APPENDIX J Municipal Peer Review Comment Record



Guelph/Guelph-Eramosa Tier 3 WQRA Peer Review Process

Summary of Activities (2013-2017)

Glossary of Abbreviations

Blackport	Blackport Hydrogeology Inc.
Burnside	R.J. Burnside & Associates Limited
CofG	City of Guelph
Erin	Town of Erin
GET	Township of Guelph/Eramosa
GRCA	Grand River Conservation Authority
Harden	Harden Environmental Services Ltd.
LESPR	Lake Erie Source Protection Region
Local Area	Wellhead Protection Area related to water quantity
Matrix	Matrix Solutions Inc.
MOECC	Ministry of the Environment and Climate Change
MNRF	Ministry of Natural Resources and Forestry
Peer Reviewers	Provincial Peer Reviewers
Puslinch	Township of Puslinch
RMMEP	Risk Management Measures Evaluation Process
RMOW	Regional Municipality of Waterloo
RMO	Risk Management Official
SAAD	Safe Additional Available Drawdown
Wellington	County of Wellington
WHPA	Wellhead Protection Area
WSWP	Wellington Source Water Protection
WQRA	Water Quantity Risk Assessment

Study Participants

The current members of th	e Guelph-Guelph/Eramosa Tier 3	Water Budget Study are:
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Role	Name -Affiliation
Peer Review Leader	James Etienne, Martin Keller – GRCA
Peer Reviewers	Dr. Dave Rudolph – University of Waterloo
	Dr. Hugh Whiteley – University of Guelph
	Tony Lotimer – ARL Groundwater Resources Ltd.
Municipal Reviewers	Dave Belanger, Peter Rider – City of Guelph
	Eric Hodgins, Richard Wootton – Regional Municipality of Waterloo
	Jim Baxter, Dwight Smikle – R.J. Burnside for Guelph/Eramosa Township
	Stan Denhoed – Harden Environmental Services for Puslinch Township
	Ray Blackport – Blackport Hydrogeology for Town of Erin
SPP Manager	Martin Keller – Lake Erie Source Protection Region
Municipal RMO	Kyle Davis – Wellington Source Water Protection
Consultant Team	Paul Chin, Patty Meyer – Matrix Solutions Inc.
Agency Representatives	Scott Bates, Lynne Milford – MNRF
	Kathryn Baker, Cynthia Doughty – MOECC
SP Region Staff Support	Sonja Strynatka, Stephanie Shifflett – GRCA

Guelph/Guelph-Eramosa WQRA Report Preparation

The following is a brief description of the history of the Guelph/Guelph-Eramosa Tier Three Process and the update that was conducted for the Rockwood and Hamilton Drive municipal systems.

The municipal supply wells for the City of Guelph and the Guelph/Eramosa Township (Rockwood and Hamilton Drive) required a Tier Three Water Quantity Risk Assessment to be conducted under the *Clean Water Act, 2006*. These water supply wells are located within the Upper Speed Assessment Area within the Grand River Watershed. The Tier Two Water Budget and Subwatershed Stress Assessment completed for the Grand River Watershed in December 2009 identified this area as having a *"moderate"* potential for groundwater stress. The identification of this stress indicator led to the requirement of a Tier Three Water Budget and Water Quantity Risk Assessment for the City of Guelph and Township of Guelph/Eramosa (Rockwood and Hamilton Drive) municipal drinking water systems because all of the municipal wells are located within this area.

The City of Guelph Tier Three Water Budget project was initiated in 2008 as a provincial pilot project, prior to completion of the Tier Two work, to conduct a Tier Three Water Quantity Risk Assessment on Guelph's municipal wells. This study comprised field work, a desktop characterization exercise (of the water resource and the water use) and the development of numerical surface and groundwater flow models. This work was mostly complete by early-2010, and the Characterization Report and Groundwater Flow Model Report were issued in draft in June 2010 and July 2011 respectively. The two reports were reviewed by the province and external experts and received peer reviewer acceptance in January 2013.

The City of Guelph Tier Three Risk Assessment was conducted using a calibrated numerical groundwater flow model and the results were documented in the Water Quantity Risk Assessment Report released in draft in May 2013. At that time, the Local Area was assigned a *"significant"* water quantity risk level based on ecological impacts to cold-water streams. The WQRA report was peer reviewed and a second draft of the report received peer reviewer acceptance in August 2013. The province deferred their final review of the WQRA report and the *"significant"* risk assignment until the completion of the Tier Three study for GET's Rockwood and Hamilton Drive municipal wells, as well as the Region of Waterloo Tier Three Study due to the proximity of the Local Areas.

On December 2, 2013 the MOE Source Protection Programs Branch issued a memo with revised guidance designed to clarify the process for assigning risk levels based on the evaluation of impacts to other water uses including cold-water streams. As a result of this new guidance the assignment of water quantity risk to the City of Guelph Local Area became *"moderate"*.

In June of 2013 Matrix commenced work to integrate GET's municipal drinking water systems (Rockwood and Hamilton Drive) Tier Three Risk Assessment with the City of Guelph Tier 3 Risk Assessment. This study comprised additional characterization of the geology and hydrogeology relevant to the municipal systems for Hamilton Drive and Rockwood. On December 17, 2013, representatives from Matrix Solutions, Wellington County, the Township of Guelph/Eramosa (GET), the GRCA, and the City of Guelph were invited to participate in a project initiation meeting held on January 15, 2014. At that time, Matrix gave an overview of the Tier Three process and the preliminary results from the Guelph WQRA which had just been reassigned a *"moderate"* water quantity risk for the City of Guelph's water supply. As an action item at the meeting, Matrix requested additional information and data from GET to characterize the municipal systems of Rockwood and Hamilton Drive. On June 5, 2014 GET provided approval of the key metrics required to finalize the risk assessment (including Safe Available Drawdown, current and future pumping rates).

The data provided by GET as well as other geological and hydrogeological data obtained for the study were used to refine the hydrogeologic characterization and update the numerical groundwater flow model. The Risk Assessment for the Local Area (which includes the City of Guelph and GET's municipal systems in Rockwood and Hamilton Drive) was conducted and the result was another reassignment of risk for the WHPA-Q1 that includes the City of Guelph and GET's Hamilton Drive wells to *"significant"*. The individual WHPA-Q1s that encompass GET's Rockwood wells were assigned a *"low"* risk level. The change in risk assignment back to *"significant"* in the final assessment was due to the refined hydrogeologic characterization and a requisite update to the groundwater flow model.

On June 13, 2014, LESPR arranged a meeting of municipal partners to discuss the water quantity policy implications of the WHPA-Q1 overlap for Guelph and Cambridge. At that meeting the County of Wellington and GET were informed of the reassigned risk level for the Guelph/Guelph-Eramosa Tier 3 risk assessment.

A draft report entitled "City of Guelph and Communities of Rockwood and Hamilton Drive Tier Three Water Budget and Local Area Risk Assessment" was released for peer reviewer acceptance on July 30, 2014. This report received peer reviewer acceptance in August 2014 and the Province agreed with the findings of the report, including the risk assignment in September 2014.

A complete record of the following correspondence and documentation on the Guelph/Guelph-Eramosa Water Quantity Risk Assessment report preparation can be found in *Appendix A*.

Date	Documentation
May 2013	Draft CofG Tier 3 Local Area Risk Assessment report submitted for peer review (peer reviewer signoffs received in August 2013) – not included but listed for completeness

May 2013	Peer review comments on CofG Tier Three Local Area Risk Assessment
Dec/17/13 to	Series of e-mails between GRCA, GET, CofG, Matrix, WSWP and Wellington
Jan/08/14	County to arrange start-up of the GET Tier 3 project
Jan/15/14	GET Tier 3 Start-up meeting presentation slides by Matrix including a request for
	GET allocated demand and SAAD values
May/09/14	CofG Tier 3 Water Budget and Local Area Risk Assessment peer review meeting
	presentation slides by Matrix, including GET Tier 3 update
May/13/14 to	Series of e-mails between Matrix and GET to obtain approval to incorporate GET
Jun/05/14	allocated demand and SAAD values in the final GET Tier 3 WQRA report
Jun/13/14	Meeting with municipal partners to discuss water quantity policy implications
	and WHPA-Q1 overlap for Guelph and Cambridge.
July/30/14	Matrix completes the Tier 3 Characterization and Groundwater Flow Model
	Updates for GET's Rockwood and Hamilton Drive and submits the amended CofG
	and Communities of Rockwood and Hamilton Drive Tier 3 Water Budget and
	Local Area Risk Assessment report, including the GET Tier 3 reports in Appendix C
	and D, for peer reviewer signoff (peer reviewer signoffs received on August 22 nd ,
	25 th and 28 th)

Municipal Peer Review Comments

On July 7, 2014, LESPR staff met with senior staff from Wellington County, GET and Puslinch to discuss Tier Three water quantity technical studies and the process for moving forward and developing water quantity policies. At this meeting, GET raised a concern whether "correct" information and data was provided to Matrix with respect to the Hamilton Drive and Rockwood municipal water supplies. On July 30, 2014, Wellington Source Water Protection submitted comments dated July 28, 2014 from R.J. Burnside & Associates (Burnside) on behalf of GET raising questions about some of the data and assumptions used in the completion of the Rockwood and Hamilton Drive portions of the WQRA.

A meeting was arranged on September 19, 2014 for LESPR staff to review GET's comments with the City of Guelph and discuss how to address these comments as part of the upcoming Risk Management Measures Evaluation Process (RMMEP). Deliverables from the meeting included submission of a memo by Matrix on September 23, 2014 to address Burnside's data and data source questions. On October 24, 2014, Burnside requested additional information and more time to review the Guelph WQRA. In September 2014, Wellington Source Water Protection expanded the review of the Guelph WQRA to Puslinch and Erin asking for more time to bring their municipal councils up to speed on the WQRA work and have their municipal consultants, Harden and Blackport, respectively, review the report.

By late December 2014, MNRF and LESPR staff indicated that a technical workshop should be planned early in 2015 to bring all the parties together to comprehensively review the municipal concerns so that municipal comments could be finalised and submitted. Draft comments were

submitted by Burnside, Harden and Blackport in early February and a workshop was held on February 13, 2015 during which common issues from the three municipalities were tabled to be immediately addressed or carried on for further review. As a result, Matrix were contracted to conduct individual meetings with Burnside on March 13, 2015 and Harden on March 16, 2015 to address outstanding questions prior to submission of their final WQRA comments. On the basis of the Erin's comments, Blackport was satisfied that an individual meeting with Matrix was not required.

On March 24, 2015, LESPR staff met with Senior County of Wellington and Township staff to discuss the RMMEP and policy development work that would result from the completion of the Guelph/Guelph-Eramosa WQRA. The County voiced concerns from the municipal consultant's peer review that the area of the draft WHPA-Q1 may be oversized and that the final water quantity policies in the Source Protection Plan could apply to an area that was larger than necessary. The County also asked for an explanation why the Guelph Local Area changed from *"significant"*, as established in the peer reviewed August 2013 Guelph WQRA, to *"moderate"* and back to *"significant"*. In response to this request, a memorandum was prepared and sent to Wellington Source Water Protection on April 20, 2015, explaining the multiple revisions to the Local Area Risk Assignment.

On June 19, 2015, Wellington Source Water Protection submitted final comments from the Townships of Guelph/Eramosa and Puslinch and Erin including concerns that the WHPA-Q1 delineation from the final WQRA Report would be locked into the Source Protection Plan regardless of modifications that may come out of the RMMEP work.

Date	Documentation
Jul/07/14	LESPR Developing Water Quantity Policies presentation to Wellington, GET,
	Puslinch and WSWP
Jul/28/14	Burnside submit additional comments to GET CAO, Kim Wingrove, in response to
	the May 13, 2014 request from Matrix for GET allocated demand and SAAD
	values
Sep/19/14	LESPR presentation to Burnside, GET, WSWP and CofG in response to July 28,
	2014 comments along with action items for all parties to address after the
	meeting
Sep/23/14	Matrix memo in response to action items from September 19, 2014 meeting
Oct/24/14	Matrix e-mail including Burnside e-mail with attached comments
Dec/17/14	GRCA e-mail in response to Burnside e-mail on October 24, 2014 and November
	12, 2014 teleconference
Feb/09/15	Draft comments from Harden on the "City of Guelph and communities of
	Rockwood and Hamilton Drive Tier 3 Water Budget and Local Area Risk
	Assessment" report

A complete record of the following correspondence and documentation on the Municipal Peer Review comments from GET, Puslinch and Erin can be found in *Appendix B*.

Feb/10/15	Draft comments from Blackport on the "City of Guelph and communities of
	Rockwood and Hamilton Drive Tier 3 Water Budget and Local Area Risk
	Assessment" report
Feb/10/15	Draft comments from Burnside on the "City of Guelph and communities of
	Rockwood and Hamilton Drive Tier 3 Water Budget and Local Area Risk
	Assessment" report
Feb/13/15	Technical Meeting to Discuss Wellington Municipalities' Comments on Guelph
	WQRA Report (Tier 3)
Mar/24/15	Agenda for LESPR Tier 3 Project Update to Wellington County Municipalities
Apr/20/15	Memo from GRCA to WSWP in response to discussions at the March 24, 2015
	meeting with Wellington County staff and lower tier municipal representatives
Jun/19/15	Cover letter from WSWP including final comments from Blackport (June 10,
	2015), Harden (June 12, 2015) and Burnside (June 16, 2015) on the July 2014
	Guelph/Guelph-Eramosa Tier 3 WQRA report

Response to Municipal Peer Review Comments

On June 25, 2015 the LESPR responded on behalf of the City of Guelph, MOECC and MNRF explaining how the LESPR would use the GET, Puslinch and Erin municipal peer review comments and the direction from the province to advise Matrix of their next course of action on completing the WQRA and commencing the RMMEP. Following email correspondence between LESPR and Wellington Source Water Protection, WSWP on July 6, 2015 asked for written confirmation of the process on how consultation could alter the size and significance of the WHPA-Q1 prior to it being "set in stone" in the Source Protection Plan.

On July 24, 2015 a meeting was held at the GRCA to discuss the start-up of the RMMEP. It was agreed that the County of Wellington municipal peer review comments would be addressed in a revision of the Guelph-Guelph/Eramosa WQRA and that Matrix would work with GET, Puslinch and Erin to obtain the necessary data to rerun the numerical groundwater flow model in an effort to get the most up to date refinements of the WHPA-Q1 for sign-off of the WQRA.

Throughout the fall of 2015 and the early winter of 2016 Matrix worked to address the comments submitted by the municipal consultants and undertook further data collection in Puslinch to address a number of Harden's concerns regarding large non-municipal water takings. Following this additional work by Matrix, responses to the municipal comments were prepared and sent to WSWP under a GRCA cover letter on March 9, 2016, proposing that Matrix's responses to the municipal comments be discussed with the municipal consultants at a meeting on April 1, 2016.

At the April 1, 2016 meeting Matrix outlined which of the municipal consultant comments submitted on June 19, 2015 had been addressed through updates to the WQRA and which of the comments requesting additional work would be parked for future model updates. By the end of the meeting, there were several comments documented as being unresolved. Wellington County

also reiterated their concern that the WHPA-Q1 boundaries with a *"significant"* Local Area Risk Assignment would be "set in stone" once the WQRA report was finalized. On April 7, 2016, MOECC sent a letter of response to WSWP's request for clarity in the municipal consultation process for the Guelph/Guelph-Eramosa WQRA and the concern with fixed WHPA-Q1 boundaries.

On April 22, 2016 meeting at the County offices to discuss outstanding concerns and process going forward. LESPR and County staff, Municipal Review consultants, Senior staff from County and local municipalities, WSWP, and Lake Erie Source Protection Committee member Dale Murray participated.

On May 17, 2016, in response to the March 4, 2016 and March 7, 2016 comments by Matrix and the April 1 and 22, 2016 meetings, WSWP submitted an additional package of municipal consultant comments and concerns particularly with the unresolved comments. The comments from Harden (April 22, 2016) and Burnside (May 10, 2016) both refer to unresolved comments, while the letter from Blackport (May 16, 2016) recognizes that all of Erin's comments had been addressed. WSWP requested that the full peer review package including the unresolved concerns be brought to the Provincial Peer Review Committee at a meeting scheduled for June 15, 2016.

On June 13, 2016, the MOECC responded to the May 17, 2016 from WSWP, supporting the process for the Provincial Peer Reviewers to hear the municipal concerns at the June 15, 2016 meeting and outlining the Ministry's process and expected timelines for concluding the peer review process.

Date	Documentation
Jun/25/15	GRCA/LESPR response to the WSWP submission of municipal peer review
	comments and advising of the intentions to use the comments to complete the
	WQRA and commence the RMMEP
Jul/06/15	E-mail from WSWP requesting clarification on the process to complete the WQRA
	and commence the RMMEP
Jul/24/15	Agenda to discuss start-up of the Guelph/Guelph-Eramosa RMMEP
Mar/09/16	Letter from GRCA/LESPR to WSWP including the March 7, 2016 response from
	Matrix to Erin's municipal comments, the March 4, 2016 response from Matrix to
	the municipal comments from Guelph-Eramosa and Puslinch, a February 25, 2016
	memo to WSWP with a proposed timeline to complete water quantity policy by
	December 31, 2017 and an agenda to discuss these items at a meeting on April 1,
	2016
Apr/01/16	Agenda and slide presentation from Matrix to present their response to the
	municipal peer review comment submitted by WSWP on June 19, 2015
Apr/01/16	Municipal Peer Review meeting notes prepared by LESPR
Apr/07/16	MOECC letter of response to WSWP's request for clarity of the municipal
	consultation process for the Guelph/Guelph-Eramosa WQRA, WSWP's concern

A complete record of the following correspondence and documentation on the response to Municipal Peer Review comments can be found in *Appendix C*.

	about the timeline and that the WHPA-Q1 boundaries with a "significant" Local Area Risk Assignment would be "set in stone" once the WQRA report was
	finalized
May/17/16	Letter from WSWP to GRCA and MOECC including comments from Harden (April
	22, 2016), Burnside (May 10, 2016) and Blackport (May 16, 2016) in response to
	the comment provided by Matrix on April 1, 2016
June/13/16	Letter from MOECC to WSWP responding to May 17, 2016 letter from WSWP

Concluding the Municipal and Provincial Peer Review Process

On June 9, 2016 a cover letter, which included the agenda, a list of the outstanding concerns, and outlined the process for discussion was sent under GRCA letterhead to all participants of the June 15, 2016 peer review meeting.

At the June 15, 2016 meeting, provincial peer reviewers, GRCA staff, municipal staff from the City of Guelph and the Region of Waterloo, municipal consultants for the Townships of Puslinch and Guelph/Eramosa and the Town of Erin, WSWP, and MOECC staff were present. The meeting was chaired by the Lake Erie Region Source Protection Committee Chair. Each issue was presented, discussed and provincial peer reviewers were able to ask questions and dialogue occurred between municipal and provincial peer reviewers and other participants. Not all issues were able to be addressed and a second peer review meeting was scheduled for June 30, 2016 to complete the discussion. The June 15 and June 30, 2016 peer review meetings provided an opportunity for municipal comments and concerns to be heard by the provincial peer reviewers.

The Provincial Peer Reviewers concluded the municipal peer review process with their August 2016 comments and determination that the Tier 3 study was "fit for purpose" and could move forward without pause. The Provincial Peer Reviewers also commented on the need to consider new information as it becomes available and look at opportunities for further studies to refine the hydrogeological understanding and reduce uncertainties.

With the Provincial Peer Reviewer's direction Matrix worked to update the 2016 Model Update Appendix E that summarises the updates and revisions to the Tier 3 model as a result of the municipal peer review process. Following peer review and sign-off of the 2016 Model Update Appendix E Matrix then completed the draft Guelph/Guelph-Eramosa Water Quantity Risk Assessment Report for final peer review and sign-off. On February 15, 2017 and March 8, 2017 Burnside and WSWP provided comments on the draft WQRA report, and on February 17, 21, and 28, 2017, respectively, the Provincial Peer Reviewers provided their review and sign-off of the draft Guelph/Guelph-Eramosa Water Quantity Risk Assessment Report. On March 23, 2017, MOECC provided a memo accepting the Guelph/Guelph-Eramosa Township Tier 3 Water Budget and Local Area Risk Assessment in accordance with the provincial Technical Rules.

A complete record of the following correspondence and documentation on the conclusion of the Municipal and Provincial Peer Review process can be found in *Appendix D*.

Date	Documentation
Jun/9/16	Cover Letter for June 15, 2017 Peer Review meeting participants
Jun/15/16	Peer Review Committee: Meeting Agenda, List of Outstanding Municipal
	Concerns, Presentation, Meeting Summary Notes
Jun/30/16	Peer Review Committee – Part 2: Meeting Agenda, List of Outstanding Municipal
	Concerns, Presentation, Meeting Summary Notes
Aug/4/16	Provincial Peer Review Comments: A.R. (Tony) Lotimer
Aug/5/16	Provincial Peer Review Comments: David L. Rudolph
Aug/8/16	Provincial Peer Review Comments: H.R. Whiteley
Feb/15/17	Letter from R.J. Burnside on behalf of Township of Guelph/Eramosa and March 8,
	2017 Email from Kyle Davis, Wellington Source Water Protection: review
	comments on Draft Guelph/Guelph-Eramosa Water Quantity Risk Assessment
	Report
Feb/17/17	Provincial Peer Review Final Sign-off: David L. Rudolph
Feb/21/17	Provincial Peer Review Final Sign-off: H.R. Whiteley
Feb/28/17	Provincial Peer Review Final Sign-off: A.R. (Tony) Lotimer
Mar/23/17	Memo from MOECC: Acceptance of the Guelph/Guelph-Eramosa Township Tier 3
	Water Budget and Local Area Risk Assessment

Appendix A

Guelph/Guelph-Eramosa Water Quantity Risk Assessment Report Preparation

May 2013 through July 30, 2014

DRAFT



TIER THREE WATER BUDGET AND LOCAL AREA RISK ASSESSMENT

Report Prepared for: CITY OF GUELPH

Prepared by: MATRIX SOLUTIONS INC.

May 2013 Breslau, Ontario

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Table 3. Lot	cal Area F	Risk A	ssessme	nt Report - Guelph Tier Three Peer Review Comments	
Revlewer	Comment #	* Page	Section #	Comment	Response to Comment
			Draft Re	port - May 2013	
Tony Lotimer, A	ug 7, 2013				
T. Latimer	H	47	3.1.1	In Table 3.1, it is not clear why "not applicable" is shown under "permitted Rate" for the following wells: Edinburgh, Clythe Creek, Sacco, Smallfield. The wells may not be operating or may be out-of-service for an extended period, but that is not the same as saying that the wells do not have a Permit to Take Water,	Table 3-1 has been updated with the most current permit details.
T. Lotimer	2	53	3.2.1	Table 3.4 (incorrectly labelled as Table 3.7) - Footnote 5 does not show in the actual table. Which wells does footnote 5 refer to? (Arkell 14 & 15, Clythe, Sacco, Smallfield ?)	Footnote 5 referred to Sacco and Smallfield, but this table has now been revised as table 3-5 and has estimated capacity for Sacco and Smallfield.
T. Lotimer	m	55	3.2.2	At the top of page 55, reference is made to the City's maximum capacity of 112,000 m3/day (Table 3-4) and that this capacity may only be relied upon to meet maximum day demand. The analysis that follows in the text uses this number to back out the average day capacity of the water supply system using a peaking factor of 1.5. This was discussed in some detail at the meeting on May 23 and was an action item in the meeting minutes. Notwithstanding that discussion and the email of May 125 (from Paul Ctini at Matrix), it is not clear how the 112,000 m3/day was arrived at. This is not clearly evident in Table 3-4.	This section (now 3.2.3) and the associated tables have been revised according to comments provided.
T. Lotimer	4	53	3.2,2	In Table 3-5 (incorrectly labelled Table 3-8), it would be useful (and might clear up some confusion) to add the column of estimated well capacities and the column of individual maximum permitted rates, both from Table 3-4. A comparison of the information in these tables appears to show that the 2031 Demand – Allocated Rates (Drought Conditions) are all below the estimated well capacities with the exception of Calico, Dean, Sacco and Smallfield, which are all equal to the estimated well capacities, and Downey which is marginally above the estimated well capacities, and	This table, now Table 3-7, has been updated with the most current permit details and estimated well capacities as suggested.
T. Lotimer	S			Notwithstanding the above comments, the approach used in assigning the allocated rates and the conclusions that the existing system of wells and collector can meet the future average day (2031) demands are reasonable.	Agreed.
T. Lotimer	Ø	60	3.3	The estimates of consumptive water demand for non-municipal sources presented in this section of the report are important. However, there is limited discussion surrounding the methods and rationale used to arrive at the consumptive numbers presented in Table 3-6 and Appendix B – Table 2.7, and the uncertainty associated with these numbers.	Section 3.3.1 has been updated with a brief summary discussing methodology, rationale and uncertainty as suggested. The reader is also directed to Appendix B2, where the consumptive water demands are presented in full.
T. Latimer	٢	8	4.3.2.1	What is the rationale for multiplying the average municipal well demands by 120%, and adding the estimated maximum monthly consumptive demand for nonmunicipal demands to arrive at the monthly maximum consumptive demand for the area?	This section has been revised using the actual maximum monthly pumpages for the municipal wells, $\ensuremath{\sc m}$
T. Lotimer	00	95	5,5.1,1	Does Scenario C differ significantly from the steady-state mode calibration results, or should it be considered the same as the calibrated model simulation and perhaps referenced as such ?	Scenario C differs from the model calibration results in that the pumping rates for four municipal wells are different between the model runs. For steady-state model calibration, the average 2008 pumping rate is used for Carter, Emma, Helmar, and Park 1/2. These rates were significatly lower than the "typical" pumped rate due to the wells price off-line for significant periods of 2008. The typical pumped rates are used in Scenario C in order to simulate he in-well water level during typical pumped conditions. This is noted in Footnote 1 of Table C-2 in Appendix C (page 6). This explanation has been added to Section 5.6.1.1.

Г. Latimer	ŋ	110	5.2.1	The Carter and Burke hydrographs appear to show similar effects from the drought; the Carter hydrograph does not appear to show more of an affect of the drought than the Burke hydrograph.	Revised risk scenario results now show the Carter and Burke wells reaching maximum drawdown during the same two-month period. Text indicating that the Carter Wells show more of an effect of the drought than the Burke Wells have been removed.
Mike Garraway, I	May 6, 2013	3 (as com	ments to pr	eliminary version of Draft RA)	
M. Garraway	4	>		Noted that the Halton report provided water budgets for the Subwatersheds and not just the groundwater model area? Is this report going to provide information by subwatershed?	Figure 4-9 has been added with the water budget for all subwatersheds
M. Garraway	œ			Need to discuss the surface waternoted the IPZ and no SW assessment latter in the report but need to know the percentage of surface water injection to GW pumping to see if we include the IPZ as part of the local area	The Eramosa intake is a significant taking in the subwatershed and needs have its supply protected. The IP2-Q has been delineated as the vulnerable area for surface water and is included as part of the local area.
M. Garraway	14	32		Recharge in Credit River Watershed: How did the recharge of MikeShe compare to HSPF?	The Credit River watershed was not a focus of this study and a comparison with the recharge modelled in the Halton Hills Tier Three was not done. The reviewer is referred to the Halton Hills Tier Three for further information
M. Garraway	18	45		What about permitted surface water takings! assume significant SW takings are also included in the model	Surface water takings are not included in the groundwater flow model. Any surface water takings would be included in the GAWSER surface water model. This has been clarified in Section 3.
M. Garraway	26	53		This is interesting. Can the infrastructure limitations [of the Eramosa Intake] be addressed? If so, would the 31,822 permit be pumped?	Additional water could be pumped, but there are limitations on the ability to infiltrate. Section 3.1.4 has been updated to include this.
M. Garraway	27	54		Has there been any significant change [in exsiting pumping rates] between 2008 and 2012-13	Average Day water demand has decreased by 2,500 m3/d between 2008 (47,681 m3/d) and 2012 (45,244 m3/d)
M. Garraway	28	55		Does [the WCES, 2009] include places to grow estimates?	The City confirms that the WCES does include places to grow population estimates
M. Garraway	R	62		[Dolime Quarry modelling] Can you explain this a little morei.e. what heads and what rate of consumptive pumping. Not sure what portion of total pumping is from surface water and groundwaterhow was surface water separated? How was consumptive value calculated and modelled?	This is is explained in detail in Appendix B - Model Report. The quarry was simulated with seepage boundary type that permits groundwater to exit from Gasport when the aquifer heads are greater than the elevation of the quarry pond (290.0 mas); Table 2-4 Appendix B). As this is a groundwater flow model, no surface water is simulated. The rate of water use by the quarry is thus simulated as the volume necessary to remove from the model to maintain a head of 290 m at the quarry location. This was roughly 7000 m3/d.
M. Garraway	34	S	4.0	ls this another way of saying steady state?	The comment refers to this statement: "Each of the components presented were calculated assuming no net change in stored water occurs over the time period 1960 to 2006 and were based on the limitations and assumptions of the long-term climate dataset discussed in Appendix B. This sentence was removed from the draft report as it was found to be confusing in that context. The statement was not meant to convey that this was a seledy-state situation, but that any changes in net storage between 1960 and 2006 are neglected. The changes in storage are account for year over year, but the total changes is neglected.
M. Garraway	36	81	4	3 Did the surface water potential stress change do to updated recharge?	The surface water stress assessment was not recalculated as the surface water vulnerable area was considered attached to the groundwater assessment area. The stress assessment for the groundwater assessment area is reported in section 4.3

