.8 m below grade. Limestone was encountered between 24.8 and 35.5 m. Below 35.5 m, the well penetrated a layered shale and limestone sequence which is thought to represent the similar layer encountered in MW-3 to a depth of 36.1 m. Based on the previous drilling experience in the area the hole was not advanced past this depth (Burnside, 2001b).

The overburden in the Town of Mono consists of glacial formations comprised of glaciolacustrine (glacial lake) sediments, fluvial (river) and glacio-fluvial deposits and ice deposited drift. The soils in fluvial and glacio-fluvial outwash deposits vary from well bedded and sorted sand and gravel in outwash plains and meltwater channels, to irregularly stratified sand and gravel in kame hummocks.

The overburden thickness in the Town appears to reflect the presence of bedrock valleys. The three main bedrock groups that underlie the study area consist of the Amabel Formation, the Clinton and Cataract Group and the Queenston Formation. The formations that act as aquifers beneath the study site are the Amabel and Fossil Hill Formation dolostone which are 10 to 15 m thick. The Clinton Group is locally identified as Fossil Hill Formation dolomite and is underlain by Cabot Head Formation shale and sandstone which is in turn underlain by Manitoulin Formation dolomite and Whirlpool Formation sandstone. The Cabot Head, Manitoulin and Whirlpool Formations form the base of the aquifer and are approximately 30 m thick (Burnside, 2001a).

The water table elevation ranges from up to 485 metres above sea level (masl) on the west side of the Town to 265 masl within Hockley Valley. In general, the groundwater flow reflects the surface topography and bedrock slope with the overall direction of groundwater flow being towards the east and northeast.

Information presented for the Cardinal Woods section of this Chapter is based on Burnside, 2010c and 2010f reports.

19.3.1 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 Mono supply wells has been delineated following the process recommended in the Technical Rules. The areas that contribute groundwater to the wells were delineated as WHPA. The Groundwater Vulnerability within the WHPA was assessed and consideration was included to consider the effects of man-made structures that may increase the Vulnerability. The WHPA and the Vulnerability were considered together as per the Technical Rules to determine a Vulnerability Score for the Cardinal Woods Water Supply. Details of the methods for the vulnerability analysis are provided in the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010f).

19.3.1.1 Wellhead Protection Area (WHPA) Delineation

The delineation of WHPAs for the Town of Mono supply wells was undertaken using the methodology outlined in the report "Towns of Orangeville and Mono Wellhead Protection Area Delineation Report" completed by AquaResource (2010). The method of delineation was based on groundwater modeling completed as part of the Tier 3 Study and utilizes the reverse particle tracking capacities of the MODPATH software package.

The pumping rates used for the delineation of capture zones were the same as those used for the Tier 3 Water Quantity Risk Assessment (Tier 3 Study) for the Town of Orangeville, Town of Mono and Township of Amaranth completed by AquaResource and Burnside (2008) and they represent the estimated long-term demand of the Town using average day pumping rates. These rates in some cases are lower than the current permitted rates for the wells; however, the town does not expect significant growth in its population due to provincial guidelines contained in the Greenbelt policy. The rates used therefore represent the estimated demand on the Town of Mono wells based on the projected population growth.

The Cardinal Woods PTTW does not allow pumping of MW1, MW3 and MW4 to occur at the same time. Two different scenarios were modeled during the delineation of the WHPAs. The first scenario was pumping MW3 with MW1 and MW4 inactive. The second scenario was

pumping of MW1 and MW4 with MW3 inactive. The largest capture zone associated with these scenarios has been used.

As part of the Tier 3 study, the model was calibrated to steady state and transient conditions. The steady state calibration was selected for the delineation of capture zones because this method is based on long-term hydrogeologic conditions.

The model was calibrated using over 1,100 water level head values from the MECP~~OE~~ water well database. Additionally, water level data from the Town of Orangeville monitoring well network were also included as calibration targets.

In order to evaluate the impact of uncertainty in the input parameters, a sensitivity analysis was conducted. The analysis concentrated on reviewing sensitivity associated with the following parameters:

1. hydraulic conductivities and recharge
2. porosity
3. alternate conceptual models for the location of overburden and bedrock conductivity zones

Based on the above a total of six sensitivity scenarios were developed and model runs completed using these scenarios.

Capture zones were delineated for each scenario, base case and sensitivity, using reverse particle tracking. Additionally, some forward tracking of particles was used to confirm the locations of the capture zones. Capture zones were then transferred to a Geographic Information System (GIS) environment where the zones derived from each model scenario were merged to produce a single composite capture zone. Capture zones were developed for the 2 year, 5 year and 25 year times of travel.

The WHPAs for the Cardinal Woods Wells shown in Figure 19a-1. Further details on the groundwater modeling can be found in the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010f)

19.3.1.2 WHPA-E~~/WHPA-F~~

The Technical Rules require that all wells that are identified as Groundwater Under the Direct Influence of surface water (GUDI) as determined in accordance with Subsection 2(2) of the Ontario Regulation 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.

The Cardinal Woods Wells are identified as GUDI (Burnside, 2001c and 2006). The WHPA-E was delineated using a combination of surface water modeling and GIS. Surface water modeling was completed using the HEC-RAS software which allows for the computation of stream flow based on assigned stream cross sectional profiles. Cross sectional profiles were developed for HEC-RAS using detailed topographical mapping available for the Town and also based on field visits conducted as part of this study. Steam velocities were estimated and used to project a time-of-travel (TOT) of 2 hours upstream on the associated stream channel. Mapping data from Credit Valley Conservation (CVC) was also incorporated into the delineation to demarcate the lateral extent of each WHPA-E. Where this data was missing a 120 m offset from the channel was used to define the lateral extent of the WHPA-E. The methodology for the delineation of WHPA-E is provided in more detail, along with maps showing cross sectional locations in the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010f).

The locations of the Cardinal Woods MW1 and MW4 WHPA–E zones are shown in Figure 19a-2. The WHPA-E for MW1 and MW4 extend in a northwest direction along Monora Creek for approximately 600 m before ending at the surface water ponds. Based on the dimensions of the pond and its flow control characteristics, it has been assumed that the transit time of water through these ponds is over two hours and hence the WHP-E has been truncated at this point.

~~The Technical Rules requires that a WHPA-F is delineated when a WHPA-E has been delineated and a Drinking Water Issue is identified that originates outside of the areas WHPA-A through WHPA-E.~~

19.3.1.3 Groundwater Vulnerability

The Groundwater Vulnerability was calculated using the Aquifer Vulnerability Index (AVI) method as outlined in the Draft Assessment Report Guidance Module 3 – Appendix 3 (December 2006). Aquifer vulnerability mapping was completed as part of the Burnside study in 2007. The AVI map was prepared for the entire Town of Mono based on the aquifer tapped by the municipal wells and encompassed both overburden and bedrock aquifers.

The methodologies employed in the current AVI evaluation were refined as a result of knowledge gained during the 2007 study to help overcome inaccuracies in the water well database that is the starting point of all the calculations performed. The current methodologies also modified the method of interpolation of the data in order to improve the spatial validity of the results. The primary datasets used in this support role were the Ministry of Northern Development and Mines Surficial Geology of Southern Ontario and the Ministry of Natural Resources and Forestry (MNRF) Ontario Base Data.

This improved methodology resulted in AVI data that agreed with the other related datasets, an important aspect of spatial data-sets since ultimately these data are usually employed together for mapping and analysis purposes.

As part of the previously completed contamination assessment Burnside also updated the locations and conditions of wells throughout the study area. The updated information from the Burnside study was also incorporated into the current assessment. Using the most up to date information a strategy for the analysis of aquifer vulnerability was developed as outlined below.

Based upon a review of the data and experience in water well construction, it was noted that certain types of well construction methods provide less reliable geological information. In order to reflect the lack of confidence in the data provided by these types of wells, they were removed from the database and their information was not used in any of the calculations.

Calculations for aquifer vulnerability are based upon the geologic material present and the thickness of the material overlying an aquifer. Based on this, the water well database was analyzed and the appropriate data was extracted to allow for the calculation of the AVI.

Various interpolation methods were evaluated to determine the best for creating the AVI surface. It was determined that the interpolation produced by the Australian National University's Digital Elevation Model algorithm (ANUDEM) performed the best. Following this, post processing was performed on the results to produce a vector polygon dataset, with some post processing edits being applied to remove data outliers of 5 hectare in size or less. More details on the AVI approach and the limitations are available in the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010f).

The Groundwater Vulnerability is shown in Figure 19a-3. The Town of Mono is dominated by aquifers that are classed as Low to Medium Vulnerability with High Vulnerability areas being mainly non-continuous throughout the study area. Areas of High Vulnerability are located north of Island Lake, just east of the Cardinal Woods sub-division and at the Coles Industrial Subdivision on Highway 109.

19.3.1.4 Transport Pathway Increase

The Technical Rules allows for an increase in Vulnerability Rating of an aquifer due to the presence of Transport Pathways that may increase the vulnerability of the aquifer by providing a conduit for contaminants to bypass the natural protection of the aquifer. The Vulnerability Rating can be increased from Medium to High, Low to Medium, or from Low to High in accordance with the potential for artificial Transport Pathways to increase the observed vulnerability.

Transport pathways are developed where man-made (anthropogenic) features in the aquifer provide a path along which contaminants can migrate to the regional aquifer. The following features were considered as Transport Pathways within the context of the Burnside, 2010f study:

Subsurface Utilities

Utilities that are constructed in the sub-surface are potential preferential pathways as they provide a pathway for contaminants to enter into the aquifer below. Utilities that may act as preferential pathways include storm-water trunk sewers and sanitary infrastructure. The depth of excavation for the construction of utilities will determine the risk that these features pose on the municipal supply aquifer. Since the aquifers used by the municipal supply wells are generally protected by an upper aquitard, the risk due to subsurface utilities is Low.

