
TIER 3 WATER BUDGET AND LOCAL AREA RISK ASSESSMENT – EXECUTIVE SUMMARY

The Source Protection Program under the Province's *Clean Water Act, 2006* (CWA) was developed to protect the water quality and quantity of existing and proposed municipal drinking water systems across the Province. To date, the water quality components of the Grand River Source Protection Plan have been approved and in place since July 1, 2016.

Background

The ability of municipal drinking water systems located within the Grand River watershed to meet the current and future water needs of its customers was evaluated using a phased approach. The initial phase identified municipal drinking water systems that relied on groundwater or surface water supplies with a potential for stress (this was called a "Tier 2" Water Budget Study). Groundwater or surface water resources were identified as "stressed" if the amount of water taken by the municipalities and other permitted takers (i.e., water demand) was large in comparison to the quantity of water available for withdrawal in the groundwater or surface water. In the Guelph area, the Upper Speed River Assessment Area of the Grand River watershed was classified in the Tier 2 Water Budget Study as having a potential for groundwater quantity stress. As a result, a comprehensive evaluation of the City of Guelph (City) and the Guelph-Eramosa Township (GET) municipal drinking water supply systems was undertaken because these systems were located in the Upper Speed River Assessment Area. The Tier 3 Water Budget and Local Area Risk Assessment (Tier 3 Assessment) evaluated the ability of City's and GET's water supply to meet current needs and future needs resulting from population growth. The Tier 3 Assessment also evaluated the effects that a prolonged drought would have on the municipalities' ability to meet current and future needs.

This summary describes the results of the Tier 3 Assessment completed by the Lake Erie Source Protection Region for municipal drinking water systems of the City and GET. The City's drinking water supply system consists of 23 wells that draw water from a shallow sand aquifer, a shallow fractured bedrock aquifer (Guelph Formation) and a deep fractured bedrock aquifer (Gasport Formation). The City also draws water from an intake on the Eramosa River near Arkell, east of Guelph. GET has municipal drinking water systems located in the communities of Rockwood and Hamilton Drive with four and two wells, respectively that also draw water from the deep fractured bedrock aquifer.

Tier 3 Water Budget

The Tier 3 Assessment was completed following the Province's Technical Rules, which were applied across southern Ontario. The model findings were verified by real world water monitoring results. Flexibility in the Rules allowed the team of experts to achieve a better match between the model and real world water monitoring results. A review team of local technical experts and academics appointed by the Province have accepted the results. The Ontario Ministry of the Environment and Climate Change (MOECC) has also endorsed the results of the Tier 3 Assessment.

As part of the Tier 3 Assessment, complex surface water and groundwater computer models were developed to help evaluate the sustainability of the municipal water supplies. The models incorporated the best available information about local geology, groundwater and surface water resources, precipitation and infiltration and water withdrawals. The models developed a water budget for municipal water supplies that quantified the additions (e.g., precipitation infiltrating into the ground, runoff to streams and rivers, flow within and between the aquifers) and withdrawals (e.g., surface water and groundwater flowing out of the study area, water taking by municipalities and other takers and groundwater contributions to rivers). The groundwater and surface water systems are in balance when the water additions and withdrawals are approximately equal.

Risk Assessment

In addition to the water budget calculations, the models were also used to determine an area where the municipal drinking water systems could be affected by other existing, new or expanded water takings, referred to as a water quantity wellhead protection area (WHPA-Q). The WHPA-Q for the City's wells is a circular area with a diameter of approximately 20 km around the City and extending into the adjacent Townships (see Figure 1). Similarly, the WHPA-Q for the GET wells for the Rockwood area are circular in shape around the wells but much smaller in size due to lower pumping rates. The surface water Intake Protection Zone for water quantity (IPZ-Q) is the upstream catchment area that contributes water to the City's surface water intake on the Eramosa River (see Figure 2).

The final task of the Tier 3 Assessment was to assign a risk level to the groundwater and surface water quantity vulnerable areas. According to the Rules, the risk level may be "low", "moderate" or "significant" depending on whether the municipal water supply is predicted to be able to meet the water needs of its customers under the modelled risk scenarios. For example, if, under prolonged drought conditions, the water level in a municipal well is predicted to be lowered to a level too close to the well pump intake for safe operation, the well would trigger a significant risk level. The Rules guiding the Tier 3 Assessment followed a conservative approach to ensure the cumulative effects of water takings across the vulnerable area are included in the

assessment. As a result, the highest risk level triggered in at least one well is assigned to the entire vulnerable area. For example, if the scenario for current and future municipal needs produced a “low” risk, but the added stress of a prolonged drought produced a “significant” risk level, the vulnerable area would be assigned a “significant” risk level. If this significant risk level was found for one well, the significant risk level was also assigned to the entire water quantity vulnerable area.

