

# Wellhead Protection Study

## Terms of Reference

### 1. Background

#### Source Water Protection – Municipal Systems and Private Communal Systems:

Drinking water resources for municipal residential drinking water systems in Ontario are protected under Ontario's *Clean Water Act*, 2006, which is administered by the Ministry of Environment, Conservation and Parks (MECP). The purpose of the *Clean Water Act* is to protect existing and future drinking water resources from contamination and depletion. Under the *Act*, all municipal residential water supplies must have drinking water protection zones delineated based on the Director's Technical Rules, a companion document to the *Clean Water Act*. Drinking water protection zones include Wellhead Protection Areas (WHPA) for supply wells and Intake Protection Zones (IPZ) for surface water intakes. In addition, there must be policies in ministry-approved source protection plans to manage significant drinking water threat activities so that they cease to be a threat to drinking water resources. Specific circumstances under which activities are considered significant drinking water threats are outlined in the Provincial tables of drinking water threats and circumstances.

Local Source Protection Assessment Reports describe the scientific basis for the delineation drinking water protection zones. While policies to manage significant drinking water threat activities are outlined in Source Protection Plans.

The City of Ottawa is located within three Source Protection Areas (SPA); the Mississippi Valley SPA, the Rideau Valley SPA and the South Nation SPA. Each SPA has a Source Protection Assessment Report, which describes the physical characteristics of the area, local water quantity and quality, delineates Drinking Water Protection Zones and enumerates potential threats to drinking water sources.

The City of Ottawa is located within two Source Protection Regions, each with its own locally developed Source Protection Plan that contains policies to protect municipal drinking water resources:

- [Mississippi-Rideau Source Protection Plan](#)
- [Raisin-South Nation Source Protection Plan](#)



The *Safe Drinking Water Act* conforms with the *Clean Water Act* such that all new or altered drinking water systems in Ontario must have the associated source protection technical reporting approved by the local Source Protection Authority prior to obtaining a new or amended license and the local Source Protection Assessment Report and Source Protection Plan must be amended to include the new or altered drinking water system and be approved by the MECP prior to the provision of water. All new or altered municipal well systems must follow the Terms of Reference herein to comply with requirements under the *Clean Water Act*.

Although only municipal residential drinking water systems currently fall under the *Clean Water Act*, the MECP has developed recommendations and guidance for source protection for communal residential drinking water systems that do not fall under the *Clean Water Act*. In addition, OP Policy 4.9.5.9 identifies that the City shall establish measures to protect communal drinking water systems serving six or more private residences; this Terms of Reference outlines requirements for Wellhead Protection Studies for private communal systems as well as municipal systems. The technical study requirements for private communal systems herein reflect the accepted best practices in Ontario.

Note that the City of Ottawa will not enter into a Municipal Responsibility Agreement or agree to municipal ownership for a water works to be supplied by a proposed communal well or well field, unless the proponent provides a Wellhead Protection Study, as outlined in this Terms of Reference and to the satisfaction of the City. The report must clearly demonstrate that the source of the groundwater supplying the communal well or well field is delineated based on an accepted methodology and will be protected through the recommendations within the Wellhead Protection Study.

### **Wellhead Protection Studies in the City of Ottawa:**

The quality of groundwater from any water well reflects the natural ambient quality of groundwater in the supply aquifer and impacts from human activities (anthropogenic impacts). Future well water quality cannot be predicted by looking at current well water quality alone; land uses and activities within the capture zone of a well can impact future water quality. Thus, to predict future well water quality, including possible future anthropogenic impacts, it is necessary to understand the following:

- i. The source(s) of groundwater supplying the well (where does the water come from?);
- ii. The sources of contamination that could potentially impact the well water quality; and



- iii. The degree of risk posed by the potential sources of groundwater contamination.

To ensure that the City is provided with sufficient information regarding the aquifer/groundwater within the capture zone of a proposed communal well or well field, proponents of private communal well systems must complete a Wellhead Protection Study according to this Terms of Reference. The Wellhead Protection Study must consist of:

1. The determination of the source of recharge to the aquifer(s) from which the well or well field obtains its water;
2. Delineate (map) the well or well field capture zones using a method identified in the technical rules under the *Clean Water Act*, and agreed with technical staff at City of Ottawa (e.g. numerical modeling);
3. Compilation of an inventory of existing contaminant sources within the WHPA, as per the technical rules under the *Clean Water Act*, and all associated assessments and mapping to identify potential significant drinking water threats; and
4. Clear recommendations for actions to protect the source water for the well.
5. The proponent will be responsible to fulfil all possible measures outlined in the Wellhead Protection Study to protect the groundwater within the WHPA.