Aggregate Operations

Aggregate operations can pose a risk to the groundwater aquifer as they remove the upper layer protecting the aquifer and provide a direct pathway for contaminants to enter the groundwater system. When an aggregate operation expands below the water table there is additional risk as ponds may form which can accumulate contaminants. There were no aggregate operations identified within the WHPAs.

Domestic Water Wells

Domestic water wells are the most common man-made preferential pathway in rural areas. Improperly constructed wells can potentially introduce a cumulative impact to drinking water sources especially when the casing deteriorates. Similarly, if the well is no longer in use, improper abandonment also provides a preferential pathway for a contaminant to impact a drinking water source.

A review of water well records from the MOE water well database was conducted to identify wells within the WHPAs. The wells located in these zones were then ranked based on their risk to the supply aquifer. The risk posed by a well is based on the date of construction (hence degree of confidence in its ground level seal) and completion depth in terms of proximity to the aquifer of concern. The survey resulted in the identification of 69 water wells within the WHPAs and classified 42 of the wells as high risk wells.

Water wells are the main Transport Pathway of concern because they present a risk to the municipal supply as they may create a conduit for contaminants to enter the aquifer. To account for the potential risk for contaminants to enter the aquifer by high risk wells, the

Vulnerability around each well for a 30 m radius was increased by one category. A 30 m radius has been chosen based on the recommended setback distance from contamination sources in the Ontario Regulation 903 as amended.

Within the Burnside, 2010f study, an upgrade of Vulnerability based on Transport Pathways was only performed for areas that fell within the WHPAs delineated as part of the study. The locations of transport pathways and increased vulnerability are reflected in the maps of Vulnerability Scores (see Section 19.3.1.5).

19.3.1.5 Vulnerability Score

The WHPA zones for the Cardinal Woods Water Supply, as shown in Figure 19a-1, and the Groundwater Vulnerability, as shown in Figure 19a-3, and the Transport Pathways identified in Section 19.3.1.4, were used to assign a Vulnerability Score by using the matrix from Table 5.3 (Chapter 5: Methods Overview, Section 5.2.4). Figure 19a-4 illustrates the Vulnerability Scores for the Town of Mono Water Supply; these will be used to assess Drinking Water Threats in Section 19.3.3. The Transport Pathways are illustrated as circles with 30 m radius in the WHPAs.

19.3.1.6 Vulnerability Score for WHPA-E

The Technical Rules: Assessment Report (*Clean Water Act 2006*) 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 current study area vulnerability and source vulnerability were developed using the following methodology.

Area Vulnerability was calculated based on surficial geology, slope and land use within the delineated WHPA-E. Each factor was rated as either vulnerable or not vulnerable and assigned a score of 1 or 0, respectively. Scores were summed at the end of the analysis and based on total score of 1, 2, or 3, the area vulnerability was ranked as 7, 8 or 9.

Source Vulnerability was calculated based on the depth of the well and the dimensions of the associated water body and the inferred potential for dilution of contaminants within that body. Wells that were less than 15 m deep were regarded as vulnerable and given a score of one (1), those greater than 15 m deep were scored as zero (0) for less vulnerable. The dimensions of each water body and the potential for dilution of contaminants were examined. A water body with a large capacity for dilution was rated as low vulnerability and scored as 0 while a water body with low potential for dilution was rated as 1. These numbers were summed to produce the overall source vulnerability which was assigned as a summed score of 1 representing a

source vulnerability of 0.9 and a summed score of two (2) representing a source vulnerability of 1.0.

The overall Vulnerability Score for the WHPA-E at Cardinal Woods MW1 and MW4 was determined by the above methodology and is shown in Figure 19a-5.

Table 19-2 summarizes the derivation of the final vulnerability score for the WHPA-E of Cardinal Woods MW1 and MW4. The methodology used for the derivation of the Vulnerability Score is provided in the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010f).

Table 19-2: Cardinal Woods Wells WHPA-E Vulnerability Score

Well	Intake Type	Area Vulnerability Factor	Source Vulnerability Factor	Final Vulnerability Score
Cardinal Woods MW1	C	7	0.9	6.3
Cardinal Woods MW4	C	7	0.9	6.3

19.3.1.7 Uncertainty Rating

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

The Uncertainty Rating associated with the WHPA A-D delineation was assessed using a qualitative process outlined in Burnside 2010f. As mentioned above, a technical peer review consultant was also used to assess the uncertainty of the WHPA delineation. As a more conservative assessment, the results from the peer review are presented for this section.

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

The WHPA-E delineation Uncertainty Assessment methodology used by Burnside, 2010f, considers the terrain model used for cross sectional analysis and the associated field

verification. Considering the level of detail available for analysis and delineations there is Low level of uncertainty assigned to the WHPA-E.

The Uncertainty Assessment methodology used by Burnside, 2010f, 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. Using information from the Vulnerability mapping and the Transport Pathway update it is concluded that the uncertainty of the overall Vulnerability Score can be considered to be High.

19.3.2 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.

As part of the Issues Evaluation, Burnside 2010c assessed whether any contaminants are impacting or have the potential to impact or interfere with Cardinal Woods drinking water source by a review of available water quality data.

The following parameters were identified as parameters of consideration: sodium and chloride.

Although all sodium concentrations recorded in the water quality do not exceed the Ontario Drinking Water Quality Standards (ODWQS) of 200 milligrams per Litre (mg/L), the results for Cardinal Woods do exceed the 20 mg/L level for which the local Medical Officer of Health should be notified. Using available water quality data, the sodium concentrations for the Mono Wells were plotted to determine any increasing trends. The trends were projected for 50 years and compared to the ODWQS to determine if there may be an exceedance. The trends do not anticipate that sodium will exceed the ODWQS within the 50 year timeframe. It is recognized that these trends were developed using minimal data and it is recommended that more data should be added as collected to determine any changes in trends.

Chloride concentrations for the Mono Wells were plotted to determine any increasing trends. The trends were projected for 50 years and compared to the ODWQS to determine if there may be an exceedance. The ODWQS aesthetic objective (AO) for chloride is 250 mg/L. There is a

trend developed at Cardinal Woods MW1 that shows an increase in concentrations over time. Based on this trend, the concentration is not expected to exceed the AO within 50 years and hence this trend is not considered to be an Issue. There is also an indication of a rise in concentration beginning at Cardinal Woods MW3; however, there is insufficient data on which to determine if this rise represents the development of a trend.

No Drinking Water Issues were identified for the Cardinal Woods Water Supply.

19.3.3 Drinking Water Threats Evaluation

An assessment of Drinking Water Threats for the Cardinal Woods water supply was completed in accordance with the detailed methodology presented in Burnside 2010c. 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 Cardinal Woods water supply builds on the information from the Vulnerability Analysis and Issues Evaluation and includes preparation of:

- a list of Drinking Water Threats for Activities
- a list of Drinking Water Threats for Conditions
- maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Activities
- maps showing areas that are or would be Significant, Moderate, or Low Drinking Water Threats for Conditions
- an enumeration of Drinking Water Threats

19.3.3.1 List of Drinking Water Threats – Activities

The list of Prescribed Drinking Water Threats considered in the assessment for the Cardinal Woods drinking water supply is provided in Chapter 5, section 5. 5.1.

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

19.3.3.2 List of Drinking Water Threats – Conditions

The following information sources were consulted to identify existing Conditions that could affect the Cardinal Woods Well Supply:

- Ecolog Environmental Risk Information Services Ltd Search. Databases include:
  - Federal Government Source databases
  - Provincial Government Source Databases
  - Private Sources Databases
- Aerial Photo Interpretation
- Municipal Parcel Assessment codes
- Site Reconnaissance

More details on these sources can be found in the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010c).

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

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

The areas where Activities are or would be Drinking Water Threats are illustrated on a series of maps based on the Vulnerability Scores and Vulnerable Area delineations. The maps combined with the Technical Rules threat~~table of Drinking Water Threats~~ 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/~~. ~~Government of Ontario's Drinking Water Threats and Circumstances.~~

19.3.3.3.1 Pathogen Parameters

The ~~MECP table of Drinking Water Threats~~Technical Rules ~~Key Table on Figure 19a-6~~ can be used in conjunction with the Vulnerability Scores to identify the areas where Activities associated with pathogen threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Cardinal Woods Well Supply (Figure 19a-6). Activities that are or would be Significant Drinking Water Threats for pathogens can be observed within the areas where the Vulnerability Score is ten (10). Pathogens can also only be a Significant, Moderate or Low Threat within WHPA-A, -B and -E.

19.3.3.3.2 Chemical Parameters

The ~~MECP table of Drinking Water Threats~~Technical Rules ~~Key Table on Figure 19a-7~~ can be used in conjunction with the Vulnerability Scores to identify the areas where activities associated with chemical threats are or would be Significant, Moderate, or Low Drinking Water Threats for the Cardinal Woods Well Supply (Figure 19a-7). Activities that are or would be Significant Drinking Water Threats for chemicals can be observed within areas where the Vulnerability Score is equal to or greater than eight (8).

19.3.3.3.3 DNAPL (Dense Non-Aqueous Phase Liquid) Chemical Parameters

Figure 19a-8 illustrates the area of the 5-year time-of-travel zone (WHPA-C) and areas with a Vulnerability Score of six (6), where activities associated with DNAPL parameters are considered to be a Significant Drinking Water Threat for the Cardinal Woods Well Supply. The ~~MECP table of Drinking Water Threats~~Technical Rules ~~Key Table on Figure 19a-8~~ can be used to can be used to identify the circumstances in which these Activities would be Significant or Moderate Drinking Water Threats.