Risk Assessment Results

The Tier 3 Assessment scenarios predicted that the City’s and GET’s municipal wells can meet current needs. However, the assessment predicted that the City’s Queensdale municipal well would be unable to meet future needs under normal climate conditions and during prolonged drought. All of the City’s other wells and GET’s wells are expected to be able to meet future needs under all scenarios, but there is a high level of uncertainty with the results for the City’s Arkell Well 1. As a result of these assessments, and since the City’s drinking water system is dependent on the contribution of water from the Eramosa River intake, the City’s WHPA-Q and IPZ-Q are assigned a significant risk level.

The findings of the Tier 3 Assessment are supported by the historical operating experience in the City where many of the wells reliably provided water over prolonged periods of time. The City primarily draws water from the deep bedrock aquifer which is protected in most areas by a protective layer. The protective layer isolates the deep bedrock aquifer from short-term changes in climate (e.g., a dry summer with little rainfall) and it takes a prolonged drought, as Ontario experienced in the early 1960s, for declines in water levels to be observed in City’s wells. While all the City municipal wells, except the Queensdale Well, are expected to meet the City’s future needs, water levels at some of the City’s other wells (Arkell Well 1, Arkell Well 8, Arkell Well 14, Arkell Well 15, Burke Well, Carter Well and Emma Well) and GET’s Bernardi Well 3 have water levels in the wells that are close to the pump intake and may be more susceptible to drought conditions. With the addition of new Arkell Spring Ground wells, the City’s water supplies have the capacity to meet the 2031 estimated water needs; however, there is little redundancy in the water supply system.

Since the Tier 3 Assessment identified areas where the municipal systems may be affected by water takings (WHPA-Q or IPZ-Q), all water takings that could potentially impact the municipal systems were identified. For water quantity vulnerable areas with a significant risk level, all existing and new water takings located within the area that draw water from the municipal aquifers or Eramosa River or activities that reduce groundwater recharge are classified as Significant Drinking Water Quantity Threats (significant threats). The City and GET municipal wells are significant threats as are other permitted water takings in the WHPA-Q and the IPZ-Q. The significant threats for the WHPA-Q and IPZ-Q are shown in Figures 3 and 4, respectively.

Next Steps

Now that the Tier 3 Assessment is complete, a Risk Management Measures Evaluation Process (Process) will be undertaken to assess the sustainability of the municipal drinking water systems by further evaluating significant threat water takings and exploring effective risk management measures. The Process will be a collaborative project amongst municipal partners and the Lake Erie Source Protection Region.

