

## Centre Wellington Scoped Tier 3 Water Budget Study: Discussion on draft Groundwater Flow Model Development and Calibration Report

**Location:** Grand River Conservation Authority Head Office, Cambridge

**Date:** Sept 27, 2018

**Time:** 10:00 am to Noon

**Meeting Objective:** To review and discuss comments provided by Save Our Water (SOW) on the draft Groundwater Flow Model Development and Calibration Report.

**Discussion Items:** A list of discussion items are included in the meeting agenda in Appendix A. These discussion items reference initial comments provided by SOW, which are included in Appendix B.

**Participants:** A list of participants is available in Appendix C.

**Point of Recognition:** The meeting began by recognizing that Ian MacRae (in attendance) is currently a candidate for Centre Wellington Council. The Clerk, Kerri O'Kane, has advised that as Mr. MacRae has attended meetings in the past as a SOW representative, there is no conflict between his attendance at this meeting and municipal election rules, as the circumstance is similar to incumbent Councilors carrying on with meetings during the election period. The potential for conflict exists, however, if information gleaned from the meeting is used during campaigning; Mr. MacRae agreed that he would not use information from this meeting during campaigning.

### Summary

This summary is organised by agenda point (see Appendix A for the agenda). Each agenda point is in reference to written comments provided by SOW, with the specific references noted in parentheses at the end of each agenda line (SOW comments are available in Appendix B).

#### **1. Short-term project (c. 1)**

The project team will remove references to 'long-term' from the report. SOW inquired if the modelling was still confined to 2031 due to limitations relating to infiltration levels and density. The Township responded that the Provincial Policy Statement, which provides growth and density targets, only projects to 2031. Modelling includes changes in development and related changes to impervious areas; as growth and density targets only project to 2031, modelling cannot project densities and impervious area cover past 2031.

Matrix added that the Tier 3 evaluates wells that are permitted or specifically planned to be permitted; potential future wells are not included. The Water Supply Master Plan (WSMP), which is currently in progress, does provide potential additional well sites. Moving forward, it will be important to look at the WSMP and the model together to assess the timeframe past 2031.

**2. *How will future water-taking be balanced? (c. 10)***

Matrix is starting the risk assessment process, which will include an assessment of how future water taking affects the overall water balance (i.e. how additional water takings change groundwater flow as compared to current conditions).

**3. *How can ecological impacts be assessed? (c. 11)***

Matrix noted that the Tier 3 framework is not a detailed ecological risk assessment and is meant to be a screening process. The study will identify areas where there is a potential for ecological impacts based on thresholds described in the Province's Technical Rules for completing Tier 3 water budget studies. This information will provide those looking for a new water supply guidance on where to complete additional monitoring and characterization efforts to address potential ecological risks in greater detail.

SOW inquired if the takings from bedrock aquifers increase from 4% to 6%, where the extra 2% of water takings will be sourced from, and if the source could be the overburden and upper bedrock layer, outside the study area, or from river recharge. Matrix provided discussion on groundwater movement through the shallow and deeper aquifer systems.

SOW noted that it can take 50 years for water to move down into bedrock aquifers, and are concerned this time requirement will not allow for the impacts of increased water takings from bedrock aquifers to be understood and noticed until many years after increased takings begin. Matrix acknowledged this and noted that the model will provide good direction on what the impacts might be. SOW suggested it would be impossible to measure where additional water takings from the bedrock aquifer would be sourced from (in terms of surface water recharging the aquifer). Matrix noted that they would not know with certainty, but that modelling helps identify potential areas for further investigation, which helps identify where to spend limited monitoring resources.

SOW inquired where the best places for spending additional monitoring resources would be. MECP and the Township explained that it is possible to investigate impacts to surface water features through pumping tests by monitoring surface water features during the tests to pick up interferences. However, the scope of monitoring can be limited by budget constraints and complex environmental features such as the fractured rock environment in Centre Wellington. The groundwater model provides insight for siting potential monitoring locations when trying to use limited resources to monitor in an effective way. The Township further noted that there are future steps in the process, past the modelling stage, including class environmental assessments (EAs) and water studies. The Tier 3 is not the end of the process but is more of a screening tool to identify potential risks and areas in need of further investigation.