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

Further to Section 19.3.3.2, no Conditions were confirmed within the WHPA for the Cardinal Woods Well Supply.

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

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

- **Significant**: where the Vulnerability Score is ≥ 8 and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well
- **Moderate**:
    1. where the Vulnerability Score ≥ 6 and < 8, and there is evidence that the Condition is causing off-site contamination, and/or that the Condition is located on the same property as the supply well; or

2. where the Vulnerability Score is 10, and there is no evidence of off-site contamination

- **Low**: where the Vulnerability Score ≥ 8 and < 10 and there is no evidence of off-site contamination

Figure 19a-4 and Figure 19a-5 illustrates the Vulnerability Score map for Cardinal Woods well supply that can be used to determine where a Condition is or would be a Significant, Moderate or Low Threat to Drinking Water.

19.3.3.5 Enumerating Drinking Water Threats

~~19.3.3.4.1~~19.3.3.5.1 Enumerating Significant Drinking Water Threats – Methods

Identification and enumeration of Significant Drinking Water Threats related to Issues and Conditions have been described in Section 19.3.2 and 19.3.3.2, 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 the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010c). Additional refinement of the Significant Drinking Water Threats enumeration was completed using the methodology outlined in Chapter 5 (Section 5.5.6.4) of this Assessment Report.

In order to classify activities in the study area the various databases and sources outlined in Section 19.3.3.2 were reviewed and information on site activities was compiled. The circumstances under which activities are considered threats and the classification of those Threats are contained in the Table of Drinking Water Threats provided by the MOE (MOE 2008b).

An automated process was developed to search the Table and provide an indication of the Hazard and Risk Score for each identified Activity. The automated process generates a project database that houses information on the Threat and also includes the various component scores that are included in the final determination of risk category. The risk category in the automated process is calculated using processes described by the MOE in their document Threats Environmental Bill of Rights (EBR) Lookups (MOE, 2009d) and is identical to that used by the ~~Tables of Drinking Water Threats~~Technical Rules. As a quality control mechanism, the calculated risk categories were verified by manual searches of the ~~MOE Tables of Drinking Water Threats~~Technical Rules to ensure that the automated calculations were correct for threats categorized as Significant. In order to ensure consistency in the approach for

assumptions regarding various activities and the methodology for the evaluations of threats a consensus was arrived at among all consultants conducting work within the SGBLS Region (SGBLS, 2010).

Once a Hazard Rating is assigned to an identified parcel based on the MOE tables, then a Risk Score can be assigned. The Risk Score is calculated by multiplying the Vulnerability Score as defined by the Vulnerability component of the study (Section 19.3.1.5) with the Hazard Rating which provides a score out of 100. The Risk Score is classified as Significant when the score is greater than 80.

Two unique 'polygon' Threats were assigned to each WHPA with a Vulnerability Score of ten (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', where present, 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.

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 SGBLS Source Protection Region and was based on the MOE Technical Bulletin for Managed Land and Livestock Density Calculations (MOE, ~~November~~September 2009). Managed Lands, Livestock Density and Impervious Surfaces are discussed in more detail below.

~~19.3.3.4.1.1~~19.3.3.5.1.1 Managed Lands

Managed Land is land to which nutrients Agriculture Source Material (ASM), commercial fertilizer, Non-Agricultural Source Material (NASM) are applied. 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) ~~(August 2009)~~ requires the Assessment Report to include maps showing the location of Managed Lands and the percentage of Managed Lands within a Vulnerable Area, including WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in ~~the~~ ~~Part XII of~~ the Technical Rules ~~(December 2021).~~ ~~Table of Drinking Water Threats.~~ Managed Lands were identified and the Managed Lands proportions were determined for the Cardinal Woods WHPA as outlined in the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010c). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 19.3.3.5.2).

Figure 19a-9 and Figure 19a-10 illustrates the distribution of Managed Lands within the delineated WHPA zones for the Cardinal Woods Supply.

~~19.3.3.4.1.2~~19.3.3.5.1.2 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) ~~(August 2009)~~ requires the Assessment Report to include maps showing the Livestock Density within WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in ~~Part XII of~~ the Technical Rules~~les~~ ~~(December 2021).~~ ~~the Table of Drinking Water Threats.~~ The Livestock Density was determined for the Cardinal Woods WHPAs as outlined in the Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010c). The results from this analysis were used in the enumeration of Significant Drinking Water Threats (Section 19.3.3.5.2). Figure 19a-11 and Figure 19a-12 illustrates the distribution of Livestock Density within the delineated WHPA zones for the Cardinal Woods Supply.

~~19.3.3.4.1.3~~19.3.3.5.1.3 Impervious Surfaces

Impervious surfaces are defined in the Technical Rules as areas that receive road salt application and include roads and parking lots. The areas were determined using road mapping from the National Road Network (Natural Resources Canada) and satellite air photography to identify large parking lots and paved areas. Using a 1 km x 1 km grid centered over each vulnerability area, the percentage of impermeable surfaces within each square kilometer was calculated. For further details on the methods used to assess impervious surfaces for the

Cardinal Woods WHPAs, see Credit Valley Source Protection Area Assessment Report (based on Burnside, 2010c). Methodology in Technical Memorandum A5.1 (Appendix MO) was used in 2023 to update the proportion of Impervious Surfaces within the delineated WHPA zones using the 2021 Technical Rules.

Technical Rule 16(11) ~~(August 2009)~~ requires the Assessment Report to include maps showing the percentage of surface area where road salt could be applied to Impervious Surfaces within WHPA-A, -B, -C, -D, and -E. This mapping is not required where the Vulnerability Scores for the area are less than the Vulnerability Score necessary for the Activity to be considered a Threat in ~~Part XII of~~ the Technical Rules ~~(December 2021).~~ ~~the Table of Drinking Water Threats.~~ The Impervious Surfaces are used in the identification of threat activities associated with the application of winter de-icing agents (salt).

Figure 19a-13 illustrates the distribution of Impervious Surface within the delineated WHPA zones for the Cardinal Woods Supply.

~~19.3.3.4.2~~19.3.3.5.2 Enumerating Significant Drinking Water Threats – Results

As discussed above, there are no Significant Threats associated with Conditions or Drinking Water Issues.

Table 19-3 documents the enumeration of existing and potential activities that are considered to be Significant Drinking Water Threats within the WHPAs for the Cardinal Woods Water Supply.

A total of fourteen (14) activities that are considered to be potential Significant Drinking Water Threats have been identified in association with thirteen (13) land parcels. Twelve (12) parcels were identified as having potential significant threat activities relating to residential land use via the use of private individual sewage disposal systems. One (1) Significant threat and parcel have been included within the area where the Vulnerability Score is ten (10) to represent the potential for subsurface storage of fuel for home heating purposes. There are eleven (11) residential parcels within this area. One (1) other Significant Threat related to handling and storage of fuel was identified on a specific parcel.

The methods of enumerating Significant threats related to subsurface storage of fuel for home heating purposes differs between the SGBLS Region and the CTC Region. As described above, and as presented in Table 19-3, the SGBLS Region counts a single threat activity and parcel to each area where the Vulnerability Score is high enough to make the activity a potential Significant Threat. This approach is partly taken in recognition of the uncertainty of accurately identifying properties that have subsurface fuel storage. In contrast, the CTC Region counts

every property in the vulnerable area. Therefore, their method would result in eleven (11) significant fuel threats, leading to a total of twenty-four (24) Significant Threats for Cardinal Woods on twelve (12) parcels.

Table 19-3: Number of Significant Drinking Water Threats for the Cardinal Woods Well Supply, Enumeration of Significant Threats (Wellhead Protected Area)

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	12
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	0

Threat Number	Threat	Significant Threat Counts Number of Threats
17	The handling and storage of an organic solvent	0
18	The management of runoff that contains chemicals used in the de-icing of aircraft	0
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. O. Reg. 385/08, s. 3; O. Reg. 206/18, s. 1.	0
-	**Total Number**	**14*** significant threats (on **13** properties)

Notes 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
2. *11 verified existing Threats and 3 potential Threats that require further investigation

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19.4 Orangeville Well Supply

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~~2.~~ Figure 19 1 also depicts the wellhead protection area for three Orangeville wells. The wellheads are all located within the CTC Source Protection Region, while WHPAs B through D also extend into both the South Georgian Bay Source Protection Region and the Lake Erie Source Protection Region. Policies may apply in the WHPA-B, which has a vulnerability score of 6.