## 2. Objective

The purpose of the study is to:

- Delineate the WHPAs;
- Characterize the vulnerability within the WHPAs;
- Identify and enumerate potential threats to the drinking water source; and
- Recommend actions for long-term protection of the source water

A Wellhead Protection Study is required for all new communal residential drinking water well systems and may be required for an alteration to a communal drinking water systems (for example, the addition of a supply well, or increased water taking). The study must be completed in accordance with the technical rules under *Clean Water Act*, and must meet locally developed rules and methodologies as applicable.

## 3. Definitions / Key Terms

**Drinking Water Works Permit or License** - means a permit or license issued under Part V of the [\*Safe Drinking Water Act\*](#).



**Drinking Water Protection Zones** - term that includes Wellhead Protection Areas and Intake Protection Zones.

**Municipal Responsibility Agreement** - Where municipal ownership of communal services cannot be achieved, a Municipal Responsibility Agreement between the developer and the municipality will be requested by the planning authority. Such agreements will include provisions for municipal assumption of the communal services in the event of default and the provision of up-front secured funds.

**Intake Protection Zone (IPZ)** - means an area that is related to a surface water intake and within which it is desirable to regulate or monitor drinking water threats.

**Source Protection Area (SPA)** - means a drinking water source protection area established by subsection 4 (1) or by the regulations under the *Clean Water Act*. For City of Ottawa, there are three SPAs: Mississippi Valley SPA, the Rideau Valley SPA and the South Nation SPA.

**Source Protection Assessment Report** – there is an Assessment Report for each Source Protection Area which identifies the drinking water protection, vulnerable areas and threats, for City of Ottawa there is one report for each of: Mississippi Valley SPA, the Rideau Valley SPA and the South Nation SPA.

**Source Protection Plan** - means a drinking water source protection plan prepared under the *Clean Water Act*, developed by the Source Protection Regions and approved by the Ministry of Environment, Conservation and Parks.

**Source Protection Region (SPR)** - means a drinking water source protection region established by the regulations under the *Clean Water Act*. For City of Ottawa there are two SPRs: the Mississippi-Rideau Source Protection Region and the Raisin-South Nation Source Protection Region.

**Source Protection Technical Studies** – include technical studies to define designated vulnerable areas as defined under the *Clean Water Act*, and threats and risk assessments.

**Wellhead Protection Area (WHPA)** - means an area that is related to a wellhead and within which it is desirable to regulate or monitor drinking water threats.

#### 4. Authority To Request

Under Ontario's *Clean Water Act*, municipalities must implement Source Protection Plans to protect existing and future sources of municipal drinking water from contamination and depletion.

All new municipal systems require the preparation of source protection technical studies, in accordance with the technical rules under the *Clean Water Act*, prior to obtaining a Drinking Water Works Permit or Licence under the *Safe Drinking Water Act*. Thus, any residential drinking water system that will be owned by the City or may be owned by the City in the future (as is the case when a Municipal Responsibility Agreement is required), will be required to complete source protection technical studies prior to any *Planning Act* approval. In addition, OP Policy 4.9.5.9 identifies that the City shall establish measures to protect communal drinking water systems serving six or more private residences; as such, Wellhead Protection Studies are required for all private communal residential drinking water systems.

The technical rules under the *Clean Water Act* identify several different methods to delineate WHPA for supply wells. Three-dimensional numerical groundwater modelling must be applied for all planned municipal well systems or systems where ownership will be transferred to the municipality. Flexibility regarding the methodology will be permitted for private systems; however, the methodology must still meet the requirements under the technical rules and must be mutually agreed upon with City technical staff through technical pre-consultation.

#### 5. When Required

A Wellhead Protection Study is required for all new communal residential drinking water well systems; including new municipal wells, new private communal wells (small water works) that require a Municipal Responsibility Agreement, expansions or increased water takings from an existing municipal well or existing private communal well and new private communal wells (that do not require a Municipal Responsibility Agreement) when identified by development review staff at pre-consultation. This includes but is not limited to institutional facilities that have residences, such as care facilities and seasonal campgrounds.

The requirement for, and specific scope of, the Wellhead Protection Study will be confirmed through the study's specific Terms of Reference or at the formal technical pre-consultation meeting, as applicable.



