



UPPER THAMES RIVER ASSESSMENT REPORT

Municipal Drinking Water System Summary - Embro Water Supply System

Assessment Reports compile and summarize information from the technical reports that have been completed on each of the municipal drinking water systems in the Thames-Sydenham and Region.

This Municipal Drinking Water System Summary provides an overview of information in the Upper Thames River Assessment Report related to this system. For more detailed information and mapping, please refer to the Upper Thames River Assessment Report at www.sourcewaterprotection.on.ca.

The information presented in the Assessment Report, including this system summary, will be used to develop Source Protection Plans as required by the Clean Water Act (2006). Source protection is the first barrier that helps provide safe drinking water for Ontario and focuses on protecting the source of the drinking water systems (raw, untreated water). The other barriers that help protect drinking water, including treatment, testing and distribution, are governed by the Safe Drinking Water Act, 2002.

Embro Water Supply System Overview

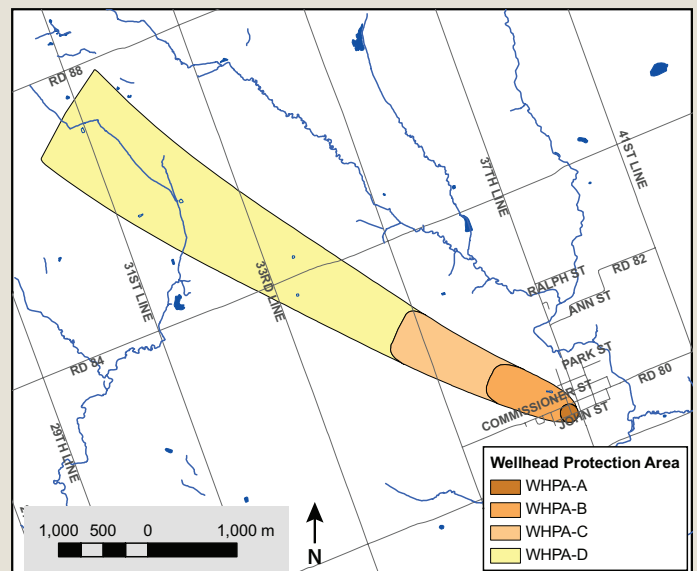
System	Embro Water Supply System			
Operating Authority	County of Oxford			
Classification of System	Drinking Water System – 1 (Large municipal residential)			
Pumping Rates (m ³)		Maximum Annual	Average Annual	Average Monthly
	Well 1	46,248	38,049	3,171
	Well 3	46,693	43,282	3,607
Source	Groundwater			
Location	Embro			
Description of Wells	2 pumping wells Water is from a bedrock aquifer Well screen depths are 60 metres below ground surface			
Approximate Population Served	828			
Area Served	Community of Embro			

Wellhead Protection Areas

Wells are used to extract drinking water from aquifers in the ground. A Wellhead Protection Area, or WHPA, is an area delineated around a municipal wellhead, through which contaminants are reasonably likely to move toward or reach the well. Within a WHPA, certain activities and conditions (past activities) can pose a threat to the municipal drinking water supply.

Computer models and other tools are used to build a picture of the groundwater conditions around a well. In the Upper Thames River Source Protection Area (SPA), numerical groundwater models have been used to delineate WHPAs around the municipal wells (Figure 1). These models calculate the time it takes for water to travel through the aquifer to the well.

Figure 1. Embro Wellhead Protection Areas



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Each WHPA is comprised of three areas based on this time of travel, and one area that is a fixed radius around the well.

WHPA-A – 100 metre radius around the well

WHPA-B – 2 year time of travel to the well, excluding the WHPA-A

WHPA-C – 2 to 5 year time of travel to the well

WHPA-D – 5 to 25 year time of travel to the well

Two other areas (WHPA-E and WHPA-F) can be delineated for groundwater wells that are under the direct influence of surface water (GUDI). The Embro well supply system is not GUDI.