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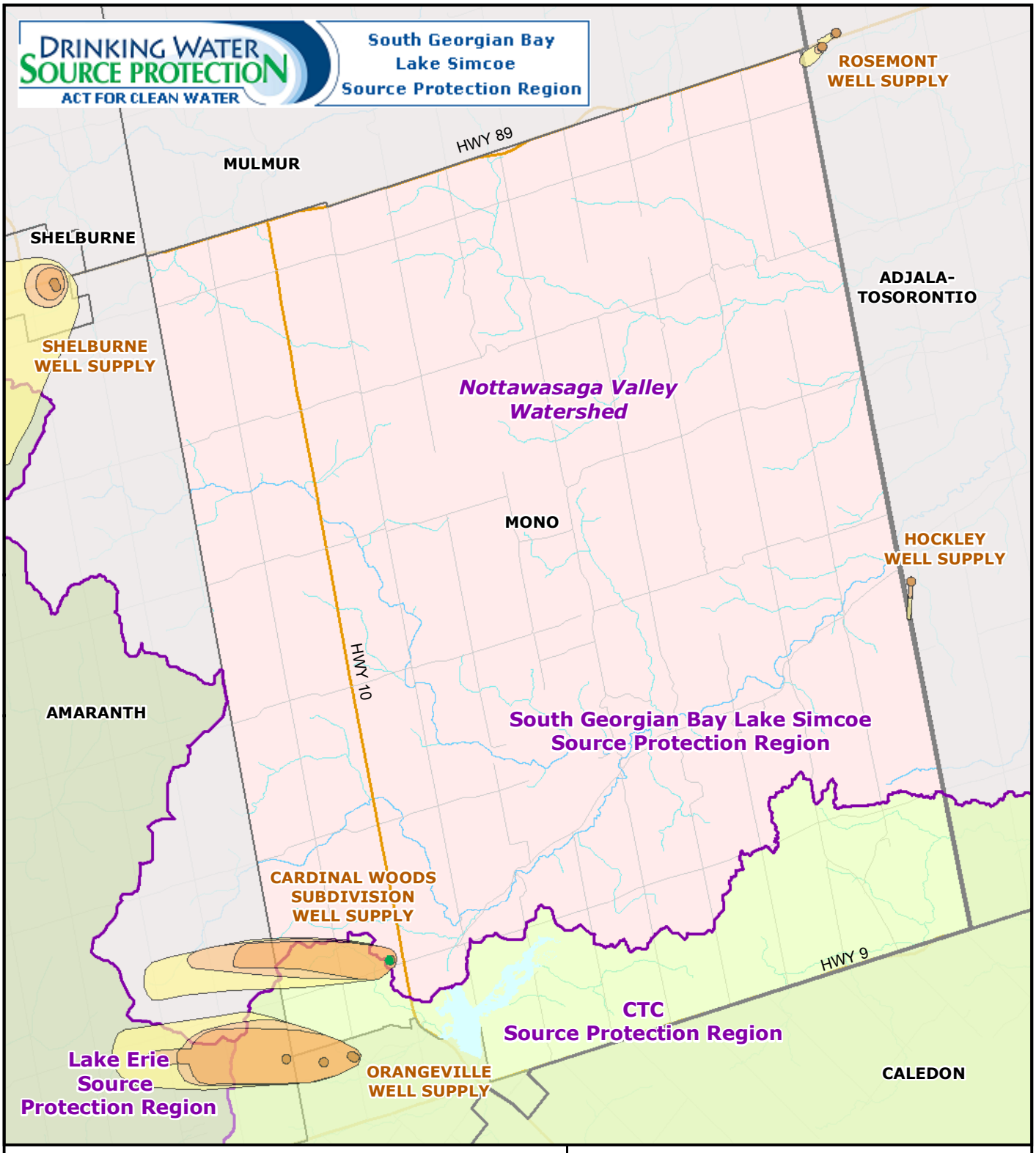

- Municipal Supply Well in Town of Mono
- WHPA-A (100m)
- WHPA-B (2 years time of travel)
- WHPA-C (5 years time of travel)
- WHPA-C1 (10 years time of travel)
- WHPA-D (25 years time of travel)
- SWP Watershed Region
- Upper Tier Municipality
- Lower Tier Municipality

Drinking Water System Vulnerable Areas in Town of Mono

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Figure 19-1

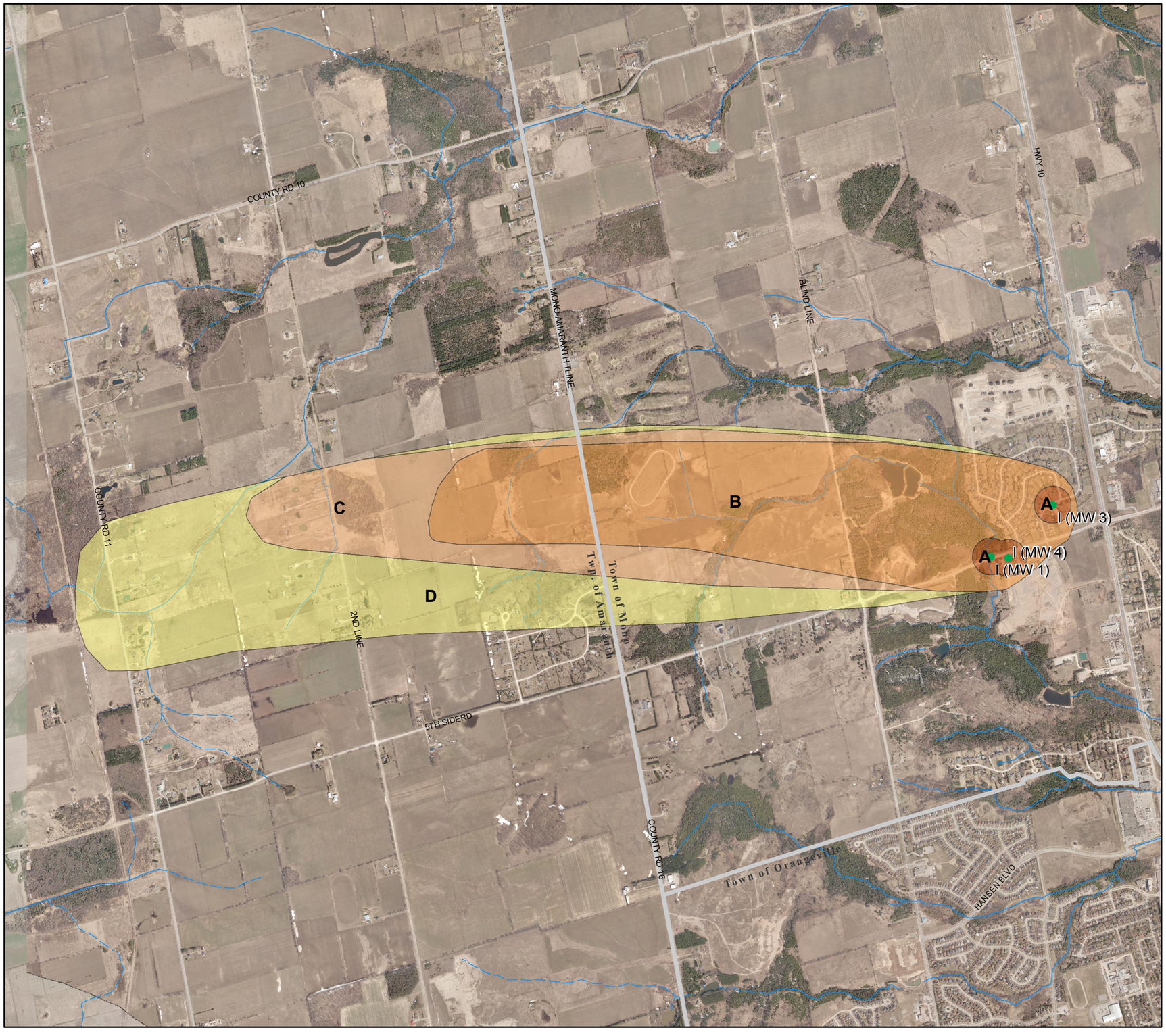

Figure 19a-1

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

WELL HEAD PROTECTION AREAS CARDINAL WOODS WELLS

LEGEND

- Production Well Location (Type - I)

Well Head Protection Area Zones

- WHPA-A: 100m Buffer Zone (Pathogen Security/Prohibition Zone)
- WHPA-B: Pathogen Management Zone (2 Year Time of Travel)
- WHPA-C: DNAPL/Contaminant Protection Zone (5 Year Time of Travel)
- WHPA-D: Secondary Protection Zone (25 Year Time of Travel)
- Municipal Boundary
- Watercourse: Permanent
- Watercourse: Intermittent

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Projection: UTM Zone 17
Datum: NAD 83

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Verified By: D. Smikle

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Figure 19a-2

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

WELL HEAD PROTECTION AREA WHPA E CARDINAL WOODS WELLS

LEGEND

- Production Well Location (Type - I)

Well Head Protection Area Zone

- WHPA-E: Surface Vulnerability Zone (GUDI Well)
- Wellhead Protection Area (Zones A,B,C, & D)
- Municipal Boundary
- Watercourse: Permanent
- Watercourse: Intermittent