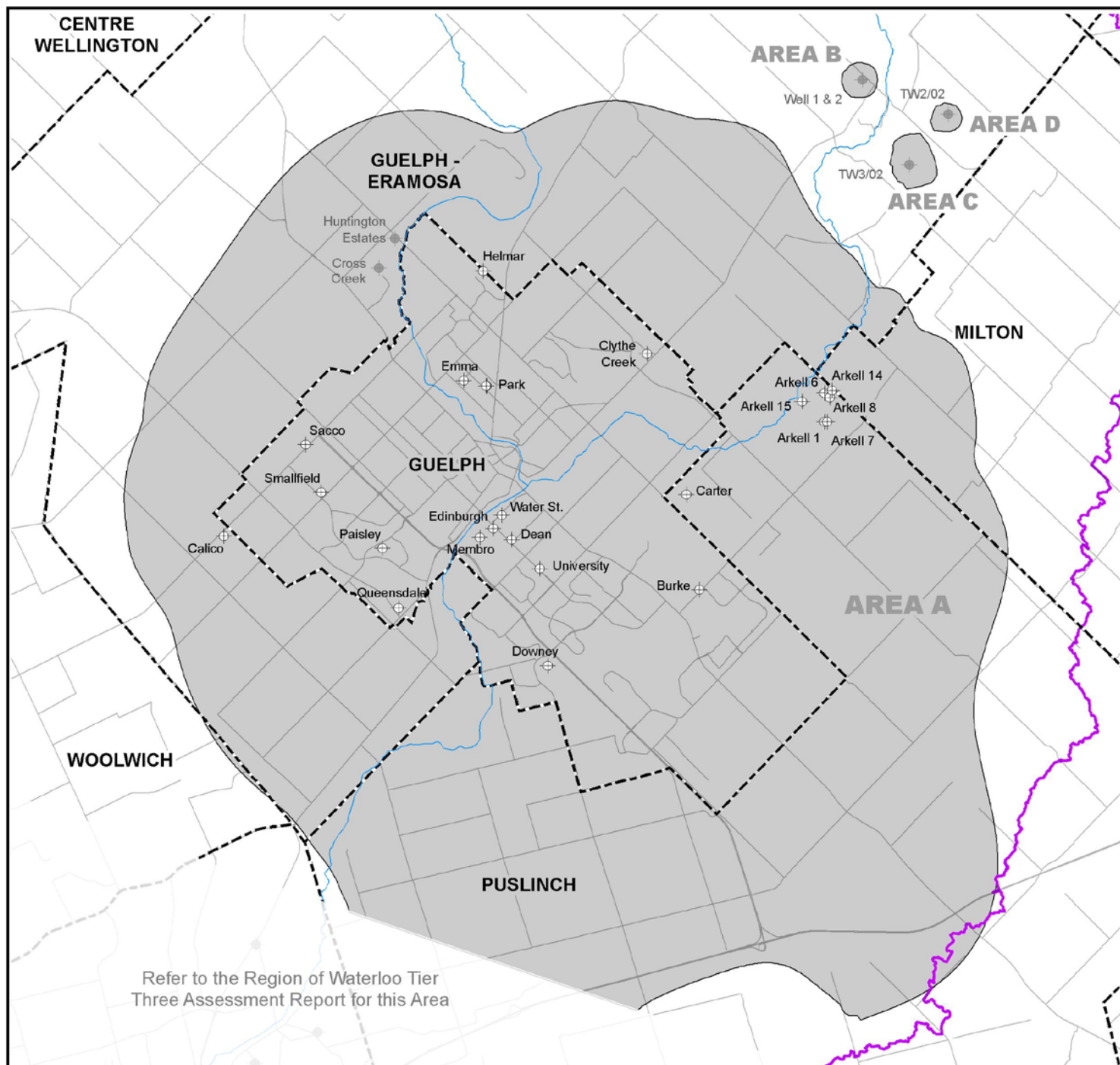
The Process will evaluate and determine the water takings that have the greatest impact on the municipal supplies. Using the Tier 3 model, risk management measures will be evaluated to determine the most effective approach for the City's and GET's systems. Risk management measures that will be evaluated include options such as optimized municipal pumping; water conservation, water loss management and education and outreach programs.

The results of the Process will be used to help guide the development of Source Protection Plan Policies. The Lake Erie Region Source Protection Committee, working with the municipalities, and with significant public consultation, will prepare an update to the Approved Grand River Source Protection Plan that will include the new technical work and water quantity policies.

Figure 1
Guelph/Guelph-Eramosa Tier 3 Groundwater Wellhead Protection Areas for Water Quantity (WHPA-Q)

- Roads
- Major Streams
- Municipal Boundary
- GRCA Boundary
- City of Guelph Wells
- Other Municipal Wells
- WHPA-Q

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Refer to the Region of Waterloo Tier Three Assessment Report for this Area



Figure 2

Guelph/Guelph-Eramosa Tier 3 Surface Water Intake Protection Zones for Water Quantity (IPZ-Q)

- Roads
- Major Streams
- Municipal Boundary
- GRCA Boundary
- Intake
- IPZ-Q

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0 1,100 2,200 4,400 6,600 Meters