M. Garraway	ŝ	06	We should discuss [WHPA-Q1 and Local Area delineation]. Figure 3 is correct per the rules but if we include Cambridge local area then all consumptive takings and reduction in recharge will classified as significant threats. This perception however will be offset when the threats ranking is performed and only the Guelph wells cousing the reduction in GW discharge will be ranked higher than likely the Cambridge wells ect Also, it would be hipful to know the risk classification of the Cambridge local areamight already be significant in which case combining the local areas makes sense.	This has been addressed through the delineation of a groundwater divide and 2km buffer region between the Cambridge and Guelph Vulnerable Areas
M. Garraway	42/43	96	May wish to modify this sentence by stating that the province and peer review team supported the decision that a surface water risk assessment was not required. Suggest that you discuss and get this concurrence at the peer review meeting Need to know surface water contribution as a percentage to total surface water discharge and to total water being pumped during average and drought conditions. If we feel that the percentage is significant or the municipality could not meet demand without the surface water contribution, we can consider combining the WHPA and IPZ as one Local Area.	The Eramosa intake is not pumped during a drought condition due to the low water in the river. During a drought other wells are increased and thus the SW inputs do not have a bearing on the meeting demand. Nevertheless, the review team agreed that the Eramosa intake is an important source for the Guelph water supply and the upstream contributing area should be included as a surface water vulnerable area (IPZ-Q).
M. Garraway	48	103	Suggest that you talk to Daren and get the insert that he used in the Halton report to explain why the values of H(2) and H(3) don't add to the values of H(1).	The description of the results of Scenario H in Section 5.6.2.1 has been updated to explain that the drawdown due to climate variation (i.e., Scenario D - drought conditions) is included in both Scenario H(2) and H(3). Therefore, the summation of drawdown due to H(2) and H(3) would double count the impact of climate variation.
M. Garraway	23	119	Not sure that this is correct. The 2010 bulletin states that a moderate risk level can be assigned if: the reduction in existing groundwater levels and/or flows results, in response to the allocated pumping rates, in measurable and potentially unacceptable impacts to existing regulated water levels and/or flows or permits. Certainly measurable but is it unacceptable?	This has been addressed under the 2013 guidance document
M. Garraway	55	120	is 21 redds found in the south branch change anybody minds about the branch being marginal to support a trout population?	According to Stantec (2012), this was not evidence of the branch being able to support a trout population.
M. Garraway	57	120	Does the passage of redds in the south branch change anybody minds about the branch being marginal to support an upstream population in blue springs?	According to Stantec (2012), this was not evidence of the branch being able to support a trout population.
M. Garraway	62	131,	See attached generic table to quantify the water quantity threats. Probably need to discuss how to list the threats inclusive of Cambridge and possibly the IPZ area.	Enumeration of significant threats is now in it's own section 6.2.3
M. Garraway	66	139 7.3.2	Was the 202 mm/yr retained? [for the SGRA threshold?]	The 202 mm/vr was retained for the Tier Three SGRA threshold. Text has been updated.
M. Garraway	67	139 7.3.2	Has these areas been compared to the surficial geology ie. I assume no areas were deleted that are shown on OGS geologic maps as sands and gravels	SGRAs and sufficial geology mapping were reviewed and areas mapped as sand and gravel by the OGS have now been included. Figure 7-3 and text in Section 7.3.2 have been revised.
M. Garraway	72	143 8.0	Add step 8 ie assign risk level to local area and prepare list of moderate and significant threats where required	Revised text with Step 8 (Evaluate Risk Scenarios), Step 9 (Assign Risk Levels), and Step 10 (Identify Drinking Water Quantity Threats and Areas where they are <i>Significant</i> and <i>Moderate</i>)
M. Garraway	75	143 8.1.1	"These results are supported by historical operating experience in the City where many of the wells have pumped their allocated rates over prolonged periods of time" Is This True?	This has been confirmed with the City as true

M. Garraway	11	144 8.1.1	was going to ask the same questionif it doesn't meet peak demand than tolerance should be low and significant assigned? Yes-No?	Section 3.2.3 has been revised to address demand, peak demand and tolerance. There is enough storage capacity in the Guelph system to accommodate the peak demand
tems from Peer	Review Meet	ting Minutes, May 2	23, 2013	
		3) Estimate	e Allocated Quantity of Water	This section has been revised using the suggestions of the peer reviewers
Committee	-		o Hugh W. asks if the right method has been used to arrive at the sustainable pumping rate.	This section has been revised using the suggestions of the peer reviewers
Committee	2		 Mike G. adds that the risk assessment does have to address peak pumping in the methodology. Mike G. feels this calculation needs to go back to planned allocation and bring in the peaking factor later to fine tune the calculation. 	This section has been revised using the suggestions of the peer reviewers
Committee	m		o Mike G. recommends meeting with GRCA and municipalities to agree on an approach to including current studies that have dated information when current trends are contradicting past forecasts.	To be addressed by the Source Protection Committee
		7) Delineati	e Vulnerable Areas	
Committee	4		o MSI's final mapping for the Guelph and RMOW WQRAs will need hatching on the WHPA mapping to refer the reader to the correct Tier 3 analysis to understand potential changes	Hatching has been added to Figures 5-1 (WHPA-Q1), 5-2 (WHPA-Q2) and 5-3 (Vulnerable Areas), refering the reader to the ROW Tier 3 for additional details.
		8) Evaluate	e Risk Scenarios	
Committee	LU		Eramosa IP2 not required for Arkell surface water intake. Mike G. is okay with not requiring a Tier 3 WQRA for the surface water because it is accounted for in groundwater through the Arkell Recharge System but good justification is needed in the report to quantify the significance of the surface taking. Mike G. wants to confirm the proportion of water taken from the Eramosa. Paul C. believes it is quite small. Need background on all other water uses in the Eramosa subwatershed. MSI can get additional, up to date, information from Amanda W. and prepare a memo to respond to Mike G's request for more justification on revised water use.	The Eramosa intake accounts for a significant proportion of the water use in the Eramosa subwatershed. The review team agreed that the Eramosa intake is an important source for the Guelph water supply and the upstream contributing area should be included as a surface water vulnerable area (IPZ-Q).
		Next Steps		
Committee			o. Add missing Rockwood wells – verify RA results	The municipal wells of Rockwood and Hamilton Drive have been added as Tier 3 municipal wells and the Risk Assessment has been revised to include discussion and evaluation of these wells.
Committee		~	o Calculate water budgets on subwatershed basis	This has been completed and is now summarized in new Figure 4-9 - 'Water Budget'
Committee			o Verify results against most recent fisheries and stream thermal conditions mapping/studies	The most recent fisheries and stream thermal conditions mapping/studies have been used in this Tier 3 Risk Assessment
Committee			o SGRA – compare against surficial geology	SGRAs and surficial geology mapping were reviewed and areas mapped as sand and gravel by the OGS have now been included. Figure 7-3 and text in Section 7.3.2 have been revised.
		o Awaiting	RMOW Tier Three Risk Assessment	
Committee			§ Update merged Guelph/Cambridge Local Area	The Vulnerable Areas (Figure 5-3 and 5-4) have been updated with the groundwater and surface water vulnerable areas for the City of Guelph Tier 3 Assessment. The groundwater divide has been use to delineate the division between the Guelph and the Cambridge Local Area.
Committee	1		§ Update Water Quantity Threats	These have been updated.
Committee	1.	2	Finalize Guelph Water Budget and Local Area Risk Assessment Report in conjunction with the release of the RMOW WQRA report.	This has been done.

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James Etienne

From:	Kyle Davis <kdavis@centrewellington.ca></kdavis@centrewellington.ca>
Sent:	Wednesday, January 08, 2014 1:47 PM
То:	James Etienne
Subject:	RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Mark Paoli <markp@wellington.ca>

-----Original Message-----From: James Etienne [mailto:jetienne@grandriver.ca] Sent: Wednesday, January 08, 2014 1:42 PM To: Kyle Davis Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Sure,

Do you have his e-mail address?

jbe

-----Original Message-----From: Kyle Davis [mailto:KDavis@centrewellington.ca] Sent: January-08-14 1:36 PM To: James Etienne; Saidur Rahman Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Thanks James. Would you please add Mark Paoli from the County to the invite also?

Thanks,

Kyle

-----Original Message-----From: James Etienne [mailto:jetienne@grandriver.ca] Sent: Wednesday, January 08, 2014 1:18 PM To: Saidur Rahman Cc: Kyle Davis Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

I can make the switch to 10am. I have invited 10 people, although I only have confirmations from 6 people so far. I had invited Aldo and Janice for their information but was not expecting all to attend.

jbe

-----Original Message-----From: Saidur Rahman [mailto:srahman@get.on.ca] Sent: January-08-14 1:14 PM To: James Etienne Cc: Kyle Davis

1

Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Then I would suggest to start the meeting at 10:00 a.m. incase councill have some questions for Kyle. How mnay people will attend the meeting?

Saidur

-----Original Message-----From: James Etienne [mailto:jetienne@grandriver.ca] Sent: January-08-14 12:58 PM To: Saidur Rahman Cc: Kyle Davis Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Hi Saidur:

It looks like Kyle wants to start the meeting at 9:30. I can send out a revised meeting notice along with confirmation that the meeting will be held in Brucedale.

Sincerely,

James

-----Original Message-----From: Saidur Rahman [mailto:srahman@get.on.ca] Sent: January-08-14 12:38 PM To: James Etienne Cc: Kyle Davis Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

I can escape from the strategic planning meeting and I want to keep our meeting on as scheduled on 15th 9 to 11 a.m. Still waiting for Kyle to confirm. Thanks.

Saidur

Saidur Rahman, Ph.D., P.Eng. Director of Public Works

T: 519-856-9596 ext. 109 F: 519-856-2240 www.get.on.ca

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[?]

-----Original Message-----From: James Etienne [mailto:jetienne@grandriver.ca] Sent: January-07-14 3:34 PM To: Saidur Rahman Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Thanks Saidur:

I will wait to hear further.

jbe

-----Original Message-----From: Saidur Rahman [mailto:srahman@get.on.ca] Sent: January-07-14 12:22 PM To: Kyle Davis; James Etienne Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Hello Kyle and James,

Belated Happy New Year. I left voice message for both of you. I asked changing the meeting in the afternoon on 15 January? Or another date?

We have strategic planning meeting with the council in the morning from 9 to noon. Kyle will be there too. I just heard that there is a possibility of rescheduling our strategic planning meeting. Then our meeting will be on time. Please stay tuned. I will confirm as soon as I know.

Regards,

Saidur

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Saidur Rahman, Ph.D., P.Eng. Director of Public Works

T: 519-856-9596 ext. 109 F: 519-856-2240 www.get.on.ca

[?]

-----Original Message-----From: Kyle Davis [mailto:KDavis@centrewellington.ca] Sent: January-07-14 10:45 AM To: Saidur Rahman Subject: Re: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Hi Saidur,

On the 15th would work well after our meeting. Thank you for arranging that. I have done some driving around on my own but find it useful to touch base with someone on the water staff also as I find they know the areas around the wells very well.

Thanks and looking forward to seeing you on the 15th.