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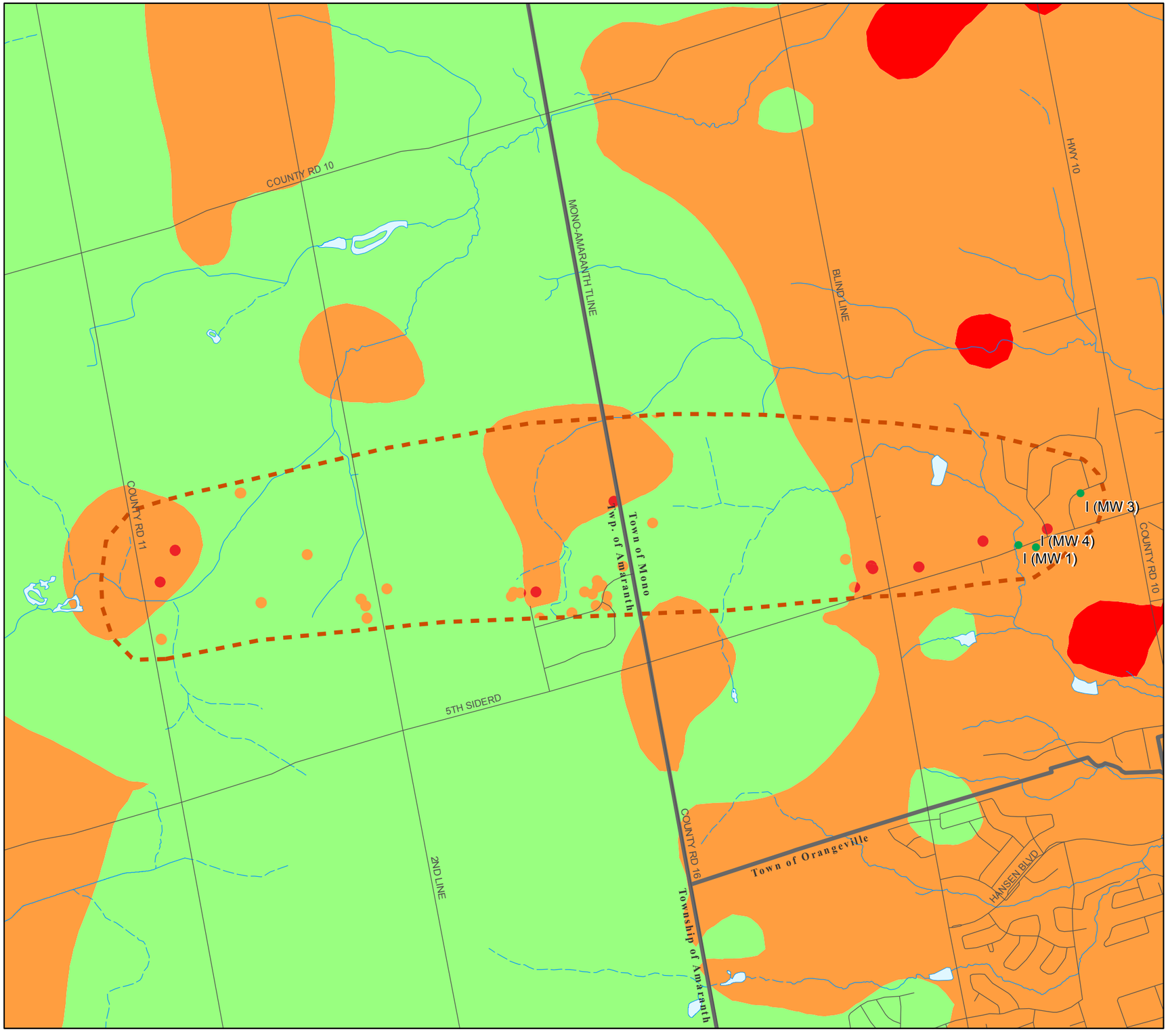
Figure 19a-3

TOWN OF MONO

GROUNDWATER VULNERABILITY ASSESSMENT

UPDATED AQUIFER VULNERABILITY CARDINAL WOODS WELLS



LEGEND

- Production Well Location (Type - I)
- Well Head Protection Area (WHPA A-D)

Vulnerablity Rating

- High
- Medium
- Low
- Municipal Boundary
- Roads
- Watercourse: Permanent
- Watercourse: Intermittent
- Waterbody

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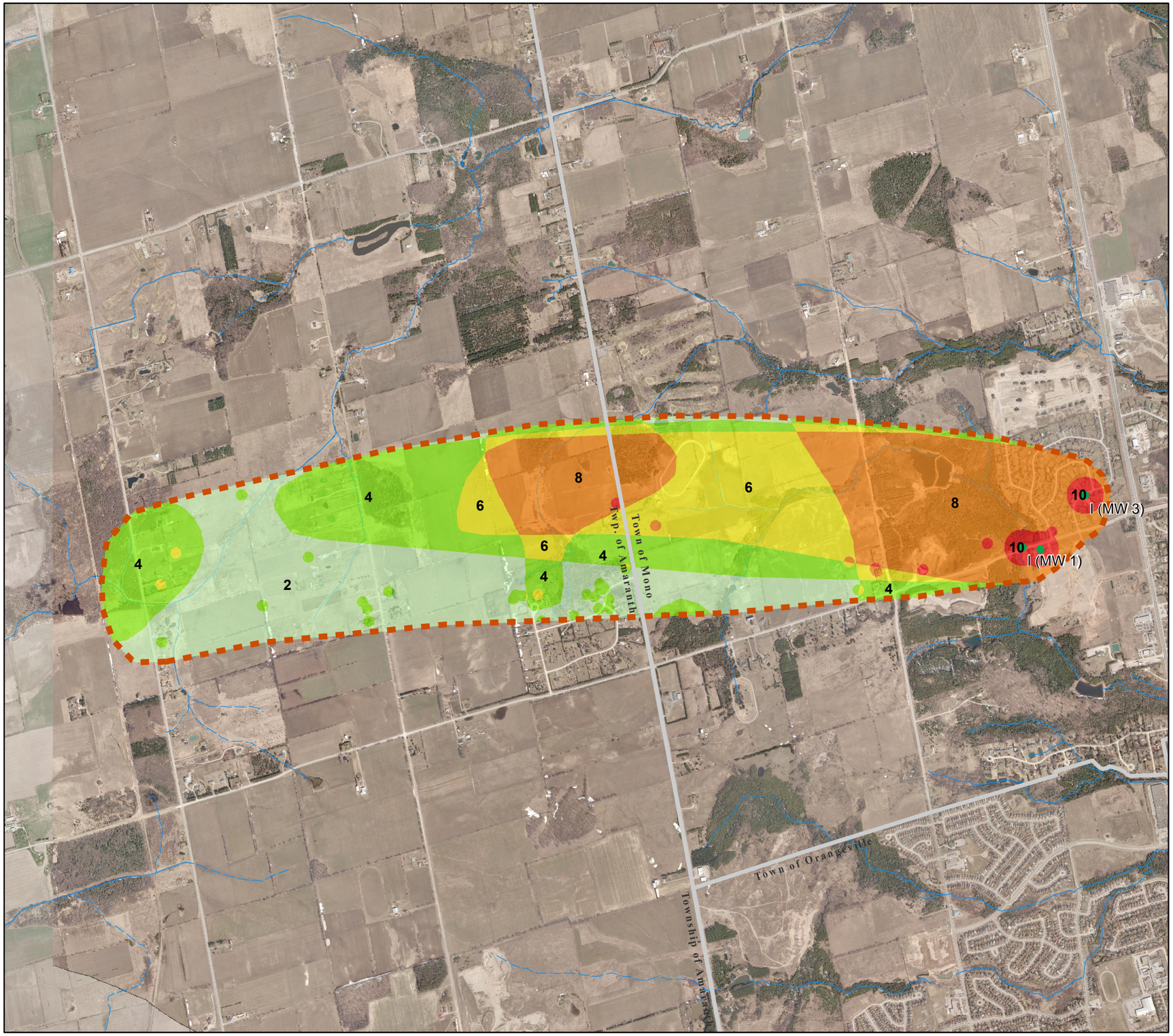

Figure 19a-4

TOWN OF MONO

AQUIFER VULNERABILITY AND WHPA DELINEATION REPORT

VULNERABILITY SCORES CARDINAL WOODS WELLS

LEGEND

- Production Well Location (Type - I)
- Well Head Protection Area

Vulnerability Score

- 10
- 8
- 6
- 4
- 2
- Municipal Boundary
- Watercourse: Permanent
- Watercourse: Intermittent

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Figure 19a-5

TOWN OF MONO

GROUNDWATER VULNERABILITY ASSESSMENT

VULNERABILITY SCORES CARDINAL WOODS WELLS WHPA E

LEGEND

- Production Well Location (Type - I)

Vulnerability Score

- 10
- 8
- 7.2
- 6.3
- 6
- Wellhead Protection Area (Zones A,B,C,D & E)
- Municipal Boundary
- Watercourse: Permanent
- Watercourse: Intermittent

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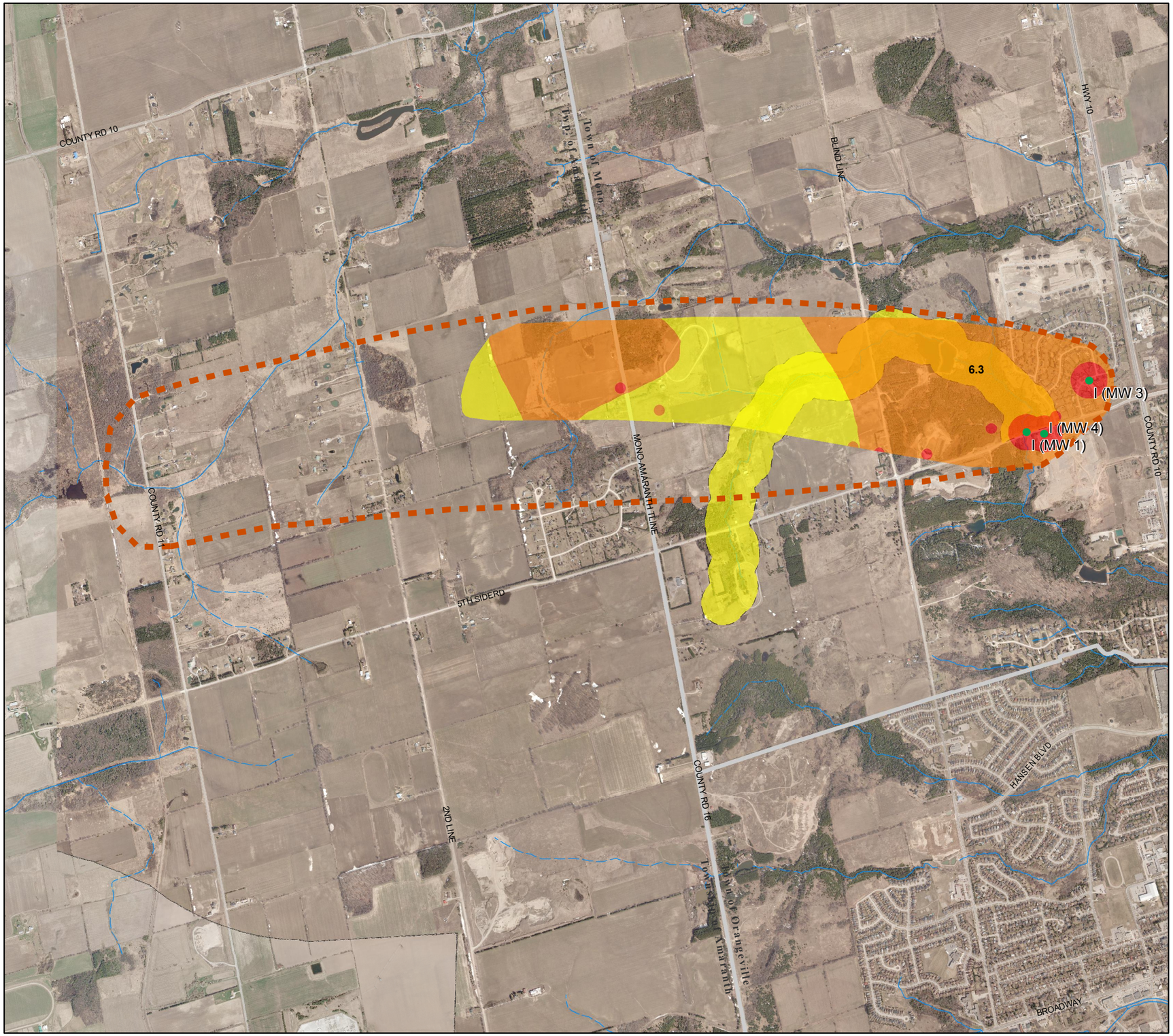