NAD 1983 UTM Zone 17N

Scale: 172,548

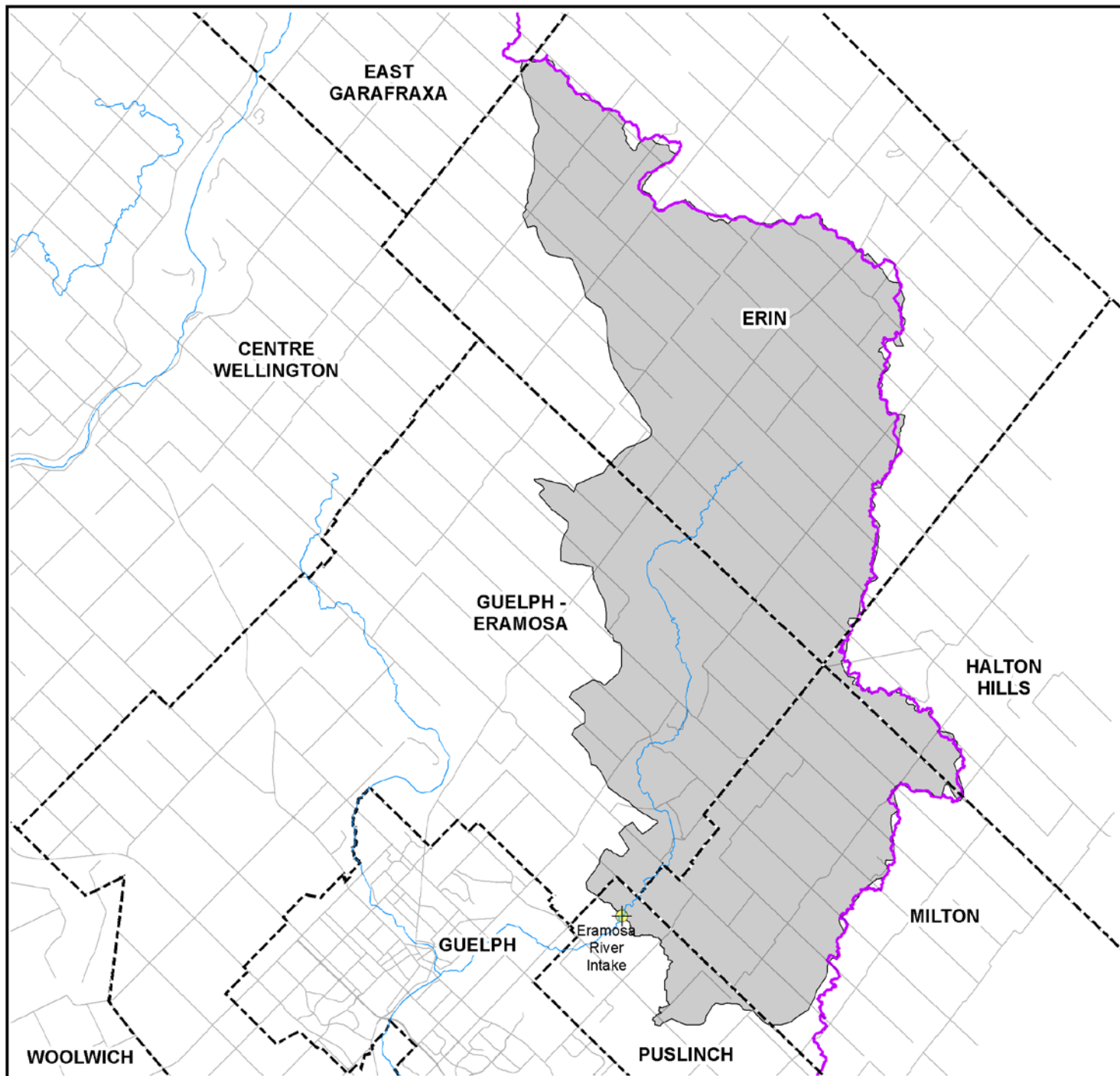




Figure 3

Guelph/Guelph-Eramosa Tier 3 Groundwater Wellhead Protection Area A (WHPA-Q) Significant Water Quantity Threats

- Roads
 - Major Streams
 - - - Municipal Boundary
 - ⬢ GRCA Boundary
 - ⊕ City of Guelph Wells
 - ⊕ Other Municipal Wells
 - ⊕ WHPA-Q
 - Recharge Reduction Threats
- Water Quantity Threats:
- ▲ Agricultural
 - ▲ Commercial
 - ▲ Dewatering
 - ▲ Industrial
 - ▲ Institutional
 - ▲ Miscellaneous
 - ▲ Recreational
 - ▲ Remediation
 - ▲ Water Supply

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Figure 4

Guelph/Guelph-Eramosa Tier 3 Surface Water Intake Protection Zones (IPZ-Q) Significant Water Quantity Threats

- Roads
 - ~ Major Streams
 - - - Municipal Boundary
 - ⊕ GRCA Boundary
 - ⊕ Intake
 - ⊕ IPZ-Q
 - Recharge Reduction Threats
- Water Quantity Threats:
- ▲ Agricultural
 - ▲ Commercial
 - ▲ Miscellaneous
 - ▲ Recreational

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