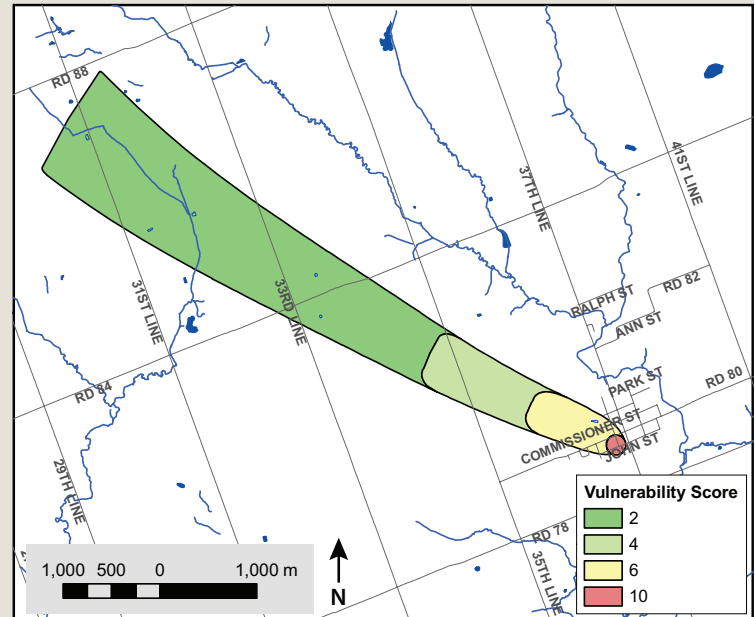
Vulnerability Assessment

The first step in assessing the vulnerability of the Embro WHPA was to determine the intrinsic (inherent) vulnerability of the aquifer. The Aquifer Vulnerability Index (AVI) method was used. This is an index approach where spatial calculations are completed with the available hydrogeological data and mapping products (e.g., overburden soil type and thickness; depth to aquifer; etc.) to produce an index or numerical score that reflects the relative amount of protection provided by the physical features that overlie the aquifer. It results in a score which is then categorized as high, medium or low.

From the results of the AVI analysis, the vulnerability for the Embro supply aquifer was categorized as low. Based on the AVI analysis and WHPA zone, the areas within the Embro WHPA were assigned vulnerability scores ranging from 2 to 10 (shown in Figure 2) on a 10-point scale, with 10 being the highest vulnerability.

Information on constructed transport pathways was also reviewed. These man-made constructions, such as oil wells, may circumvent the natural protective layers above a groundwater aquifer. In the Embro WHPA, an increase in the vulnerability scores due to constructed transport pathways was not deemed necessary. The uncertainty due to bedrock fracture was considered in the delineation of WHPA-A to D.

Figure 2. Embro WHPA Vulnerability Scores



Peer Review of Vulnerability Assessment

The Source Protection Committee established a peer review committee to review the vulnerability assessment. This peer review committee included consultants and academics who are experts in surface water or groundwater modelling and vulnerability assessment. The committee reviewed the technical reports and met with the consultants and municipal staff involved with the work. The peer reviewers provided opinions as to whether the work met the appropriate rules and guidance and whether it was scientifically valid. They also provided comments that the consultants used to improve the documentation of their work.

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Issues

A drinking water issue is a parameter (substance) or pathogen (disease-causing microorganism) that is present at a level that may cause the deterioration of the quality of water used as a source of drinking water. An issue may also be identified when levels of that substance or organism show an increasing trend that may result in deteriorated quality of water used as a source of drinking water. The Safe Drinking Water Act (2002) identifies the parameters that can be considered. Parameters and pathogens are described in Section 5.0 - Issues Evaluation, of this Assessment Report.

Issues were identified by following the Thames-Sydenham and Region Issues Evaluation Methodology (May 14, 2009). The evaluation is a two-step process. Firstly, in the screening step, raw (untreated) water quality data are compared to a benchmark and parameters or pathogens may be flagged if they meet the screening criteria.

For chemical, physical and radioactive parameters, the benchmarks are generally half the applicable human health based Ontario drinking water standards (Maximum Acceptable Concentrations, or MAC), and the full levels of the aesthetic objectives (AO) and operational guidelines (OG), and any plant operating authority concerns.

For parameters flagged through the screening, the second identification step involves a review of trends and spikes, frequency and duration of occurrence, presence at or trending towards the applicable MAC, AO or OG benchmark, consideration of existing water treatment plant capabilities and discussions with the water treatment plant operating authority.

Pathogens are evaluated differently. A known pathogen of concern that is flagged through the screening process must be subject to a microbial risk assessment to identify it as an issue. This assessment involves pathogen characterization, exposure assessment and risk characterization.

If an issue (known to be partially or wholly due to anthropogenic causes) is identified at an intake or wellhead of a system included in the Terms of Reference, the activities that contribute to the issue and the areas where they occur (within vulnerable areas) must also be identified. The activities that contribute to the identified issue are deemed to be significant risks to the drinking water source and must be mitigated through the Source Protection Plan.

Table 1 provides drinking water quality issues identified in the raw (untreated) water of the Embro municipal wells. Parameters may be due to anthropogenic (man-made) sources, i.e., activities on land, or may be naturally occurring, or both. No pathogens were identified as issues in the raw (untreated) source water in the Upper Thames River SPA. Information on flagged parameters is provided in an Appendix to the Assessment Report.