Figure 19a-6

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

AREAS OF SIGNIFICANT, MODERATE OR LOW THREATS - PATHOGENS CARDINAL WOODS WELLS

LEGEND

- Production Well Location (Type - I)
- Well Head Protection Area Zones

Vulnerability Score

- 10
- 8
- 6
- 6.3 (WHPA-E)
- Municipal Boundary
- Watercourse: Permanent
- Watercourse: Intermittent

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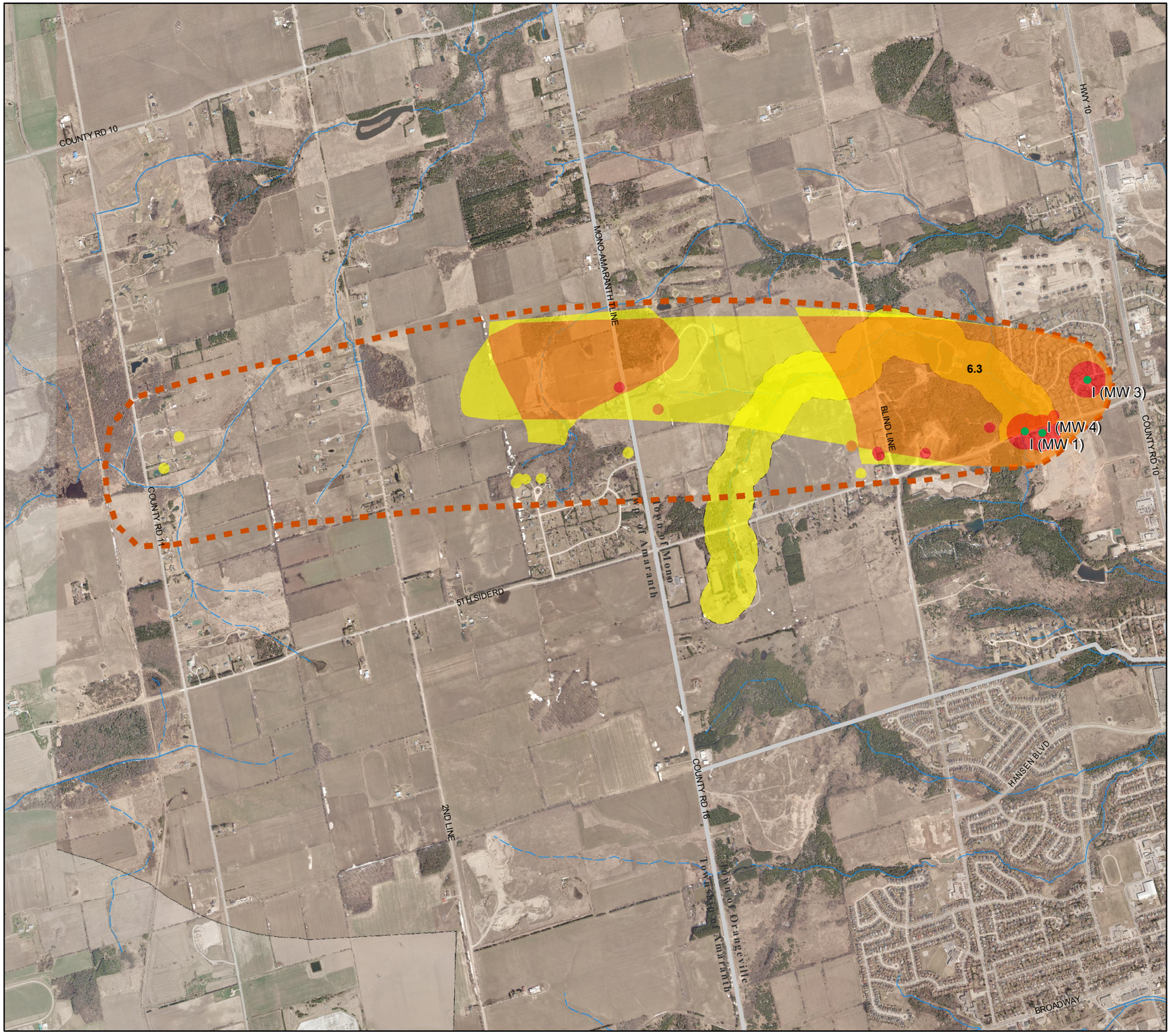

Figure 19a-7

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

AREAS OF SIGNIFICANT, MODERATE OR LOW THREATS - CHEMICALS CARDINAL WOODS WELLS

LEGEND

- Production Well Location (Type - I)
- Well Head Protection Area Zones

Vulnerability Score

- 10
- 8
- 6
- 6.3 (WHPA-E)
- Municipal Boundary
- Watercourse: Permanent
- Watercourse: Intermittent

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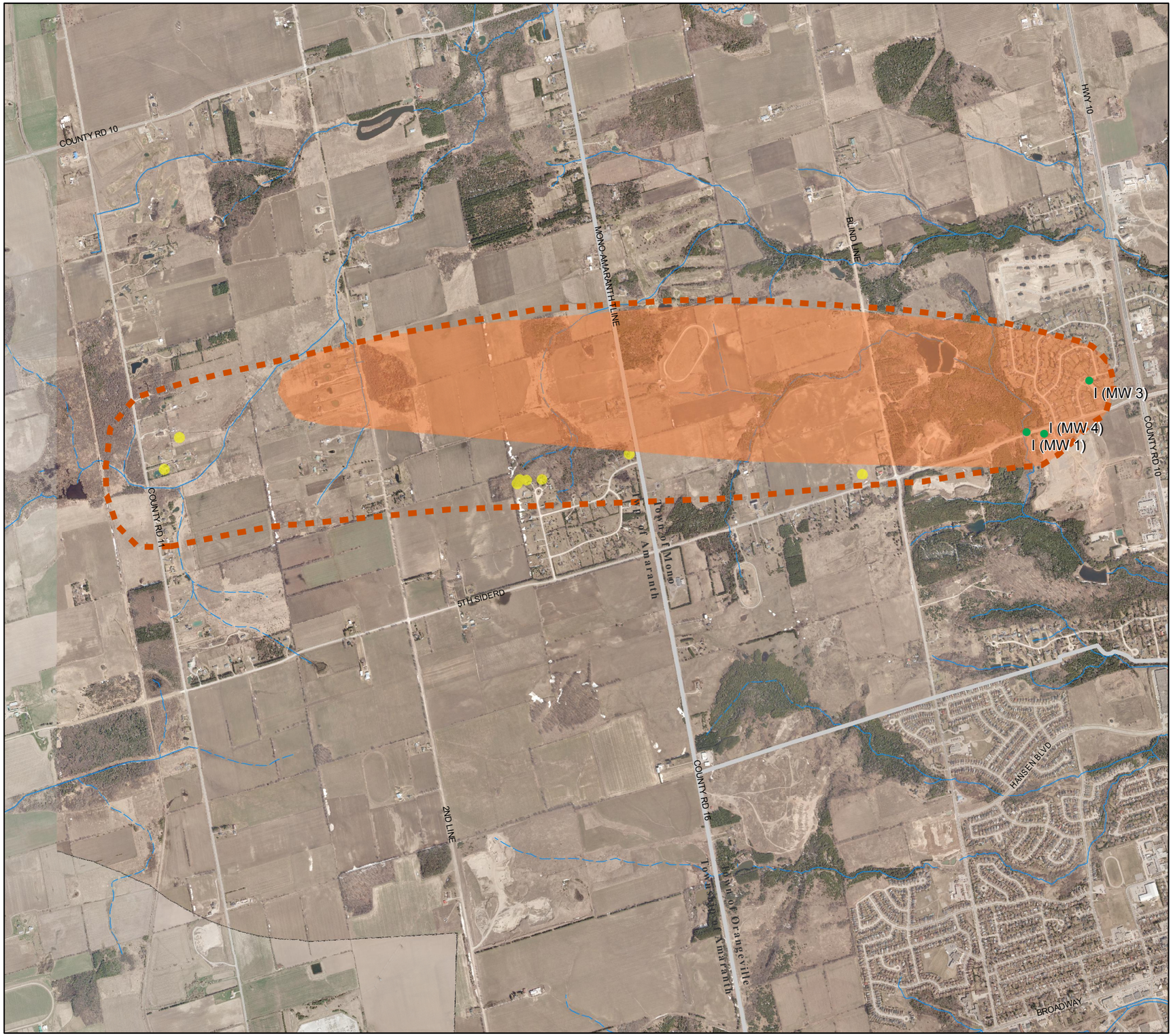