Kyle

~~~~~

Sent from my BlackBerry 10 smartphone on the Bell network. From: Saidur Rahman Sent: Thursday, December 19, 2013 3:18 PM To: Kyle Davis Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Thanks Kyle. I can arrange somebody will drive you to the sites on January 15th after our meeting or another date. Please let me know.

Saidur Rahman, Ph.D., P.Eng. Director of Public Works

T: 519-856-9596 ext. 109 F: 519-856-2240 www.get.on.ca<http://www.get.on.ca/>

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From: Kyle Davis [mailto:KDavis@centrewellington.ca] Sent: December-19-13 11:10 AM To: Saidur Rahman Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Thanks Saidur, looking forward to the meeting.

Also, are there any dates in January that might work for you or someone from your staff to meet and drive by the Rockwood and Hamilton Drive wells?

Thanks,

Kyle

From: Saidur Rahman [mailto:srahman@get.on.ca]

Sent: Tuesday, December 17, 2013 1:53 PM

To: James Etienne; Martin Keller; pchin@matrix-solutions.com<mailto:pchin@matrix-solutions.com>;

dvanvliet@matrix-solutions.com<mailto:dvanvliet@matrix-solutions.com>;

Dave.Belanger@guelph.ca<mailto:Dave.Belanger@guelph.ca>; aldos@wellington.ca<mailto:aldos@wellington.ca>; Janice Sheppard; Kyle Davis

Subject: RE: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

Thanks James for your prompt get back and setting up the meeting. January 15 will work and all are welcome to our Brucedale Office.

Regards,

Saidur

-----Original Appointment-----

From: James Etienne [mailto:jetienne@grandriver.ca]

Sent: Tuesday, December 17, 2013 1:15 PM

To: Martin Keller; Paul Chin (pchin@matrix-solutions.com<mailto:pchin@matrix-solutions.com>); David Van Vliet (dvanvliet@matrix-solutions.com<); Dave Belanger

(Dave.Belanger@guelph.ca<mailto:Dave.Belanger@guelph.ca>); aldos@wellington.ca<mailto:aldos@wellington.ca>; Saidur Rahman; Janice Sheppard; kdavis@centrewellington.ca<mailto:kdavis@centrewellington.ca> Subject: Rockwood and Hamilton Drive Tier 3 WQRA Introduction

When: Wednesday, January 15, 2014 9:00 AM-11:00 AM (GMT-05:00) Eastern Time (US & Canada). Where: TBD

Good afternoon Saidur and Kyle:

As discussed, I have invited a group to attend a meeting to allow Matrix Solutions to provide you with a presentation on the Tier 3 Water Quantity Risk Assessment reporting for Guelph-Eramosa's municipal water supplies at Rockwood and Hamilton Drive. As noted on pages 75-76 and 88-89 of the December 2009 Grand River Tier 2 Water Quantity Stress Assessment Report (http://www.sourcewater.ca/index/document.cfm?Sec=7&Sub1=6&sub2=5), this work is a requirement of the Source Protection Water Quantity Technical Rules. However, Guelph-Eramosa Township does not have to pay for the Tier 3 reporting as it is being completed by Matrix Solutions as an addendum to the City of Guelph's Tier 3 WQRA Report using MNR Water Budget Technical Studies funding.

Paul Chin from Matrix Solutions will provide the presentation and has supplied the attached executive summary from the draft Guelph Tier 3 WQRA Report delivered to the City in May.

Paul has suggested the morning of January 15th for a presentation which could be held at the Guelph-Eramosa office in Brucedale, Matrix Solutions office in Breslau or the GRCA's office in Cambridge. Please let me know if this date is suitable and which location would be most convenient to you.

Sincerely,

James B. Etienne, P.Eng.

Senior Water Resources Engineer

Grand River Conservation Authority

400 Clyde Road, Cambridge, ON N1R 5W6

Tel: 519-621-2763 ext. 2298

email: jetienne@grandriver.ca<mailto:jetienne@grandriver.ca>

<< File: Guelph Tier 3 Risk Assessment Executive Summary and TOC - 0513 draft.pdf >>





Source Protection - Impetus

- Walkerton Tragedy
 - 2,500 illness, 7 deaths
- Inquiry O'Connor Report
 - Drinking water focused
 - Quality Management
- Quantity Management
- Ontario Clean Water Act (2006)
 - to protect municipal drinking water sources throughout Ontario

1/16/2014

Results presented in this document are DRAFT for Discussion



Water Budget & Water Quantity Risk Assessments

- Guidance for water resource management professionals
- Assists source protection teams in delivering the water budget components of the Clean Water Act
 - Water Budgets
 - Stress Assessments
 - Delineating significant groundwater recharge areas

www.waterbudget.ca

1/16/2014



Water Quantity Assessments

- Framework
 - Evaluate municipal water supply sustainability
 - Current and Planned water demands
 - Surface Water Intakes or Wellheads
 - Help managers understand risk
- Approach
 - Tiered Approach
 - − Screening tools → detailed water budget tools



Results presented in this document are DRAFT for Discussion



Water Budget – Tiered Assessment



Conceptual Water Budget -Characterization

- Understanding and interpreting existing data is critical to project success
- meteorology, geology, hydrology and hydrogeology





Tier 3 Water Budget and Risk Assessment

Goal:

- Assess the ability to meet future water quantity requirements under scenarios:

1. increased demand

2. projected land development

3. drought conditions

- Highly detailed numerical models

Where?

- Tier 2 Assessment with a Moderate or Significant stress level

- Historical issues with water sources meeting demand

Focus shifts from subwatershed analysis to wellhead analysis Results presented in this document are DRAFT for Discussion

1/16/2014



GUELPH TIER 3 PROJECT SUMMARY



1/16/2014

Results presented in this document are DRAFT for Discussion





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Field Studies (2008/09)

- Streamflow Monitoring (spot baseflow)
 ~30 locations, 3 rounds
- Drilling
 - 11 locations
- Objectives
 - Bedrock Geological Characterization (Vinemount, Gasport)
 - Overlying Aquifer/Aquitard
 - Establish deep groundwater monitoring wells outside of the City of Guelph
 - Assess hydraulic controls on deep bedrock groundwater flow system



1/16/2014

Results presented in this document are DRAFT for Discussion

Field Program Drilling Locations

- 10 Boreholes drilled through bedrock aquifer system and into underlying Cabot Head shale (depths of 60 -145 m)
- Step-off overburden wells
- Geophysical logging (gamma, cond., televiewer, video)
- Coring at 3 sites (funded by OGS)
- Additional 11th borehole (cored) mid-way between Cambridge and Guelph (funded by OGS and City of Guelph)



1/16/2014

Identified Highly Permeable Zones




















Tier 3 Local Area Risk Assessment Methodology

- 1. Develop the Conceptual and Numerical Tier Three Assessment Models
- 2. Characterize Municipal Wells and Intakes
- 3. Estimate the Allocated Quantity of Water
- 4. Identify and Characterize Potential Drinking Water Quantity Threats
- 5. Characterize Future Land Use
- 6. Characterize Other Water Uses
- 7. Delineate Vulnerable Areas
- 8. Evaluate Risk Scenarios
- 9. Assign Risk Level
- 10. Identify Drinking Water Quantity Threats

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Results presented in this document are DRAFT for Discussion



Guelph/Eramosa Wells

Well Name	Permit Number	Permitted Capacity (m³/d)	Average Annual Reported Taking (2008) (m ³ /d)	Average Annual Reported Taking (2012) (m ³ /d)	
		Hamilton Drive Wells			
Cross Creek Well	91-P-2034	812	91	109	
Huntington Estates Well	03-P-2295	916	90	128	
	TOTALS		181	237	
		Rockwood Wells			
Well #1 (TW# 1-67)	0823-7BTHTK		286	419	
Well #2 (TW# 1-76)	(set to expire 31/03/2018)	1,965	217	421	
TW3/02		1,313	411	339	
	TOTALS	3,278	914	1,179	



1/16/2014

Results presented in this document are DRAFT for Discussion

Hamilton Drive Monthly Total Pumping 2004 to 2012





3. Estimate Allocated Quantity of Water

Urban Centres

	2006	2011	2015	2021	2026	2031
ROCKWOOD						
Total Population	3,790	4,510	5,180	5,610	6,050	6,150
Households	1,310	1,540	1,750	1,880	2,020	2,060



Tier 3 Local Area Risk Assessment Methodology

Results presented in this document are

DRAFT for Discussion

- 1. Develop the Conceptual and Numerical Tier Three Assessment Models
- 2. Characterize Municipal Wells and Intakes
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- 8. Evaluate Risk Scenarios
- 9. Assign Risk Level
- 10. Identify Drinking Water Quantity Threats

1/16/2014





Potential Imperviousness Increase







7. Delineate Vulnerable Areas

- WHPA-Q1
 - delineated as the drawdown cone of the municipal wells when pumping at allocated rates compared to nonpumping conditions
 - Intersected with drawdown cone from all other consumptive water users
 - 2 m drawdown contour based on seasonal fluctuations
- WHPA-Q2
 - WHPA-Q1 plus any area where a future reduction of recharge would have a measurable impact on water levels at the municipal wells
- Local Area is derived from WHPA-Q1 and WHPA-Q2







Merged Local Area

1/16/2014

8. Evaluate Risk Scenarios

	the second s		Model S	cenario Details		
Scenario	Time Period	Land Cover	Municipal Pumping	Model Simulati	on	
c	Period for which climate and stream flow data are available for the Local Area (2008)	Existing	Existing	Steady-state, Average Ann	ual Recharge	Existing Land Cover & Existing Pumping
D	10 year drought period	Existing	Existing	Transient (1960-1970); Mo recharge rates (GAWSER)	nthly	Average & Drought Climate
G(1)	Period for which	Planned or existing plus committed (Official Plan)	Planned plus Existing plus Committed	Groundwater Recharge Reduction and Increase in Demand	Steady-	Plannad Land Cover
G(2)	climate and stream flow data are available for the Local	Existing	Planned plus Existing plus Committed	Groundwater Discharge Reduction from Increase in Demand	state, Average Annual	Planned Lana Cover & Planned Pumping Average Climate
G(3)	Areə (2008)	Planned or existing plus committed (Official Plan)	Existing	Groundwater Recharge Reduction	Recharge	
H(1)		Planned or existing plus committed (Official Plan)	Planned plus Existing plus Committed	Groundwater Recharge Reduction and Increase in Demand	Transient (1960-	Name di and Causa
H(2)	10 year drought period	Existing	Planned plus Existing plus Committed	Groundwater Discharge Reduction from Increase in Demand	1970); Monthly recharge	& Planned Pumping
H(3)		Planned or existing plus committed (Official Plantesults)	Existing presented in thi	Groundwater Recharge Reduction s document are	rates (GAWSER)	Drought Climate

Carter Wells – Scenarios D / H





Impacts to other uses - >10 % Reduction of Groundwater Discharge to Streams 33% Reduction Cold water Upper Reach - Cool Water 41% Reduction gs Ck at 28% SORD 31% Warm water Impacted Watercourse logo Ellin Ck at Welk 33% oton Rd 32 Guelph 31% Reduction t Lik of Sitone Hid Cold water Intermittent Watercourse 13% Reduction Cold water 15% Reduction S Cold water document 1/16/2014 DRAFT for Discussion

9. Assign Risk Level

Criteria	Risk Level	Uncertainty
Drawdown at Municipal Wells	Low	Low
Impacts on Groundwater Discharge to Cold Water Streams > 20%	Moderate (as pumping increases already permitted)	High
Impacts on Groundwater Discharge to Cold Water Streams 10-20%	Moderate	Low
Impacts on Groundwater Discharge to Provincially Significant Wetlands	Moderate	High

Local Area tentatively assigned a Risk Level of Moderate In this document are DRAFT for Discussion

10. Identify **Drinking Water Quantity Threats**

Drinking water quantity threat:

- Any consumptive water user, and
- Any activity that reduce groundwater recharge to an aquifer

within the Local Area.



1/16/2014

Implications of Water Quantity Risk Level

- For Local Areas with water quantity risk level of:
 - Significant a Risk Management Measures
 Evaluation Process is conducted under the Clean
 Water Act.
 - Moderate no requirements under the Act



1/16/2014

Results presented in this document are DRAFT for Discussion

Tier 3 Local Area Risk Assessment Methodology

- 1. Develop the Conceptual and Numerical Tier Three Assessment Models
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- 4. Identify and Characterize Potential Drinking Water Quantity Threats
- 5. Characterize Future Land Use
- 6. Characterize Other Water Uses
- 7. Delineate Vulnerable Areas
- 8. Evaluate Risk Scenarios
- 9. Assign Risk Level
- 10. Identify Drinking Water Quantity Threats



1/16/2014

Results presented in this document are DRAFT for Discussion

Water Budget Models – Risk Management Tools

- Risk Management Measures Evaluation Process
- Water Resource Management
- Monitoring Planning
- Permit to Take Water Applications
- Capture Zones / Well Head Protection Areas
- Contaminant Transport Analysis
- Environmental Impact Assessments
- Land Development Planning
- Climate Change Impact Evaluation



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Results presented in this document are DRAFT for Discussion

NEXT STEPS



1/16/2014

Results presented in this document are DRAFT for Discussion

Next Steps and Timeline

- Gather additional data and information
- Complete characterization (end of Jan)
- Update model and check calibration (mid-Feb)

Results presented in this document are

DRAFT for Discussion

- Conduct Risk Assessment (end of Feb)
- Complete Tier 3 Report (end of March)



1/16/2014



City of Guelph Tier Three Water Budget and Local Area Risk Assessment

> Peer Review Meeting May 9, 2014



Guelph Tier Three Process



Guelph Tier Three Process



- Guelph Risk
- Assessment Re-run



- Updates Completed for Rockwood/Hamilton Drive
 - Conceptual Model
 - Numerical Model
- Characterized Municipal Wells
 - Allocated Quantity of Water
 - Safe Additional Available Drawdown
- Risk Assessment Results
 - Drawdown
 - Impacts to Other Water Uses
 - Updated Risk Level Based on Revised Guidelines for Other Water Uses
- Delineation of Surface Water Vulnerable Area, IPZ-Q
- Updated merged Guelph/Cambridge Local Areas
- Remaining Work and Timeline



UPDATES COMPLETED FOR ROCKWOOD/HAMILTON DRIVE

Study Area



Conceptual Model Updates



Conceptual Model - Rockwood



Conceptual Model Updates - Rockwood

Revised Top of Bedrock Surface:

- Cross-section analysis revealed inconsistencies in representation of penetration and continuity of buried bedrock channels near and NE of Rockwood
- New surface developed and layers updated
 - Re-picked borehole lithology from BH records/WWRs
 - Control points added along inferred buried channel thalwegs to capture continuity and depth
- Infill reinterpreted to be coarse grained
 - based on OGS drilling

Conceptual Model Updates - Rockwood

Revised Top of Bedrock Surface:



Conceptual Model Updates - Rockwood

Revised Top of Bedrock Surface: Compared to previous surface



Conceptual Model Updates - Rockwood

Revised Top of Bedrock Surface: FEFLOW Update Area



New Surface Shallower

Conceptual Model Updates - Rockwood

Revised FEFLOW LAYERS – Previous FEFLOW Representation



Conceptual Model Updates - Rockwood

Revised FEFLOW LAYERS – Updated FEFLOW Representation



Conceptual Model Updates – Hamilton Drive

- Gasport sub-crop moved west
- Vinemount Windows reduced





Numerical Model Updates

- Revise model layer elevations to ensure consistency with conceptual model
- Bedrock valleys updated
- Update hydrogeologic zones
 - Bedrock valley infill fine grained to coarse
 - Vinemount hole under Guelph Lake reduced
 - Sub-crop of Gasport moved westward

Numerical Model Updates

- Added Rockwood Bernardi (Well 3)
- Update pumping rates for RW/HD
 - Existing (2009-2010 avg)

		S Martin S Zalakar V	Rate	s (m³/day)
Community	Municipal Well Aquifer		Maximum Permitted	Existing Demand (Average 2009 to 2010)
	Station St. 1	Middle Gasport	1.005	283
	Station St. 2	Middle Gasport	1,905	262
Rockwood	Bernardi (Well 3)	Upper to Middle Gasport	1,310	422
			Total	967
	Cross Creek	Upper to Middle Gasport	812	87
Hamilton Drive	Huntington	Upper to Middle Gasport	916	92
			Total	179

Numerical Model Updates

Head Calibration Targets:

11 additional observation points

Steady-State Calibration Stats:

- Entire Model: Unchanged
- Hamilton Drive area: Unchanged

Whole Model	Updated
Mean Error	-0.3 m
Root Mean Squared	5.7 m
Normalized RMS	2.1 %

Rockwood Area
 Previous
 Updated
 Mean Error
 -1.1 m
 -1.4 m
 Root Mean Sq
 6.6 m
 6.8 m
 Normalized RMS
 6.0 %
 6.1 %

Numerical Model Updates

Baseflow Calibration Targets:

- Minor Decreases in Chilligo/Ellis and Hopewell Creeks
 - Due to moving sub-crop of Gasport
 - Still close to the high baseflow estimates
- Minor Increases in Eramosa River
 - Due to bedrock valley updates



Numerical Model Updates

 Verification of transient groundwater levels in HD – 2008 to 2012



Numerical Model Updates

 Verification of transient groundwater levels in RW – 2008 to 2012





CHARACTERIZE MUNICIPAL WELLS

Determine Allocated Rates

Well Name	Maximum Permitted Rate ^A (m ³ /day)	Existing Rate ⁸ (m ³ /day)	Committed Rate ^C (m ³ /day)	Allocated Rate – Existing plus Committed (m ³ /day)
	Hami	lton Drive		
Cross Creek Well	812	87	3	90
Huntington Estates Well	916	92	3	95
Total	1,728	179	6	185
	Ro	ckwood		
Station St. Well 1 (TW1-67)	1.065	283	62	345
Station St. Well 2 (TW1-76)	1,202	262	62	324
Bernardi Well 3 (TW3-02)	1,310	422	62	483
Total	3,275	967	185	1,152

^A from PTTW

^B 2009-2010 average rate

^c from 2020 growth projections (Watson and Associates Economists Ltd. 2011)

Note: the values presented represent the final rounded values and any apparent discrepancies in summation are an artifact of this rounding.

Determine Allocated Rates

RW/HD Existing Demand:

- Based on average demand from 2009 to 2010
- Time frame aligns with available WL data and reference data used for municipal growth forecasts

RW/HD Committed Demand:

- Estimated using forecasts from a 2011 Water Use Study
- Demand forecasted until the year 2020
- Increase in pumping was distributed equally among municipal wells

Determine Safe Additional Available Drawdown



Determine Safe Additional Available Drawdown

Styles and the			(A)	(B)	(C)	(D)	(C – D)	
Well Name	Ground Surface Elevation (m asl)	Depth to Bedrock (m)	Top of Open Bedrock Borehole Interval Elevation (m asl)	Current Intake Elevation (m asl)	Average Pumped Water Level for 2009-2010 (m asl)	Safe Water Level (m asl)	Safe Additional Available Drawdown (m)	Safe Water Level Based On?
and the second second		k	De	pth Below Gro	ound Surface (m) [-	12
			Ha	amilton Driv	/e		\bigwedge	
Cross Creek Well	351.4	21.3	311.7 [39.6]	302.6 [48.8]	320.2 [31.1]	303.6 [47.8]	16.6	Intake
Huntington Estates Well	338.1	3.1	303.0 [35.1]	303.3 [34.9]	321.6 [16.5]	304.0 [34.1]	17.6	Top of Open Bedrock
				Rockwood				
Station St. Well 1 (TW1-67)	361.0	6.9	324.5 [36.5]	332.3 [28.7]	348.5 [12.5]	325.5 [35.5]	23.0	Top of Open Bedrock
Station St. Well 2 (TW1-76)	361.0	6.3	322.6 [38.4]	333.6 [27.4]	350.6 [10.4]	323.6 [37.4]	27.0	Top of Open Bedrock
Bernardi Well 3 (TW3-02)	360.4	12.7	316.7 [43.7]	325.3 [35.2]	333.9 [26.5]	317.7 [42.7]	16.2	Top of Open Bedrock

Rockwood Land Use Changes

 Planned development in Rockwood (Official Plan)





RISK ASSESSMENT RESULTS

Maximum Drought Drawdown

Changes at Guelph Wells, and RW/HD Results:

Well Name	Safe Additional Available Drawdown (inc. Well Losses)	Previous Simulated Maximum Drawdown (m)	New Simulated Maximum Drawdown (m)
	City of G	uelph	
Arkell 1	1.9	1.7	1.8
Carter Wells	2.3	1.9	2.1
Emma	4.7 (originally 4.2)	3.7	4.2
Water Street	9.3	8.5	8.6
	Rockw	ood	
Station St. 1	23.0	-	3.2
Station St. 2	27.0	-	3.2
Bernardi	16.2	-	6.4
	Hamilton	Drive	
Cross Creek	16.6	-	2.9
Huntington	17.6	-	2.6

Updated Areas and Municipal Wells



Impacts to Other Water Uses

Reduced Groundwater Discharge (>10%)

Surface Water Course	Description	Previous Baseflow Reduction % [Scenario G(2)]	Previous Risk Level	New Baseflow Reduction % [Scenario G(2)]	New Risk Level
Blue Springs Creek	South Branch — At 28 th Side Rd.	31.2 %	Significant	30.1 %	Moderate
Chilligo/Ellis Creek	At Kossuth Rd.	9.8 %	Low	10.4 %	Moderate
	At Wellington Rd. 32	32.8 %	Significant	38.8 %	Moderate
Uselan Creek	At Waterfowl Park	12.6 %	Moderate	13.3 %	Moderate
Hanion Creek	South Trib. At Hwy 6	15.4 %	Moderate	16.5 %	Moderate
Torrance Creek	At Stone Rd.	41.3 %	None (not coldwater)	41.4 %	None (not coldwater)

Impacts to Other Water Uses

Water Table Decline Below PSWs [> 1m; Scenario G(2)]:

- Marden South Complex
- Ellis Creek Complex
- Guelph North-East Complex
- Clythe Creek Wetland (updated from previous draft)

The model's prediction of water table drawdown near PSWs is uncertain due to:

- 1) coarse representation of shallow gw flow and wetlands
- 2) use of regional surficial geology mapping
- 3) the uncertain extent and thickness of the Vinemount aquitard

As a result of the potential impact to wetlands, Local Area is assigned *Moderate* Risk Level (unchanged from previous draft).

Impacts to Other Water Uses

Updated Risk Level Based on Revised Guidelines for Other Water Uses

- New Risk Level = *Moderate*
- Previous Risk Level = Significant

Recent MOE guidance indicates that the highest Risk Level associated with impacts to other water uses is now '*Moderate*', when only the Allocated Quantity of Water is considered.



DELINEATION OF SURFACE WATER VULNERABLE AREA, IPZ-Q



Surface Water Vulnerable Area, IPZ-Q

IPZ-Q:

- 1) Drainage area that contributes surface water to the Eramosa intake (Arkell Recharge System)
- 2) Area that provides recharge to an aquifer that contributes groundwater discharge to the drainage area
- Previous draft included 1)
- Now 'IPZ-Q' includes both 1) and 2)
- Particle tracking tools in FEFLOW groundwater model used to delineate 2)
Surface Water Vulnerable Area, IPZ-Q

Previous IPZ-Q

Revised IPZ-Q







UPDATED MERGED GUELPH/CAMBRIDGE LOCAL AREAS



Local Area

Revised Local Area:





REMAINING WORK AND TIMELINE

Project Completion

- Items to be completed:
 - Rockwood/Hamilton Drive Characterization Report and Numerical Model Update Memos (May 31)
 - Needs to be reviewed and provide comments
 - RW/HD Allocated Rates and Safe Water Levels accepted by Guelph/Eramosa Township (May 20)
 - Finalize Guelph Water Budget and Local Area Risk Assessment Report (May 31)
 - Need to confirm previous comments have been addressed, and review new material

Questions / Discussion

Guelph - ROW/Cambridge Tier Three Model Integration



Tier Three Models



Model Comparison Memo

- Model Structure
- Boundary Conditions
- Hydrogeologic Layers and Properties
- Flow Solution Comparisons

Model Structure

- Mesh generation process used same input features (i.e., lakes, rivers, and production wells)
- Vertical discretization
 - ROW and Cambridge models have more overburden layers (13 and 7)
 - Guelph has 3

A LUT STREET	Layer	Unit	Interpreted Units	Regional	Cambridge	Guelph		
	1100	Aquitard	Whittlesey clay (surficial geology)	1	1			
		Aquifer	Whittlesev sand			1&2		
1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	a)	Aquitard	Wentworth Till (may contain abundant stratified drift)	2	2			
		Aquifer	Outwash deposits (mainly Grand River valley outwash)		3			
		Aquitard	Fine grained deposits in Grand River valley					
		Aquitard	Upper Maryhill Till, Port Stanley Till, Tavistock Till, Mornington Till, etc	3	4	3		
	_	Aquifer	Upper Waterloo Moraine Stratified Sediments and equivalents	4	5	Not present		
	<u>a</u>	Aquitard	Middle Maryhill Till and equivalents	5	5	Not present		
	purc	Aquifer	Middle Waterloo Moraine Stratified Sediments and equivalents	6&7	5	Not present		
	ē	Aquitard	Lower Maryhill Till and stratified equivalents	8	6	Not present	8	
	6	Aquifer	Lower Waterloo Moraine Sediments or Catfish Creek Till Outwash	9	Not present	Not present		
		Aquitard	tard Upper/ Main Catfish Creek Tili		6	6		
		Aquifer	Middle Calfish Creek Stratified Deposits	10	Not present	Not present	- 1	
	1	Aquitard	Lower Catfish Creek Till		6		e 📘	
		Aquifer	Pre-Catfish Creek coarse-textured glaciofluvial/lacustrine deposits	11	7	Not present		
		Aquitard	Canning Drift (till, associated fine-textured glaciolacustrine deposits)	12	Not present	Not present		
		Aquifer	Pre-Canning coarse-textured glaciofluvial/glaciolacustrine deposits	13	7	Not present		
	1	Aquitard	Pre-Canning coarse-textured till				_	
		Contact Zone Aquifer	Fractured bedrock and overlying basal unconsolidated deposits	14	8	4		
		Aquifer	Bois Blanc Fm.	Layers 15-21	Not present	Not present	ě.	
		Aquifer	Bass Island Fm.	west of	Not present	Not present	2	
	×	Aquifer/ Aquitard	Salina Fm _{er}	Waterloo Moraine (not present east of Moraine)	Not present	Not present		
	ĕ	Aquifer	Guelph Fm. & Stone Road Mbr, Eramosa Fm	15	9	5		
	Bed	Aquifer/ Aquitard	Eramosa Fm; Reformatory Quarry Mbr	16	10	6	2	
		Aquitard	Eramosa Fm: Vinemount Member	17	11	7 - 9	25	
		Aquifer/ Aquitard	Goat Island Fm.	18	12	10	8	
		Aquifer	Upper Gasport Fm.	19	13	11	2	
		Aquifer	Middle Gasport Fm.	20	14	12	8	
		Aquifer	Lower Gasport Fm.	21	15	13	ĝ.	
		Aquitard	Cabot Head Fm.	Not present	Not present	14		

Boundary Conditions

Feature	ВС Туре	Remark	Regional	Cambridge	Guelph
Aerial Recharge	Recharge		GAWSER based	GAWSER based	GAWSER based
Rivers, Lakes	Type 1	Common inputs: stream network, DEM	Equivalent	Equivalent	Equivalent
Municipal Wells	Well	Common between: Reg- Cam (WRAS Db)	Equivalent	Equivalent	Equivalent within overlap
Non- Municipal Wells	Well	Common between: Reg- Cam (GRCA PTTW Db)	Equivalent	Equivalent	Equivalent within overlap

Hydrogeologic Properties

 Material distribution and properties are equivalent where there is overlap



Flow Solution Comparisons

In overlapping areas between the Guelph and Cambridge models:

- Permits to Take Water
 - Check water budget on non-municipal PTTW
- Groundwater flow divide
 - Estimate based on head contours and particle tracks
- Compare predictions
 - Cambridge northern boundary condition update

Permits to Take Water

Check water budget on nonmunicipal PTTWs within polygon for both models

9,014 m³/d and 9,026 m³/d



Groundwater Flow Divide

Check hydraulic head contours for both models



Guelph Model

Groundwater Flow Divide

Check hydraulic head contours for both models



Guelph Model

Groundwater Flow Divide

Particle Track in both models from same locations



Groundwater Flow Divide

Particle Track in both models from same locations



Compare Predictions – G(2) Scenario

- Cambridge uses heads from Guelph base case for future scenarios
- Update Cambridge Model boundary conditions using Guelph G(2) model-simulated heads
- Max change in Cambridge Wells < 10 cm

Update Cambridge Model BC

Compare Predictions

Well Field	Consit_id	Head No Update	Head With Update	Head Diff
Shade's Mill	G39	271.54	271.52	0.02
Clemens Mill	G17	272.34	272.29	0.05
Clemens Mill	G18	270.34	270.29	0.05
Clemens Mill	G16	284.50	284.41	0.09
Dunbar Road	P6	274.75	274.74	0.01
Middleton Street	G2	250.39	250.39	0.00
Pinebush	P11	290.49	290.42	0.07
Willard	G15	259.01	259.00	0.00
Middleton Street	G1	252.33	252.33	0.00
Clemens Mill	G6	280.43	280.37	0.06
Pinebush	Р9	286.46	286.40	0.06
Pinebush	P17	291.99	291.91	0.08
Hespeler	Н5	290.88	290.85	0.03
Middleton Street	G1A	252.85	252.85	0.00
Middleton Street	G14	253.96	253.96	0.00
Pinebush	P10	289.10	289.03	0.07
Middleton Street	G3	252.11	252.11	0.00
Shade's Mill	G7	280.89	280.87	0.02
Hespeler	НЗ	283.15	283.10	0.05
Hespeler	H4	295.26	295.23	0.03
Elgin Street	G9	275.23	275.23	0.01
Pinebush	G5	288.07	288.02	0.05
Pinebush	P15	286.56	286.50	0.06
Shade's Mill	G38	275.86	275.84	0.02
Shade's Mill	G8	282.37	282.35	0.02
Blair Road	GA	260.45	260.45	0.00

Project Completion

- Item to be completed:
 - Guelph ROW/Cambridge Tier Three Model Integration Memo (May 31)

James Etienne

From:Saidur Rahman <srahman@get.on.ca>Sent:Thursday, June 05, 2014 4:19 PMTo:Paul Chin; Donna ButtonCc:Jeffrey MelchinSubject:RE: Your approval requested for Tier Three Water Quantity Risk Assessment

Hi Paul,

We are in agreement. Please proceed with the report. Thanks.

Saidur Rahman Director of Public Works

T: 519-856-9596 ext. 109 F: 519-856-2240 www.get.on.ca

GET Guelph/Eramosa Township

From: Paul Chin [mailto:pchin@matrix-solutions.com]
Sent: June-05-14 2:18 PM
To: Donna Button
Cc: Saidur Rahman; Jeffrey Melchin
Subject: RE: Your approval requested for Tier Three Water Quantity Risk Assessment

Hello Saidur and Donna,

Have you finished your review of the memo, and are you able to confirm that you are in agreement with the estimated increased pumping (Allocated rates) and the safe available drawdown in the wells?

Thank you, Paul

Paul Y.S. Chin, M.Sc., P.Eng. Hydrogeological Engineer

Matrix Solutions Inc. Direct: 519-772-3777 x119 Mobile: 519-897-2490

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From: Paul Chin Sent: May-29-14 9:08 AM To: 'Donna Button' **Cc:** Saidur Rahman; Jeffrey Melchin (<u>JMelchin@matrix-solutions.com</u>) **Subject:** RE: Your approval requested for Tier Three Water Quantity Risk Assessment

Hello Donna,

Thank you for your questions. The calculations were based on increases from the Existing Demand which was taken as the "average demand from 2009 to 2010 for each municipal well" (p.2). These demands are calculated from the reported pumping rates at the wells. We did not use the "Existing" numbers from Watson's Table 1-1 and 1-2 as these were estimated from the <u>Billing volumes</u> (not volumes pumped from the wells) during 2010 and are not from the same time period as the water level data we had available for calibration.

We took the increase in water demand, or the "Committed Rate" from Watson as it represents the best forecast of increased water requirements. These increases do not account from any incremental losses due to infrastructure leakages, treatment processing or storage losses, etc.

Thus our calculation was: Hamilton Drive 2,080 / 65,335 = 3% Rockwood 67,410 / 352,955 = 19%

Your comment: "Just a small notation for table 1- Rockwood - Total committed Rate ^c (m^3 /day) = 186". I am not sure if I am missing something as I calculate 67,410 / 365 = 184.68 = 185

I hope these responses address your questions.

Best Regards, Paul

Paul Y.S. Chin, M.Sc., P.Eng. Hydrogeological Engineer

Matrix Solutions Inc. Direct: 519-772-3777 x119 Mobile: 519-897-2490

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From: Donna Button [mailto:dbutton@get.on.ca] Sent: May-28-14 2:40 PM To: Paul Chin Cc: Saidur Rahman Subject: FW: Your approval requested for Tier Three Water Quantity Risk Assessment

Hi Paul,

Can you tell me how you came to the 3% and 19% in the statement below? I did what I thought to be the math and I came up with a different number. I may be misinterpreting the statement for doing the math. Just a small notation for table 1- Rockwood - Total committed Rate ^c (m³/day) = 186

Hamilton Drive 2080/55853=3.72% Rockwood 67410/306149=22% Water users forecast tables from that study are reproduced in Appendix A. These estimates represent the increased demand forecasted until the year 2020 that is over and above the demand recorded in 2010. The increase in pumping over Existing demand was estimated to be 2,080 m₃/year or 6 m₃/day (an increase of 3%) for the Hamilton Drive water supply system, and 67,410 m₃/year or 185 m₃/day (an increase of 19%) for the Rockwood system (**Table 1**).

Regards Donna Button Compliance & QMS Rep. Water & Wastewater Public Works Dept. Guelph/Eramosa Township 519-856-9596 ext. 122 dbutton@get.on.ca

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From: Paul Chin [mailto:pchin@matrix-solutions.com]
Sent: May-20-14 12:37 PM
To: Donna Button
Cc: Jeffrey Melchin
Subject: FW: Your approval requested for Tier Three Water Quantity Risk Assessment

Hello Donna,

I sent this memo to Saidur last week, and followed-up with a phone call and email today. I am not even sure if he is getting my messages. Would you be so kind as to check that he has received it? Our deadline is quite tight on this one.

Thanks, Paul

Paul Y.S. Chin, M.Sc., P.Eng. Hydrogeological Engineer

Matrix Solutions Inc.

Direct: 519-772-3777 x119 Mobile: 519-897-2490

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From: Paul Chin

Sent: May-20-14 9:31 AM To: 'srahman@get.on.ca' Subject: RE: Your approval requested for Tier Three Water Quantity Risk Assessment

Hello Saidur,

I hope you had a good weekend. I just left a voicemail asking if you had any questions about this memo and when you will be able to provide your approval.

Please let me know that you have received this email and the memo.

Thank you, Paul

Paul Y.S. Chin, M.Sc., P.Eng. Hydrogeological Engineer

Matrix Solutions Inc.

Direct: 519-772-3777 x119 Mobile: 519-897-2490

(\$) Please consider the environment before printing this email.

From: Paul Chin
Sent: May-13-14 2:34 PM
To: 'srahman@get.on.ca'
Cc: Jeffrey Melchin (<u>JMelchin@matrix-solutions.com</u>)
Subject: Your approval requested for Tier Three Water Quantity Risk Assessment

Dear Saidur,

I hope you are well. The Tier Three Risk Assessment is almost complete and we will be able to present the results to you soon. The preliminary assessment revealed no issues with GET's wells being able to meet future water needs.

I have attached a memo that requires your review and approval within the next 3 weeks. The purpose of this memo is to summarize the Allocated Demand and the Safe Additional Available Drawdown for the Township's water supply wells. We require your approval prior to incorporating these metrics into the final Risk Assessment Report. The results of the Risk Assessment will be included in the Lake Erie Source Protection Committee's Assessment Report.

As they need to finalize the Assessment Report soon, we require your approval by **May 31, 2014**. If comment has not been received by then, we will proceed to finalize the Risk Assessment assuming that these items are acceptable to Guelph/Eramosa Township.

Please contact me if you have any questions or wish to discuss further. I will call you shortly to discuss.

Best Regards, Paul

Paul Y.S. Chin, M.Sc., P.Eng. Hydrogeological Engineer

Matrix Solutions Inc.

Environment & Engineering

31 Beacon Point Court, Breslau, Ontario NOB 1M0 Direct: 519-772-3777 x119 Mobile: 519-897-2490 Fax: 519-648-3168 www.matrix-solutions.com

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Martin Keller

Subject: Location:	Cambridge-Guelph WHPA-Q1 Water Quantity Risk Assessment Mapping Conestogo Meeting Room
Start:	Fri 2014-06-13 10:30 AM
End:	Fri 2014-06-13 12:00 PM
Show Time As:	Tentative
Recurrence:	(none)
Organizer:	James Etienne

As discussed at the May 9th RMOW Tier 3 Peer Review Meeting, I am arranging a meeting of municipal partners to discuss the water quantity policy implications of the WHPA-Q1 overlap for Guelph and Cambridge.

The WHPA-Q1s also include portions of Wellington County between Cambridge and Guelph and around Guelph.

The discussion will include:

- an overview of the overlapping WHPA-Q1s for the Cambridge and Guelph municipal water supplies

- ways to present the mapping in the Final WQRA Reports for the Region of Waterloo and City of Guelph

- consideration of the implications of Guelph's "moderate" water quantity risk with respect to future PTTW applications



Sincerely,

James B. Etienne, P.Eng. Senior Water Resources Engineer Grand River Conservation Authority 400 Clyde Road, Cambridge, ON N1R 5W6 Tel: 519-621-2763 ext. 2298

James Etienne

From:	Paul Chin <pchin@matrix-solutions.com></pchin@matrix-solutions.com>
Sent:	Wednesday, July 30, 2014 5:59 PM
То:	James Etienne; Dave Rudolph; Hugh R Whiteley; 'A.R. (Tony) Lotimer'; Bates, Scott (MNR); Martin Keller
Cc:	David Van Vliet
Subject:	Guelph Tier Three - Risk Assessment Update
Attachments:	Guelph T3 Risk Assessment Report Text Draft_3.0 July_30_2014.pdf; Guelph T3 APPENDIX C Characterization Update Rockwood and Hamilton Drive Text July_30_ 2014.pdf; Guelph T3 APPENDIX D Groundwater Flow Model Update Rockwood and Hamilton Drive Text July_30_2014.pdf; GuelphT3 Risk Assessment Report_Peer Review Comments Response Matrix.pdf

Dear Peer Reviewers,

We have finished the Guelph Tier Three Risk Assessment draft report and I have attached the draft text for your review (**Guelph T3 Risk Assessment Report Text Draft_3.0 July_30_2014.pdf**). We have highlighted in yellow, any additions or edits to the report you peer reviewed last year. Most of the highlights address:

- 1) Peer review comments from last year,
- 2) Hamilton Drive and Rockwood additions, and the change in results because of the updates to the model,
- 3) The new guidance from the MOE/MNR that Allocated rates only consist of Existing plus Planned demands, and not Committed demands and that allocated rates up to the currently permitted rates can only lead to moderate risk levels for other water uses, and
- 4) A change from using the term "Local Area" to "Vulnerable Area" to allow the distinction between groundwater and surface water vulnerable areas (and thus separate the WHPA-Q1-A from the Eramosa IPZ-Q).

Also attached is the matrix of reviewers comments and our responses for the Risk Assessment Report: GuelphT3 Risk Assessment Report Peer Review Comments Response Matrix.pdf

I have also attached the new appendices related to the Hamilton Drive and Rockwood updates:

- a) APPENDIX C Characterization Update Rockwood and Hamilton Drive (Guelph T3 APPENDIX C Characterization Update – Rockwood and Hamilton Drive Text July_30_2014.pdf)
- b) APPENDIX D Groundwater Flow Model Update Rockwood and Hamilton Drive (Guelph T3 APPENDIX D Groundwater Flow Model Update – Rockwood and Hamilton Drive Text July_30_2014.pdf)

The two original appendices are not attached as they have not changed since they were reviewed in July/Aug 2011, but they are:

- a) APPENDIX A Characterization Report Final
- b) APPENDIX B Groundwater Flow Model Report Final

All these reports/appendices along with figures and secondary appendices are located on our file server: <u>www.aquaprojects.ca</u>

Here is the link to the file manager once you have logged in: http://ap.aquaprojects.ca/webfm

All the updated reports are in the directory: / GUELPH_TIER3 / Reports/

Right click on the individual files to download them.

Please let me know if you have trouble accessing the files.

I will let James Etienne indicate by when he would like the reviews completed.

Best regards, Paul

Paul Y.S. Chin, M.Sc., P.Eng. Hydrogeological Engineer

Matrix Solutions Inc.

Environment & Engineering

31 Beacon Point Court, Breslau, Ontario NOB 1M0 Direct: 519-772-3777 x119 Mobile: 519-897-2490 Fax: 519-648-3168 www.matrix-solutions.com