#### **4. *Conforming to provincial wetland strategy (c. 15)***

Matrix noted that the Tier 3 is not a wetlands assessment process. The hydrology of wetlands is often not understood until they are studied at a higher level of detail. Matrix provided further examples of areas within the Grand River watershed with differing wetland hydrology regimes.

MECP noted that some SOW comments seemed to relay unhappiness that a more holistic approach to water management was not being used. That was a conscious choice by the Province as the scope of the technical studies was not extensive enough to evaluate all impacts definitively.

SOW noted that assessing impacts on Provincially Significant Wetlands (PSWs) and cold-water streams are important. The group reiterated that assessing both PSWs and non-PSWs are important. MECP noted that PSWs and cold-water streams are captured in subsequent evaluations, such as Permit to Take Water applications. It was also noted that the Ministry of Natural Resources and Forestry (MNR) was involved in the development of the wetlands portion of the Tier 3 Technical Rules and in the decision that the Tier 3 would look at cold water streams and PSWs.

#### **5. *What portion of the 6% is available to the Township's wellfield (c. 8)***

Matrix responded that theoretically all of the 6% is available if municipal wells are spread across the area. The operational challenge, as identified in the Water Supply Master Plan, is the function of the physical nature of pumping wells, where to place these wells, and how deep and efficient they have to be so they don't affect other nearby wells. Therefore, it is actually a smaller piece than 6% that is available for sustainable pumping.

SOW noted that Figure 6 of the Groundwater Model Development report shows recharge areas. If one looks at flow boundaries, the flow would exit from the areas of recharge, with the lowest recharge area around the municipal wells. Matrix noted that the recharge map shouldn't be confused with leakage into the aquifer. Areas with high recharge rates also have larger baseflow to cold water streams. In till areas, the water doesn't travel to cold water streams and tends to migrate into the aquifer or run off to surface water features. Therefore, the map of recharge doesn't reflect what is available for municipal takings.

SOW inquired if Fergus and Elora could be getting water from near Elmira, as a part of the 6%. Matrix provided an explanation as to how water from the Elmira area does not contribute to the Centre Wellington water supply.

#### **6. *Not all of the water available to Centre Wellington's municipal wells is usable (c. 18)***

Matrix explained that all Tier 3 studies assume the water supply is potable or treatable to a potable level; non-potable (or water that cannot be treated to become potable) is not included in the rate of available water.

Matrix noted that the source protection water quality process is meant to accomplish two things: to identify threats to water quality, and to identify the sources of contamination. This is a parallel process to the Tier 3 study. Further discussion ensued with regard to the Water Supply Master Plan and MECP's concern with contaminated sites in fractured rock environments.

***7. Impact of Middlebrook should be assessed with all aspects of the Tier 3 (c. 3)***

Matrix discussed how the project is scoped to address the Middlebrook Well throughout the process. The Middlebrook Well was used in the model's calibration, and the project team and peer reviewers find it acceptable as to how with how the model represents the Middlebrook Well pumping test. The next step is to evaluate various scenarios and assess how the aquifer can support municipal water supplies and other permitted water takers currently, and into the future.

***8. Groundwater infiltration to Fergus sewer system (Additional question Sept. 22)***

SOW inquired if the Fergus sewer system has combined sanitary and storm sewers (combined sewage overflows (CSOs)). The Township responded that they do not have any CSOs.

Matrix noted that the groundwater model does not include this infiltration. As it would have likely discharged to a stream in the absence of the sewers, this infiltration doesn't affect the overall water balance. Therefore in the model, infiltration into sanitary and storm sewers should not be thought of having a significant impact on the water that flows into the aquifer.