## 6. Technical Pre-Consultation

Pre-consultation is a dialogue between the proponent and the City of Ottawa prior to submission of a Wellhead Protection Study. Pre-consultation is meant to assist proponents in defining the objectives and requirements for the Wellhead Protection Study.

In the pre-consultation with the City, the proponent must be prepared to present and discuss a preliminary conceptual model of the hydrogeological system of the region surrounding the well or well field. A good understanding of the hydrogeological system within which the communal wells would operate (the conceptual model) is needed to define a WHPA with a high degree of confidence. The hydrogeological conceptual model will include, at a minimum, a description of recharge and discharge areas, general groundwater flow directions, local groundwater use, and the characteristics of aquifers/aquitards in the region surrounding the well or well field. Also, as part of pre-consultation, the proponent must present and discuss a preliminary contaminant source inventory and discuss information required for associated mapping to define significant threats (livestock density, percentage of managed lands and impermeable surfaces) for the area within a five-kilometre radius of the well or well field.

Note that a site-specific Terms of Reference will be required for every Wellhead Protection Study; site-specific investigation and reporting requirements will be discussed at the pre-consultation.

## 7. Contents

Wellhead Protection Studies must be completed in compliance with the technical rules under the *Clean Water Act*; see Part V: Delineation of vulnerable areas: highly vulnerable aquifers, significant groundwater recharge areas and wellhead protection areas; Part VII: Vulnerability: highly vulnerable aquifer and wellhead protection areas and Part XI: Drinking water threats: water quantity. The most recent revision of the Technical Rules under the *Clean Water Act* will be applicable.

### **Aquifer and Aquitard Parameter Characterization**

Aquifer and aquitard parameters such as thickness, hydraulic conductivity and effective porosity must be determined, either from reliable existing information or through collection of new data. The hydrogeological system, as described in the conceptual model, must be considered to determine the appropriate aquifer and aquitard parameter data requirements.



A minimum of one properly completed pump test at each well is required. The type and duration of the pumping test will also be based on the hydrogeological system and needed to determine aquifer and aquitard parameters. A properly completed pump test uses drilled observation well(s), and if possible, the acquisition of data concerning the vertical position and yield of individual water bearing zones within the aquifer formation(s) (bedrock or overburden). Downhole hydrogeophysical logging, downhole packer testing, and the installation of multilevel monitoring wells for the determination of site-specific vertically referenced data may be required to successfully complete the Wellhead Protection Study.

### **Wellhead Protection Area (WHPA) Delineation and Vulnerability Assessment**

The definition of the WHPA will be based on calculated groundwater capture zone(s) as outlined in technical rules under the *Clean Water Act*. The proponent will make use of available maps, air photos, water well record data, relevant hydrogeological and environmental reports, published databases of potential contaminant sources (MOE databases and others) and pumping test data. Where required to properly characterize the hydrogeological system, the collection of additional groundwater quality, geophysical (down-hole or surface surveys), downhole packer test, environmental isotope, or other types of data may be necessary to successfully complete the Wellhead Protection Study. While the need to collect additional data will be determined by the proponent, the City will apply a high standard of care in its confirmation of the successful completion of the Wellhead Protection Study by the proponent.

For municipal systems: WHPA extents must be determined by time of travel to the wellhead(s) using a computer based three-dimensional groundwater flowmodel. The scope of work must be approved by the City and the Source Protection Region.

For non-municipal systems: WHPA extents may be determined by one of the methods permitted listed in the technical rules under the *Clean Water Act*. The method and scope of work must be agreed upon by City staff. In relation to the study methodology, consideration will be made for the hydrogeologic setting, the yield requirements for the new well, adjacent land uses and potential threats, and availability and limitations of hydrogeologic data.

Vulnerability scores within WHPAs are required to assess the potential risk of drinking water threat activities. Vulnerability will be characterized and vulnerability scores will be assigned within WHPAs based on the technical rules under the *Clean Water Act* and will follow the methodology approved by the Source Protection Region (i.e. surface to aquifer advective times). The methodology to assign

vulnerability scores within WHPAs will be discussed at the pre-submission consultation.

Please be advised, the proponent must complete a comprehensive WHPA study for all affected well systems to account for interactions between vulnerable areas. This will be required if the proposed new WHPA intersects a neighbouring WHPA or affects the groundwater flow regime to a neighboring municipal well system which may result in changes to the existing WHPA delineation.

### **Threats Inventory and Associated Assessments**

A detailed threats inventory must be conducted for the properties within the WHPA, in accordance with the technical rules under the *Clean Water Act*. The objective of this assessment is to identify past, present and possible future activities that are current, or potential future, point, and non-point sources of groundwater contamination.