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Appendix B

Municipal Peer Review Comments (GET, Puslinch and Erin)

July 28, 2014 through June 19, 2015





	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Watershed Studies			_								
Municipal Technical Studies		-	100		-						
Water Quality Policy Process								-	•		
Grand River Tier 2 Water Budget		-									
Guelph & RMOW Tier 3				-	-	_	_	-	-		
Rockwood/Hamilton Dr. Tier 3									-	-	
Water Quantity Policy Process										-	-
Assessment Reports							-				
Source Protection Plans						-	-	_			
Review and Approval								-			















Tier 3 Project	Study Started	Conceptual Model		Water Budget		Risk As	Expected Completion	
		Report	Peer Review	Report	Peer Review	Report	Peer Review	with Peer Review
xisting Projects				-				
Guelph	Oct-07	Jul-11	Yes	Aug-11	Yes	Apr-13	Draft	Jun-14
Rockwood & Hamilton Drive (Desktop review based on Guelph model)	May-13	Jul-11	Yes	Aug-11	Yes	Jun-14	Draft	Jun-14
RMOW Integrated Urban System	Oct-07	Jan-12	Yes	Nov-12	Yes	Apr-14	Draft	Jun-14
RMOW Small Rural Systems	May-11	Sep-12	Yes	Nov-12	Yes	Apr-14	Draft	Jun-14
014 Projects								
Whitemans Creek (Paris-Bethel, Bright)	Jul-14	Surplus MNR Water Budget funding will be used to commence a conjunctive modeling project, Oxford may have to drill deeper well for Bright.					Post 2014	
ancelled Projects								
Lynden	Apr-13	Updated water use information have confirmed the Tier 2 stress potential in the Big Creek subwatershed is "low" and a Tier 3 study is no longer required.						n/a
eferred Projects								
Fergus-Elora	Deferred "N	as future w loderate" s	ork, Reassess r stress threshold	nunicipal fi is still exce	uture water use eeded under fut	estimates to Jre use scen	confirm if the arios	Post 2014

























July 28, 2014

Via: Email

Ms. Kim Wingrove CAO Township of Guelph/Eramosa 8348 Wellington Road 124 P.O. Box 700 Rockwood ON N0B 2K0

Dear Ms. Wingrove:

Re: Allocated Demand and Safe Additional Available Drawdown - Matrix Solutions Inc. Review of Memorandum Dated May 13, 2014 Project No.: MSA152470.2014

R.J. Burnside & Associates Limited (Burnside) was requested by the Township of Guelph/Eramosa to review the Matrix Solution Incorporated (MSI) Memorandum dated May 13, 2014. This memorandum was presented to the Township of Guelph/Eramosa by Matrix Solutions in order to obtain agreement that suitable Allocated Rates and Safe Additional Available Drawdowns have been identified for each of the Township's municipal production wells. Burnside's review of the memorandum has identified discrepancies in the appropriate Allocated Rates and the Safe Additional Available Drawdowns at some of the wells. This letter provides preliminary comments on the Matrix memorandum and requests additional technical data to support the Allocated Rates and Safe Additional Available Drawdowns identified.

Matrix's calculation of municipal water demand has made use of data from 2009 and 2010. Review of precipitation data from these years indicates these were average to above average years for precipitation and likely resulted in below average water supply demands for the water systems. Water use data from 2007 or 2012 would be likely more indicative of a high demand year which would provide a more conservative estimate of water use. This is critical in the Huntington and Cross Creek wells where the short term summer demands need to be assessed.

The Township of Guelph/Eramosa and Burnside provided data to Matrix in order to determine the existing water use rates and the Safe Additional Available Drawdown in the wells. Review of the values indicate that at least 3 of the 5 pumping water levels are significantly different than what has been measured by Township or Burnside staff. In order to clarify the appropriate pumping water levels we request that the processed water level data likely in the form of graphs completed by MSI be provided to Burnside for review.

The safe water levels identified in Table 2 were determined based on a physical pump intake level plus 1 m. This approach to determining a safe water level in a well is not considered to be

appropriate as submersible pumps require a certain minimum level of submergence to operate efficiently. Burnside plans to review the above water level data to document suitable minimum pumping water levels to which the 1 m buffer can be added.

The use of average day demand to determine the Allocated Rates for each well is appropriate for larger municipal systems, such as Rockwood, where the ratio of maximum day to average day (maximum day factor) is approximately 2.0. It is preferable to using the permitted rates which can over estimate impacts as wells are not continuously pumped at permitted rates and hence the average day rate is more representative of actual pumping than the permitted rate.

We do not agree with the use of average day demand for the Huntington and Cross Creek wells. These wells are connected to a small system with limited storage and as a result the maximum day factor is in the range of 4.0+. In this scenario, the maximum day is significantly different from the average day and calculations using average day do not represent maximum day conditions. We note that it is critical for the supply systems to be able to provide water for their maximum day demands and for planning at these systems to account for their uniqueness.

The MSI memorandum indicates that the Allocated Rates for the systems is much lower than the permitted pumping rates. However, review of data indicates that maximum day rates are within 30% of the permitted rates. We recommend use of the permitted or at a minimum maximum day rates from 2012 as the Allocated Rates for the Huntington and Cross Creek Wells.

The Committed Demand predicted for the future has been equally distributed between each existing well in both Township water supply systems. It would be more appropriate to distribute the additional water use in proportion to the current water use as the wells are permitted and pumped at different rates. Additional information on the future growth scenarios utilized in the modelling is requested, so that it can be assured that the model adequately reflects the planned growth within the Township.

We also note that Rockwood Well 4 has not been included in the future water supply for the community. This well is part of the previous source water protection modelling and should be a part of this assessment. Construction and testing of Rockwood Well 4 will be completed this year and it is expected that this well will provide at least 15% of the future water demand. We recommend a distribution of the Committed Rate of 25% for Rockwood Wells 1 and 2 and 35% and 15% for Rockwood Wells 3 and 4, respectively.

The Tier 3 model is based on annualized data. As noted above the maximum day factors and resulting water level response in the summer months significantly exceed the average day continuous impacts. It is recommended that a 100 day summer assessment be modelled to determine the short term interaction between the City of Guelph wells and the Huntington and Cross Creek Wells. A long term combined pumping test of the closest Guelph Wells, or at a minimum, continuous monitoring of Township wells during summer demand, may be warranted.

Ms. Kim Wingrove July 28, 2014 Project No.: MSA152470.2014

We expect that this letter will initiate discussion between the involved parties in this project. We would appreciate meeting to discuss the issues in this Tier 3 analysis.

Yours truly,

R.J. Burnside & Associates Limited

Water Resources Engineer

Jim Baxter, P.Eng.

JB:mp

CHIT

Jim Baxter, P.Eng. Senior Manager – Water/Wastewater

152470.201 Guelph Tier 3 memo review _Wingrove Letter.docx 28/07/2014 2:21 PM

GUELPH & GUELPH-ERAMOSA TIER 3 WQRA COMMENTS

September 19, 2014



Tier 3 Water Quantity Risk Assessment

- Work completed in accordance with Provincial technical rules
- WQRA has received a full peer review



Chronology of Comments

- · January 15, 2014 meeting and presentation
- May 13, 2014 memorandum by Matrix
- June-July Matrix addresses peer review comments on draft WQRA
- July 28, 2014 Burnside comments on Matrix memorandum sent to Guelph/Eramosa
- · July 30, 2014 Matrix issues revised WQRA
- · September Matrix ready to finalize WQRA
| Well Name | Permit
Number | Permitted
Capacity (m³/d) | Average Annual
Reported Taking
(2008) (m ³ /d) | Average Annua
Reported Taking
(2012) (m ³ /d |
|----------------------------|-------------------------------|------------------------------|---|---|
| | | Hamilton Drive Wells | 11.1.1 (1.1.1 | |
| Cross Creek Well | 91-P-2034 | 812 | 91 | 109 |
| Huntington Estates
Well | 03-P-2295 | 916 | 90 | 128 |
| | TOTALS | 1,728 | 181 | 237 |
| | | Rockwood Walls | | |
| Well #1 (TW# 1-67) | 0823-78THTK | 1 965 | 286 | 419 |
| Well #2 (TW# 1-76) | (set to expire
31/03/2018) | | 217 | 421 |
| TW3/02 | | 1,313 | 411 | 339 |
| | TOTALS | 3.278 | 914 | 1.179 |







	2006	2011	2016	2021	2026	2031
an a					1	
Total Population 1	3,790	4,510	5,180	5,610	6,050	6,150
louseholds	1,310	1,540	1,750	1,880	2,020	2,060





James Etienne

From:	Kyle Davis <kdavis@centrewellington.ca></kdavis@centrewellington.ca>
Sent:	Friday, September 19, 2014 12:01 PM
То:	Wingrove Kimberly (kwingrove@get.on.ca); jim.baxter@rjburnside.com;
	David.Paetz@rjburnside.com; Peter Rider (peter.rider@guelph.ca);
	Dave.Belanger@guelph.ca; James Etienne
Subject:	Summary of Action Items from September 19, 2014 Tier 3 meeting - GET, Guelph and
	GRCA

As discussed,

Action Items

- 1. James to provide water level graphs to address Safe Additional Available Drawdown comment for Burnside review.
- 2. Participation in RMMEP process will help address concerns about what has changed since 2009 / 2010 data and to assess uncertainty and risk
- 3. County and Township to confirm growth estimates used for Rockwood.
- 4. Burnside to provide Seaton well Class EA report and notice of completion.
- 5. Confirm why no pumping rate for Seaton well in Assessment Report (check Golder 2006 County GW study report).
- 6. Document in Water Quantity Risk Assessment the existence of Seaton well and put placeholder in so Seaton is included into the Risk Management Measures Evaluation Process (RMMEP) project.
- 7. James to provide draft WQRA report
- 8. Township to review and provide comments within 2 weeks of receipt (likely by Thanksgiving).

Please note my new phone number and extension

Kyle DavisRisk Management Official | kdavis@centrewellington.caDrinking Water Source Protection – Wellington County7444 Wellington Road 21, Elora, ON NOB 1S0 | Ph. 519.846.9691 ext 362 | Fx. 519.846.9858

Serving the Townships of Centre Wellington, Guelph / Eramosa, Mapleton, Puslinch, Wellington North and the Towns of Erin and Minto. Working in partnership with the County of Wellington.



- MEMORANDUM -

 TO: James Etienne, Grand River Conservation Authority
 FROM: Paul Chin, Hydrogeological Engineer, Matrix Solutions Inc. Jeff Melchin, Hydrogeologist, Matrix Solutions Inc.
 RE: Rockwood and Hamilton Drive – Data and Data Sources
 DATE: September 23, 2014

1. INTRODUCTION

This memo summarizes the production well pumping data and water level data, as well as data sources, used in the City of Guelph, and Communities of Rockwood and Hamilton Drive Tier Three Water Budget and Local Area Risk Assessment (Tier Three Assessment). The data described specifically applies to the communities of Rockwood and Hamilton Drive.

2. ROCKWOOD

The water level and pumping data used in the Tier Three Assessment for Station St. Well 1, Well 2 and Bernardi Well 3 of Rockwood are provided in Figures 1 to 3.

- Pumping data was provided by Donna Button of Guelph/Eramosa Township (GET) on May 15, 2013 in the form of a scanned summary report titled "2008 RWD Summary Report.pdf" and a MS Excel spreadsheet titled "Raw Volumes 2009_2012.xlsx".
- Water level data was provided by Donna Button of GET on February 12, 2014 in the form of MS Excel spreadsheets titled:
 - 2009 Well Levels RWD R1.xls
 2010 Well Levels R1.xls
 2011 Well Levels RWD R1.xls
 2012 Well Levels RWD R1.xls

Water levels in the raw data were given under the headings of "Pumping Depth (m)" and "Static Depth (m)". The data was interpreted to represent pumping or non-pumping conditions based on the headings. Figures 1 and 2 appear to show both pumped and non-pumped water levels grouped together at the deeper end of the range of water levels. This is likely due to water levels being reported as "static depths" when they are actually levels that are in the process of recovering from a pumped level. Only the "Pumped Depth" levels were used in the subsequent calculations of Safe Additional Available Drawdown (SAAD).

It was determined that the reported water levels represented a height above a reference elevation of a sensor and therefore water levels were converted to elevations above mean sea level using 'Pit Sensor



Elevations' provided by Jeff Paznar of Burnside on April 23, 2014 (325.81 masl – Bernardi, 334.40 masl – Station St. 2 and 334.88 masl – Station St. 1).

Figure 1. Water Levels and Pumping - Station St. Well 1 (2009-2012)







Figure 3. Water Levels and Pumping - Bernardi Well 3 (2009-2012)

3. HAMILTON DRIVE

For Hamilton Drive, the water level and pumping data used in the Tier Three Assessment for the Cross Creek and Huntington wells are provided in Figures 4 and 5.

- Pumping data was provided by Donna Button of GET on May 15, 2013 in the form of a scanned summary report titled "2008 HD Summary.pdf" and an MS Excel in the form of an MS Excel spreadsheet titled "Raw Volumes 2009_2012.xlsx".
- Water level data was provided by Donna Button of GET on February 4, 2014 in the following forms:

2008 Water Levels: scanned hard copy operator logs
 2009 Water Levels: MS Excel file '2009 Well Levels HD.xls'
 2010 Water Levels: MS Excel file '2010 Well Levels HD.xls'
 2011 Water Levels: MS Excel file '2011 Well Levels HD.xls'
 2012 Water Levels: MS Excel file '2012 Well Levels HD.xls'

Water levels in the raw data were given under the headings of "Pumping Depth (m)" and "Static Depth (m)". Only levels that were judged to represent true "Pumped Depth" levels were used in the subsequent calculations of SAAD.

These water levels represent a depth below a reference elevation and therefore water levels were subsequently converted to elevations. For Huntington, a reference elevation (338 masl) was provided on April 24, 2014 by Jeff Paznar of Burnside. For Cross Creek, the reference elevation was the top of casing. Therefore, the top of casing elevation was calculated using ground surface elevation (351.4 masl from 10m DEM) and the stick-up height of the casing (0.65 m provided by Aaron Chase of GET on April 24, 2014).



Figure 4. Water Levels and Pumping - Cross Creek (2008-2012)



Figure 5. Water Levels and Pumping - Huntington (2008-2012)

4. SAFE ADDITIONAL AVAILABLE DRAWDOWN CALCULATION

The amount of Safe Additional Available Drawdown (SAAD) represents the difference between the average pumped water level elevation and the safe water level elevation in the well. For the wells in Rockwood and Hamilton Drive, the average pumped water levels were determined using the pumping water level data as described above for 2009-2010 (Table 1). Safe water levels were conservatively determined to be the lower elevation of either the pump intake elevation or the bottom of the casing/top of the open bedrock interval elevation plus a 1 m safety factor (Table 1). The derivation of SAAD for each well in Rockwood and Hamilton Drive is summarized in the figures presented in Appendix A and SAAD values are presented in Table 1.

Table 1. Determination of SAAD

Well Name	Average (2009-2010) Pumped Rate (m ³ /day)	Average (2009-2010) Pumped Level (masl)	Safe Water Level (masl)	Safe Water Level Determined by:	SAAD (m)			
Hamilton Drive								
Cross Creek Well	87	320.2	303.6	Intake Elevation + 1 m	16.6			
Huntington Estates Well	92	321.6	304.0	Bottom of Casing + 1 m	17.6			
Rockwood								
Station St. Well 1	283	348.5	325.5	Bottom of Casing + 1 m	23.0			
Station St. Well 2	262	350.6	323.6	Bottom of Casing + 1 m	27.0			
Bernardi Well 3	422	333.9	317.7	Bottom of Casing + 1 m	16.2			

Appendix A: Derivation of Safe Additional Available Drawdown











From: Jeffrey Melchin Sent: Friday, October 24, 2014 6:54 PM To: Paul Chin Subject: Fwd: Guelph Teir 3 - Guelph/Eramosa Production Wells - SAAD

Fyi

------ Original Message ------Subject: Guelph Teir 3 - Guelph/Eramosa Production Wells - SAAD From: Jim Baxter <<u>Jim.Baxter@rjburnside.com</u>> To: Jeffrey Melchin <<u>jmelchin@matrix-solutions.com</u>> CC:

Jeff

Further to your memo to James Etienne dated September 23, 2014 we have completed a review for the approach to SAAD calculation. I am emailing you directly to start a discussion because our numbers are very different.

We have used an approach similar to the work completed by Matrix and Burnside in Orangeville. We have included the actual pump installation depth and the water levels measured during long term testing of the wells and then added 2 m above the pump to make sure that it can operate effectively.

The use of average pumping level effectively uses water levels measured after the well has been pumping for 5 minutes with water levels measured after the well has been pumping for an hour.....there is no scientific support for this sort of statistical filtering.....the lowest water levels are those measured after the well has been pumping for a significant period.....but even these do not allow for long term pumping that will occur when there is a fire that lasts more than a few hours. This is why we complete 72 hour tests to obtain PTTW. If you disagree with this approach it may be a good idea to obtain/review continuous water level data from each of the wells to observe the actual operating water levels.

This is a graph from 2014 for the Huntington Well and I have attached a graph from the Huntington 72 hour test in 2004.



Please consider the following table and then let me know your thoughts.

Also, we plan to request that Rockwood Well 4 be included in this phase of the study, it was in previous phases and is part of the plan so there is no reason that it should not be included.

						Long Term	Long Term	Average Pumping	
	Grade Elevation (m amsl)	Pump Intake (m amsl)	Pump Intake (m bgs)	Top of Casing (m agl)	Operating Low WL (m amsl)	Water Level (m amsl)	Water Level (m bgs)	Water Level (m amsl)	Guelp SAAD (m am
Cross Creek Well	351.3	302.7	48.6	0.8	317	310.8	40.5	320.2	1
Huntington Well	338.1	302.6	35.5	0.5	314	311	27.1	321.6	1
Rockwood Well 1	361	328.3	32.7	0.5	344	335	26	348.5	
Rockwood Well 2	361	329.6	31.4	0.5	345	335	26	350.6	
Rockwood Well 3	360.4	321.3	39.1	0.8	331	348.5	11.9	333.9	1
Rockwood Well 4	367	329	38	0.8		332	35		

Beyond the water level interference issues there is a water quality issue that needs to be resolved. Your work indicates that there will be 5 m of drawdown in the area of the Huntington and Cross Creek wells. Currently there is an upward gradient between the bedrock aquifer and the Speed River. If the water level in the bedrock aquifer is lowered by even 2 m then the gradient will be reversed and both wells will potentially become GUDI wells. Please check your model and see if water in the Speed River becomes recharge in the modelled scenario.

Give me a call so that we can discuss these issues.

Regards

Jim

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Thank you.

Township of Guelph/Eramosa, Huntington Pumping Test



Township of Guelph/Eramosa Huntington Pumping Test M 1237.10

R.J. Burnside Associates Ltd. File:P:\M\M-1237.10\Hydrographs\Speed River.xls Prepared By: J Baxter Date: 3/22/2013

James Etienne

From:	James Etienne
Sent:	Wednesday, December 17, 2014 4:34 PM
То:	jim.baxter@rjburnside.com
Cc:	kdavis@centrewellington.ca; Dave Belanger (Dave.Belanger@guelph.ca); 'Bates, Scott (MNR)' (Scott.Bates@ontario.ca); Martin Keller; Paul Chin (pchin@matrix-solutions.com)
Subject:	Guelph-Eramosa WQRA Comments

Good afternoon Jim:

In response to your October 24th e-mail to Matrix Solutions Inc. and our teleconference on November 12th, I have consulted with Dave Belanger (City of Guelph) and Scott Bates (MNRF) to address the following four questions raised as a result of your initial comments regarding the preparation of the Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment (WQRA).

1) Peer Review Process for the Guelph / Guelph-Eramosa Tier 3 WQRA Report

The WQRA documentation for the communities of Rockwood and Hamilton Drive has been included as an amendment to the peer reviewed and amended Guelph Tier 3 WQRA Report (Matrix Solutions Inc., 2013). In 2008, AquaResource Inc. (later merging with Matrix Solutions Inc.) initiated the Guelph Tier 3 Water Budget and Water Quantity Risk Assessment (WQRA) project. The Final documentation for the Guelph Tier 3 WQRA includes the peer reviewed Characterization Final Report (Golder Associates, July 2011) and Groundwater Flow Model Report (AquaResource Inc., August 2011) both of which received final peer reviewer sign-off in January 2013 on the basis of peer reviewer comments on draft and final draft documents.

The final draft of the Guelph Tier 3 WQRA was submitted for peer review on May 15, 2013 and discussed at a Peer Review meeting on May 23, 2013. The peer review included the approach to estimate the allocated quantity of water, an item which did generate discussion and comments. As a result of their input on the approach, the peer reviewers agreed in August 2013 that the Guelph Tier 3 project could proceed towards final revision and completion of the report which would include the preparation of the Guelph-Eramosa WQRA using an updated Guelph model and accepted WQRA approach.

In January 2014, Matrix Solutions Inc. met with Guelph-Eramosa Township staff to provide an overview of the Tier 3 Water Budget and WQRA process and to request Township information to complete their WQRA for the municipal drinking water systems in the communities of Rockwood and Hamilton Drive. After several requests by Matrix, the Township provided enough information to calibrate the model and determine the safe water levels. On May 13, 2014 Matrix submitted a memorandum to the Township to request sign-off of the safe water levels and allocated rates. Matrix were aware of Source Protection deadlines to finalize the Guelph/Guelph-Eramosa Tier 3 report and advised the Township that if comments were not received by May 31st Matrix would proceed with the finalization of the WQRA. On the basis of this assumption, Matrix drafted the final amendments to the Tier 3 report including the Guelph-Eramosa WQRA and submitted this documentation along with a summary of peer review comments to the Peer Reviewers on July 30, 2014.

Unfortunately, Burnside's July 28, 2014 comments on the May 13th Allocated Demand and SAAD memo were received after Matrix had prepared the revised document. This document was subsequently signed-off by the peer review team in August 2014. The MNR also gave their approval to the peer reviewed Guelph/Guelph-Eramosa Tier 3 WQRA on September 12, 2014, however the final printing of the document is still awaiting the resolution of outstanding concerns identified by Burnside.

2) Approach to SAAD Calculation

The Rockwood & Hamilton Drive SAAD calculations prepared by Matrix have been completed in accordance with the Technical Rules: Assessment Report (amended November 2009), the Water Budget Technical Guidance (October 2011), the MOE Technical Memorandum on Assignment of Water Quantity Risk (December 2013) and based on experience and input from provincial representatives of the MNRF and MOECC. Discussion with the MNRF (Scott Bates, Water Budget Program Analyst) has confirmed that the use of a 72 hour, peaking pump test is not appropriate for the determination of average pumping rates and water levels during the Study Period, as required under the Technical Rules. The MNRF has also confirmed that all other Tier 3 Risk Assessments within the province have used average pumping rates during the Study Period to define the "Existing Water Level" for calculation of the Safe Additional Drawdown. The MNRF agrees that the approach used by Matrix for the Guelph/Guelph-Eramosa WQRA is appropriate for the assessment of long-term sustainability of the source waters. The assessment of short-term peaking impacts, such as those observed under a 72-hour pumping test or those observed for fire suppression can be semiquantitatively or qualitatively assessed under the Technical Rules through a discussion of the municipal system "Tolerance" in accordance with Technical Rule 100.

3) Omission of Rockwood Well No. 4

Matrix Solutions Inc. were aware of Rockwood Well No. 4, and knew it was included as a planned well for water quality, but unfortunately had a difficult time obtaining relevant information from the Township with details about the well. Matrix did not know of any plans to pump the well in the future and what rates the Township were planning on pumping it for. As a result, Matrix assumed that as an unpermitted well it was to be used as a back-up sometime in the future and proceeded on the basis of the information they had available. Matrix is still not sure if Well 4 is considered a planned demand according to the MOE Guidance since the allocated rate can be met with the three other wells and Well 4 is not necessary to meet the future demand. The total permitted rate for the Rockwood Wells is 3,275 m3/d and the existing rate is 967 m3/d so there is extra capacity of 2,300 m3/d. The forecast increase in demand to the year 2020 is only 185 m3/d.

The implications of the omission of Well 4 from the WQRA report are minimal as the increased demand is minor. The well is already physically in the model with zero pumping. Matrix can include the well and update the pumping rates in the Risk Management Measures Evaluation Process (RMMEP) and have already scoped adding wells and "threats" for the threats ranking and scenarios. Right now the Rockwood Wells do not trigger a moderate or significant risk. The WHPA-Q1s for these wells are very small and the maximum drawdown for nearby Well 3 under drought is 6.4 m with 16.2 m SAAD. The omission of Well 4 can be clarified in the preparation of the final report and going forward, this well will be included in the assessment of scenarios during the RMMEP study.

4) Water Quality (GUDI) Issue for the Huntington & Cross Creek Wells

While we are uncertain of the context of your reference to "5 m of drawdown", we assume you are referring to the WHPA-Q1 in Figure 5-1. This is the drawdown in the semi-confined Gasport Formation aquifer. We note that the WHPA-Q1 delineation and drawdown is defined as the difference between <u>no</u> <u>pumping</u> and the full <u>allocated pumping</u> rates. Therefore, the drawdown shown in Figure 5-1 (WHPA-Q1) is not the appropriate map for Guelph-Eramosa Township to be looking at for simulated drawdown purposes.

Figures 5-8, 5-10, 5-12 and 5-19 more appropriately illustrate the drawdown in the Guelph Formation relative to the existing conditions. These figures show that there is no predicted drawdown in the shallow bedrock in the area of Hamilton Drive and Cross Creek wells and therefore there is unlikely to be GUDI effects under these scenarios. However, strictly speaking, the scope of the Tier 3 WQRA does not include an assessment of GUDI threats from an operational perspective.

In conclusion, the Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment has been prepared as a requirement of the Technical Rules (Part III.2; MOE, 2009) to assess the long term sustainability of municipal drinking water systems located within the Upper Speed assessment area identified as having a "moderate" potential for stress in the Grand River Tier 2 Stress Assessment Report (AquaResourec Inc., 2009). As a result of the Tier 3 work completed in 2014 by Matrix Solutions Inc., the municipal water supplies for Guelph-Eramosa Township were identified as having a "low risk", however the City of Guelph water supply has been identified as having a "significant risk" and as a result, the Guelph and Guelph-Eramosa municipal water supplies will undergo a Risk Management Measures Evaluation Process. This process will review the Tier 3 results, identify additional municipal wells for impact assessment (i.e. Rockwood Well No. 4) and update the Tier 3 model allowing for clarification of concerns and an operational level of review to assess and improve the sustainability of the municipal system.

It is recommended that Matrix Solutions Inc. integrate minor corrections in the Guelph/Guelph-Eramosa WQRA report to address the Township concerns regarding the omission of Rockwood Well No. 4 and finalize the WQRA Report. It is also recommended that we should let the municipality/operators decide on what this level should be in relation to the pump intake or aquifers. A safe water level of 2 metres above the pump intake appears conservative but reasonable. As Matrix Solutions Inc. have previously noted, a discussion could be provided in the report on the ability (or lack thereof) of the municipality to lower the pumps, but there is no obligation within the Technical Rules to do so. Finally, It is recommended that the Township's concerns regarding the Tier 3 modelling be addressed as part of the RMMEP study which can proceed upon the finalization of the Tier 3 WQRA.

Sincerely,

James B. Etienne, P.Eng. Senior Water Resources Engineer Grand River Conservation Authority 400 Clyde Road, Cambridge, ON N1R 5W6 Tel: 519-621-2763 ext. 2298

email: jetienne@grandriver.ca



Harden Environmental Services Ltd. 4622 Nassagaweya-Puslinch Townline Road R.R. 1, Moffat, Ontario, LOP 1J0 Phone: (519) 826-0099 Fax: (519) 826-9099

Groundwater Studies				
Geochemistry	File: 1417			
Phase I / II	February 9, 2015	DRAFT		
Regional Flow Studies	1001001 y 3, 2015			
Contaminant Investigations	To: Kyle Davis – Risk Mar	nagement Official – County of ¹	Wellington	
OMB Hearings	Frank Chan Dankard D	Fre Hardon Environmental S	onvicos I to	
Water Quality Sampling	From: Stan Denhoed, P.Eng. – Harden Environmental Servi			
Monitoring	Re: City of Guelph and	d Communities of Rockwood a	nd Hamilton	
Groundwater Protection Studies	Drive Tier 3			
Groundwater Modelling	Kyle			
Groundwater Mapping				

We have reviewed the Tier 3 Water Budget and Local Area Risk Assessment for the City of Guelph and the Communities of Rockwood and Hamilton Drive. We have reviewed this report on behalf of the Wellington Source Water Protection and have focused our attention mainly on issues related to the Township of Puslinch.

Figure 5.1, attached shows the extent of the Well Head Protection Area Q1 (WHPA-Q1). It appears that two thirds of Puslinch Township falls within the WHPA-Q1. This is not only because of water taking within the City of Guelph, but also because of water taking in Puslinch Township and Flamborough Township. Although policies related to the WHPA-Q1 have not been established, the inclusion of a significant portion of the Township within the WHPA-Q1 is of concern to the Township since a significant portion of the existing and future employment lands fall in this area. There are also several holders of permits to take water that in this area and will be deemed as significant threats to the water quantity available to the City of Guelph municipal system.

It is thus very important to the Township of Puslinch that the delineation of the WHPA-Q1 is correct and that the correct risk level assigned.

We offer the following comments related to the size and shape of the WHPA-Q1.

COUNTY OF WELLINGTON (DRAFT) February 9, 2015 Page 2

Eramosa River as a Groundwater Discharge Zone

One of the tasks of this study is to develop and calibrate surface and groundwater models to assess water budget components in the study area. Harden Environmental has recently been involved in a streamflow study in the Eden Mills area and determined that a significant volume of water is lost from the Eramosa River to the aquifer in the reach between Indian Trail Road and the confluence of the Eramosa River and Blue Springs Creek. Depending on streamflow, the loss ranges from 100 to 500 L/s. Based on our review of the reporting in the Tier 3 Study, we conclude that this reach of the Eramosa River is modeled as a groundwater discharge zone whereas our observations are the opposite. This information was not available at the time of writing this study but may have significant implications to the size and shape of Well Head Protection Areas in Wellington County and protective measures needed for the City of Guelph water supply. This new information should be incorporated into the existing model.

Region of Waterloo and City of Guelph Overlap

This report only addresses the WHPA-Q1 for the City of Guelph and a two kilometer buffer with the watershed divide with the City of Cambridge. Therefore, the township should consider if the City of Cambridge report should also be reviewed. When will this be available and will policies associated with the City of Cambridge WHPA-Q1 be the same as the City of Guelph policies?

Vinemount Formation as an Aquitard

The follow-on to the statement (page viii) that the Vinemount Aquitard is already a limiting factor for recharging the Gasport Aquifer and therefore a reduction in recharge has a minimal impact on municipal water levels is that in the areas where the Vinemount is absent, there may be direct recharge from ground surface to the Gasport Aquifer. The accurate identification of the extent of the Vinemount therefore becomes important. This is particularly true for areas east and north of the City of Guelph. As discussed in *Section 2.3.1*, a large area east of Rockwood is described as being underlain by the Reformatory and Vinemount Aquitard. What is the evidence for this determination? Outcrops along Hwy 7 (near Crewson's Corner) are Gasport or Goat Island and the aquitard was not observed at the Hidden Quarry site (Lot 1, Concession 6, Guelph-Eramosa). The presence/absence has significant effect on modeled hydraulic head levels in the Rockwood area. The presence of the Vinemount also factors

significantly in the potential effect of water taking from the Gasport Aquifer on water levels in the overburden.

Defining of WHPA-Q1

If the natural fluctuation in the Gasport Aquifer is two metres, then an additional two metre drawdown (the criterion for the edge of the WHPA-Q1) results in four metres of drawdown from high water conditions. What is the intention of delineating the WHPA-Q1 in this manner?

Extent of WHPA-Q1

The water taking by Nestle Waters Canada and another commercial water taking in the City of Hamilton (formerly Flamborough Twp.) has a significant impact on the size and shape of the WHPA-Q1 for the City of Guelph. In essence, this results in a larger portion of the Township of Puslinch falling within the WHPA-Q1 than would occur just from the City of Guelph water taking. The ramifications (financial considerations, planning considerations etc..) of this enlargement may impact on the Township of Puslinch municipal government and or the administration of the WHPA-Q1 policies by the County of Wellington. There are potential employment lands within the WHPA-Q1 (wet and dry uses) along the Hwy 401 corridor that will be subject to Clean Water Act policies that would not have been if the commercial water taking was not occurring. It is therefore crucial that the inclusion of the area of influence of the Nestle Waters Canada well and other water takings be carefully assessed prior to finalization of the WHPA-Q1.

According to Table 2-7 Appendix B, the water taking rates in Puslinch Township were obtained from the 2006 Guelph Puslinch Groundwater Study. We have the following comments in this regard.

PTTW 7043-74BL3K Nestle Waters Canada

Figure 6.8 of *the CRA report (Test Pumping Investigation Supply Well TW3-80,December 2004)* shows that after 72 hours of pumping at 700 igpm (4,576 m³/day vs 2,396 m³/day in the model) the drawdown from the well was estimated to be one metre at a location 200 metres north of County Road 34. The 2014 Matrix Solutions Inc. report (Figure 5.1) indicates a drawdown of five metres approximately 650 metres north of County Road 34. Also, the 2004 CRA report shows a drawdown of less than one metre from TW3-80 at Mclean Road whereas the Matrix Solutions Figure 5.1 suggests a drawdown of 3-5 metres extending well south of the Hwy 401.

COUNTY OF WELLINGTON (DRAFT) February 9, 2015 Page 4

The Matrix Solutions Inc. drawdown arises mainly from the combined water taking by Mini Lakes, Mill Creek Campground, Meadows of Aberfoyle and Nestle Waters Canada. The consumptive rates of these takings are 129, 164, 18 and 2396 m³/day respectively. Nestle Waters Canada accounts for 90% of this taking. The Matrix Solutions drawdown is significantly greater than observed during the pumping test resulting in a much greater area of influence of the permitted taking in this area and possibly the reason for overlapping areas of influence near the south end of Guelph.

In order for the WHPA-Q1 to extend south of Maltby Road, the combined drawdown of the Downey well, Burke well and Puslinch takings must be greater than two metres in the Gasport aquifer. None of the individual 25 year capture zones of the Burke or Downey Road wells extend to Maltby Road (we have not been able to find individual drawdown values for Burke Well or Downey Road Well). It is thus not possible to estimate drawdown from these individual wells. We respectfully request that the conditions resulting in overlapping areas of influence between the City of Guelph municipal wells and the Nestle Waters Canada wells be reviewed and confirmed as accurate. For example, the 2013 Stantec Environmental Assessment for Burke Well has a hydrograph with pumping elevations within the Burke Well at approximately 317 m AMSL. The 2006 Guelph Puslinch Groundwater Protection Study (Golder Associates) has a model-projected potentiometric water level for the Burke Well at approximately 313 m AMSL. The 2014 Matrix Solutions report suggests a water level of 325 m AMSL in the Burke well. The reason for this difference should be evaluated to ensure accuracy of the model.