Matrix provided further discussion on the water budget and how uncertainty is assessed. The team noted the feedback provided by SOW is helpful as it helps the consultants understand how to best report on the many values they have found.

***9. Total demand from households on private wells is low (c. 16)***

The value provided in the draft groundwater modelling report is a typo, and will be revised to state 251 litres per person per day.

***10. Groundwater boundary flow (c. 9)***

Matrix provided discussion around how boundary conditions were assigned in the groundwater model as they relate to the overburden and bedrock layers, and how groundwater flows across the boundaries. Matrix further explained how they are undertaking an assessment of the model's sensitivity to the uncertainty of boundary conditions and will include a text explanation in the Groundwater Flow Model report as to why these areas were assigned. The uncertainty analysis which will assess how uncertainty around boundary conditions impact model output. MECP added that the uncertainty analysis should also provide a degree of confidence around where the water in the deeper groundwater system comes from.

**11. Future land uses within the study area (c. 4)**

Matrix noted that they will address future land use and how it could potentially influence groundwater recharge as a part of the project. Future land use can only be assessed through information available in the Official Plan. Additional water demands for future land uses are not evaluated as this is an unknown and cannot be predicted.

MECP expanded that the purpose of the study is to ensure that water is available for future municipal water needs including growth. The study does not include speculation about water demand associated with future land uses. The process municipalities go through to anticipate their growth is extensive and technical and has a public commenting process. The legal framework for water states that the Province doesn't own water, and they also don't assign and reserve it. The Tier 3 study will evaluate scenarios that include the Middlebrook Well because there is a more substantiated interest for additional water taking in that area.

SOW inquired if there is pumping data from the Middlebrook well. MECP stated there is data from a pumping test that was conducted in 2004, and the geological information from that well is informing the model. In the future, if a proponent were to come along with a proposed water taking, it is evaluated using the model and looking at the potential impacts on existing users.

SOW explained that although Middlebrook Well had a pumping test, the well wasn't used to any degree (although it was permitted). Additionally, the assumptions are the population will grow, but in the scenarios, there are no assumptions that business, industry and demand will grow. MECP replied that the challenge is establishing how the Ministry regulates and plans ahead, because though plans are developed, they are not firm. The Ministry can pick some sites and develop some models, but the challenge for the Ministry is how to make decisions on current takers, while somehow anticipating future takings in a way that won't be challenged and appealed, as the Ministry wouldn't have the technical grounds to not permit that water taker.

SOW inquired if the 2004 pumping test data was compared to data from the municipal wells for interference. Matrix did complete this comparison, and there was a response in the pumping test resulting from pumping in Elora. There is a hydrogeological connection as the Middlebrook well is completed in the municipal water supply aquifer. In 2012 there was an approximate two-metre change in water level at the Middlebrook Well as part of the municipal capacity test.

MECP noted that the Tier 3 study is helping municipalities identify the safe available drawdown level for their municipal water supply wells. Municipalities have allowed for conservative estimates to ensure there is protection. If one were to influence the municipal well and draw water levels down below the elevation set, that becomes a negative impact. In private wells, they don't define that impact line. For example, if the interference is below a pump, the Ministry would then ask if the pump could be lowered; this is not interference if both takers could still be accommodated after lowering the pump. The issue is when a taking interferes with operations in a way that cannot be corrected.



**12. Private well residences becoming serviced (Additional question Sept. 22)**

Matrix responded that as the risk assessment is completed, they will ensure the representation of private wells is consistent with the WSMP.

**13. Please explain the 98% (c. 7)**

Matrix explained that recharge enters the groundwater system from the ground surface. A small portion of this travels through the upper Guelph Formation. It then flows horizontally through various bedrock aquifers, but most of the water stays shallow, flowing into shallow features such as streams and surface water bodies. Matrix provided further information about the water budget as is contained in the model report, and committed that the risk assessment report would describe the changes in the water budget associated with the future water taking scenarios.