Figure 19a-8

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

AREAS OF SIGNIFICANT, MODERATE OR LOW THREATS - DNAPLS CARDINAL WOODS WELLS

LEGEND

- Production Well Location (Type - I)
- 5 Year Time-of-Travel
- Vulnerability Score of 6
- Well Head Protection Area Zones
- Municipal Boundary
- Watercourse: Permanent
- Watercourse: Intermittent

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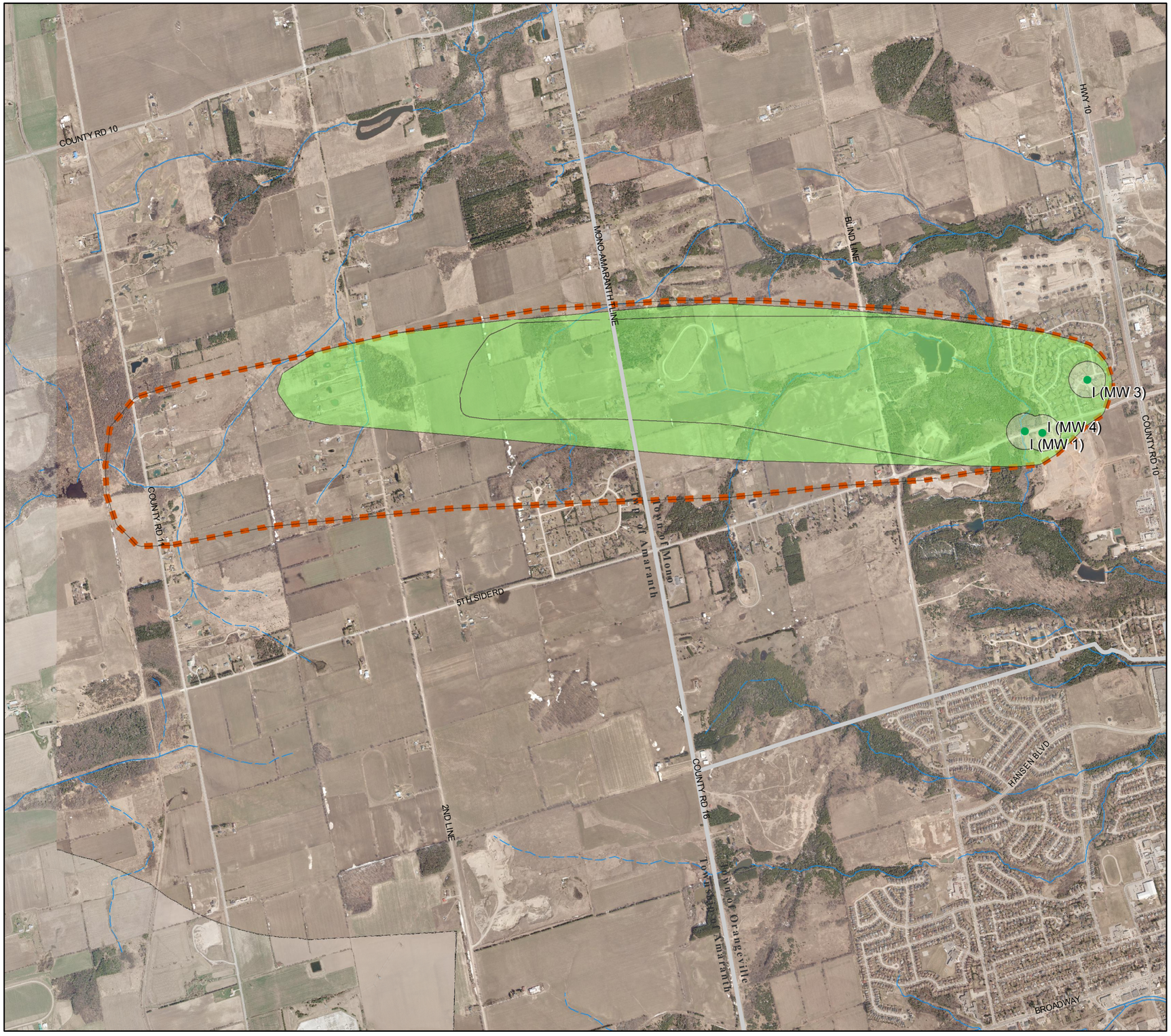

Figure 19a-9

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

MANAGED LANDS CARDINAL WOODS WELLS

LEGEND

- Production Well Location (Type - I)
- Well Head Protection Area Zones

Percent Managed Lands

- > 80 %
- 40 - 80 %
- < 40 %
- Non-Applicable
- Watercourse: Permanent
- Watercourse: Intermittent
- Municipal Boundary

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Figure 19a-10

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

MANAGED LANDS CARDINAL WOODS WHPA E

LEGEND

- Production Well Location (Type - I)
- Municipal Boundary
- Well Head Protection Area Zones

Percent Managed Lands

- > 80 %
- 40 - 80 %
- < 40 %
- Non-Applicable
- Watercourse: Permanent
- Watercourse: Intermittent

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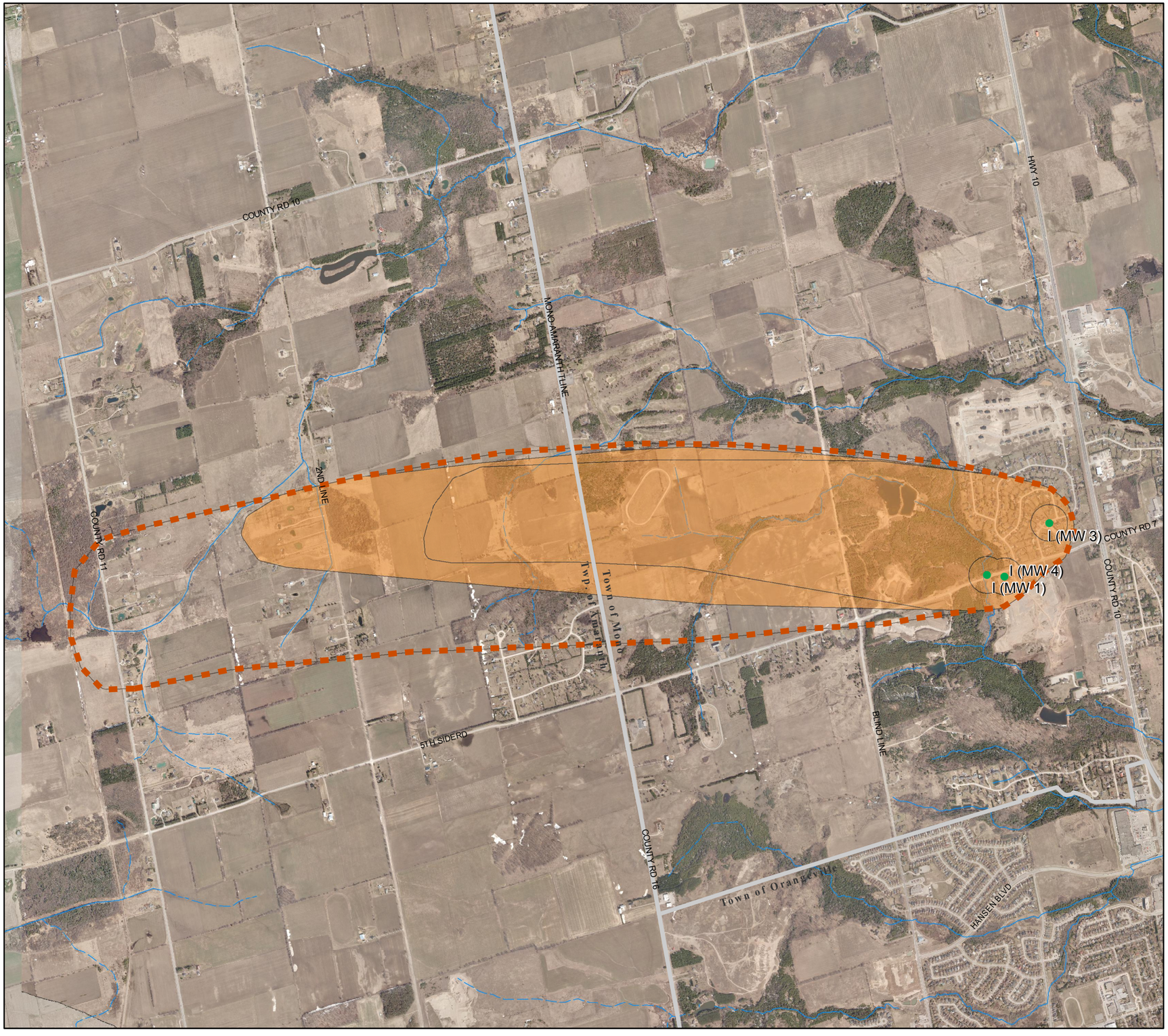

Figure 19a-11

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

LIVESTOCK DENSITY CARDINAL WOODS WELLS

LEGEND

- Production Well Location (Type - I)
- Municipal Boundary
- Well Head Protection Area Zones