Permit 8228-76XLE Meadows of Aberfoyle

The current (since 2009) PTTW is 5626-7WLQ3W.

Permit 02P-2064 Kraus Nurseries Ltd.

Kraus Nurseries have holdings in Waterdown, Ontario and Mrs. Kraus confirmed that 02P-2064 is an old permit of hers but she does not own property in Puslinch, the permit is for her property in Waterdown. In addition, this is an expired permit.

99P-2132 Kats Okashimo Fish Farm

There is no evidence that water has ever been taken through PTTW 99P-2132. The PTTW was not renewed in 2009. A site visit to the Kats Okashimo Fish Farm failed to find a fish farm at the location (now a Tarot Card reader) and the present tenant confirmed that fish farming has not been done for at least twelve years (nor is he aware

if it ever occurred). As seen on Figure 5.1, the modeled water taking at the Kats Okashimo Fish Farm has a significant effect on drawdown beneath Puslinch Township. The effect, of removing this taking, on the size and shape of the WHPA-Q1 must be evaluated.

Significant Risk Assignment to WHPA-Q1

The combined WHPA-Q1 as shown on Figure 5.1 for all of the City of Guelph wells has been assigned a *Significant Risk* level. The significant risk level is assigned as a result of the high uncertainty that Arkell Well 1 can meet its allocated rate (page 133). The high uncertainty caused the assigned *Moderate Risk* level to be elevated to *Significant Risk* level. The policy implications of this to the Township of Puslinch is that all existing water taking and future water takings become Significant Threats to the City of Guelph municipal wells. Therefore, permits to take water such as issued to Nestle Waters Canada, ConCast, Mini Lakes, Royal Canin, Mill Creek Campground and all aggregate washing will be subject to any policies for *Significant Threats* developed under the Clean Water Act.

Arkell Well 1 obtains water from the overburden aquifer and a water quantity risk to the overburden aquifer does not necessarily represent a threat to wells completed in the Gasport Aquifer. Similarly, water taking from the Gasport Aquifer near Aberfoyle will not affect the safe drawdown of Arkell Well 1. Shouldn't the high uncertainty for Arkell Well 1 then apply only to the capture area of Arkell Well 1 and the risk level raised from moderate to significant only for the WHPA-Q1 of that well? This would allow for a *moderate risk* level for the remainder of the WHPA-Q1 and thus only future water taking will be subject to the new policies.

As an example of potential policies, we have reviewed the proposed polices in the amended Source Protection Plan for the CTC Source Protection Region that apply to a WHPA-Q1. The policies for WHPA-Q1 with *significant risk* include;

- Reviewing and amending existing PTTWs,
- not allowing any new PTTW or increase in a PTTW within the WHPA-Q1 unless certain conditions are met,
- not allowing new developments that require a PTTW unless certain conditions are satisfied,
- require Province to ensure that population/employment projections do not result in a significant water quantity threat

COUNTY OF WELLINGTON (DRAFT) February 9, 2015 Page 6

The inclusion of a significant portion of the Township of Puslinch within the WHPA-Q1 mainly because of water taking by Nestle Waters Canada will result in the enforcement of new policies developed by the Source Protection Committee. These policies are presently unknown, but as can be seen in the CTC Source Protection Area proposed policies, may not be inconsequential. It is therefore important that the extent of the WHPA-Q1 be as accurate and scientifically defendable as possible.

Threats Ranking

Any threats ranking of the Industrial threats identified in Puslinch Township on Figure 6-1 should consider the following;

The vast volume of water stored in the pit ponds near Aberfoyle are not considered in the model. There is an estimated 12,000,000 m³ of water stored in pit ponds south of Hwy 401, let alone those north of Hwy 401. This is several times greater than that stored in Puslinch Lake. The volume of water that is stored in gravel pits in Puslinch Township is several times greater than in the former sand and gravel aquifer. Therefore, permitted water taking from the ponds should be carefully evaluated before deeming them a significant threat to the City of Guelph water supply.

Water Quantity Risk Management Measures Evaluation Process List of Tasks

We have reviewed the list of tasks and do not have any comment other than given above.



56 Alexandra Ave., Waterloo, Ontario N2L 1L5 Telephone 519-884-5549 Email: blackport_hydrogeology@rogers.com

Blackport Hydrogeology Inc.

Memo

To:	Kyle Davis, Township of Centre Wellington
From:	Ray Blackport, Blackport Hydrogeology Inc.
CC:	Kathryn Ironmonger, Town of Erin
Date:	February 10, 2015
Re:	Draft Comments, City of Guelph, Water Quality Risk Assessment

Draft Comments – Town of Erin Review of the City of Guelph Tier 3 WQRA and the Guelph/Wellington County Water Quantity Risk Management Work Plan

For Internal Review Only

1. Background and Scope of Review

Background

The City of Guelph conducted a Tier Three Water Budget and Local Area Risk Assessment (Tier Three Assessment) as a requirement under the Clean Water Act for the Province of Ontario. Previous water quantity studies, completed at the watershed scale, classified the local subwatershed as having a moderate to significant water demand due to high water supply usage. The findings of the Tier Three Assessment concluded that there is a significant water quantity risk level encompassing a large area of City of Guelph, the Townships of Guelph/Eramosa and Puslinch and the Town of Erin. Three areas were identified as being vulnerable to water quantity threats, two being groundwater vulnerable areas (WHPA-Q1 and WHPA-Q2) and one being a surface water vulnerable area (IPZ-Q). The WHPA-Q1 area is the cone of influence of each municipal well, including the cones of influence of wells the each well it intersects. The WHPA-Q2 area is the land area where recharge has the potential to have a measurable impact on water levels at the municipal wells. The IPZ-Q area is the drainage area and associated recharge area that contribute to a surface water intake.

Scope of Review

The primary focus of this review is to provide comments on the Draft Tier 3 Water Quantity Risk Assessment (WQRA) Report for the City of Guelph Water system, as related to potential water quantity concerns within the geographic area of the Town of Erin, on behalf of the Town of Erin. It was also requested that a review of the Work Plan for the "Water Quantity Risk Management Measures Evaluation Process" (RMMEP) be completed. With respect to the Town of Erin, there are no WHPA-Q1 and WHPA- Q2 areas for the City of Guelph and Village of Rockwood water supply systems that extend into the geographic boundaries of the Town of Erin. Only the surface water quantity area (IPZ-Q) extends into the geographic limits of the Town and as such the scope of review is limited to reviewing the WQRA report and in relation to the IPZ-Q and providing general comments on the RMMEP Work Plan.

2. Water Quantity Risk Assessment

a. Groundwater

i.

Geology/Hydrogeology

From the perspective of the Town of Erin, the there are no groundwater related water quantity concerns within the Town boundaries, related to the Guelph WQRA Tier Three Assessment. The groundwater capture areas of the municipal water supply wells for the City of Guelph do not extend into the Town of Erin and as such, an assessment of the geology and hydrogeology was not conducted. It is noted that extensive testing of the Arkell Spring grounds municipal well field has been conducted over the last three years and the findings show that the capture zones do not extend into the Town of Erin. It is also noted that a characterization update was conducted for the area around Rockwood, as part of the Tier 3 Water Budget and Local Area Risk Assessment. No update on the Wellhead Protection zones was provided; however, based on the previous information found in the Grand River Source Protection Plan (2013), the Wellhead Protection Zones are shown to extend into the Town of Erin but there are no water quantity threats with the Town.

ii. Municipal Wells

Not applicable for the Town of Erin

iii. Delineation of WHPA – Q1 and Q2 – Application of Technical Rules

This is beyond the scope of review for the Town of Erin as the WHPA-Q1 and WHPA-Q2 do not extend into the Town of Erin

b. Surface Water

The IPZ-Q for the City of Guelph water supply is the entire Eramosa-Blue Springs Creek watershed upstream of the Arkell Spring Grounds Intake on the Eramosa River (Figure 5-4 of the Tier Three Assessment Report). Since the intake is on the Eramosa River, all of the upstream drainage area and associated recharge area of the Eramosa River and Blue Springs Creek is considered to contribute to the surface water intake. The surface water pumped from the Eramosa River is not directly fed into the municipal drinking water system but into an artificial recharge system where it is stored and then pumped out, treated and made available for the municipal supply system. The water taking is constrained, based on a specified river flow rate, to maintain sufficient flow for operation of the wastewater treatment plant.

i. Hydrology

The hydrology and flow rates in the Eramosa River have been investigated in detail for decades. In recent years discharge at the Eramosa intake has fallen below the threshold level (for operation of the Waste Water Treatment Plant on several occasions; however, this has not impacted the drinking water quantity as make up water, if needed, can be derived from storage within the artificial recharge system and from water supply wells at Arkell.

ii. Delineation of IPZ-Q – Application of Technical Rules

Part VI.7 of the Technical Rules was applied (page 94 of the Tier Three Assessment Report) appropriately. Simulated particle tracking was used to assess potential recharge to the watershed, through the groundwater system outside the watershed boundaries. Given the uncertainty in the groundwater divide and the limited recharge contribution in this area, this additional area was removed, to constrain the IPZ-Q to within the Grand River watershed boundary

Additional Considerations

It was noted in the Tier Three Assessment Report (page 99) that the Surface Water Vulnerable Area (IPZ-Q) was assigned the same Risk level as the groundwater vulnerable area that contains the groundwater collector system (Glen Collector) at the Arkell Spring Grounds where the surface water used in the system is discharged. This was done since the water pumped from the Eramosa intake is not fed directly into the drinking water system but into the groundwater collector, which was included in the Risk Assessment for groundwater.

3. Water Quantity Risk Management Measures Evaluation Process Work Plan

As indicated in the Work Pan, the Risk Management Measures Evaluation Process (RMMEP) the water quantity polices must address one of the prescribed drinking water threats, and, as a result may or may not address some of the factors considered in setting the risk level for a local area. There are two water quantity prescribed drinking water threats:

- An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body
- An activity that reduces recharge to the aquifer.

As indicated in the introduction to the Water Quantity RMMEP, the objective is to provide a methodology to select risk management measures that would manage significant threat activities so that they cease to become significant drinking water threats. The following comments are provided with respect to the RMMEP Work Plan

Task 1: Review - Identification of Drinking Water Quantity Threats

I generally agree with the proposed work plan; however, it is important that whomever is undertaking the RMMEP is familiar with the existing Tier 3 assessment, as it may be overkill for the consultant to update and refine threats, identify additional wells/intakes for impact assessment etc., given how much work has gone into the Tier 3 assessment (i.e. was that not the point of the Tier 3 assessment?).

Task 2: Where Required, Identify Percentage Impacts and Rank the Tier 3 Local Area Significant Threats

- Have not some of the scenarios presented in Table 1 already been performed as part of the Tier 3 assessment (e.g. modelling pumping at the permitted rates)?
- Realistic consumptive and non-consumptive use need to be refined, where possible, for many of these scenarios in Table 1. For example, most rural non-permitted water takings (private wells) is non-consumptive, water is typically removed from the lower bedrock aquifer and returned via septic systems to the shallow aquifer. In the case of Guelph, water taking and potential impacts from the Town of Erin (surface water only), this would in fact potentially enhance discharge to the surface water as recharge to the shallow groundwater is effectively increased.
- Part of the ranking or level of impact will depend on the location or distance from the well or
 intake and geologic conditions e.g. where is the main recharge area of the municipal wells and
 the distance this is from the wells. Is the use of the term "recharge" referring to recharge to the
 water supply aquifer (big difference between local recharge to an unconfined shallow aquifer
 and regional recharge to a deeper confined aquifer). It is noted for example, in the Conclusions
 (page viii of the Tier 3 Assessment report) that: "Recharge reductions in response to future land
 developments, have a minimal impact on water levels at the Tier Three municipal pumping wells.
 The Gasport aquifer is protected in most area by the Vinemount aquitard which reduces the
 impact of reduced groundwater recharge on water levels in the aquifer. With respect to the City of
 Guelph and community of Rockwood, future land developments generally occur around the
 periphery of these communities with minimal increase in imperviousness over the Local Area."

Task 3: Select Preliminary Risk Management Measures (RMMs) and Evaluate the Risk Management Measures

It would appear that there are two components to this that should be explored together. The
operational aspects are important, as purely for an operational risk perspective there may be
operational procedures to optimize the system, while there may be RMM measures to aid in
maintaining overall recharge or decreased withdrawal from the aquifer system.

Task 4: Prepare a "Draft Threats Management Strategy" to discuss with Municipalities and Stakeholders.

• The key will be consultation throughout the previous tasks to ensure there is a reasonable consensus moving forward.

4. Conclusions

Implications for the Town of Erin

There are no groundwater related concerns regarding the Tier Three Assessment for the City of Guelph, given that the capture zones for the Guelph system do not extend into the Town of Erin and there are no groundwater quantity threats. From a surface water perspective, the Surface Water Vulnerable Area (IPZ-Q) extends into the Town of Erin upstream of the Arkell Spring Grounds Intake. It is not expected that that there would be any impact on water quantity from activities within the Town of Erin, given several factors:

- Any increase in impervious areas as a result of development would potentially increase surface water flow rather than decrease surface water flow.
- Most rural wells obtain water from the deeper aquifer system and "recycle" the water via septic systems to the shallow groundwater system, increasing the overall recharge to the shallow groundwater system and the potential discharge to the surface water system.
- The Town of Erin is the most upstream portion of the watershed and least developed so it is unlikely that would be an impact on the surface water system that could be measured downstream at the Arkell Spring Grounds Intake.

5. Recommendations

It is not anticipated that any activity within the Town of Erin could measurably impact the quantity of surface water at the Arkell Spring Grounds Intake. If measures are recommended for the RMMEP that could potential impact land use or land use activities in the Town of Erin the Town should be consulted to assess the need and the implications.



February 10, 2015

Via: Email

Mr. Kyle Davis Risk Management Official County of Wellington 7444 Wellington Road 21 Elora ON N0B 1S0

Dear Kyle:

Re: Comments on the Draft City of Guelph Tier 3 Water Quantity Report Project No.: 300036495.0000

R.J. Burnside & Associates Limited (Burnside) was requested by the Township of Guelph/Eramosa to review the Matrix Solution Incorporated (MSI) Draft City of Guelph, and Communities of Rockwood and Hamilton Drive Tier 3 Water Budget and Local Area Risk Assessment. This letter provides Burnside's comments on the report including an update regarding well construction and testing of Rockwood Well 4.

Scope of Technical Review

The purpose of a Tier 3 water quantity analysis is to evaluate the impact of the proposed/modelled water takings to ensure that the approved water supply within a municipality can meet the required growth and demand to 2031. This evaluation is completed using a groundwater model that is based on the documented hydraulic properties of the hydrogeologic units, surface water and weather patterns that sustain the flow of water within the study area.

The review completed by Burnside assumes that the groundwater model for the study area is a suitable representation of on-site conditions as it has been peer reviewed by approved reviewers. This review focuses on identifying specific issues that have a direct impact on the Township of Guelph/Eramosa, in areas where pumping is planned by the City of Guelph.

Existing Plus Committed Demands and Allocated Rates

The allocated pumping rates used in the groundwater model for each well in Guelph/Eramosa are identified in Section 3.2.4 of the report. Guelph/Eramosa would like revised allocation rates based on (i) the changes to growth predictions since the 2011 Watson report and, (ii) the selection of the most accurate year's water use being selected to calculate the existing water demand.

The calculation of municipal water demand has made use of data from 2009 and 2010. Review of precipitation data from these years indicates these were average to above average years for
precipitation and likely resulted in below average water supply demands for the water systems. Water use data from 2007 or 2012 would be more indicative of a high demand year which would provide a more conservative estimate of water use. This approach was used in the Orangeville study where data from 2012 was used for pumping rates. It is critical in the Huntington and Cross Creek wells where the short term summer demands can vary significantly from year to year.

Safe Additional Available Drawdown

Burnside has previously provided comment on the Safe Additional Available Drawdown (SAAD) calculations in the draft report. Based on the technical rules the SAAD is the difference between the average pumping water level and 1 m above the pump intake. In most water systems the average pumping water level is determined using electronically collected water level data. Whereas water levels used to calculate the water levels in the Guelph/Eramosa wells are based on once a day manual water levels. In the case of the Cross Creek well there are only three pumping water levels measured during a year of operation because the well only runs for approximately six hours every second day. It is our opinion that this data does not provide an adequate basis on which to compute an average water level.

The lack of suitable pumping water level information prevents the proper calculation of an average pumping water level. As a result, the average pumping water level should be estimated based on operator knowledge, by selecting an appropriate pumping water level or by installing an automatic water level recorder (AWLR) and monitoring water levels. Data of this type is available for only the Huntington Well but could easily be obtained for the other production wells. In lieu of this data, we have reviewed the water level data and estimated acceptable average water levels and safe additional available drawdown values for each well as outlined below in Table 1.

	Grade Elevation (m amsl)	(2) Pump Intake (m amsl)	Pump Intake (m bgs)	Top of Casing (m agl)	(1) Operating Low WL (m amsl)	Report Average Pumping Water Level (m masl)	Report SAAD (m amsl)	Guelph/ Eramosa SAAD (m amsl)
Cross Creek Well	351.3	302.7	48.6	0.8	317	320.2	16.6	13.3
Huntington Well	338.1	302.6	35.5	0.5	314	321.6	17.6	10.4
Rockwood Well 1	361	328.3	32.7	0.5	344	348.5	23	14.7
Rockwood Well 2	361	329.6	31.4	0.5	345	350.6	27	14.4
Rockwood Well 3	360.4	321.3	39.1	0.8	331	333.9	16.2	8.7
Rockwood Well 4	367	320	47	0.8	327	67 2 8	-	6.0
Guelph/Eramosa SAAD calculated (1) - (2) - 1 m; Well 4 estimated based on pumping test data.								

Table 1. Recommended Sale Adumional Available Drawdown for Suephrenamosa w	ells
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Rockwood Well 4

A test well called TW2-02 was constructed as part of the Rockwood Water Supply Environmental Assessment in 2002. This well site was identified as a future municipal well with a capacity of 683 L/min. This site has been included in all of the previous models leading up to the present study. The site which will become Rockwood Well 4 in 2015 has not been included in this study. Rockwood Well 4 was constructed at the TW2-02 site in December 2014. The new well was tested in January 2015 and has a capacity of approximately 910 L/min. A permit will be applied for and obtained in 2015. The pump house for the site will likely be constructed allowing connection of the well to the Rockwood system in 2016. The current version of the Tier 3 study should include Rockwood Well 4 at its proposed pumping rate of 910 L/min. This issue has been reviewed by the project team and we understand that the report will be revised to include Rockwood Well 4.

It is expected that the water demand will rotate between Rockwood Wells 1 and 2 (1,365 L/min.), Rockwood Well 3 (910 L/min) and Rockwood Well 4 (910 L/min.) We therefore recommend a distribution of the committed rate of 40% for Rockwood Wells 1 and 2 combined and 30% each for Rockwood Wells 3 and 4. This change as well as likely changes related to future demands will require the model to be re-run.

We note that drilling at the TW2-02 site did encounter a dark brown limestone layer that was less than 10 m thick at the top of the bedrock. The layer was not petroliferous and as a result we have interpreted that the Eramosa Formation is not present at this location. The project team may wish to review the interpreted presence of the Eramosa Formation which has been extended to a considerable distance east of Rockwood in the report based on well logs that reported dark brown limestone.

Huntington and Cross Creek GUDI Status

The modeled long term pumping water levels from the draft report indicate drawdown in the area of the Speed River adjacent to the Huntington and Cross Creek Wells. Depending on the level of drawdown and the period it takes place it could significantly change the hydraulic gradients at the Speed River from a gaining to loosing water course. The model for this area should be examined to see if this is the case and to determine if water flowing in the Speed River will become recharge to the Huntington and/or Cross Creek Wells. This aspect is significant as the change in hydraulic gradients may change the GUDI status of these wells, from currently being non-GUDI, to GUDI, which would require the Township to implement additional treatment. We understand that the 2013 proposed changes to the GUDI analysis in Ontario have been delayed indefinitely and as a result must be addressed based on the current approach.

Report Name

The name of the report does not properly identify the Townships of Guelph/Eramosa, Puslinch and Town of Erin as primary stakeholders in this study. The pilot study completed for the Town of Orangeville, Town of Mono and Township of Amaranth was entitled "Orangeville, Mono and Amaranth Water Quantity Risk Management and Climate Change Adaptation Assessment Pilot Study". Accordingly, the present Study should be entitled "Guelph, Guelph/Eramosa, Puslinch, and Erin Tier Three Water Budget and Risk Assessment".

General – Township Participation

The context of our comments is based on our experience in completing a similar study in the Orangeville area where there were three municipalities involved. It is noted that the Orangeville study was used as the pilot study for the Tier 3 process and it is our opinion that the approach

followed by that study has merit with regard to how the concerns of the individual municipalities were coordinated and managed.

In the Orangeville study all municipalities were involved with the project from initiation through implementation and were kept abreast of developments along the way. The process of obtaining model input was consultative with the municipalities being requested to provide data ahead of time and this data being included into the modelling process. Municipalities developed data on water taking, planned volumes and safe additional available drawdown and provided this to the modelling team. This approach resulted in the municipalities taking ownership of the data provided and resulted in a basic agreement on the numbers being modelled.

Our review has focused on aspects of the report related solely to the computations conducted for wells in Guelph/Eramosa. In recent weeks we have been made aware of other concerns regarding the underlying assumptions of the model. Burnside notes that we have not made an attempt to review the model, but instead were assuming that the modelling represented the best understanding of the regional hydrogeology at the moment. In light of the recent concerns we would like to point out that our position is in support of making the model the most representative of the available data. We think that best available data should be used in this model in a scenario where the predicted outcomes have implications for the City of Guelph, Township of Guelph/Eramosa, Township of Puslinch and the Town of Erin.

At present there are no policies in the Wellington County Source Protection Plan that address significant drinking water threats for quantity. Should these policies be developed, they will need to be implemented by the surrounding municipalities on behalf of water sources inside the City of Guelph. There is no doubt in our minds that the implementation of these policies would be best undertaken in a spirit of collaboration and cooperation between the municipalities. It is our recommendation that all relevant municipalities be brought to the table and involved going forward in any adjustments or enhancements to the project.

Yours truly,

R.J. Burnside & Associates Limited

Dwight Smikle, P.Geo. Senior Hydrogeologist DS/JB:mp Jim Baxter, P.Eng. Groundwater Resource Engineer

Enclosure(s)

cc: Ms. Kim Wingrove, Township of Guelph-Eramosa (enc.) (Via: email)

036495 Draft Guelph Tier 3 Report review _Davis Letter.docx 10/02/2015 4:06 PM

Martin Keller

Subject:	Technical Meeting to Discuss Wellington Municipalities' Comments on Guelph WQRA Report (Tier 3)
Location:	GRCA office, 400 Clyde Road, Cambridge - sign in at the front desk for directions to the board room
Start:	Fri 2015-02-13 10:00 AM
End:	Fri 2015-02-13 12:30 PM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Not yet responded
Organizer:	Kyle Davis

I did not receive any other agenda items, so please see below for Friday's agenda.

Regards,

Kyle

Agenda

1/ Introductions

2/ Review of Wellington County municipalities' comments

- Guelph/ Eramosa
- Puslinch
- Erin

3/ Discussion

4/ Next Steps

Agenda - Guelph Water System Tier 3 Project Related to Wellington County Municipalities

Chair – Kyle Davis

Attendees – County of Wellington, Township of Puslinch, Township of Guelph / Eramosa, Town of Erin, RMO, Harden Environmental, R.J. Burnside, Blackport Hydrogeology, GRCA

Location – County of Wellington office – Council Lounge – Main Floor, 74 Woolwich Street, Guelph

Date: March 24, 2015 1:00 to 4:00 pm

AGENDA

- 1. Introductions
- 2. Overall Process and Timeline for Guelph Water System Tier 3 (water quantity) project
- 3. Update on Municipal Peer Review of City of Guelph's Water Quantity Risk Assessment Report
 - a. Harden Environmental Review for Township of Puslinch
 - b. R.J. Burnside Review for Township of Guelph / Eramosa
 - c. Blackport Hydrogeology Review for Town of Erin
- 4. Risk Management Measures Evaluation Project (next technical phase for the Tier 3 project)
 - a. Timeline
 - b. Proposed Process including Technical Steering Committee Participation
 - c. Proposed MOECC Screening Tool Project
- 5. Water Quantity (Tier 3) Policy Development within the County of Wellington
 - a. Proposed GRCA Process and Timing
 - b. Resourcing

GRAND RIVER CONSERVATION AUTHORITY

MEMORANDUM

TO: FROM: CC:	Kyle Davis – Wellington Source Water Protection RMO James Etienne - GRCA Martin Keller – GRCA Scott Bates – MNRF Dave Belanger – City of Guelph Paul Chin – Matrix Solutions Inc.	DATE: FILE:	20 April 2015				
RE:	Guelph/Guelph-Eramosa Tier 3 WQRA Peer Review						
REMARKS:	🗌 Urgent 🖾 For your review 🔲 Reply ASAP		Please Comment				

In response to the discussions at the March 24, 2015 meeting at Wellington County, Matrix Solutions has prepared a synopsis of the chronology and technical assessment that resulted in the decision to apply a *"significant"* water quantity risk designation to the Guelph water supply in the Guelph/Guelph-Eramosa Tier 3 Water Quantity Risk Assessment (WQRA). The synopsis notes that the Ministry of Natural Resources & Forestry (MNRF) agreed to the risk designation in the Guelph-Eramosa WQRA after the peer reviewers accepted the May 2014 WQRA using additional information that refined the hydrogeological characterization.

1) Study Chronology

The following is a brief description of the history of the Guelph/Guelph-Eramosa Tier Three Process and the update that was conducted for the Rockwood and Hamilton Drive municipal systems.

The municipal supply wells of Guelph, Rockwood and Hamilton Drive require a Tier Three Water Quantity Risk Assessment to be conducted under the Clean Water Act. These water supply wells are located within the Upper Speed Assessment Area within the Grand River Watershed. The Tier Two Water Budget and Subwatershed Stress Assessment completed for the Grand River Watershed identified this area as having a *"moderate"* potential for groundwater stress. The identification of this stress indicator led to the requirement of a Tier Three Water Budget and Water Quantity Risk Assessment for Guelph, Rockwood and Hamilton Drive because all of the municipal wells are located within this area.

The City of Guelph Tier Three Assessment was initiated in 2008 as a provincial pilot project to conduct a Tier Three Water Quantity Risk Assessment on Guelph's municipal wells. This study comprised field work, a desktop characterization exercise (of the water resource and the water use) and the development of numerical surface and groundwater flow models. This work was mostly complete by early-2010, and the Characterization Report and Groundwater Flow Model Report were issued in draft in June 2010 and July 2011 respectively. These two reports were reviewed by the province and external experts and received peer reviewer acceptance in January 2013.

The Guelph Risk Assessment was conducted using the accepted groundwater flow model and the results were documented in the Water Quantity Risk Assessment Report released in draft in May 2013. At that time, the Local Area was assigned a *"significant"* water quantity risk level based on ecological impacts to cold-water streams. The WQRA report was peer reviewed and a second draft of the report received peer reviewer acceptance in August 2013. The province deferred their final review of the WQRA report and the *"significant"* risk assignment until the completion of the Tier Three study for the Rockwood and Hamilton Drive municipal wells, as well as the Region of Waterloo Tier Three Study due to the proximity of the Local Areas.

On December 2, 2013 the MOE Source Protection Programs Branch issued a memo with revised guidance designed to clarify the process for assigning risk levels based on the evaluation of impacts to other water uses including cold-water streams. As a result of this new guidance the assignment of water quantity risk to the City of Guelph Local Area became "moderate".

The Rockwood and Hamilton Drive Tier Three Assessment was initiated in December 2013. This study comprised additional characterization of the geology and hydrogeology relevant to the municipal systems for Hamilton Drive and Rockwood. Representatives from Matrix Solutions, Wellington County, the Township of Guelph-Eramosa (GET), the GRCA, and the City of Guelph held a project initiation meeting on January 15, 2014. At that time, Matrix gave an overview of the Tier Three process and the preliminary results from the Guelph WQRA which had just been reassigned a *"moderate"* water quantity risk for the City of Guelph's water supply. As an action item at the meeting, Matrix received additional information and data from GET to characterize the municipal systems of Rockwood and Hamilton Drive. Staff at GET provided the requested information which was analyzed by Matrix. GET provided approval of the key metrics required to conduct the risk assessment on May 6, 2014 (including Safe Available Drawdown, current and future pumping rates).

The data provided by GET as well as other geological and hydrogeological data obtained for the study were used to refine the hydrogeologic characterization and update the groundwater flow model. The Risk Assessment for the Local Area (which includes Guelph, Rockwood and Hamilton Drive) was conducted and the result was another reassignment of risk for the WHPA-Q1 that includes the Guelph and Hamilton Drive wells to *"significant"*. The individual WHPA-Q1s that encompass the Rockwood wells were assigned a *"low"* risk level. The change in risk assignment back to *"significant"* in the final assessment was due to the refined hydrogeologic characterization and a requisite update to the groundwater flow model.

A draft report entitled CITY OF GUELPH, AND COMMUNITIES OF ROCKWOOD AND HAMILTON DRIVE TIER THREE WATER BUDGET AND LOCAL AREA RISK ASSESSMENT was released in draft in July 2014. This report received peer reviewer acceptance in August 2014 and the Province agreed with the findings of the report, including the risk assignment in September 2014.

2) Technical Reassessment of Risk Assignment

The following bullets identify specific items that led to the change in the Guelph and Hamilton Drive risk assignment to *"significant"*. The sensitivity or relative impact on the final WQRA results would require a sensitivity analysis and some forensic modeling. The bullets refer to slides from the May 9, 2014 peer review presentation that explained the change in the risk assignment:

- The top of bedrock surface was refined in the area surrounding Rockwood and to the northeast (in the direction of the previous 2006 capture zones for the Rockwood wells (Slides 9-12).
- There is a buried bedrock valley to the west of Rockwood that stretches to the northeast beneath Erin. The characterization of the buried bedrock valley was adjusted close to Rockwood based on the new bedrock surface noted above. The material infilling this valley was refined from the first study based on OGS drilling information. In most places this resulted in coarser material which changed the interaction between the bedrock aquifers and the overburden and surface water system. This led to a slight decrease in water levels in Rockwood (Slide 18) and slight increases in groundwater discharge in the Eramosa River (Slide 19).
- Pumping rates for Rockwood were revised with updated data and Well 3 was added. The first draft model used data from 2002 that was reported in the Wellington County Groundwater Protection Study (Golder, 2006) Rockwood Wells 1 and 2 were pumped at a total of 751 m³/d and that pumping rate was held constant for the future scenario. With the GET Tier Three update, the current condition pumping rates for the three Rockwood Wells increased to 2009/2010 pumping rates for a total of 967 m³/d, and the future (allocated) rates were set at 1,152 m³/d (Slide 23). Thus there was a total increase of 401 m³/d in the Rockwood Wells under future

conditions in the final Guelph/GET Tier Three WQRA as compared to the draft Guelph Tier Three WQRA.

- Other geologic refinements were made for the area north of Hamilton Drive that impacted results in the north of the city – e.g., Emma Well (Slides 29 & 30).
- The updates made to the GET Tier Three combined to change the supply of water such that under the drought scenario, water levels were lower in the Arkell 1, Carter, Emma and Water Street Wells (Slide 29). Many of these wells were already very close to their safe available drawdown levels (within 0.2 m for Arkell 1 and Carter wells). The Emma well dropped by 0.5 m and reached the original safe water level used in the first draft. Matrix took closer looks at all of the wells to see if the safe water levels could be adjusted to accommodate these changes. With the Emma Well, Matrix identified an additional 0.5 m of available drawdown by refining the understanding of where the water bearing zones and the pumping levels were. Matrix could not identify any additional available drawdown in the other wells. As these wells are very close to their safe levels and because Arkell 1 and Carter Wells are shallower wells, there is enough uncertainty inherent in this assessment that only having 0.1m of drawdown available in Arkell 1 led to a "significant" risk level being assigned to the WHPA-Q1.

As a result of the consideration of this explanation, and in discussion with the MNRF and the City of Guelph, it is felt that the Guelph/Guelph-Eramosa WQRA designation of *"significant"* has been correctly applied. If you have any further questions regarding this information, please feel free to contact the undersigned.