An assumption in the model is what is known about the bedrock aquitard and the upper bedrock in the Fergus and Elora areas. The Ontario Geologic Survey agrees with the assumptions made, but there is still uncertainty over the variability of permeability in the rock. There are different permeabilities of geological features in Guelph; this impacts aquifer water levels. It is difficult to completely understand these features as consultants must rely on the interpretation of current data from existing boreholes and wells.

**14. The study does not assess the sustainability of the aquifer (c. 2)**

Matrix explained that by definition this is true; the objective of the study is to assess the sustainability of municipal water takings, not to assess what the maximum takings should be.

SOW noted that the study doesn't address the sustainability of the larger regional aquifer. Assuming this aquifer extends to Waterloo and Cambridge, there are assumptions about inflows and outflows into the aquifer that are not addressed. MECP explained that when the Ministry issued the moratorium on new water bottling permits, they did this in part because they realized there was limited research available, and they wanted to change policies regarding how water was used in an informed way. They realized there were limitations to the understanding of the bigger picture of water use in the area. The moratorium provided the Ministry with a pause with which they could do additional investigation. The approach to focusing on the sustainability of municipal supply was a choice made by the Province in developing the framework in order to remain pragmatic; in part because there are some aquifers where there can be a readily defined boundary, and others where boundaries cannot be delineated with certainty. The bedrock aquifers in the Guelph, Fergus, and Elora area have a large extent of coverage, and the aquifer properties change and vary greatly over this area; the Ministry does not have the ability to monitor the entire area and complete water budgets of that type and size, which is why they focus on the municipal availability of water.

SOW inquired if the project team could expand on how to deal with sustainability. They expanded by inquiring if Nestle could acquire a PTTW based on current information even if there is interference with the Elora wells. SOW inquired how, through the regulatory system, it

can be ensured that one private well doesn't stop the municipality from putting in a new well to meet municipal needs. Matrix explained that the Tier 3 process is scoped so that it flags scenarios where there is a potential threat to meeting municipal water needs. If a scenario is flagged as a potential threat to the sustainability of municipal water needs, then that should be considered in the PTTW process. If a risk is identified, then within the PTTW process administrators can request additional information from the proponent in terms of data analysis or further testing, and can consider that information when making a decision around the permit application.

#### ***15. Groundwater model needs regular updates (c. 5)***

The project team agreed to the need for regular updates to the groundwater model. SOW inquired what plans are in place for that to happen. The Township noted that they are required to submit a work plan to renew permits in 2020. This work plan may trigger updates and additional modelling exercises as a part of their submission for permit renewal.

The GRCA noted that the entire source protection plan program is designed for continuous improvement. It's recognized that groundwater models are assets that need to be maintained to retain value. As there are six Tier 3 groundwater flow models in the Lake Erie source protection region, the GRCA recognizes need to create a more fulsome framework for governance and management; that includes a funding request to the Province for updates. The GRCA is working towards the development of this framework.

The Township noted that they are looking at collecting additional field data (e.g. borehole data); if council approves additional drilling they can install high quality wells to further inform the model.

An example of the use of the Tier 3 model are updates to quality Wellhead Protection Areas using the Tier 3 groundwater model that are in progress this fall.

SOW inquired if there needs to be a longer pause (longer moratorium) to deal with uncertainties. MECP responded that the current government is reflecting on the budget, and although all parties see the need for continuous improvement, this may depend on budgeting. MECP recognizes the models are large pieces of infrastructure that cross municipal boundaries.

The Lake Erie source protection region is in the process of developing guidance for continuously improving their models. Municipalities or source protection authorities could take over management of the models, but any source protection authority with a model that resulted in significant threats have so far requested funding from the province to ensure updates are possible.

The GRCA noted that the Centre Wellington Tier 3 model is owned by the GRCA on behalf of the municipality. MECP noted that asking for funding for maintenance is common, and the

province is hearing this from various groups and they acknowledge the need to upkeep these models.