Several associated mapping assessments are required to support the assessment and enumeration of potential drinking water threats. These threats include the percentage of managed lands, livestock density and impervious surface area calculations within the WHPAs. All associated maps will be completed as per the technical rules under the *Clean Water Act* and local approved methodologies, which will be discussed at the pre-consultation.

### **Source Protection Recommendations and Wellhead Protection Plan**

The Wellhead Protection Study report must include recommendations to protect the source water. Prior to developing recommendations, the proponent must review the local Source Protection Plan policies and relevant City policies, by-laws and programs concerning rural development, environmental protection, etc. The Wellhead Protection Study must include specific actions to be undertaken by the proponent to address problems identified by the threats assessment. The need for the proponent to undertake additional groundwater investigations or establish a groundwater monitoring program must be addressed in the Wellhead Protection Study. If necessary, the City may require land securement by the proponent in order to address issues related to potential sources of contamination.

## **8. Evaluation Criteria**

Evaluation of the Wellhead Protection Study will be based on requirements set out in the *Clean Water Act* technical rules or site-specific Terms of Reference criteria (as agreed with City staff at project). Evaluation criteria will be defined at the onset of the study.





All Wellhead Protection Studies must undergo a technical peer review and a report on the peer review must be submitted to the City. It is recommended that the peer reviewer be engaged early in the process to provide comments on methodology. Peer review may be concurrent with the City and Source Protection Region reviews. The peer reviewer would be retained at the expense of the proponent. The City and Source Protection Region need to agree on the selected peer reviewer. The City can provide the proponent with a list of acceptable peer reviewers.

## 9. Roles and Responsibilities / Qualifications

Wellhead Protection Studies must be prepared and signed by a professional geoscientist or professional engineer specializing in hydrogeology.

### Technical Consultation and Peer Review Requirements

Technical pre-consultation with the City is required to review and approve the scope of work for all Wellhead Protection Studies.

For municipal systems, technical pre-consultation will include the applicable Source Protection Region. Technical peer review, at the expense of the proponent, will be required for Wellhead Protection Studies prior to approval.

For private systems, technical pre-consultation with City technical staff and technical peer review, at the expense of the proponent, will be required.

## 10. Submission Requirements

Any supporting model files and GIS files shall be included with the submission of the final report. Any digital files for systems that will be included in local Source Protection Plans must meet submission requirements of the Source Protection Region, to be defined at the onset of the project. The final report shall be signed and sealed by the qualified professional who prepared the report

## 11. Resources / Background

The documents below provide additional, detailed information on the requirements related to Wellhead Protection Studies and drinking water source protection in the City of Ottawa.

*Clean Water Act*, 2006. S.O. 2006, c. 22., Ontario Ministry of the Environment, Conservation and Parks (as amended)

[Clean Water Act, 2006, S.O. 2006, c. 22 \(ontario.ca\)](#)



Technical Rules under the *Clean Water Act*, 2021, Ontario Ministry of the Environment, Conservation and Parks (as amended)

[2021 technical rules under the Clean Water Act | ontario.ca](https://www.ontario.ca)

Assessment Report for the Mississippi Valley Source Protection Area, August 2011, prepared by the Mississippi-Rideau Source Protection Region

[Mississippi-Rideau Source Water Protection - Assessment Report \(mrsourcewater.ca\)](https://mrsourcewater.ca)

Assessment Report for the Rideau Valley Source Protection Area, December 2011, prepared by the Mississippi-Rideau Source Protection Region

[Mississippi-Rideau Source Water Protection - Assessment Report \(mrsourcewater.ca\)](https://mrsourcewater.ca)

Assessment Report for the South Nation Source Protection Area, revised September 2016, prepared by the Raisin-South Nation Source Protection Region

[Assessment Report, South Nation Source Protection Area « Raisin-South Nation Source Protection \(yourdrinkingwater.ca\)](https://yourdrinkingwater.ca)

Mississippi-Rideau Source Protection Plan, revised May 2020, prepared by the Mississippi-Rideau Source Protection Region

[Mississippi-Rideau Source Water Protection - Mississippi-Rideau Source Protection Plan \(mrsourcewater.ca\)](https://mrsourcewater.ca)

Source Protection Plan for the Raisin-South Nation Source Protection Region, revised September 2016, prepared by the Raisin-South Nation Source Protection Region

[Source Protection Plan « Raisin-South Nation Source Protection \(yourdrinkingwater.ca\)](https://yourdrinkingwater.ca)