It is important to note that the drinking water quality issues identified in Table 1 are based on raw (untreated) water quality and do not represent the quality of water after treatment. The operation of a water treatment plant, including treatment and distribution, is governed separately by the Safe Drinking Water Act (2002).

Table 1. Drinking Water Quality Issues Identified – Embro Raw (Untreated) Water

Parameter	Description	Natural or Anthropogenic (man-made)
None	None identified.	



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Conditions

A condition is the result of a past activity that has the potential to pose a risk to a drinking water source. The Source Protection Committee is required to list as a drinking water threat any "condition" of which it is aware. The Technical Rules: Assessment Report identifies the types of situations that can be considered a condition. The situations pertaining to wellhead protection areas may be summarized as follows:

- the presence of a non-aqueous phase liquid in groundwater in a highly vulnerable aquifer, significant groundwater recharge area or wellhead protection area;
- the presence of a contaminant in groundwater in a highly vulnerable aquifer, significant groundwater recharge area or a wellhead protection area, if the contaminant is listed in Table 2 of the MOE publication 'Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act' (March 9, 2004); and is present at a concentration that exceeds the potable groundwater standard set out for the contaminant in that Table.

Based on limited data available for review, no conditions have been identified in this wellhead protection area. At the time of drafting of this Assessment Report, the Source Protection Committee has not completed an extensive investigation to determine whether there are any conditions that need to be reported. If additional information becomes available to the SPC to identify conditions, that work would be included in a subsequent Assessment Report.

Threats and Risk Assessment

Risk assessment is the process of assessing threats to drinking water, in order to determine their relative risk to the drinking water source. The Clean Water Act prescribes activities that may be considered drinking water threats. The activities associated with drinking water quality are summarized in the Threats and Risk Assessment Section of the Assessment Report.

The Ministry of the Environment has developed "Tables of Drinking Water Threats" to identify the level of risk associated with an activity. Threats related to pathogens and chemicals are considered in separate tables. Under the Clean Water Act, it is required to determine the number of locations at which a significant threat is thought to occur. Also, a list of activities that are or "would be" threats is to be included. Generally this is addressed by including all prescribed activities even if they are not currently occurring in an area. Activities not currently occurring in the vulnerable areas "would be" threats if the activities were to occur in the future. The circumstances that result in them being significant threats must also be included in the Assessment Reports.

Through the vulnerability scoring approach, the level of risk is dependent on the vulnerability score of the area where the activity takes place and the circumstances under which the activity occurs. An activity can only be identified as a threat if it occurs in a vulnerable area and the vulnerability score of the area is greater than 4. The circumstances to be considered include the type of material (chemical, pathogen or dense non-aqueous phase liquid), the quantity of material and whether the material might be released to surface water or groundwater.

Figures 3a, 3b and 3c show areas in the Embro WHPAs where activities "are or would be" low, moderate or significant threats. The level of threat is dependent upon the vulnerable area (WHPA-A, B, C or D) where the activity occurs, the vulnerability score and the circumstances associated with the activity. As per the MOE threats tables, dense non-aqueous phase liquids (DNAPLs) are a significant risk in WHPA-A, B and C.

Table 2 indicates the number of locations where significant threats could occur in the Embro WHPAs, based on current land use. Site-specific risk assessment would be undertaken if needed during the development of the source protection plan. This would help to confirm the number of locations where a significant threat occurs. The outcome of that assessment will be part of a subsequent Assessment Report.

Table 2. Number of Locations where Significant Threats Could Occur



Chemicals	
WHPA-A	1
WHPA-B, C, D	0
Pathogens	
WHPA-A	20
WHPA-B, C, D	0
DNAPLs	
WHPA-A	1
WHPA-B	3
WHPA-C, D	0

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Figures 3a-c. Embro Areas where Activities would be Drinking Water Threats

Legend

-  Wellhead Protection Area Boundaries
-  Waterbody

Threat Level (dependent on circumstances)






-  Low
-  Moderate or Low
-  Significant or Moderate or Low
-  Significant or Moderate
-  Significant