**16. *Uncertainties and the risk scenario assessment (c. 14)***

Matrix explained that uncertainties for the Centre Wellington Tier 3 are no greater than any other municipal Tier 3 study. There is a lot of high-quality data available in the area, and the Tier 3 study has been designed to be conservative, knowing there is uncertainty present. Matrix will evaluate various scenarios to identify whether any scenarios create a significant risk to the municipal supply and also evaluate the uncertainty related to the identified risk. If a risk is identified, the municipality must identify how to mitigate that risk. Overall it is a very conservative approach.

**17. *When will the uncertainty assessment be undertaken? (c. 13)***

The uncertainty assessment is beginning this fall.

**18. *Data gap regarding recharge rate through the Tavistock Till (c. 12)***

It was acknowledged by the group that this comment was addressed as a part of prior discussions during the meeting.

**19. *Verifying accuracy (c. 19)***

Matrix noted that this comment is connected to the model calibration process. The calibration results show a very good match between the numerical model (simulated data) and the well data (observed data). In the future, when new municipal wells are in place, the model calibration will be evaluated again to assess whether the fit is still appropriate. There is always a need to consistently ground truth the models as time moves forward. Municipalities need to capture their monitoring data and record it to allow for these checks in the future.

**20. *Still confusion about aquitards (c. 6)***

SOW suggested that the WSMP characterization and description relating to aquitards should be consistent with the Tier 3 characterization. Matrix noted they will work with Township to ensure that this is consistent.

**21. *Error on Table 3 (c. 17)***

Matrix acknowledged this error and will correct it.

**Other questions and comments**

There was an inquiry as to whether there is a boundary for the use of the model under current calibrations (e.g. do the models still apply if water use is doubled?) and at what point the model would need to be recalibrated based on the addition of new wells. Matrix responded that there is a capacity at which, if one tried to pump the wells, the model identifies that one can't obtain the amount of water that is desired from the current configuration. Matrix further responded that the system is fairly linear (if pumping is doubled, drawdown is approximately doubled); therefore, the projections are considered to be fairly good quality. What changes is how long it will take for



water to move through the system (e.g. it can take a long time for water to move up from groundwater features).

### **Meeting Outcomes**

The following list details how the draft Groundwater Model Development and Calibration Report will be updated based on the discussion provided in the meeting summary below.

- Edit draft Groundwater Flow Model Development and Calibration Report to incorporate the following:
  - Remove references to lengths of time such as long-term
  - The value of 251 litres per day per household provided on page 19 of the draft Groundwater Modelling report is a typo. This will be revised to state 251 litres per day per person. The value of 251 litres per day per person is employed in the groundwater model.
  - Type of Table 3, page 18 of the report which lists the average annual consumptive rate of municipal well E3 as 249 m<sup>3</sup>/day which is a typo. This volume should be 569 m<sup>3</sup>/day and will be updated in the table.

### **Next Steps**

The GRCA will publish a summary of the meeting to the project web page; this will close the comments from the CLG meeting in May. Matrix will finalize the groundwater model development and calibration report and move onto completing the uncertainty and risk assessment.

## Appendix A – Agenda

### **Centre Wellington Scoped Tier 3 Water Budget Study: Discussion on draft Groundwater Flow Model Development and Calibration Report**

**Location:** Grand River Conservation Authority Head Office, Cambridge  
**Date:** September 27, 2018  
**Time:** 10:00am to Noon

#### **Invited Participants:**

Community Liaison Group Public Representative	Ministry of Environment, Conservation and Parks
Grand River Conservation Authority	Save Our Water
Lura Consulting	Township of Centre Wellington
Matrix Solutions Incorporated	Wellington Source Protection

**Meeting Objective:** To review and discuss comments provided by Save Our Water on the draft Groundwater Flow Model Development and Calibration Report.