Livestock Density

Nutrient Units / Acre

- < 0.5 NU / Acre
- 0.5-1.0 NU / Acre
- > 1.0 NU / Acre
- Non-Applicable
- Watercourse: Permanent
- Watercourse: Intermittent

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Project Number: MSA12359

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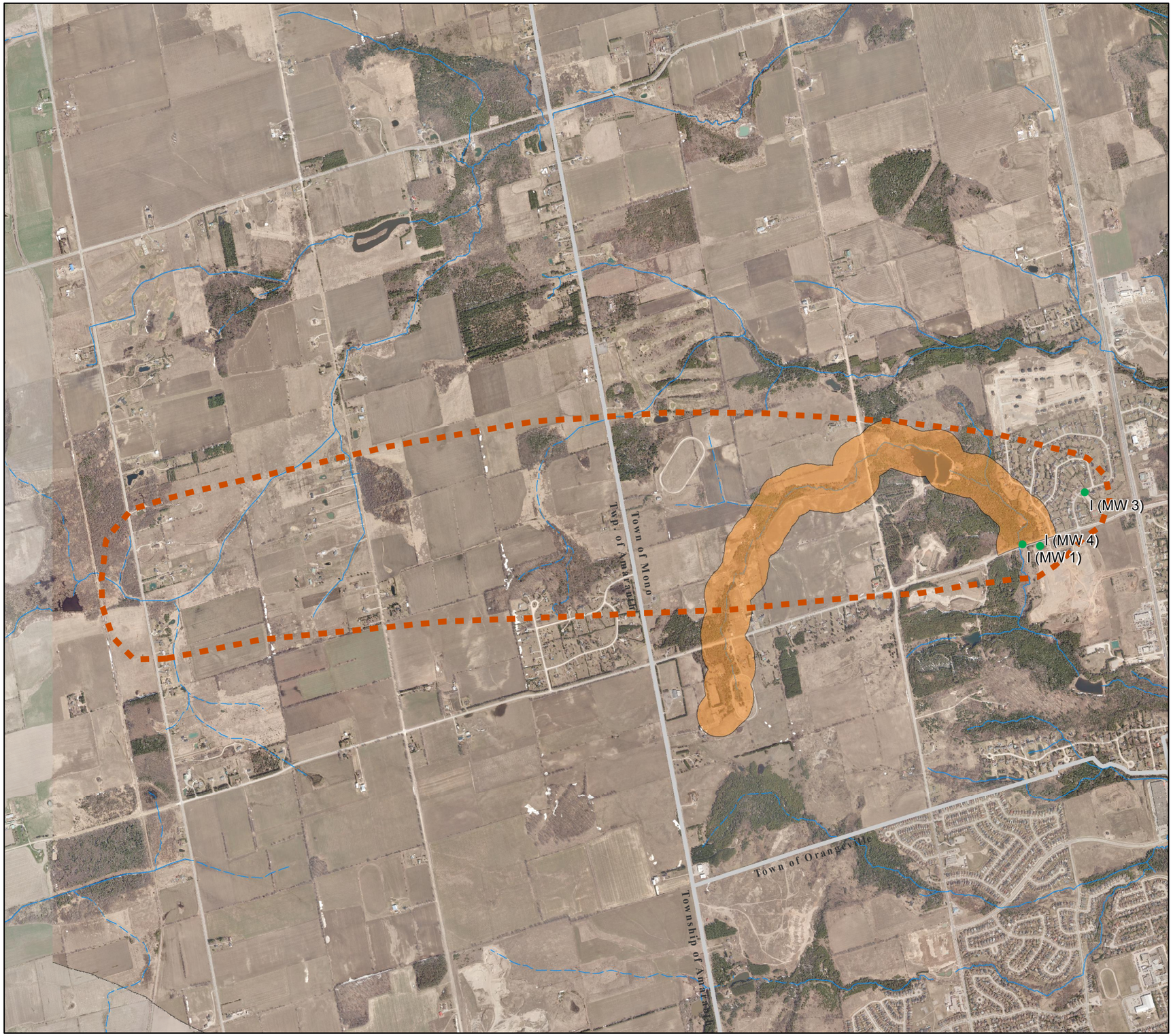

Figure 19a-12

TOWN OF MONO

ISSUES EVALUATION AND THREATS ASSESSMENT

LIVESTOCK DENSITY CARDINAL WOODS WHPA E

LEGEND

- Production Well Location (Type - I)
- Well Head Protection Area Zones

Livestock Density

Nutrient Units / Acre

- < 0.5 NU / Acre
- 0.5-1.0 NU / Acre
- > 1.0 NU / Acre
- Non-Applicable
- Municipal Boundary
- Watercourse: Permanent
- Watercourse: Intermittent

Data Sources:
Ministry of Natural Resources: Produced using information provided by the Ministry of Natural Resources, Copyright © Queen's Printer, 2009

National Topographic Data Base (NTDB), Canada

R.J. Burnside & Associates Limited

N

0 250 500 750 1,000 1,250 1,500

Meters

Scale: 1:22,000
June, 2010
Project Number: MSA12359

Projection: UTM Zone 17
Datum: NAD 83

Prepared By: C. Dickie

Verified By: D. Smikle

BURNSIDE

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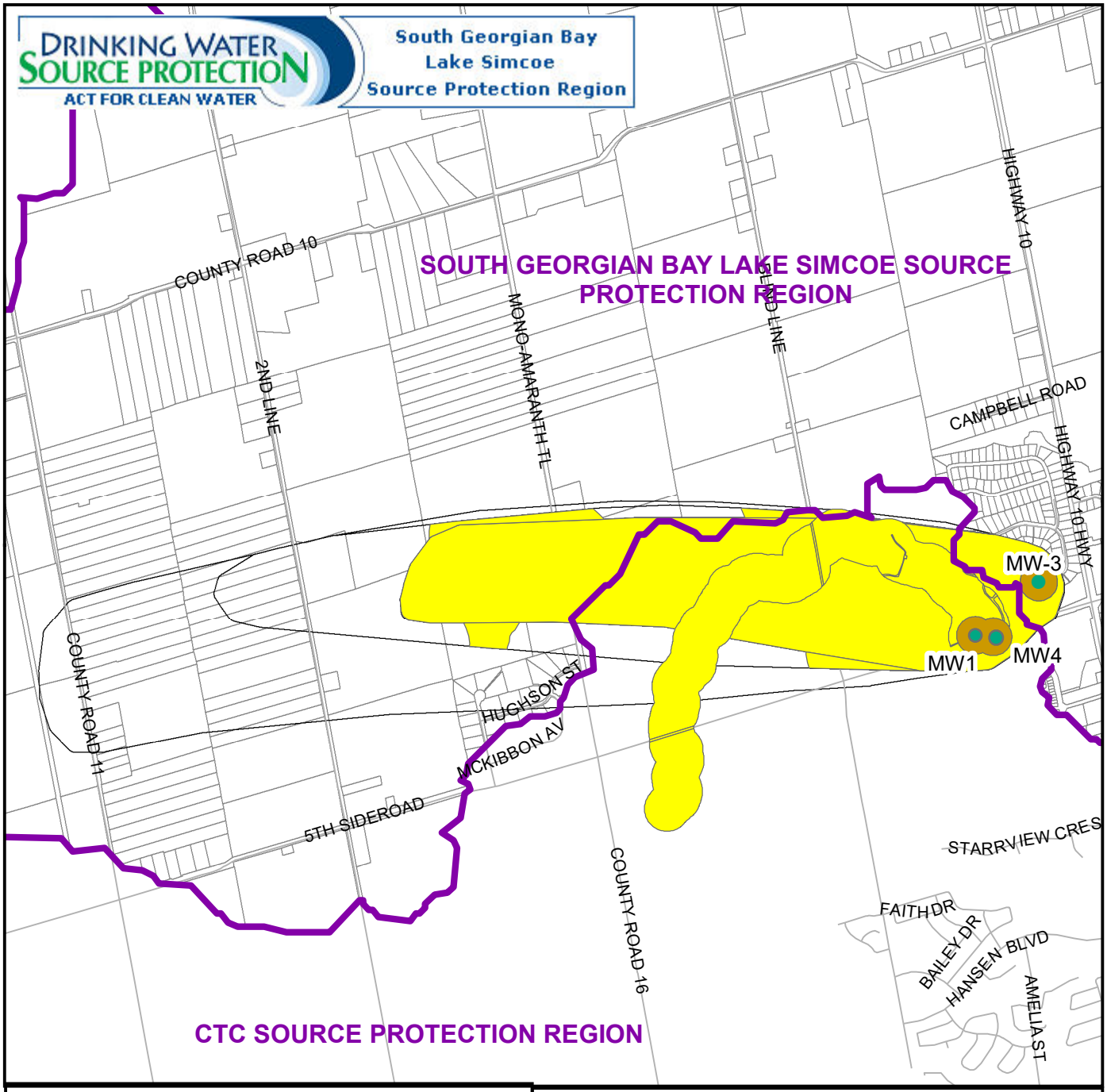

Legend

- Municipal Well Location
- <1%
- =1 - <6%
- =6 - <8%
- =8 - <30%
- =>30%
- Source Protection Region

N W E S

360 180 0 360 Meters

The Impervious Surfaces proportion is illustrated where the vulnerability score is greater than 6.

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.

IMPERVIOUS SURFACES - CARDINAL WOODS

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

Created by: NVCA
Date: 2025-09

Scale: 1:32,000

UTM Zone 17N, NAD83

Nottawasaga Valley Conservation Authority

Ontario

Figure 19a-13