Sincerely,

James Etienne, P.Eng., Sr. Water Resource Engineer



June 19, 2015

James Etienne, P. Eng. Senior Water Resources Engineer Grand River Conservation Authority 400 Clyde Road, Cambridge, ON Via Email and Regular Mail

Dear Mr. Etienne,

RE: Wellington County Municipal Peer Review Comments Regarding Water Quantity Risk Assessment Report (Tier 3) – City of Guelph and Guelph / Eramosa Township Water Systems

On behalf of Guelph / Eramosa Township, the Township of Puslinch, the Town of Erin and the County of Wellington, please find enclosed peer review documents by the Township and Town hydrogeologists on the draft Tier 3 Water Budget and Local Area Risk Assessment for the City of Guelph and the Communities of Rockwood and Hamilton Drive (Tier 3 report). The attached documents also provide comment on the additional information, data and reports provided by the Grand River Conservation Authority (GRCA), the City of Guelph and their consultants during our peer review process to date. We appreciate the opportunity to participate as a peer review for this study.

As outlined in our attached comments, our peer review indicates serious concern with the delineation of the Well Head Protection Area – Quantity (WHPA Q1 / 2) extent and significance level. We also continue to have concerns that additional data needs to be included to ensure the Tier 3 report and model is an accurate representation of field conditions and based on the best available science. As a result of our peer review, our municipalities are respectfully requesting:

- A commitment from the GRCA, City of Guelph, Ontario Ministry of the Environment and Climate Change (MOECC) and Ontario Ministry of Natural Resources and Forestry (MNRF) to address the attached concerns. In particular, addressing the concerns regarding the extent and significance of the water quantity threat and inclusion of additional sources of relevant data.
- Written confirmation of the process and necessary timing to alter the extent and / or significance of the WHPA – Q1 / Q2.

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- Confirmation of a council, public and industry consultation process including discussion on the timing of this consultation relative to Tier 3 report acceptance / approval. Given the large number of private water users (domestic and commercial / industrial) within the WHPA Q1 / Q2, discussion and agreement on the consultation process is needed.
- Further discussion, perhaps through policy discussion papers, to address the balance between potentially competing public interests such as municipal, domestic and industrial water users.

Our attached comments reflect our municipalities' current understanding of the next steps in the Tier 3 process. In particular, our understanding is that the provincial technical rules do not allow a Risk Management Measures Evaluation Process (RMMEP) project to alter the extent of a WHPÅ – Q1 / Q2 or its significance level once the Tier 3 report has been accepted. This understanding has been confirmed over the past months by the GRCA, MOECC and MNRF. Based on this understanding, our peer review requests that these concerns be addressed prior to an acceptance of the Tier 3 report and prior to the initiation of the Risk Management Measures Evaluation Process (RMMEP) project.

Recently, however, MOECC and MNRF representatives indicated that the official acceptance of the Tier 3 report would occur through the approval of an updated Grand River Assessment Report. Therefore, there may be a method to alter the extent and / or significance of a WHPA Q1 / Q2 through the RMMEP project after the Tier 3 report is accepted but prior to official acceptance through the Assessment Report. MOECC and MNRF representatives indicated that the exact process is unclear at this time as it is not outlined in the provincial technical rules. Based on this uncertainty regarding the process to alter the extent and / or significance of a WHPA Q1 / Q2 through the RMMEP project, our municipalities respectfully request that the GRCA, MOECC and MNRF provide in writing confirmation of this process especially in respect to the timing necessary to address our attached peer review comments.

Our municipalities look forward to continuing our collaboration with the GRCA, City of Guelph and the Province to ensure that the Tier 3 report includes the best available science in which to support the protection of groundwater resources. This is an important report that has long term impacts for City and County residents and

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as such, our municipalities will continue our involvement in the review of the technical work and in development of water quantity policy.

If you require further information, please contact the undersigned.

Regards,

Kyllain

Digitally signed by kdavis@centrewellington.ca DN: cn=kdavis@centrewellington.ca Date: 2015.06.19 12:17:07 -04'00'

Kyle Davis, Risk Management Official 519-846-9691 ext 362 kdavis@centrewellington.ca

Wellington Source Water Protection Risk Management Office 7444 Wellington Road 21 Elora, ON, NOB 150 1-844-383-9800 sourcewater@centrewellington.ca wellingtmwater.ca

c.c.

Via E-mail

Karen Landry, CAO – Township of Puslinch Kim Wingrove, CAO – Guelph / Eramosa Township Kathryn Ironmonger, CAO – Town of Erin Gary Cousins, Director of Planning – County of Wellington Martin Keller – Grand River Conservation Authority Dave Belanger – City of Guelph Peter Rider – City of Guelph Scott Bates – Ontario Ministry of Natural Resources and Forestry Kathryn Baker – Ontario Ministry of the Environment and Climate Change

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Blackport Hydrogeology Inc.

Memo

To:	Kyle Davis, Township of Centre Wellington
From:	Ray Blackport, Blackport Hydrogeology Inc.
CC:	Kathryn Ironmonger, Town of Erin
Date:	June 10, 2015
Re:	Comments, City of Guelph, Tier 3 Water Quantity Risk Assessment and the Guelph/Wellington County Water Quantity Risk Management Work Plan

1.0 Background and Scope of Review

Background

The City of Guelph conducted a Tier Three Water Budget and Local Area Risk Assessment (Tier Three Assessment) as a requirement under the Clean Water Act for the Province of Ontario. Previous water quantity studies, completed at the watershed scale, classified the local subwatershed as having a moderate to significant water demand due to high water supply usage. The findings of the Guelph/Guelph-Eramosa Tier Three Water Quantity Risk Assessment concluded that there is a "significant" water quantity risk level encompassing a large area of City of Guelph, the Townships of Guelph/Eramosa and Puslinch and the Town of Erin. Three areas were identified as being vulnerable to water quantity threats, two being groundwater vulnerable areas (WHPA-Q1 and WHPA-Q2) and one being a surface water vulnerable area (IPZ-Q). The WHPA-Q1 area is the cone of influence of each municipal well, including the cones of influence of wells the each well it intersects. The WHPA-Q2 area is the land area where recharge has the potential to have a measurable impact on water levels at the municipal wells. The IPZ-Q area is the drainage area and associated recharge area that contribute to a surface water intake.

Several meetings were held to discuss the findings of the Draft Tier Three Assessment. Concerns were raised at the March 24th, 2015 meeting with respect to the decision to apply a "significant" water quantity risk designation to the Guelph water supply in the Tier Three Assessment. The Grand River Conservation Authority (GRCA) provided a summary of the chronology of the investigations and technical reassessments of the Risk Assignment in a Memo dated April 20, 2015.

Scope of Review

The primary focus of this review is to provide comments, on behalf of the Town of Erin, with respect to the Draft Tier 3 Water Quantity Risk Assessment (WQRA) Report for the City of Guelph Water system, as related to potential water quantity concerns within the geographic area of the Town of Erin. It was also requested that a review of the Work Plan for the "Water Quantity Risk Management Measures Evaluation Process" (RMMEP) be completed. It is noted that with respect to the Town of Erin, there are no WHPA-Q1 and WHPA-Q2 areas for the City of Guelph and Village of Rockwood water supply systems, which extend into the geographic boundaries of the Town of Erin. Only the surface water quantity area (IPZ-Q) extends into the geographic limits of the Town and as such the scope of review is limited to reviewing the WQRA report in relation to the IPZ-Q and to providing general comments on the RMMEP Work Plan.

1. Water Quantity Risk Assessment

a. Groundwater

i. Geology/Hydrogeology

From the perspective of the Town of Erin, the there are no groundwater related water quantity concerns within the Town boundaries, related to the Guelph WQRA Tier Three Assessment. The groundwater capture areas of the municipal water supply wells for the City of Guelph do not extend into the Town of Erin and as such, an assessment of the geology and hydrogeology was not conducted. It is noted that extensive testing of the Arkell Spring grounds municipal well field has been conducted over the last three years and the findings show that the capture zones do not extend into the Town of Erin. It is also noted that a characterization update was conducted for the area around Rockwood, as part of the Tier 3 Water Budget and Local Area Risk Assessment. No update on the Wellhead Protection zones was provided; however, based on the previous information found in the Grand River Source Protection Plan (2013), the Wellhead Protection Zones are shown to extend into the Town of Erin but there are no water quantity threats with the Town.

ii. Municipal Wells

Not applicable for the Town of Erin.

iii. Delineation of WHPA – Q1 and Q2 – Application of Technical Rules

This is beyond the scope of review for the Town of Erin as the WHPA-Q1 and WHPA-Q2 do not extend into the Town of Erin.

b. Surface Water

The IPZ-Q for the City of Guelph water supply is interpreted to be the entire Eramosa-Blue Springs Creek watershed upstream of the Arkell Spring Grounds Intake on the Eramosa River (Figure 5-4 of the Tier Three Assessment Report). Since the intake is on the Eramosa River, all of the upstream drainage area and associated recharge area of the Eramosa River and Blue Springs Creek is considered to contribute to the surface water intake. The surface water pumped from the Eramosa River is not directly fed into the municipal drinking water system but is diverted into an artificial recharge system where the water is "stored" in the shallow aquifer and then pumped out, treated and made available for the municipal supply system. The water taking from the surface water is constrained, based on a specified river flow rate required to maintain sufficient flow for operation of the wastewater treatment plant.

i. Hydrology

The hydrology and flow rates in the Eramosa River have been investigated in detail for decades. In recent years discharge at the Eramosa intake has fallen below the threshold level (for operation of the Waste Water Treatment Plant on several occasions; however, this has not impacted the drinking water quantity as make up water, if needed, can be derived from storage within the artificial recharge system and from water supply wells at the Arkell Spring Grounds.

ii. Delineation of IPZ-Q – Application of Technical Rules

Part VI.7 of the Technical Rules was applied (page 94 of the Tier Three Assessment Report) appropriately. Simulated particle tracking was used to assess potential recharge to the watershed, through the groundwater system outside the watershed boundaries. Given the uncertainty in the groundwater divide and the limited recharge contribution in this area, this additional area was removed, to constrain the IPZ-Q to within the Grand River watershed boundary.

Additional Considerations

It was noted in the Tier Three Assessment Report (page 99) that the Surface Water Vulnerable Area (IPZ-Q) was assigned the same Risk Level as the groundwater vulnerable area that contains the groundwater collector system (Glen Collector) at the Arkell Spring Grounds, where the surface water used in the system is discharged. This was done since the water pumped from the Eramosa intake is not fed directly into the drinking water system but into the groundwater collector, which was included in the Risk Assessment for groundwater. Although the same Risk Level is assigned across the large drainage area upstream of the Arkell surface water intake, there will be a highly variable level of "real risk" across this area, especially in the upstream areas of the watershed.

2. Water Quantity Risk Management Measures Evaluation Process Work Plan

As indicated in the Work Pan, the Risk Management Measures Evaluation Process (RMMEP) the water quantity polices must address one of the prescribed drinking water threats, and, as a result may or may not address some of the factors considered in setting the risk level for a local area. There are two water quantity prescribed drinking water threats:

- an activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body; and,
- an activity that reduces recharge to the aquifer.

As indicated in the introduction to the Water Quantity RMMEP, the objective of the RMMEP is to provide a methodology to select risk management measures that would manage significant threat activities so that they cease to become significant drinking water threats. The following comments are provided with respect to the RMMEP Work Plan.

Task 1: Review - Identification of Drinking Water Quantity Threats

I generally agree with the proposed work plan; however, it is important that whomever is undertaking the RMMEP is familiar with the existing Tier 3 assessment, as it may be overkill for the consultant to update and refine threats, identify additional wells/intakes for impact assessment etc., given how much work has gone into the Tier 3 assessment (i.e. was that not the point of the Tier 3 assessment?).

Task 2: Where Required, Identify Percentage Impacts and Rank the Tier 3 Local Area Significant Threats

- Have not some of the scenarios presented in Table 1 already been performed as part of the Tier 3 assessment (e.g. modelling pumping at the permitted rates)?
- Realistic consumptive and non-consumptive use should be refined, where possible, for many of the scenarios in Table 1. For example, most rural non-permitted water taking (e.g. private wells) is non-consumptive, water is typically removed from the lower bedrock aquifer and returned via septic systems to the shallow aquifer. In the case of the Guelph WQRA, (i.e. IPZ-Q, surface water only risks in the Town of Erin), the potential impact from this type of water taking within the Town of Erin, would be minimal and would in fact potentially enhance discharge to the surface water, as recharge to the shallow groundwater is effectively increased.
- Part of the risk ranking and potential level of water quantity impact will depend on the location or distance from the municipal well or intake and local and regional geologic conditions (e.g. where is the main recharge area of the municipal wells and the distance this is from the wells). Is the use of the term "recharge" referring to recharge to the water supply aquifer (e.g. there is big

difference between local recharge to an unconfined shallow aquifer and regional recharge to a deeper confined aquifer). It is noted for example, in the Conclusions (page viii of the Tier 3 Assessment report) that: "Recharge reductions in response to future land developments, have a minimal impact on water levels at the Tier Three municipal pumping wells. The Gasport aquifer is protected in most area by the Vinemount aquitard which reduces the impact of reduced groundwater recharge on water levels in the aquifer. With respect to the City of Guelph and community of Rockwood, future land developments generally occur around the periphery of these communities with minimal increase in imperviousness over the Local Area."

Task 3: Select Preliminary Risk Management Measures (RMMs) and Evaluate the Risk Management Measures

It would appear that there are two components to this that should be explored together. The
operational aspects are important, as purely from an operational risk perspective there may be
operational procedures to optimize the city-wide water system, while there may be Risk
Management measures to aid in maintaining overall recharge to the aquifer system or decrease
withdrawal from the aquifer system.

Task 4: Prepare a "Draft Threats Management Strategy" to discuss with Municipalities and Stakeholders.

• The key will be consultation throughout the previous tasks to ensure there is a reasonable consensus moving forward.

3. Conclusions

Implications for the Town of Erin

There are no groundwater related concerns regarding the Tier Three Assessment for the City of Guelph, given that the capture zones for the Guelph system do not extend into the Town of Erin and there are no groundwater quantity threats. From a surface water perspective, the Surface Water Vulnerable Area (IPZ-Q) extends into the Town of Erin upstream of the Arkell Spring Grounds Intake. It is not expected that that there would be any impact on water quantity from activities within the Town of Erin, given several factors:

- Any increase in impervious areas as a result of development, which will be a substantial distance
 upstream of the intake, would potentially increase surface water flow rather than decrease
 surface water flow.
- Most rural wells obtain water from the deeper aquifer system and "recycle" the water via septic systems to the shallow groundwater system, increasing the overall recharge to the shallow groundwater system and the potential discharge to the surface water system.

• The Town of Erin is the most upstream portion of the watershed and least developed so it is unlikely that would be an impact on the surface water system that could be measured downstream at the Arkell Spring Grounds Intake.

4. Recommendations

It is not anticipated that any activity within the Town of Erin could measurably impact the quantity of surface water at the Arkell Spring Grounds Intake. If measures are recommended for the RMMEP that could potentially impact land use or land use activities in the Town of Erin the Town should be consulted to assess the need and the implications.

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Groundwater Mapping

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Harden Environmental Services Ltd. 4622 Nassagaweya-Puslinch Townline R.R. 1, Moffat, Ontario, LOP 1J0 Phone: (519) 826-0099 Fax: (519) 826-9099

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We have reviewed the Tier 3 Water Budget and Local Area Risk Assessment for the City of Guelph and the Communities of Rockwood and Hamilton Drive (referred to herein as "the Tier 3 Study"). We have reviewed this report on behalf of Wellington Source Water Protection and have focused our attention mainly on issues related to the Township of Puslinch.

We presented draft technical concerns to the City of Guelph, the Grand River Conservation Authority, the County of Wellington, the Township of Puslinch and the Township of Guelph Eramosa in a meeting on February 13, 2015. A draft response to these concerns was prepared by the Grand River Conservation Authority and presented by Matrix Solutions Inc. on March 16, 2015. Clarity was provided in regards to several of the technical issues. Other issues required greater evaluation at a later date. It was agreed that a draft letter would be finalized through consultation with the Grand River Conservation Authority.

We were also present at the March 24, 2015 meeting between the County of Wellington, Township of Puslinch, Township of Guelph Eramosa and the Grand River Conservation Authority. The County of Wellington expressed concern about the "significant risk" assignment to the City of Guelph WHPA-Q1. In response, on April 21, 2015 we received a chronology of events resulting in the assignment of the 'significant risk' level from the Grand River Conservation Authority.

It is understood that once the Tier 3 Study has been adopted, the risk level assigned to the City of Guelph WHPA-Q1 cannot be altered for the foreseeable future.

This letter summarizes the technical concerns presented at the February 13, 2015 meeting, the resolution of several of those concerns and our recommendation for resolving outstanding technical concerns.

Background

Figure 5.1 attached shows the extent of the Well Head Protection Area Q1 (WHPA-Q1). Approximately two thirds of Puslinch Township falls within the WHPA-Q1. This is not only because of water taking within the City of Guelph, but also because of water taking in Puslinch Township and Flamborough Township. Although policies related to the WHPA-Q1 have not been established, the inclusion of a significant portion of the Township within the WHPA-Q1 is of concern to the Township and the County of Wellington since a significant portion of the existing and future employment lands fall in this area. There are also several holders of permits to take water that in this area and will be deemed as significant threats to the water quantity available to the City of Guelph municipal system.

As an example of potential policies, we have reviewed the proposed polices in the amended Source Protection Plan for the CTC Source Protection Region that apply to a WHPA-Q1. The policies for WHPA-Q1 with *significant risk* include;

- Reviewing and amending existing PTTWs,
- not allowing any new PTTW or increase in a PTTW within the WHPA-Q1 unless certain conditions are met,
- not allowing new developments that require a PTTW unless certain conditions are satisfied,
- require Province to ensure that population/employment projections do not result in a significant water quantity threat

The inclusion of a significant portion of the Township of Puslinch within the WHPA-Q1 mainly because of water taking by Nestle Waters Canada will result in the enforcement of new policies developed by the Source Protection Committee. These policies are presently unknown, but as can be seen in the CTC Source Protection Area proposed policies, they may not be inconsequential. It is therefore important that the extent of the WHPA-Q1 be as accurate and scientifically defendable as possible.

There are six technical issues that we raise with respect to the Tier 3 WHPA –Q1 and our recommendations for resolution.

1) Eramosa River as a Groundwater Discharge Zone

One of the tasks of the Tier 3 Study is to develop and calibrate surface and groundwater models to assess water budget components in the study area. Harden Environmental has recently been involved in a streamflow study in the Eden Mills area and determined that a significant volume of water is lost from the Eramosa River to the Goat Island/ Gasport aquifer in the reach between Indian Trail Road and the confluence of the Eramosa River and Blue Springs Creek. Depending on streamflow, the loss ranges from 100 to 500 L/s. This information was not available at the time of writing the Tier 3 Study but may have significant implications to the size and shape of Well Head Protection Areas in Wellington County, protective measures needed for the City of Guelph water supply and the assignment of risk level.

Based on our review of the reporting in the Tier 3 Study and additional information provided by Matrix on March 16, 2015, we conclude that the groundwater model predicts that this reach of the Eramosa River is mainly a groundwater discharge zone (minor recharge occurring near the confluence of the Eramosa River and Blue Springs Creek) whereas our observations are that the Eramosa River is a significant losing stream (recharge zone) in this area.

2) Vinemount Formation as an Aquitard

The follow-on to the statement (page viii) that the Vinemount Aquitard is already a limiting factor for recharging the Gasport Aquifer and therefore a reduction in recharge has a minimal impact on municipal water levels is that in the areas where the Vinemount is absent, there may be direct recharge from ground surface to the Gasport Aquifer. The accurate identification of the extent of the Vinemount therefore becomes important as greater recharge to the aquifer reduces the size of the WHPA-Q1. This is particularly true for areas east and north of the City of Guelph. As discussed in Section 2.3.1, a large area east of Rockwood is described as being underlain by the Reformatory and Vinemount Aquitard. Figure 1, attached, shows known locations where the Vinemount aquitard is absent. These locations are; TW3 (Test well for Town of Rockwood), MW15 (test well for Hidden Quarry) and several outcrops mapped by Telford.

Resolution for Technical Concerns 1 and 2

According to the April 14, 2015 memorandum prepared by the GRCA, the technical reasons for reassessment of the Risk Assessment are all related to the following changes made in the Rockwood area;

1) top of bedrock surface refined around Rockwood,

2) characterization of infill material in buried valley west of Rockwood,

3) updated pumping rates for Rockwood and

4) other geological refinements north of Hamilton Drive

These Rockwood related refinements were sufficient to trigger the reassignment to "significant" risk. The City of Guelph water supply, specifically the Arkell Springs well field, is thus shown to be sensitive to changes to the Tier 3 Groundwater Model in the Rockwood Area. Therefore, if the model is adjusted to;

- a) account for the significant loss of water from the Eramosa River to the Gasport Aquifer (Eden Mills area), and
- b) be refined to remove the Vinemount Aquitard from the area east of Rockwood

it may be that the "significant" risk level is removed.

Given the concern raised by the County of Wellington in regards to the 'significant risk level' assignment, it is our recommendation that model adjustments or sensitivity analysis that address these technical concerns be addressed before the 'significant' threat level is finally assigned to the Guelph Water Supply system.

3) Region of Waterloo and City of Guelph Overlap

The Tier 3 Study only addresses the WHPA-Q1 for the City of Guelph and a two kilometer buffer with the watershed divide with the City of Cambridge portion of the Regional Municipality of Waterloo Tier 3. We understand that the Cambridge portion of the RMOW Tier 3 is ranked as Low Risk, therefore, no policies need to be developed for the Township of Puslinch.

Resolution for Technical Concern 3

The assignment of a "low risk" to the RMOW Tier 3 results in no special policies being required for the Township of Puslinch or the County of Wellington. No additional comment necessary.

The RMOW Tier 3 includes a significant portion of the Township of Puslinch and issues with Permits to Take Water outlined in Comment 6 also need to be addressed by the Region's Tier 3.

4) Extent of WHPA-Q1

The water taking by Nestle Waters Canada and another commercial water taking in the City of Hamilton (formerly Flamborough Twp.) have a significant impact on the size and shape of the WHPA-Q1 for the City of Guelph. This results in a significantly larger portion of the Township of Puslinch falling within the WHPA-Q1 than would occur just from the City of Guelph water taking. The ramifications (financial considerations, planning considerations etc..) of this enlargement may impact on the Township of Puslinch municipal government and or the administration of the WHPA-Q1 policies by the County of Wellington. There are potential employment lands within the WHPA-Q1 (wet and dry uses) along the Hwy 401 corridor that will be subject to Clean Water Act policies that would not have been if the commercial water taking was not occurring. It is therefore crucial that the inclusion of the area of influence of the Nestle Waters Canada well and other water takings be carefully assessed prior to finalization of the WHPA-Q1.

4a) PTTW 7043-74BL3K Nestle Waters Canada

Figure 6.8 of the CRA report (*Test Pumping Investigation Supply Well TW3-80, December 2004*) shows that after 72 hours of pumping at 700 igpm (4,576 m³/day vs 2,396 m³/day in the Tier 3 model) the drawdown from the well was estimated to be one metre at a location 200 metres north of County Road 34. The 2014 Matrix Solutions Inc. report (Figure 5.1) indicates a drawdown of five metres approximately 650 metres north of County Road 34. Also, the 2004 CRA report shows a drawdown of less than one metre during the pumping test at Mclean Road whereas the Matrix Solutions Figure 5.1 suggests a drawdown of 3-5 metres extending well south of Highway 401.

The Matrix Solutions Inc. Tier 3 drawdown in the Aberfoyle South area arises mainly from the combined water taking by Mini Lakes, Mill Creek Campground, Meadows of Aberfoyle, Concast, Royal Canin and Nestle Waters Canada. The consumptive rates of these takings are 129, 164, 18, 200, 105 and 2396 m³/day respectively. Nestle Waters Canada accounts for 80% of this taking.

Matrix Solutions confirms that the model predicts that the Nestle Waters Canada permitted water taking alone is having a significant influence on the size and shape of the WHPA-Q1 in the Aberfoyle area. An analysis shows that without the Nestle Waters Canada taking, the WHPA-Q1 would shift some 4400 metres northward.

Resolution for Technical Concern 4a

Verification of the model predicted drawdown in the Aberfoyle area and southwards is difficult, however there are several studies available that may assist in confirming the predicted drawdown. These are;

- Recent well installations by Nestle Waters Canada
- Groundwater Monitoring by Royal Canin
- Groundwater Monitoring by Meadows of Aberfoyle
- Gilmour Road site analysis by Nestle Waters Canada

We recommend that these sources of information be reviewed for confirmation into the predicted and present drawdown from Nestle Waters Canada. We recommend that this be undertaken prior to finalization of the Tier 3 Study.

4b) Model Predicted Drawdown in City of Guelph Wells

In order for the WHPA-Q1 to extend south of Maltby Road, the combined drawdown of the Downey well, Burke well and Puslinch takings must be greater than two metres in the Gasport aquifer. None of the individual 25 year capture zones of the Burke or Downey Road wells extend to Maltby Road. We have not been able to find individual drawdown contours for the Burke Well or Downey Road Well, it is thus not possible to estimate drawdown from these individual wells. For example, the 2013 Stantec Environmental Assessment for the Burke Well has a hydrograph with pumping elevations within the Burke Well at approximately 317 m AMSL. The 2006 Guelph Puslinch Groundwater Protection Study (Golder Associates) has a model-projected pumping elevation for the Burke Well at approximately 313 m AMSL. The 2014 Matrix Solutions report suggests a pumping elevation of 325 m AMSL in the Burke well.

The draft response provided by Matrix Solutions addresses this issue by confirming that the 3-D model does under-estimate drawdown at the Burke Well by approximately 4.5 metres. However, the model reasonably predicts transient fluctuations in the well brought on by pumping changes and recharge changes. Matrix Solutions also confirms that the majority of water from the Burke Well is sourced from the Guelph Formation, not the Gasport Formation and thereby may have little influence on the potentiometric level in the Gasport Formation.

Resolution for Technical Concern 4b

Review the model predicted drawdown in the Gasport Formation from the Burke Well and comment on the significance of under-predicting drawdown in regards to the size and shape of the WHPA-Q1. We recommend that this be undertaken prior to finalization of the Tier 3 Study.

4c) PTTW 8228-76XLE Meadows of Aberfoyle

The current (since 2009) PTTW is 5626-7WLQ3W.

Resolution for Technical Concern 4c

None required.

4d) PTTW 02P-2064 Kraus Nurseries Ltd.

Kraus Nurseries have holdings in Waterdown, Ontario and Mrs. Kraus confirmed that 02P-2064 is an old permit of hers but she does not own property in Puslinch, the permit is for her property in Waterdown. In addition, this is an expired permit.

Resolution for Technical Concern 4d

Remove permit from Tier 3 Groundwater model and revise area of WHPA-Q1. We recommend that this be undertaken prior to finalization of the Tier 3 Study.

4e) PTTW 99P-2132 Kats Okashimo Fish Farm

There is no evidence that water has ever been taken through PTTW 99P-2132. The PTTW was not renewed in 2009. A site visit to the Kats Okashimo Fish Farm failed to find a fish farm at the location (now a Tarot Card reader) and the present tenant confirmed that fish farming has not been done for at least twelve years (nor is he aware if it ever occurred). As seen on Figure 5.1, the modeled water taking at the Kats Okashimo Fish Farm has a significant effect on drawdown beneath Puslinch Township. The effect, of removing this taking, on the size and shape of the WHPA-Q1 must be evaluated.

Resolution for Technical Concern 4e

Remove permit from Tier 3 Groundwater model and revise area of WHPA-Q1. We recommend that this be undertaken prior to finalization of the Tier 3 Study.

5) Significant Risk Assignment to WHPA-Q1

The combined WHPA-Q1 as shown on Figure 5.1 for all of the City of Guelph wells has been assigned a *Significant Risk* level. The significant risk level is assigned as a result of the high uncertainty that Arkell Well 1 can meet its allocated rate (page 133). The high uncertainty caused the assigned *Moderate Risk* level to be elevated to *Significant Risk* level. The policy implications of this to the Township of Puslinch is that all existing water taking and future water takings become Significant Threats to the City of Guelph municipal wells. Therefore, permits to take water such as those issued to Nestle Waters Canada, ConCast, Mini Lakes, Royal Canin, Mill Creek Campground and all aggregate washing will be subject to any policies for *Significant Threats* developed under the Clean Water Act.

Arkell Well 1 obtains water from the overburden aquifer and a water quantity risk to the overburden aquifer does not necessarily represent a threat to wells completed in the Gasport Aquifer. Similarly, water taking from the Gasport Aquifer near Aberfoyle will not affect the safe drawdown of Arkell Well 1. This would allow for a *moderate risk* level for the remainder of the WHPA-Q1 and thus only future water taking will be subject to the new policies.

Resolution for Technical Concern 5

It is understood that only one risk assignment is made for a well field. Since Arkell Well 1 has a significant risk level, the entire well field has a significant risk level. It is therefore important to consider all factors prior to the significant risk level assignment and adds further emphasis to Concerns 1 and 2.

It was discussed that 'gradational' policies would be considered based on a risk assessment after the RMMEP project is completed.

6) Threats Ranking

Any threats ranking of the Industrial threats identified in Puslinch Township on Figure 6-1 should consider the following;

The vast volume of water stored in the pit ponds near Aberfoyle are not considered in the model. There is an estimated 12,000,000 m³ of water stored in pit ponds south of Highway 401, let alone those north of Highway 401. This is several times greater than that stored in Puslinch Lake. The volume of water that is stored in gravel pits in Puslinch Township is several times greater than in the former sand and gravel aquifer. Therefore, permitted water taking from the ponds should be carefully evaluated before deeming them a significant threat to the City of Guelph water supply.

Resolution for Technical Concern 6

This can be addressed through a sector by sector analysis of Permits in the Risk Management Measures Evaluation Process.

7) Water Quantity Risk Management Measures Evaluation Process List of Tasks

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We have reviewed the list of tasks and do not have any comment other than given above.



June 16, 2015

Via: Email

Mr. Kyle Davis Risk Management Official County of Wellington 7444 Wellington Road 21 Elora ON N0B 1S0

Dear Kyle:

Re: Comments on the Draft City of Guelph Tier 3 Water Quantity Report Project No.:300036495.0000

R.J. Burnside & Associates Limited (Burnside) was requested by the Township of Guelph/Eramosa to review the Matrix Solution Incorporated (MSI) "*Draft City of Guelph, and Communities of Rockwood and Hamilton Drive Tier 3 Water Budget and Local Area Risk Assessment*". A draft of this letter was provided to the interested parties in February 2015. Ensuing meetings in March and April 2015 resulted in a memorandum from the Grand River Conservation Authority (GRCA) entitled "Guelph/Guelph-Eramosa Tier 3 WQRA Peer Review" dated April 20, 2015. This letter provides Burnside's comments on the report, the GRCA memorandum and includes an update regarding well construction and testing of Rockwood Well 4. The letter is divided into sections to represent our comments in various areas.

Technical Adequacy of the Model

The purpose of a Tier 3 water quantity analysis as required by the Clean Water Act (2006) is to evaluate the impact of the proposed/modelled water takings to ensure that the approved water supply within each municipality can meet the required growth and demand. This evaluation is completed using a groundwater model that is ideally built using the best available hydraulic properties of the hydrogeologic units, surface water and weather patterns that sustain the flow of water within the study area.