#### **Agenda:**

1. Introductions
2. Short-term project (c. 1)
3. How will future water-taking be balanced? (c. 10)
4. How can ecological impacts be assessed? (c. 11)
5. Conforming to provincial wetland strategy (c. 15)
6. What portion of the 6% is available to the Township's wellfield (c. 8)
7. Not all of the water available to Centre Wellington's municipal wells is usable (c. 18)
8. Impact of Middlebrook should be assessed with all aspects of the Tier 3 (c. 3)
9. Groundwater infiltration to Fergus sewer system (Additional question Sept. 22)
10. Total demand from households on private wells is low (c. 18)
11. Groundwater boundary flow (c. 9)
12. Future land uses within the study area (c. 4)
13. Private well residences becoming serviced (Additional question Sept. 22)
14. Please explain the 98% (c. 7)
15. The study does not assess the sustainability of the aquifer (c. 2)
16. Groundwater model needs regular updates (c. 5)
17. Uncertainties and the risk scenario assessment (c. 14)
18. When will the uncertainty assessment be undertaken? (c. 13)
19. Data gap regarding recharge rate through the Tavistock Till (c. 12)
20. Verifying accuracy (c. 19)
21. Still confusion about aquitards (c. 6)
22. Error on Table 3 (c. 17)

## Appendix B: Comments Provided by Save Our Water

### Centre Wellington Scoped Tier 3 Water Budget Assessment

#### Questions and Comments related to the Groundwater Flow Model Development and Calibration Report

1. ***This is a short-term project.*** The introductory paragraph of the Executive Summary states this project was initiated “to evaluate the long-term sustainability of the municipal water supply systems in Fergus and Elora”. The statement is repeated on p. v. It would be preferable to define this as a ‘short-term’ project following GRCA terminology.

The Grand River Watershed Management Plan: *Water Demand Management: Meeting Water Needs in the Grand River Watershed*, prepared by James Etienne and the GRCA, define ‘short-term’ water management as a 20-25-year horizon. The document recommends a 25 to 50- year planning horizon for water management, stating “this is particularly important for land-locked communities relying on local groundwater supplies.” (Appendix B, p. 3, 2014).

According to the GRCA’s criteria, the Scoped Tier 3 and the Water Supply Master Plan, both with horizons to 2041, or 23 years, would be considered ‘short-term’ water management.

The Model Report explains on p. 1 that risk scenarios reliant on the yet-to-be-determined growth targets and densities cannot be evaluated at this time beyond the year 2031, making this, in fact, a mere 13-year assessment horizon. The density requirement, and the recharge numbers calculated from that requirement, are critical factors without which the other assessments could not be valid, and certainly not ‘long-term’. Additional scenario limitations at his current time relate to the township not having a 20-year water-services plan locked into its Official Plan.

Also, the study does not assess the sustainability of the ‘water system’, as infrastructure is the mandate of the Water Supply Master Plan. The study in hand concerns sources.

2. ***The study does not assess the sustainability of the aquifer.*** Related to the above statement, our concern is that it is not made clear that the Tier 3 studies do not assess the sustainability of the large regional aquifer.

3. ***Impact of Middlebrook should be assessed with all aspects of the Tier 3.*** Figure 13d identifies the observed drawdown impact at the Middlebrook Well during Elora and Fergus municipal well pumping tests. These results indicate a connection between all of these wells. Given this connection, will the tests combine Middlebrook Well’s daily pumping along with the municipal wells? If not, why not given its proposed daily extraction rate is equivalent to almost three of Centre Wellington’s municipal wells?

4. ***Future land uses within the study area.*** To what extent will future developments in businesses such as the aggregate industry, farm businesses, golf courses, and recreational

facilities influence recharge and water demand amounts? How are these future non-municipal land uses calculated in the water budget? Now that the study has established the baseline conditions, would the study please add to the report these assumptions related to future water demand and recharge.