Figure 3a. Areas where activities related to chemicals would be threats

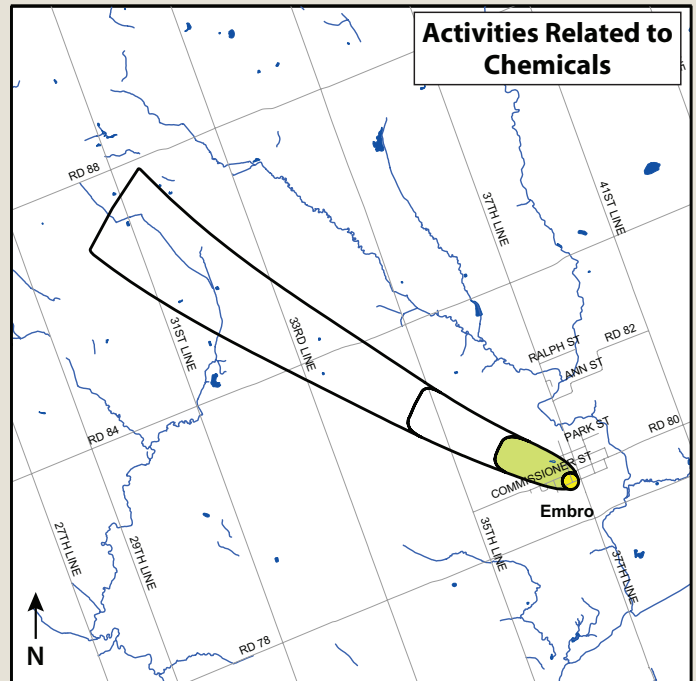


Figure 3b. Areas where activities related to pathogens would be threats

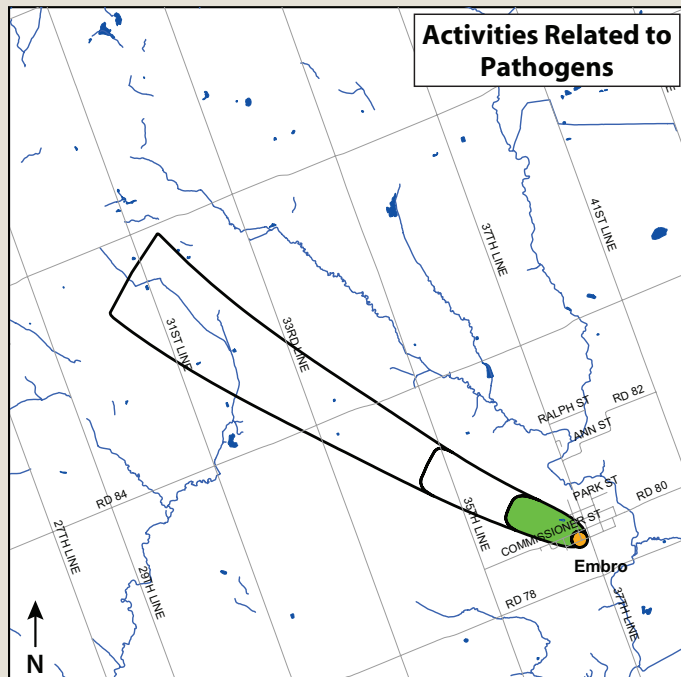
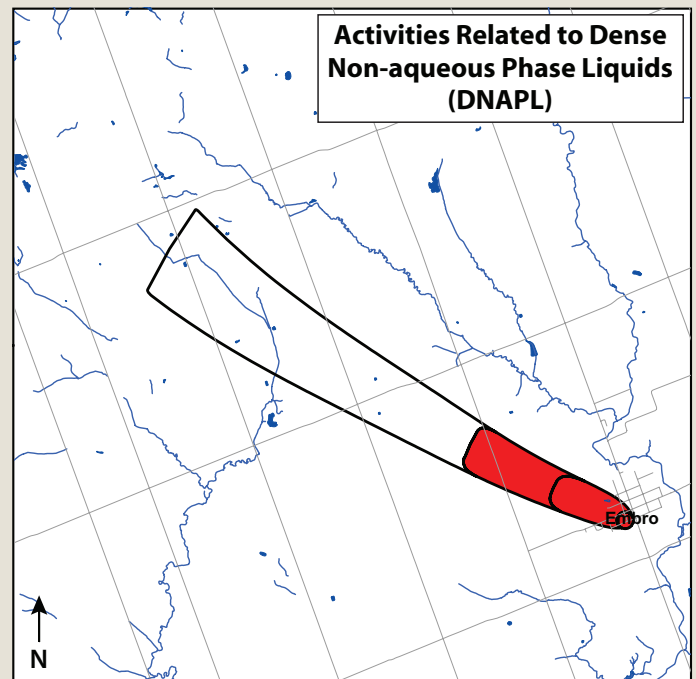


Figure 3c. Areas where activities related to DNAPLs would be threats



For more information contact your local Conservation Authority or visit our website



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