The review completed by Burnside of the "*Draft City of Guelph, and Communities of Rockwood and Hamilton Drive Tier 3 Water Budget and Local Area Risk Assessment*" originally assumed that the groundwater model for the study area was a suitable representation of on-site conditions as it had been peer reviewed by provincially appointed reviewers. Our review therefore was not a forensic examination of the model, instead it consisted of a general review at a regional scale. Our review of the model assumptions indicated that there were significant differences between documented real world conditions and the assumptions of the model at a regional and local scale. It was acknowledged by the City of Guelph and their consultant Matrix Solutions that discrepancies existed in the model and that these discrepancies should be addressed. In order to facilitate the completion and sign off on the Tier 3 process, it was suggested that all parties agree to the existing Tier 3 study and that the adjustments to the model be made during future stages of the source protection process (i.e., Risk Management Measures Evaluation Program).

A memorandum received from the GRCA dated April 20, 2015 provided a background to the current model and indicated that a series of changes had been made to the model to recognize existing conditions in the Rockwood and Hamilton Drive areas. The memorandum suggests that the result of these changes was the classification of a significant water quantity risk within the WHPA-Q1 for the Guelph Tier 3. As previously noted, the suggestion was that the report be accepted and that the WHPA-Q1 would be updated through the Risk Management Measures Evaluation Program (RMMEP).

Our review of the changes indicated in the GRCA memorandum suggests that the model is sensitive to changes that were made away from the City of Guelph and it is our position that changes to model parameters in the immediate vicinity of the City may also have significant impacts on the model predictions. These changes in the immediate vicinity of the city would be based on information that is currently available and should be made in order for the model to adequately represent the existing known and available hydraulic conditions across the model domain. The need for the changes and the nature of the existing data is discussed below.

RMMEP Process

In addition to the need for modeling changes we have had the opportunity to discuss the source water protection process with a neighbouring source water protection area, the Credit Toronto and Central Source Protection Region (CTC). Burnside initiated these discussions as the CTC has completed a number of Tier 3 studies and have also completed the only RMMEP to date in the province. The discussion was aimed at determining what their experience was through the RMMEP process and how changes to delineations were accommodated through this process. As indicated before, Burnside was proceeding with the premise that the modelling changes could be implemented through the RMMEP process. Our discussion with the CTC on their experience has led us to believe that the RMMEP is a very prescriptive process with deliverables laid out by the province. The prescriptive nature of the RMMEP and the experience of the CTC have led us to believe that the RMMEP process does not allow for modifications to an accepted WHPA-Q1. It is therefore our position that the revisions to the model should be undertaken now in an effort to ensure that the model conclusions and delineated WHPA-Q1 are based on the best available science. We recommend that the following considerations be included in the model and the simulations re-run and all applicable updates be undertaken.

Surface Water Leakage into the Bedrock Aquifer

Discussions that have been taking place as part of the review process have included Mr. Stan Denhoed representing the Township of Puslinch. Data available to Mr. Denhoed indicates that leakage to the aquifer from the Eramosa River in the vicinity of Eden Mills is orders of magnitude greater than that used in the model. Based on the noted sensitivity of the model to changes in other areas of the model and the proximity of this area to the City of Guelph, it is recommended that this update be undertaken to ensure that adequate representation of this documented interaction is included in the model. Leakage from the Eramosa River to the aquifer will likely add a significant volume of water to the aquifer thereby increasing aquifer recharge. This modification of several orders of magnitude of recharge will undoubtedly add volume to the aquifer and provide additional water to meet the current and planned demands.

Expression of the Bedrock Valley on east side of Guelph

Our review of the mapping of this feature indicates that there are undulations in the extent of the valley that seem to match the road network around which the data was developed. The undulations include areas where the valley is narrower and these constrictions likely act as restrictions on groundwater flow through the valley. Restrictions on groundwater flow will likely impact the amount of groundwater available in areas downstream (downgradient) of the restrictions. It is recommended that the interpolation for the extent of the bedrock valley be revisited to ensure that restrictions on extent are not being artificially introduced through the nature of the data itself.

Eramosa Formation Aquitard

We note that drilling at the TW2-02 site in Rockwood did encounter a dark brown limestone layer that was less than 10 m thick at the top of the bedrock. The layer was not petroliferous and as a result we have interpreted that the Vinemount Member of the Eramosa Formation is not present at this location. The modelling team may wish to review the interpreted and modelled presence of the low hydraulic conductivity Eramosa Formation which has been extended to a considerable distance east of Rockwood in the report based on well logs that reported dark brown limestone.

Considering the fact the Eramosa Formation is interpreted to be an aquitard which impedes vertical groundwater flow in the carbonate aquifer, it may be inappropriate to extend this low hydraulic conductivity layer to the area of Rockwood. The Eramosa Formation in this area is interpreted to subcrop beneath the relatively thin and permeable overburden and outcrop in the Eramosa River valley where karst topography is documented. Testing that we have undertaken at Rockwood Well 4 as part of a process to obtain a PTTW indicates that the dark brown limestone bedrock identified as Eramosa Formation is significantly weathered, produces significant water and does not act as an aquitard. Our testing has indicated that pumping within the deep bedrock results in surficial responses, which are not expected within an aquitard. Based on our test results we believe that the area where the Eramosa formation is present at the bedrock surface should be given a higher hydraulic conductivity due to its weathered condition.

In addition to the above general considerations for the model, the following considerations are specific for the Township of Guelph/Eramosa systems.

Existing plus Committed Demands and Allocated Rates

The allocated pumping rates used in the groundwater model for each well in Guelph/Eramosa are identified in Section 3.2.4 of the report. Guelph/Eramosa would like revised allocation rates based on an update to growth predictions since the 2011 Watson report. The updated demands were provided to Matrix at the meeting on March 13, 2015.

Safe Additional Available Drawdown

Burnside has previously provided comment on the Safe Additional Available Drawdown (SAAD) calculations in the draft report. Based on the technical rules the SAAD is the difference between the average pumping water level and 1 m above the pump intake. In most water systems the average pumping water level is determined using electronically collected water level data. Whereas water levels used to calculate the water levels in the Guelph/Eramosa wells are based on once a day manual water levels. In the case of the Cross Creek Well there are only three pumping water levels measured during a year of operation because the well only

runs for approximately six hours every second day. It is our opinion that this data does not provide an adequate basis on which to compute an average water level.

The lack of suitable pumping water level information prevents the proper calculation of an average pumping water level. As a result, an automatic water level recorder (AWLR) was recently installed in the Cross Creek Well. In lieu of this data, we have reviewed the water level data and estimated acceptable average water levels and safe additional available drawdown values for each well as outlined below in Table 1.

	Grade Elevation (m amsl)	(2) Pump Intake (m amsl)	Pump Intake (m bgs)	Top of Casing (m agl)	(1) Operating Low WL (m amsl)	Report Average Pumping Water Level (m masl)	Report SAAD (m amsl)	Guelph/ Eramosa SAAD (m amsl)
Cross Creek Well	351.3	302.7	48.6	0.8	317	320.2	16.6	13.3
Huntington Well	338.1	302.6	35.5	0.5	314	321.6	17.6	10.4
Rockwood Well 1	361	328.3	32.7	0.5	344	348.5	23	14.7
Rockwood Well 2	361	329.6	31.4	0.5	345	350.6	27	14.4
Rockwood Well 3	360.4	321.3	39.1	0.8	331	333.9	16.2	8.7
Rockwood Well 4	367	320	47	0.8	327	39	-	6.0
Guelph/Eramosa SAAD calculated (1) - (2) - 1 m; Well 4 estimated based on pumping test data.								

Table 1: Recommended Safe Addition	al Available Drawdown	for Guelph/Eramosa Wells
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Rockwood Well 4

A test well called TW2-02 was constructed as part of the Rockwood Water Supply Environmental Assessment (EA) in 2002. The water supply EA was completed in 2002 and the preferred solution was the phased addition of two new wells on the south side of Rockwood. Rockwood Well 3 was added in 2005. The TW2-02 site was identified as the other future municipal well site for Rockwood Well 4 with a capacity of 683 L/min. This site has been included in all of the previous models leading up to the present Tier 3 study. The site will be permitted as Rockwood Well 4 in 2015 and has not been included in this study.

Rockwood Well 4 was constructed 20 m from the TW2-02 site in December 2014. The new well was tested in January 2015 and has a capacity of approximately 910 L/min. A permit was applied for in May 2015. The pump house for the site will likely be constructed allowing connection of the well to the Rockwood system in 2016. The current version of the Tier 3 study should include Rockwood Well 4 at its proposed pumping rate of 910 L/min. This issue has been reviewed by the project team and we understand that the report will be revised to include Rockwood Well 4.

It is expected that the water demand will rotate between Rockwood Wells 1 and 2 (1,365 L/min.), Rockwood Well 3 (910 L/min) and Rockwood Well 4(910 L/min.). We therefore recommend a distribution of the committed rate of 40% for Rockwood Wells 1 and 2 combined and 30% each for Rockwood Wells 3 and 4. This change as well as likely changes related to future demands will likely require changes to the model.

Report Name

The name of the report does not properly identify the Township of Guelph/Eramosa as a primary stakeholder in this study. Based on recent meeting we have been advised that the report name is to be modified.

General – Township Participation

The context of our comments is based on our experience in completing a similar study in the Orangeville area where there were three municipalities involved. It is noted that the Orangeville study was used as the pilot study for the Tier 3 process and it is our opinion that the approach followed by that study has merit with regard to how the concerns of the individual municipalities were coordinated and managed.

In the Orangeville study, all municipalities were involved with the project from initiation through implementation and were kept abreast of developments along the way. The process of obtaining model input was consultative with the municipalities being requested to provide data ahead of time and this data being included into the modelling process. Municipalities developed data on water taking, planned volumes and safe additional available drawdown and provided this to the modelling team. This approach resulted in the municipalities taking ownership of the data provided and resulted in a basic agreement on the numbers being modelled.

In light of the current concerns we would like to point out that our position is in support of making the model the most representative of the available data. We think that best available data should be used in this model in a scenario where the predicted outcomes have implications for the City of Guelph, Township of Guelph/Eramosa, Township of Puslinch and the Town of Erin.

At present there are no policies in the Wellington County Source Protection Plan that address significant drinking water threats for quantity. Should these policies be developed, they will need to be implemented by the surrounding municipalities on behalf of water sources inside the City of Guelph. There is no doubt in our minds that the implementation of these policies would be best undertaken in a spirit of collaboration and cooperation between the municipalities. We note that the MNRF has indicated a need for comments from neighboring municipalities to be treated as peer review comments and be provided with formal project responses. Based on our current knowledge and the potential impacts of the delineations of WHPA-Q1 we are unable to support a sign off on the Tier 3 report at this time without an assurance that the modelling represents the best knowledge that is currently available.

We trust this review is suitable. If you have any questions, please contact the undersigned.

Yours truly,

R.J. Burnside & Associates Limited

Dwight Smikle, P.Geo. Senior Hydrogeologist DS/JB:mp

Jim Baxter, P.Eng. Groundwater Resource Engineer

cc: Ms. Kim Wingrove, Township of Guelph-Eramosa (enc.) (Via: Email)

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Appendix C

Response to Municipal Peer Review Comments

June 25, 2015 through May 17, 2016

400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6



Phone: 519.621.2761 Toll free: 866.900.4722 Fax: 519.621.4844 Online: www.grandriver.ca

June 25, 2015

Kyle Davis Wellington Source Water Protection Risk Management Office 7444 Wellington Road 21 Elora, ON N0B 1S0

Re: Wellington County Municipal Peer Review Comments Regarding Water Quantity Risk Assessment Report (Tier 3) – City of Guelph and Guelph/Eramosa Township Water Systems

Dear Kyle:

On behalf of the Lake Erie Source Protection Region (LESPR), I would like to thank you for your June 19, 2015 submission of municipal peer review comments from Guelph/Eramosa Township, the Township of Puslinch, the Town of Erin and the County of Wellington.

On February 13, 2015, the Ministry of Natural Resources and Forestry (MNRF) pledged commitment from the Drinking Water Source Protection (DWSP) program towards receiving and addressing the comments and concerns voiced by County of Wellington municipalities in response to the draft Guelph and Guelph/Eramosa Tier 3 Water Quantity Risk Assessment (WQRA). Subsequent to this meeting revisions were made to the 2014-15 and 2015-16 LESPR Technical Studies budgets to allow for a comprehensive peer review by Wellington County municipalities. The 2015-16 budget also included items for consultant revisions to the WQRA arising from the municipal peer review and a substantial expansion of the proposed City of Guelph Risk Management Measures Evaluation Process (RMMEP) to allow for a broader stakeholder consultation process.

Over the past four months, Matrix Solutions Inc. have engaged the consultants for the municipalities to ensure that information was delivered, questions were answered and clarifications were provided to complete the Guelph and Guelph/Eramosa Tier 3 WQRA to the best of everyone's knowledge and allow the RMMEP work to proceed in a timely fashion. After further discussion with the province, the LESPR can confirm that additional time and resources will be provided to allow for revision and completion of the WQRA including additional sources of relevant data provided by the County of Wellington. To maintain momentum and meet the business planning requirements of the DWSP program, the province has agreed to allow some components of the RMMEP to be initiated concurrently while the WQRA is being finalized. It should be noted that the water quantity policies arising from the findings of the water budget studies will be based on the interpretations of the technical studies that are included in the Updated Grand River Assessment Report.

With respect to timing, the first phase of the RMMEP work plan includes consultant time to update the modeling used to establish the extent of the WQRA Local Area boundaries and to reexamine the risk assessment scenario results. This update is expected to be completed this summer using the latest information provided and the resulting Local Area products will be used to finalize the WQRA. The municipal peer review comments provided will also be added to the final comment matrix used to make final editorial changes to the WQRA. It is expected that the final WQRA can be submitted to the MNRF for their acceptance early this fall. Once the WQRA is accepted, the consultant will be able to complete subsequent phases of the RMMEP including the consultation process. It is proposed that work on the RMMEP will be steered by a core group of provincial, LESPR, City of Guelph and Guelph/Eramosa Township representatives engaged in at least two meetings to agree to terms of reference for the RMMEP and confirm the results presented by the consultant. When appropriate, materials would be circulated for comments to a broader group of municipal and possibly sector stakeholders who would then be invited to an additional two meetings to receive an update on the work and provide input prior to completion of the RMMEP. The work on the RMMEP is expected to be completed by the fall of 2016.

Upon completion of the RMMEP, the water budget technical work (including the Final WQRA) will be incorporated into the Updated Grand River Assessment Report. At that time, there will be a requirement for an official public consultation process that will be designed to engage a variety of sector representations in water quantity policy development. It is expected that this process will evolve as the time draws closer and the range of potential impacts and mitigation strategies become clearer.

If you have any questions about this material or the expectations for completing the WQRA and RMMEP projects, please feel free to contact me at (519) 621-2761 x2298 or by e-mail at jetienne@grandriver.ca.

Sincerely,

James Etienne, P.Eng. Sr. Water Resource Engineer

Cc: Karen Landry – Township of Puslinch Kim Wingrove – Guelph/Eramosa Township Kathryn Ironmonger – Town of Erin Gary Cousins – County of Wellington Martin Keller – Lake Erie Source Protection Region Dave Belanger, Peter Rider – City of Guelph Scott Bates – Ministry of Natural Resources & Forestry Kathryn Baker – Ministry of Environment & Climate Change

James Etienne

From:Kyle Davis <KDavis@centrewellington.ca>Sent:Monday, July 06, 2015 4:14 PMTo:James EtienneCc:Martin KellerSubject:RE: Guelph and Guelph/Eramosa RMMEP Proposed Work Plan

Hi James,

Thank you for your email. That is good news that MOECC has given the go ahead to proceed concurrently with the RMMEP and the WQRA. In discussing your response letter with my colleagues and managers, we do have some questions / clarifications regarding the process. Your email helps to clarify some of the questions but I wanted to confirm my understanding of a couple of your points below. I've included my questions in blue. Thank you for your help with this.

Kyle

-----Original Message-----From: James Etienne [mailto:jetienne@grandriver.ca] Sent: Thursday, July 02, 2015 12:59 PM To: Kyle Davis Cc: Martin Keller; Dave Belanger (Dave.Belanger@guelph.ca) Subject: FW: Guelph and Guelph/Eramosa RMMEP Proposed Work Plan

Hi Kyle:

In response to your June 25th e-mail, MOECC has given the go ahead to proceed with the Guelph/Guelph-Eramosa RMMEP work. I will be working with Guelph and Matrix to get the contract signed and a start-up meeting scheduled in late July or early August. Hopefully, Wellington County is in agreement with the RMMEP work proceeding concurrently with the finalization of the WQRA.

In principle, I think we are fine with the work proceeding concurrently. Our concerns relate more to process and consultation as discussed.

In terms of steering committee involvement, we envision a two tier approach. The steering group will include Matrix (Paul and other technical staff as required), Guelph (Dave and Peter), Guelph-Eramosa (Jim and/or Dwight, and I assume yourself), GRCA (myself and Martin), MOECC (Cynthia and Kathryn), and MNRF (Scott and/or Lynne). The goal is to keep this group focussed on the business of initiating and completing the RMMEP work.

Yes, I planned on being on the steering committee, however, I would be present to represent all of my municipalities – GET, Puslinch, Wellington and Erin. I cannot represent one municipality over another, so a two tier steering committee approach does pose us some difficulties if I am not able to bring information back to all my municipalities at any time. This is what caused us concern in your June 25th letter and still causes me some concern based on your email.

As for only one technical consultant being present, I will need to discuss this further with Erin and Puslinch.

As noted in our June 25th letter, there will be opportunities to bring RMMEP updates and draft material to a broader group including Puslinch, Erin, Waterloo Region, Hamilton, Halton and possibly large non-municipal permit holders. The actual invitations will depend on the findings of the technical work. I see this process commencing as a technical study

that will probably require other administrative municipal staff (i.e. the Township CAOs and Wellington County Planning Department) to come to the table later in the process.

Thank you, this addresses some confusion from your original letter. We were unclear when it was planned to bring the large non-municipal permit holders into the process. From your response, am I correct that the draft material to be presented would be before the WQRA is finalized? Therefore, we would get input (and data) from the large non-municipal permit holders prior to finalizing the WQRA?

Perhaps, we should revise the schedule in the RMMEP work plan to include the revisions to the WQRA, the new timelines and to clearly indicate the consultation schedule with all stakeholders? Most of our concerns stem from process and consultation, so I think it would be helpful to have a document that clearly lays out what GRCA, Guelph, MOECC and MNRF are proposing (probably would help with scope creep with the consultants too) and provide confirmation on when / how the extent and significance of the WHPA – Q 1 and 2 can be changed. We could lay out the steering committee composition also. I know this is an extra step but I think the effort will be worth it to clearly understand what we are all agreeing to in regards to process. This also would more closely align with what we requested in my June 19th letter regarding written confirmation of the process (bullet 2) and more clarity on the consultation process (bullet 3 and 4). Your June 25th letter addressed some of these points partially but we are still missing the critical piece on confirmation of process from MOECC / MNRF. As I outlined in my letter, we are unclear on how the extent / significance level can be changed (ie only before finalization of the WQRA or right up until to the MOECC acceptance of the Updated Assessment Report).

One last point regarding consultation, the issue of public consultation has been raised and I know you have answered that it would be during the AR revisions. Some further explanation on why this is the case would be helpful. There are some concerns regarding the technical work being set in stone and then going out for public consultation. This really gets back to our request (to MOECC and MNRF) about written confirmation of the process on how to alter the significance and extent of a WHPA – Q.

In terms of funding assistance to the Townships for RMMEP participation, I have budgeted for Guelph-Eramosa's consultant to participate on the steering committee and provide technical input regarding the Hamilton Drive system and an upset stipend for the other Townships to review RMMEP products and attend some meetings. In order to keep this process on time and on budget, we should confirm the scope of Township involvement before the process starts.

Thank you, that is very helpful and appreciated.

Please let me know if there is anything else you require before this process commences.

Sincerely,

James B. Etienne, P.Eng. Senior Water Resources Engineer Grand River Conservation Authority 400 Clyde Road, Cambridge, ON N1R 5W6 Tel: 519-621-2763 ext. 2298

email: jetienne@grandriver.ca

-----Original Message-----From: Baker, Kathryn (MOECC) [mailto:Kathryn.Baker@ontario.ca] Sent: June-26-15 10:33 AM To: James Etienne Cc: Doughty, Cynthia (MOECC)
Subject: RE: Guelph and Guelph/Eramosa RMMEP Proposed Work Plan

James,

Please also include Cynthia Doughty (cc'd) from MOECC's Hamilton Office on the organizing email. Cynthia is the primary review hydrogeologists for the Guelph municipal PTTWs.

Thanks,

Kathryn

Kathryn Baker M.Sc., P.Geo. Hydrogeologist Source Protection Planning Ministry of the Environment and Climate Change (MOECC) 40 St.Clair Avenue West, Floor 14 Toronto ON M4V 1M2 Tel: 416-212-3708

-----Original Message-----From: James Etienne [mailto:jetienne@grandriver.ca] Sent: June-26-15 9:54 AM To: Baker, Kathryn (MOECC) Cc: Martin Keller; Bates, Scott (MNRF); Bozin Ilisinovic, Saira (MOECC); Villeneuve, Tessa (MOECC) Subject: Re: Guelph and Guelph/Eramosa RMMEP Proposed Work Plan

Thanks Kathryn!

Realistically I would say that the whole process is going to start 3 months behind the proposed schedule. Paul Chin is away until July 6th, but when he returns I will get a revised schedule drafted for the Start-up meeting (late July?) which I will send requests out for next week.

Sincerely,

James From: Baker, Kathryn (MOECC) Sent: Friday, June 26, 2015 9:28 AM To: James Etienne Cc: Martin Keller; Bates, Scott (MNRF); Bozin Ilisinovic, Saira (MOECC); Villeneuve, Tessa (MOECC) Subject: RE: Guelph and Guelph/Eramosa RMMEP Proposed Work Plan

James,

Thank you for sharing the RMMEP work plan. Please proceed with the work.

I noticed the first task was to have been completed in May 2015. Will be completed this summer or will the whole schedule shift forward a couple of months?

I look forward the kick off meeting,

Kathryn

Kathryn Baker M.Sc., P.Geo. Hydrogeologist Source Protection Planning Ministry of the Environment and Climate Change (MOECC) 40 St.Clair Avenue West, Floor 14 Toronto ON M4V 1M2 Tel: 416-212-3708

From: James Etienne [mailto:jetienne@grandriver.ca] Sent: June-25-15 10:47 AM To: Baker, Kathryn (MOECC) Cc: Martin Keller; Bates, Scott (MNRF) Subject: Guelph and Guelph/Eramosa RMMEP Proposed Work Plan

Good morning Kathryn:

Please find attached a copy of the proposed work plan for the Guelph and Guelph/Eramosa RMMEP prepared by Matrix Solutions. Please review and advise if we can proceed with initiation of this project. Once I have MOECC confirmation, I will work with the City of Guelph to initiate the procurement of services from Matrix Solutions Inc. I will also work with the City of Guelph to finalize the funding transfer agreement from the 2015-16 Technical Studies Budget. The GRCA will maintain sufficient approved funds from the 2015-16 Technical Studies Budget to support County of Wellington participation in the technical review and municipal consultation process for the RMMEP.

Sincerely,

James B. Etienne, P.Eng. Senior Water Resources Engineer Grand River Conservation Authority 400 Clyde Road, Cambridge, ON N1R 5W6 Tel: 519-621-2763 ext. 2298

email: jetienne@grandriver.ca<mailto:jetienne@grandriver.ca>

James Etienne

From: Sent: To:	James Etienne Tuesday, July 14, 2015 4:50 PM 'Bates, Scott (MNR)' (Scott.Bates@ontario.ca); Lynne.Milford@ontario.ca; kathryn.baker@ontario.ca; Doughty, Cynthia (ENE) (Cynthia.Doughty@ontario.ca); kdavis@centrewellington.ca; Dwight.Smikle@rjburnside.com; jim.baxter@rjburnside.com; Dave Belanger (Dave.Belanger@guelph.ca);
Subject: Attachments:	peter.rider@guelph.ca; Martin Keller; Paul Chin (pchin@matrix-solutions.com) Agenda for July 24th RMMEP Meeting 15072-527_2015_WP_150206.pdf; 2012-11-26 RMMEP_FINAL.PDF

Please find attached the preliminary agenda for next week's meeting along with the RMMEP Guidance and the Guelph/Guelph-Eramosa RMMEP Work Plan from Matrix Solutions Inc.

Preliminary Agenda

Guelph/Guelph-Eramosa RMMEP

Friday, July 24, 2015 10am to 12 noon GRCA, Grand Room

Meeting Goal: To reach agreement on the process to complete the Guelph/Guelph-Eramosa WQRA while commencing the RMMEP. Identify the target stakeholders and the consultation process for completing the RMMEP.

- 1) Introductions
- 2) Confirmation of Steering Committee Membership
- 3) Completion of the Guelph/Guelph-Eramosa WQRA
- 4) RMMEP Process
- 5) Terms of Reference for RMMEP
- 6) Consultation Process for RMMEP
- 7) Participation in Steering Committee and Technical Group Meetings
- 8) Set Date for Kick-Off Meeting

Sincerely,

James B. Etienne, P.Eng. Senior Water Resources Engineer Grand River Conservation Authority 400 Clyde Road, Cambridge, ON N1R 5W6 Tel: 519-621-2763 ext. 2298

email: jetienne@grandriver.ca

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Conservation Autro

400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6

Phone: 519.621.2761 Toll free: 866.900.4722 Fax: 519.621.4844 Online: www.grandriver.ca

March 9, 2016

Kyle Davis Wellington Source Water Protection Risk Management Office 7444 Wellington Road 21 Elora, ON N0B 1S0

Re: City of Guelph and Guelph/Eramosa Township Water Quantity Risk Assessment (WQRA) and Risk Management Measures Evaluation Process (RMMEP)

Dear Kyle:

On behalf of the Lake Erie Source Protection Region (LESPR), please find attached the draft agenda and technical documents package for the April 1, 2016 Technical Meeting of the RMMEP Steering Committee and Municipal Peer Review Team to review the responses prepared by Matrix Solutions Inc. (Matrix) as requested in your June 19, 2015 submission of municipal peer review comments from Guelph/Eramosa Township, the Township of Puslinch, the Town of Erin and the County of Wellington.

The attachments to this letter include:

- 1) Draft Agenda for the April 1, 2016 Technical Meeting
- 2) March 7, 2016 Matrix response to the Town of Erin Municipal Review Comments
- 3) March 4, 2016 Matrix response to the Township of Puslinch and Township of Guelph-Eramosa Municipal Review Comments
- 4) February 25, 2016 draft Terms of Reference and Work Plan for the City of Guelph and Guelph/Eramosa Township Water Quantity Risk Assessment and Risk Management Measures Evaluation Process

Over the past eight months, Matrix have engaged the consultants for the municipalities to ensure that information was delivered, questions were answered and clarifications were provided to complete the Guelph and Guelph/Eramosa Tier 3 WQRA (WQRA) to the best of everyone's knowledge. The attached responses have been prepared for Wellington Source Water Protection and their municipal partners to obtain agreement that the concerns raised on June 19, 2015 have been fully assessed by Matrix and that the information provided in the responses can be used to finalize the modelling and writing of the WQRA.

In keeping with the provincial guidance for water budget project peer review, once accepted, the municipal-comments and consultant responses will form part of the City of Guelph & Guelph/Eramosa Township Tier 3 Water Budget and Water Quantity Risk Assessment Peer Review Summary Report. The Ministry of Natural Resources & Forestry (MNRF) requires the submission of a completed Peer Review Summary Report prior to their acceptance of completed Water Budget documents for use in Assessment Reports and Source Protection Plans.

It is our expectation that, going forward from the April 1, 2016 meeting, the Steering Committee will be in a position to accept the Matrix responses, allowing Matrix to proceed with the Risk Assessment Scenarios and the update of the WQRA. It is anticipated that Matrix will circulate a revised WQRA to the Steering Committee and Municipal Peer Review Team in late April or early May 2016 for review of the model updates and Risk Assessment results at a Municipal Peer Review meeting in May 2016. Once reviewed, Matrix would submit a Final WQRA for peer reviewer sign-off in late May or early June 2016 that would be sent to the MNRF for their acceptance.

With respect to timing, the April 1, 2016 meeting will also provide an opportunity for the Steering Committee to provide comments on the proposed Terms or Reference and Work Plan to complete the WQRA, undertake the RMMEP and integrate water quantity policies into an updated Grand River Assessment Report and Grand River Source Protection Plan by December 31, 2017. Due to the complexity of the stakeholder mix involved in these projects, initial target dates have passed and there are concerns that the final deadline may be difficult to meet. These concerns will be discussed, and it is expected that dates can be set at the meeting to complete the WQRA and commence the RMMEP.

If you have any questions about the draft agenda, the technical attachments or the expectations for completing the WQRA and RMMEP projects, please feel free to contact the undersigned at (519) 621-2761 x2298 or by e-mail at <u>jetienne@grandriver.ca</u>.

Sincerely,

un A

James Etienne, P.Eng. Sr. Water Resource Engineer

Attach.

Cc: Mark Paoli – County of Wellington Ray Blackport – Blackport Hydrogeology Inc. Stan Denhoed – Harden Environmental Services Ltd. Jim Baxter, Dwight Smikle – R.J. Burnside & Associates Ltd. Martin Keller – Lake Erie Source Protection Region Dave Belanger, Peter Rider – City of Guelph Scott Bates, Lynne Milford – Ministry of Natural Resources & Forestry Kathryn Baker, Cynthia Doughty – Ministry of Environment & Climate Change Paul Chin, Patty Meyer – Matrix Solutions Inc. Matrix Solutions Inc.

MEMORANDUM

TO: James Etienne and Martin Keller, Grand River Conservation Authority

FROM: Paul Chin, Matrix Solutions Inc.

RE: City of Guelph and Township of Guelph/Eramosa Tier Three Risk Assessment – Response to Town of Erin Municipal Review Comments

DATE: March 7, 2016

1 INTRODUCTION

The Lake Erie Source Protection Region (LESPR) is undertaking a Tier Three Water Budget and Water Quantity Risk Assessment (Tier Three Assessment) for the municipal drinking water supplies of the City of Guelph, the village of Rockwood (Rockwood) and the community of Hamilton Drive (Hamilton Drive). Matrix Solutions Inc. (Matrix) was retained to complete the Tier Three Assessment and a municipal review team has been retained by the County of Wellington (Wellington) to review all technical documents prepared as part of this study.

This memo offers responses to the comments provided by Blackport Hydrogeology Inc. (Blackport) on behalf of the Town of Erin as part of their review of the draft Risk Assessment report (Matrix 2014) and the Work Plan for the Risk Management Measures Evaluation Process (RMMEP).

2 COMMENTS AND DISCUSSION

2.1 Water Quantity Risk Assessment

Matrix agrees with Blackport's general assessment of the draft Tier Three Assessment and the limited implications for the Town of Erin.

2.2 Water Quantity Risk Management Measures Evaluation Process Work Plan

Blackport generally agrees with the proposed work plan and raises a few questions for clarification. Responses to these questions are organized according to the headings in Blackport's review.

2.2.1 Task 1: Review of Identification of Drinking Water Quantity Threats

Blackport Comment 1

"it is important that whomever is undertaking the RMMEP is familiar with the existing Tier 3 assessment..."

Matrix Response 1

The Tier Three Assessment and the RMMEP are being conducted by Matrix. Matrix will update, but not duplicate work completed for the Tier Three Assessment.

2.2.2 Task 2: Where Required, Identify Percentage Impacts and Rank the Tier 3 Local Area Significant Threats

Blackport Comment 2a

"Have not some of the scenarios presented in Table 1 already been performed as part of the Tier 3 assessment (e.g. modelling pumping at the permitted rates)?"

Matrix Response 2a

Scenarios for the RMMEP will not duplicate the Tier Three Assessment scenarios, but will be variations to test the ability of Risk Management Measures to mitigate the water quantity risk (MOE 2009; TRCA 2013a). If updates to the water takings are required in Task 1, the Risk Assessment scenarios may be performed again to provide baselines for comparison with the Risk Management Measures scenarios (TRCA 2013a).

Blackport Comment 2b

"Realistic consumptive and non-consumptive use should be refined, where possible, for many of the scenarios in Table 1."

Matrix Response 2b

Matrix agrees with this comment. The consumptive use of water takings is accounted for in the Tier Three Assessment and will be incorporated into the RMMEP.

Blackport Comment 2c

"Is the use of the term "recharge" referring to recharge to the water supply aquifer (e.g. there is big difference between local recharge to an unconfined shallow aquifer and regional recharge to a deeper confined aquifer)".

Matrix Response 2c

The use of the term "recharge" refers to water that moves from the ground surface, through the unsaturated zone and reaches the saturated zone. The Tier Three Assessment did not predetermine whether recharge reaching the saturated zone provided water to the shallow or deeper aquifers. The Risk Assessment scenarios incorporated reductions in recharge (i.e., water reaching the saturated zone) due to future land use changes to determine the impact to municipal water supplies (Matrix 2014).

2.2.3 Task 3: Select Preliminary Risk Management Measures (RMMs) and Evaluate the Risk Management Measures

Blackport Comment 3

"It would appear that there are two components to this that should be explored together. The operational aspects are important, as purely from an operational risk perspective there may be