5. **Groundwater flow models need regular updates.** At the May 15 CLG meeting, Matrix acknowledged that models need to be opened up and updated with current information every 5 to 10 years. What plans are in place with the Township of Centre Wellington for this to happen?

Ideally, upon completion of the current project, the model should continue to be used to assess future proposed water and land uses (e.g., aggregate industry, farm businesses, golf courses, recreational facilities and industry) against the established baseline conditions. The desired intent is to assist municipal officials to make informed long-term water management decisions involving assessing land use planning applications as they are presented. We should not be waiting 5 to 10 years, especially given the suggested fragility of our water resource.

6. **Still confusion about aquitards.** The Water Supply Master Plan interim status report of June 13 describes the aquitards protecting the Fergus Elora Water Supply System as follows: “Bedrock units that behave as aquitards between the aquifer units include the Vinemount Member of the Eramosa Formation and, in places, the Reformatory Quarry Member and the Cabot Head Formation.” (page 4, Technical Memorandum 2)

Since the Vinemout Member is not identified anywhere near Fergus and Elora, the Reformatory Quarry Member exists only east of Fergus, and the Cabot Head is the basement floor underneath all the aquifers, the WSMP team also assumes, as Save Our Water did, that no aquitards exist to protect the Fergus and Elora well water supplies.

Would Matrix please explain to the WSMP team that with the flow model report Matrix is now suggesting “the upper portion of the Guelph Formation is a competent aquitard that limits the connection between the shallow overburden aquifers and deeper municipal bedrock aquifers.” (page 33) This is significant new information for the Water Supply Master Plan analysis, and the WSMP should now be edited to reflect this.

7. **Please explain the 98%.** The modelling report states that 98% of the water is recharged locally. What is the evidence to support this statement? Also, given that water in aquifers moves generally laterally, while water in aquitards moves generally vertically, and that the water in the deep bedrock could be up to 50 to 500 years old, does this imply that much of the bedrock in the study area would be identified more as aquitard than aquifer?

8. **What portion of the 6% is available to the Township’s wellfield?** The assessment concludes that of the total water entering the study area 6% reaches the lower bedrock aquifer. Given the size of the study area, the flow direction of water in the lower aquifer, the unequal recharge and the locations of the higher recharge areas with the large area of high recharge in the Speed river sub watershed, what portion of this 6% would be available to the Township’s municipal wellfield?

9. **Groundwater boundary flow.** Figure 4 shows no groundwater cross-boundary flow to the east, even though the flow of water from this part of the boundary is to the east toward Guelph Lake. Could you please explain?

10. **How will future water-taking be balanced?** What is the source of water to replace future large-scale municipal and potential commercial groundwater extraction from the lower bedrock aquifer? Is it coming from an increase in recharge from the overburden and upper bedrock aquifers, from a decrease in the flow of water out of the study area, from increased inflow from outside the study area, from the 2% discharged into rivers, streams and wetlands, or from the water that's stored in the aquitards and aquifers right now? Assuming more than one source, what combination and in what proportions of these sources would you expect this influx of water to balance that being removed? How does the relatively slow movement of water in the lower bedrock aquifer factor into this?

11. **How can ecological impacts be assessed?** Over a long period of time, how much of this increased extraction from the lower bedrock aquifer would be balanced by decreased output from the overburden and upper bedrock aquifers into rivers, streams and wetlands? Given that impacts would be expected to be incremental but cumulative, diffuse, spread over a very wide area and almost impossible to measure, how can these impacts be assessed?

12. **Data gap regarding recharge rate through the Tavistock Till.** On page 47, the authors mention the groundwater recharge rate through the Tavistock Till in the northeastern portion of the model represents an important knowledge gap. How might we close this gap?

13. **When will the uncertainty assessment be undertaken?** Page 45 mentions "uncertainties are typically evaluated through uncertainty assessment." At what point in the process will this uncertainty assessment be undertaken and will the results be included in the report?

14. **Uncertainties and the risk scenario assessment.** Given the high level and number of uncertainties in data from lack of good well information, will the risk scenario assessment take a conservative approach?

15. **Conforming to provincial wetland strategy.** The model will be used to assess impacts on cold water streams and Provincially Significant Wetlands (p. 1). Why is the study not assessing impacts to all streams and creeks and rivers and all wetlands? The province of Ontario's wetlands strategy: *A Wetland Conservation Strategy for Ontario 2017-2030*, provides Provincial policy with a focus on restoring wetlands across the province "to sustain biodiversity and to provide ecosystem services for present and future generations." With the loss of 70 - 80% of wetlands in the Grand River watershed, and a loss of 85% of wetlands throughout southern Ontario, should there be an aim with this Tier 3 to ensure that ALL wetlands are not only protected from any impacts but are in fact enhanced? Now that the value and function of these wetlands is better understood, is there not an obligation to *enhance* wetlands in a watershed that has lost the vast majority of its wetlands, as the MNR advises?

Are you expecting that there will be data gaps related to any reduction in groundwater discharge to any wetlands? or gaps related to gradients within and surrounding wetlands or to the recharging or discharging nature of any wetlands seasonally or over time?



16. **Total demand from households on private wells is low.** The total demand from households on private wells is low as it is stated on page 19 at 251 l/day per household. The WSMP interim report states that the per capita use based on metered use is 155-165 l/day. With an average 2.5 persons per household (Stantec, 2016), this would be 432 l/day water demand per household.

Additionally, these per capita numbers do not take into account the municipal problem with the hardness of water impacting water meters, causing them not to record accurately. Consequently, per person daily water use is underestimated. Adjusting the number closer to an Ontario municipal average would be more representative of actual use.

The WSMP interim report Memorandum 1, p. 2 now identifies 3,509 residents within Fergus and Elora in unserved homes. This increased number is from households that opted out of municipal water in serviced areas. This now represents 1 in 7 urban residents using private wells.

17. **Error on Table 3.** There is an error in Table 3, page 18 of the report, which lists the average annual consumptive rate of municipal well E3 as 249m<sup>3</sup>/day. This volume should be 569 m<sup>3</sup>/day.

18. **Not all of the water available to Centre Wellington's municipal wells is usable.** When the Tier 3 team presented the modelling report to council, a councilor asked about the quality of water at several Fergus wells. This was a good question. Of course, as has been already explained, this question is outside the scope of the Tier 3. But we would like to see a response to these kinds of questions that accepts that there are facts that cannot be addressed by Source Protection Zones, as is consistently the answer. Factors related to the nature of the bedrock itself such as excessive hardness, sulphates, high TDS, and also contamination that has not yet been tracked in the bedrock, are issues that cannot be addressed by a line on a map in the Planning Department. We would like it acknowledged that not all of the water that is available is actually going to be usable.

Case in point. Elmira is known for its polluted groundwater that is not fit to use. If you were conducting a Tier 3 study of Elmira's water supply, excluding water from Waterloo and all other regions, would you conclude that they have an abundant water supply or none whatsoever?

19. **Verifying accuracy.** What is your due diligence process to verify the accuracy of your modelling results? Will the modelling results be verified with observations from local water monitoring?

## **Appendix C: List of Participants**

### Community Liaison Group Public Representative

- Tom Nudds

### Grand River Conservation Authority (GRCA)

- Martin Keller
- Sonja Strynatka

### Lura Consulting

- Alex Lavasidis

### Matrix Solutions Incorporated

- Christian Gabriel
- David Van Vliet

### Ministry of Environment, Conservation and Parks (MECP)

- Kathryn Baker

### Save Our Water (SOW)

- Dave Blacklock
- Donna McCaw
- Ian MacRae
- Jan Beveridge
- Jim Wilton

### Township of Centre Wellington

- Colin Baker

### Wellington Source Protection

- Emily Vandermeulen
- Kyle Davis