operational procedures to optimize the city-wide water system, while there may be Risk Management measures to aid in maintaining overall recharge to the aquifer system or decrease withdrawal from the aquifer system."

Matrix Response 3

Matrix agrees with this comment. These two components will be explored together as operational aspects (e.g., System Optimization) are considered Risk Management Measures and are listed in the Water Quality and Quantity Risk Management Measures Catalogue (TRCA 2013b)

2.2.4 Task 4: Prepare a "Draft Threats Management Strategy" to discuss with Municipalities and Stakeholders

Blackport Comment 4

"The key will be consultation throughout the previous tasks to ensure there is a reasonable consensus moving forward."

Matrix Response 4

Matrix agrees with this comment. The RMMEP is designed with a high level of consultation with stakeholders (TRCA 2013a).

2.3 Conclusions: Implication for the Town of Erin, and Recommendation

Matrix agrees with Blackport's general assessment that there are limited implications for the Town of Erin and agrees with the single recommendation: *"If measures are recommended for the RMMEP that could potentially impact land use or land use activities in the Town of Erin the Town should be consulted to assess the need and the implications."*

3 REFERENCES

- Ontario Ministry of the Environment (MOE) and Ministry of Natural Resources (MNR). 2009. Water Quantity Threats Ranking Scenarios Guide. Prepared for The Ontario Ministry of the Environment and The Ontario Ministry of Natural Resources. Breslau, Ontario. October 14, 2009. http://waterbudget.ca/threatsrankingguide
- Matrix Solutions Inc. (Matrix). 2014. City of Guelph and Communities of Rockwood and Hamilton Drive Tier Three Water Budget and Local Area Risk Assessment. Report prepared for Lake Erie Source Protection Region. Draft. July 2014.
- Toronto and Region Conservation (TRCA). 2013a. *Guide Water Quantity Risk Management Measures Evaluation Process.* Prepared for The use of Source Protection Committees in preparation of the Source Protection Plans under the Clean Water Act. Toronto, Ontario. January 2013.
- Toronto and Region Conservation (TRCA). 2013b. Water Quality and Quantity Risk Management Measures Catalogue. Version: 6.0. April 5, 2013. Accessed November 1, 2013. http://trcagauging.ca/RmmCatalogue/QuantityIndex.aspx.

Matrix Solutions Inc.

MEMORANDUM

- TO: James Etienne and Martin Keller, Grand River Conservation Authority
- FROM: Paul Chin, Patty Meyer, and Jeff Melchin, Matrix Solutions Inc.
- **RE:** City of Guelph and Township of Guelph/Eramosa Tier Three Risk Assessment Response to Municipal Review Comments
- **DATE:** March 4, 2016

1 INTRODUCTION

The Lake Erie Source Protection Region (LESPR) is undertaking a Tier Three Water Budget and Water Quantity Risk Assessment (Tier Three Assessment) for the municipal drinking water supplies of the City of Guelph, the village of Rockwood (Rockwood) and the community of Hamilton Drive (Hamilton Drive). Matrix Solutions Inc. (Matrix) was retained to complete the Tier Three Assessment and a municipal review team has been retained by the County of Wellington (Wellington) to review all technical documents prepared as part of this study.

This memo summarizes the comments provided by Harden Environmental Services Ltd. (Harden 2015; in Section 2) and R.J. Burnside and Associates Ltd. (Burnside 2015a; in Section 3) as part of their review of the draft Risk Assessment report (Matrix 2014), as well as responses to those comments by Matrix. Attachment A is provided at the end of this memo which summarizes the refinements made to the Tier Three groundwater model and the results of local calibration efforts based on newly provided data.

2 HARDEN – COMMENTS AND DISCUSSION

2.1 Harden Comment 1 (Eramosa River as a Groundwater Discharge Zone)

One of the tasks of the Tier 3 Study is to develop and calibrate surface and groundwater models to assess water budget components in the study area. Harden Environmental has recently been involved in a streamflow study in the Eden Mills area and determined that a significant volume of water is lost from the Eramosa River to the Goat Island/ Gasport aquifer in the reach between Indian Trail Road and the confluence of the Eramosa River and Blue Springs Creek. Depending on streamflow, the loss ranges from 100 to 500 L/s. This information was not available at the time of writing the Tier 3 Study but may have significant implications to the size and shape of Well Head Protection Areas in Wellington County, protective measures needed for the City of Guelph water supply and the assignment of risk level.

Based on our review of the reporting in the Tier 3 Study and additional information provided by Matrix on March 16, 2015, we conclude that the groundwater model predicts that this reach of the Eramosa River is mainly a groundwater discharge zone (minor recharge occurring near the

confluence of the Eramosa River and Blue Springs Creek) whereas our observations are that the Eramosa River is a significant losing stream (recharge zone) in this area.

2.1.1 Harden - Suggested Resolution for Comment 1 and 2

The City of Guelph water supply, specifically the Arkell Springs well field, is thus shown to be sensitive to changes to the Tier 3 Groundwater model in the Rockwood Area. Therefore, if the model is adjusted to;

a) account for the significant loss of water from the Eramosa River to the Gasport Aquifer (Eden Mills area), and

b) be refined to remove the Vinemount Aquitard from the area east of Rockwood

it may be that the "significant" risk level is removed.

Given the concern raised by the County of Wellington in regards to the 'significant risk level' assignment, it is our recommendation that model adjustments or sensitivity analysis that address these technical concerns be addressed before the 'significant' threat level is finally assigned to the Guelph Water Supply system.

2.1.2 Matrix Response 1

To address Harden Comment 1, Matrix reviewed the following reports and data:

- Arkell Adaptive Management Plan Annual Monitoring reports for 2011 to 2014 (Stantec 2012, 2013a, and 2015)
- Flowrate Data for Eramosa River compiled by Richard Lay, Millpond Conservation Association Inc. (2015)
- Monitoring Report to the MOECC from Harden Environmental re: Permit to Take Water 5410-8YQNXU (Eden Mills Millpond) dated March 28, 2014 with flow measurements and analyses for 2013 (Harden 2014).
- Eramosa River Blue Springs Creek Watershed Study Hydrogeology Component, Report prepared for the Grand River Conservation Authority (Stantec 1999)

Based on the flow rate observations by the Millpond Conservation Association, the potential impact of increased hydraulic connection between the Eramosa River and the Middle Gasport production aquifer was explored in this area of the groundwater flow model through a sensitivity analysis that involved an additional model scenario. The sensitivity scenario included increasing the horizontal (K_h) and vertical (K_v) hydraulic conductivity of the bedrock beneath the Eramosa River to $K_h = 8 \times 10^{-5}$ m/s ($K_v = 8 \times 10^{-6}$ m/s), between Rockwood and Wellington Road 29. These values are representative of the middle Gasport Formation. The model used for the 2014 draft Risk Assessment scenarios simulated fractured bedrock ($K_h = 3 \times 10^{-5}$ m/s; $K_v = 3 \times 10^{-6}$ m/s) underlying the Eramosa River down to the upper Gasport Formation ($K_h = 2 \times 10^{-6}$ m/s; $K_v = 2 \times 10^{-7}$ m/s).

The set-up of the scenario simulated for this sensitivity analysis was the same used for calibration of the model for the Tier Three Assessment: a steady-state model simulating long-term average climate (1960 to 2005) and land use and water taking conditions that existed in 2008 (the Tier Three study year). Calibration of Tier Three Assessment groundwater model was to 2008 water levels, and baseflow conditions.

These changes led to a lowering of hydraulic heads in the Gasport Formation beneath the river by up to 4.5 m near Rockwood, and 1 to 2 m near Eden Mills; and slightly increased groundwater discharge along this reach of the river. Table 1 shows the impact of the hydraulic conductivity changes on baseflow at the locations used to calibrate the Tier Three Assessment model. Baseflow in the Eramosa River at Wellington 29 was simulated to increase by 6.4 L/s due to the stronger connection with the Gasport Formation aquifer, while upstream, at Rockwood, baseflow was simulated to decrease by 4 L/s, due to the lowering of hydraulic heads in the Gasport in this area from the loss of hydraulic support down gradient. At the Water Survey of Canada gauge (Eramosa River above Guelph) baseflow was simulated to increase by 6.6 L/s or about the same as at Wellington 29, so there was minimal net groundwater discharge (+ 0.2 L/s) between the two stations under this revised sensitivity scenario.

Table 1	Impacts to Baseflow due to Changes in Bedrock Hydraulic Conductivity of the Eramosa
River betw	een Rockwood and Arkell

Baseflow Calibration Location	Baseflow - Calibrated 2014 Model (L/s)	Change in Baseflow Due to Increased Hydraulic Conductivity (L/s)	% Change
Eramosa River at Rockwood	792	-4.0	-1%
Eramosa River at Wellington Rd 29	1,440	6.4	0%
WSC Eramosa River above Guelph	1,520	6.6	0%

Additional effort was expended to try to get the model to simulate the loss of water from the Eramosa River to the aquifer at this location including adjusting the stage of the river and adjusting the representation of the Eden Mill Pond dam. Efforts, including the above noted hydraulic conductivity changes, were unsuccessful in enhancing the recharge from the Eramosa River to the aquifer between Indian Train Road and just downstream of the confluence of the East Branch at Eden Mills. Although the recharge at this location could not be discretely represented, it is our opinion that on the whole, the water budget of the subwatershed (and the entire Tier Three Assessment model) is defensible. The net discharge and recharge from the Eramosa River is well represented as evidenced by the calibration to baseflow targets as described in the Model Calibration Report (Appendix B of the draft Risk Assessment Report; Matrix 2014).

The Eramosa River – Blue Springs Creek Watershed Study (Stantec 1999) demonstrated that under low flow conditions in 1995 and 1996 the reach between Rockwood and Watson Road was a net discharge area: "Water table contours indicate significant discharge locations at Eden Mills and the confluence of the Eramosa River and Blue Springs Creek and along the Eramosa River;" and "The deeper water levels show the extensive movement of water towards what would appear to be a regional discharge area from Eden Mills and the lower part of Blue Springs Creek to the confluence of Torrance Creek, west of Arkell". These observations are also supported by recent data (Stantec 2012; 2013a; 2015) and match what the Tier Three Assessment model predicts: this reach of the Eramosa River is a regional discharge

area that gains 648 L/s between Rockwood and Wellington Road 29 (including the groundwater discharge to Blue Springs Creek).

Although the Eden Mills Millpond Association observations from recent years show that the Eramosa River is losing water seasonally somewhere upstream of Station 3 (Harden 2014), above the confluence with Blue Springs Creek, it is unclear where that water flows to and/or discharges. It could be that it discharges in the Eramosa River just downstream at the confluence with Blue Springs Creek, or in Blue Springs Creek east of the confluence with the Eramosa. This possibility precludes significant recharge of the deep bedrock aquifer occurring due to the observed streamflow losses at Eden Mills.

Historical field observations (Stantec 1999) show there are losing and gaining sections of the Eramosa River between Rockwood and the gauge at Watson Road. The Stantec (1999) report identifies the lower portion of the Eramosa River downstream of Eden Mills as a losing reach: "the portion of the Eramosa River downstream of Eden Mills as a losing reach: "the portion of the Eramosa River downstream of Los L/s in baseflow".

It is difficult to determine where along the Eramosa River groundwater is discharging and where it is recharging the underlying groundwater flow system. The data suggests the nature of the recharge and discharge varies seasonally and annually. Until detailed flow profiling of the Eramosa River above the Watson gauge to Rockwood occurs, it will be unclear how to interpret the Eden Mills data and where net gains and loss are occurring (Hugh Whiteley, pers. comm.).

The objectives of the Tier Three Risk Assessment are to assess the long-term sustainability of the source water resource on a water budget basis. Calibration of the groundwater flow model was done using historical baseflow conditions as observed at the various stations and gauges identified in the draft Risk Assessment report (Matrix 2014). For this area of the Eramosa River, the groundwater flow model was calibrated to baseflow conditions for the stations shown in Table 1. This calibration was reviewed by the peer review committee and found to be acceptable for the purposes of the Tier Three study.

Based on the analysis above, we believe the model is representative of the groundwater flow system in this area and suitable for simulating and making predictions on the long-term sustainability of the water supplies in the Guelph and Rockwood areas. To simulate the seasonal and local-scale variations in groundwater discharge and recharge conditions beneath the river would require additional field work and model calibration that are beyond the scope of this project. For these reasons, changes made to the bedrock underlying the Eramosa River were not carried through to the 2016 model update described in Attachment A.

2.2 Harden Comment 2 (Vinemount Formation as an Aquitard)

The follow-on to the statement (page viii [of the Risk Assessment Report; Matrix 2014]) that the Vinemount Aquitard is already a limiting factor for recharging the Gasport Aquifer and therefore a reduction in recharge has a minimal impact on municipal water levels is that in the areas where the Vinemount is absent, there may be direct recharge from ground surface to the Gasport Aquifer. The accurate identification of the extent of the Vinemount therefore becomes important as greater recharge to the aquifer reduces the size of the WHPA-Q1. This is particularly true for areas east and north of the City of Guelph. As discussed in Section 2.3.1 [of Matrix 2014], a large area east of Rockwood is described as being underlain by the Reformatory [Quarry] and Vinemount Aquitard. Figure 1, attached, shows known locations where the

Vinemount aquitard is absent. These locations are; TW3 (Test well for Town of Rockwood), MW15 (test well for Hidden Quarry) and several outcrops mapped by Telford.

2.2.1 Matrix Response 2

Based on the interpreted absence of the confining Vinemount Member of the Eramosa Formation near and east of Rockwood, the bedrock units in the area between the Eramosa River and Blue Springs Creek was re-interpreted to be the Upper Gasport and Goat Island formations. The hydraulic conductivity of these layers in the groundwater flow model was updated to reflect that of the modelled Upper Gasport unit and a more fractured Goat Island Formation. The vertical hydraulic conductivity value was increased to 2×10^{-7} m/s from 3 to 8×10^{-8} m/s. Additional hydrogeological information was provided by Harden for the area of Hidden Quarry (Harden 2012), located east of Rockwood. This information was also reviewed by Matrix and used to update the model. This update of the numerical model, along with other updates detailed herein, was incorporated into the transient calibration effort described in Attachment A.

2.3 Harden Comment 3 (Region of Waterloo and City of Guelph Overlap)

The Tier 3 Study only addresses the WHPA-Q1 for the City of Guelph and a two kilometer buffer with the watershed divide with the City of Cambridge portion of the Regional municipality of Waterloo Tier 3. We understand that the Cambridge portion of the RMOW Tier 3 is ranked as Low Risk, therefore, no policies need to be developed for the Township of Puslinch.

2.3.1 Harden-Suggested Resolution for Comment 3

The assignment of a "low risk" to the RMOW Tier 3 results in no special policies being required for the Township of Puslinch or the County of Wellington. No additional comment necessary.

The RMOW Tier 3 includes a significant portion of the Township of Puslinch and issues with Permits to Take Water outlined in Comment 6 also need to be addressed by the Region's Tier 3.

2.3.2 Matrix Response 3

We acknowledge this comment and refer the reviewers to the Region of Waterloo Tier Three Assessment study team for further discussion, as required.

2.4 Harden Comment 4a (Extent of WHPA-Q1 – PTTW 7043-74BL3K Nestlé Waters Canada)

Figure 6.8 of the CRA report (Test Pumping Investigation Supply Well TW3-80, December 2004) shows that after 72 hours of pumping at 700 igpm (4,576 m³/day vs 2,396 m³/day in the Tier 3 model) the drawdown from the well was estimated to be one metre at a location 200 metres north of County Road 34. The 2014 Matrix Solutions Inc. report (Figure 5.1) indicates a drawdown of five metres approximately 650 metres north of County Road 34. Also, the 2004 CRA report shows a drawdown of less than one metre during the pumping test at Mclean Road whereas the Matrix Solutions Figure 5.1 suggests a drawdown of 3-5 metres extending well south of Highway 401.

The Matrix Solutions Inc. Tier 3 drawdown in the Aberfoyle South area arises mainly from the combined water taking by Mini Lakes, Mill Creek Campground, Meadows of Aberfoyle, Concast, Royal Canin and Nestlé Waters Canada. The consumptive rates of these takings are 129, 164, 18, 200, 105 and 2396 m³/day respectively. Nestlé Waters Canada accounts for 80% of this taking.

Matrix Solutions confirms that the model predicts that the Nestlé Waters Canada permitted water taking alone is having a significant influence on the size and shape of the WHPA-Q1 in the Aberfoyle area. An analysis shows that without the Nestlé Waters Canada taking, the WHPA-Q1 would shift some 4400 metres northward.

2.4.1 Harden-Suggested Resolution for Comment 4a

Verification of the model predicted drawdown in the Aberfoyle area and southwards is difficult, however there are several studies available that may assist in confirming the predicted drawdown. These are;

- Recent well installations by Nestlé Waters Canada
- Groundwater monitoring by Royal Canin
- Groundwater monitoring by Meadows of Aberfoyle
- Gilmour Road site analysis by Nestlé Waters Canada

We recommend that these sources of information be reviewed for confirmation into the predicted and present drawdown from Nestlé Waters Canada. We recommend that this be undertaken prior to finalization of the Tier 3 Study.

2.4.2 Matrix Response 4a

Matrix requested, received and reviewed the following reports pertaining to sites in the vicinity of Nestlé Waters Canada (Nestlé) and Royal Canin:

- Nestlé Waters Canada, Test Pumping Investigation, Supply Well TW3-80 (CRA 2004)
- Nestlé Waters Canada, 2010 Annual Monitoring Report (CRA 2011)
- Nestlé Waters Canada, Test Pumping Investigation for TW2-11 (CRA 2012)
- Meadows of Aberfoyle 2014 Annual Monitoring Report, Permit to Take Water No. 5626-7WLQ3W - Banks Groundwater Engineering Ltd. (Banks 2015)
- Royal Canin Canada, Hydrogeological Assessment and Pumping Test, Highway 401 and County Road 46, Puslinch, Ontario SNC Lavalin Engineers and Constructors Inc. (SNC Lavalin 2005)

Estimates of hydraulic conductivity documented in these reports based on hydraulic test interpretations were compared to modelled values. Key borehole logs and information regarding high yield bedrock zones provided in these reports were reviewed to ensure the simulated wells in the model were extracting water from the correct modelled hydrostratigraphic units.

With the availability of pumping test data from Nestlé (CRA 2011), refinements were made to the groundwater flow model and local-scale calibration of the area was conducted to ensure adequate local,

well-field scale response to pumping. Details of this effort are found in Attachment A. The results of the local-scale calibration show that the model reasonably approximates drawdown experienced during pumping tests in this area and that the model is suitable for the Tier Three Assessment.

2.5 Harden Comment 4b (Extent of WHPA-Q1 – Model Predicted Drawdown in City of Guelph Wells)

In order for the WHPA-Q1 to extend south of Maltby Road, the combined drawdown of the Downey well, Burke well and Puslinch takings must be greater than two metres in the Gasport aquifer. None of the individual 25 year capture zones of the Burke or Downey Road wells extend to Maltby Road. We have not been able to find individual drawdown contours for the Burke Well or Downey Road Well, it is thus not possible to estimate drawdown from these individual wells. For example, the 2013 Stantec Environmental Assessment for the Burke Well has a hydrograph with pumping elevations within the Burke Well at approximately 317 m AMSL. The 2006 Guelph Puslinch Groundwater Protection Study (Golder Associates) has a model-projected pumping elevation for the Burke Well at approximately 313 m AMSL. The 2014 Matrix Solutions report suggests a pumping elevation of 325 m AMSL in the Burke well.

The draft response provided by Matrix Solutions addresses this issue by confirming that the 3-D model does under-estimate drawdown at the Burke Well by approximately 4.5 metres. However, the model reasonably predicts transient fluctuations in the well brought on by pumping changes and recharge changes. Matrix Solutions also confirms that the majority of water from the Burke Well is sourced from the Guelph Formation, not the Gasport Formation and thereby may have little influence on the potentiometric level in the Gasport Formation.

2.5.1 Harden-Suggested Resolution for Comment 4b

Review the model predicted drawdown in the Gasport Formation from the Burke Well and comment on the significance of under-predicting drawdown in regards to the size and shape of the WHPA-Q1. We recommend that this be undertaken prior to finalization of the Tier 3 Study.

2.5.2 Matrix Response 4b

We reviewed the following reports in response to Harden Comment 4b:

- Burke Water Station Class Environmental Assessment Final (Stantec 2013b)
- Final Report on the Guelph Waterworks Groundwater Monitoring System (Golder 2009)
- Guelph-Puslinch Groundwater Protection Study (Golder 2006)
- Burke Well Site testing by Lotowater (1998)

The Tier Three Assessment model simulated the water level in the Burke Well to be 324.2 m above sea level (asl) under the steady-state simulation (Scenario C; 2008 pumping conditions, long-term average climate) with the Burke Well pumping at 5,385 m³/d (62 L/s). This is 5 m higher than the average 2008 observed water level at the Burke Well of 319.2 m asl, and 4 m higher than the range of observed water levels in 2008 (317.9 to 320.4 m asl; Figure 2-4 of the Burke Environmental Assessment; Stantec 2013b).

The final report on the Guelph Groundwater Monitoring System (MW06 series; Golder 2009) has an observed water level for the Burke Well of 325.5 m asl (Figure 5; Golder 2009) but it is unclear what date this data represents. This observed data is closer to the model simulated water level for the Burke well (324.2 m asl).

The Burke observation well is located 10 m from the pumping well, and the model-simulated water level was also 324.2 m asl while the average observed level in 2008 was 327.3 m asl. The lowest water level elevation in the observation well was 325 m asl in 2008. At MW06-09 A, located about 1 km to the south east, the model-predicted water level in the Gasport Formation was 326 m asl while the observed ranged from 327 to 329.5 m in 2008. Thus the simulated water level in the Gasport Formation in this area was only 1 m less than the seasonal low of that year. Thus the model was judged as reasonably calibrated in the area south of the Burke Well.

As mentioned by Harden (2015), the Guelph-Puslinch Protection Study (Golder 2006) shows the simulated head in the Amabel around the Burke Well at about 310 m asl, but the observed head in the Amabel was approximately 330 m asl. Thus the Guelph-Puslinch model severely under predicted the aquifer heads by 20 m and was not considered well-calibrated in this area.

The testing of the Burke Well by Lotowater in 1998 shows that 95% of flow comes from the Guelph Formation and the rest from the Eramosa and Gasport Formations. Thus, the significance of pumping from the Burke Well on drawdown in the Gasport is interpreted to be limited.

The Model Calibration Report (Appendix B of the draft Risk Assessment Report; Matrix 2014), Section 3.4.2.1, discusses the differences between the observed head and model-calibrated head at the municipal wells. In summary, calibration of the Tier Three Assessment model focused on matching the transient response to stresses (pumping and climate) at the municipal wells. The calibration results for the Burke well are discussed specifically and shown on Fig. 3-8c of Appendix B. As there was excellent agreement between the pattern of observed and model-simulated water levels over a 9-year verification exercise, the calibration of the Tier Three Assessment model for the Burke Well and the surrounding area was assessed as defensible by the project team.

Given the above review, we believe that the model is well-calibrated for the purposes of the Tier Three Assessment and the estimation of the size and shape of the WHPA-Q1.

2.6 Harden Comment 4c (Extent of WHPA-Q1 – PTTW 8228-76XLE Meadows of Aberfoyle)

The current (since 2009) PTTW is 5626-7WLQ3W.

2.6.1 Harden-Suggested Resolution for Comment 4c

None required.

2.6.2 Matrix Response 4c

The permit number will be updated in the final report.

2.7 Harden Comment 4d (Extent of WHPA-Q1 – PTTW 02P-2064 Kraus Nurseries Ltd.)

Kraus Nurseries have holdings in Waterdown, Ontario and Mrs. Kraus confirmed that 02P-2064 is an old permit of hers but she does not own property in Puslinch, the permit is for her property in Waterdown. In addition, this is an expired permit.

2.7.1 Harden-Suggested Resolution for Comment 4d

Remove permit from Tier 3 Groundwater model and revise area of WHPA-Q1. We recommend that this be undertaken prior to finalization of the Tier 3 Study.

2.7.2 Matrix Response 4d

This permit will be removed from the groundwater flow model used to conduct the updated Risk Assessment. The WHPA-Q1 will be updated following finalization of refinements to the model based on the municipal review comments presented in this memo.

2.8 Harden Comment 4e (Extent of WHPA-Q1 – PTTW 99P-2132 Kats Okashimo Fish Farm)

There is no evidence that water has ever been taken through PTTW 99P-2132. The PTTW was not renewed in 2009. A site visit to the Kats Okashimo Fish Farm failed to find a fish farm at the location (now a Tarot Card reader) and the present tenant confirmed that fish farming has not been done for at least twelve years (nor is he aware if it ever occurred). As seen on Figure 5.1, the modeled water taking at the Kats Okashimo Fish Farm has a significant effect on drawdown beneath Puslinch Township. The effect, of removing this taking, on the size and shape of the WHPA-Q1 must be evaluated.

2.8.1 Harden-Suggested Resolution for Comment 4e

Remove permit from Tier 3 Groundwater model and revise area of WHPA-Q1. We recommend that this be undertaken prior to finalization of the Tier 3 Study.

2.8.2 Matrix Response 4e

This permit will be removed from the groundwater flow model used to conduct the updated Risk Assessment. The WHPA-Q1 will be updated following finalization of refinements to the model based on the municipal review comments presented in this memo.

2.9 Harden Comment 5 (Significant Risk Assignment to WHPA-Q1)

The combined WHPA-Q1 as shown on Figure 5.1 for all of the City of Guelph wells has been assigned a Significant Risk level. The significant risk level is assigned as a result of the high uncertainty that Arkell Well 1 can meet its allocated rate (page 133). The high uncertainty caused the assigned moderate Risk level to be elevated to Significant Risk level. The policy implications of this to the Township of Puslinch is that all existing water taking and future water takings become Significant Threats to the City of Guelph municipal wells. Therefore, permits to

take water such as those issued to Nestlé Waters Canada, ConCast, Mini Lakes, Royal Canin, Mill Creek Campground and all aggregate washing will be subject to any policies for Significant Threats developed under the Clean Water Act.

Arkell Well 1 obtains water from the overburden aquifer and a water quantity risk to the overburden aquifer does not necessarily represent a threat to wells completed in the Gasport Aquifer. Similarly, water taking from the Gasport Aquifer near Aberfoyle will not affect the safe drawdown of Arkell Well 1. This would allow for a moderate risk level for the remainder of the WHPA-Q1 and thus only future water taking will be subject to the new policies.

2.9.1 Harden-Suggested Resolution for Comment 5

It is understood that only one risk assignment is made for a well field. Since Arkell Well 1 has a significant risk level, the entire well field has a significant risk level. It is therefore important to consider all factors prior to the significant risk level assignment and adds further emphasis to Concerns 1 and 2.

It was discussed that 'gradational' policies would be considered based on a risk assessment after the RMMEP project is completed.

2.9.2 Matrix Response 5

Comment acknowledged. The draft Risk Assessment found that five municipal wells within the City of Guelph had drawdown that came within 1 m of safe water levels during the drought scenarios. These results suggest the assignment of an elevated water quantity risk level is warranted for the City of Guelph water supplies. The Risk Management Measures Evaluation Process (RMMEP) will determine the degree of influence of each threat on each municipal well. Source Protection Plans are able to incorporate water quantity policies that account for the influence and proximity of current and future threats to municipal wells.

2.10 Harden Comment 6 (Threats Ranking)

Any threats ranking of the Industrial threats identified in Puslinch Township on Figure 6.1 should consider the following;

The vast volume of water stored in the pit ponds near Aberfoyle are not considered in the model. There is an estimated 12,000,000 m³ of water stored in pit ponds south of Highway 401, let alone those north of Highway 401. This is several times greater than that stored in Puslinch Lake. The volume of water that is stored in gravel pits in Puslinch Township is several times greater than in the former sand and gravel aquifer. Therefore, permitted water taking from the ponds should be carefully evaluated before deeming them a significant threat to the City of Guelph water supply.

2.10.1 Harden-Suggested Resolution for Comment 6

This can be addressed through a sector by sector analysis of Permits in the Risk Management Measures Evaluation Process.

2.10.2 Matrix Response 6

These permitted surface water takings will be examined, as will all permitted takings within the WHPA-Q1, during the threats ranking portion of the RMMEP.

2.11 Harden Comment 7 (Water Quantity Risk Management Measures Evaluation Process List of Tasks)

We have reviewed the list of tasks and do not have any comment other than given above.

2.11.1 Matrix Response 7

Comment acknowledged.

3 BURNSIDE – COMMENTS AND DISCUSSION

3.1 Burnside Comment 1 (Surface Water Leakage into the Bedrock Aquifer)

Discussions that have been taking place as part of the review process have included Mr. Stan Denhoed representing the Township of Puslinch. Data available to Mr. Denhoed indicates that leakage to the aquifer from the Eramosa River in the vicinity of Eden Mills is orders of magnitude greater than that used in the model. Based on the noted sensitivity of the model to changes in other areas of the model and the proximity of this area to the City of Guelph, it is recommended that this update be undertaken to ensure that adequate representation of this documented interaction is included in the model. Leakage from the Eramosa River to the aquifer will likely add a significant volume of water to the aquifer thereby increasing aquifer recharge. This modification of several orders of magnitude of recharge will undoubtedly add volume to the aquifer and provide additional water to meet the current and planned demands.

3.1.1 Matrix Response 1

The observation of a loss of water from the Eramosa River was also identified by Harden (2015). See Section 2.1.2 above for Matrix's response to this technical issue.

3.2 Burnside Comment 2 (Expression of the Bedrock Valley on east side of Guelph)

Our review of the mapping of this feature indicates that there are undulations in the extent of the valley that seem to match the road network around which the data was developed. The undulations include areas where the valley is narrower and these constrictions likely act as restrictions on groundwater flow through the valley. Restrictions on groundwater flow will likely impact the amount of groundwater available in areas downstream (downgradient) of the restrictions. It is recommended that the interpolation for the extent of the bedrock valley be revisited to ensure that restrictions on extent are not being artificially introduced through the nature of the data itself.

3.2.1 Matrix Response 2

We reviewed the data and interpolation routine used to develop the bedrock surface for the model. The sparseness of data between the roads and the interpolation routine (Natural Neighbour) leads to the width of the bedrock valley north of Rockwood to potentially be overestimated in areas between the roads rather than underestimated (as presumed by the reviewers). The width of the interpreted valley is more accurate where there is a higher density of data (i.e., from domestic wells located along the roads). The addition of control points between high quality picks of the depth of bedrock along the interpreted thalweg serves to increase the continuity of the valley, and has a tendency to deepen the valley. If we were to use the available data without control points, the result would be a more irregular and less continuous bedrock valley that would underestimate the ability of the bedrock valley to transmit water.

The borehole logs intercepting the bedrock valley north of Rockwood were reviewed during the preparation for the 2014 draft Risk Assessment. At that time, the modelled hydraulic conductivity value representing the valley infill was increased from 1×10^{-8} m/s (representative of Port Stanley Till) to 3×10^{-5} m/s, representative of coarser grained sandy sediment. This change was included in the 2014 Tier Three Assessment model and led to an increase in the ability of the bedrock valley to transmit water.

Based on the above, we are confident that restrictions on the extent of the bedrock valley and its ability to transmit water have not been artificially introduced through our interpretation of the data.

3.3 Burnside Comment 3 (Eramosa Formation Aquitard)

We note that drilling at the TW2-02 site in Rockwood did encounter a dark brown limestone layer that was less than 10 m thick at the top of the bedrock. The layer was not petroliferous and as a result we have interpreted that the Vinemount member of the Eramosa Formation is not present at this location. The modelling team may wish to review the interpreted and modelled presence of the low hydraulic conductivity Eramosa Formation which has been extended to a considerable distance east of Rockwood in the report based on well logs that reported dark brown limestone.

Considering the fact the Eramosa Formation is interpreted to be an aquitard which impedes vertical groundwater flow in the carbonate aquifer, it may be inappropriate to extend this low hydraulic conductivity layer to the area of Rockwood. The Eramosa Formation in this area is interpreted to subcrop beneath the relatively thin and permeable overburden and outcrop in the Eramosa River valley where karst topography is documented. Testing that we have undertaken at Rockwood Well 4 as part of a process to obtain a PTTW indicates that the dark brown limestone bedrock identified as Eramosa Formation is significantly weathered, produces significant water and does not act as an aquitard. Our testing has indicated that pumping within the deep bedrock results in surficial responses, which are not expected within an aquitard. Based on our test results we believe that the area where the Eramosa formation is present at the bedrock surface should be given a higher hydraulic conductivity due to its weathered condition.

3.3.1 Matrix Response 3

The interpreted absence of the Vinemount Aquitard in the area east of Rockwood was also identified by Harden (2015). See Section 2.2 above for Matrix's response to this technical issue.

3.4 Burnside Comment 4 (Existing plus Committed Demands and Allocated Rates)

The allocated pumping rates used in the groundwater model for each well in Guelph/Eramosa are identified in Section 3.2.4 of the report. Guelph/Eramosa would like revised allocation rates based on an update to growth predictions since the 2011 Watson report. The updated demands were provided to Matrix at the meeting on March 13, 2015.

3.4.1 Matrix Response 4

Matrix has received the revised Allocated Rates for the Town of Rockwood (i.e., 2026 average day flow of 1,907 m^3 /day) and will use these estimates for the revised Risk Assessment.

3.5 Burnside Comment 5 (Safe Additional Available Drawdown)

Burnside has previously provided comment on the Safe Additional Available Drawdown (SAAD) calculations in the draft report. Based on the technical rules the SAAD is the difference between the average pumping water level and 1 m above the pump intake. In most water systems the average pumping water level is determined using electronically collected water level data. Whereas water levels used to calculate the water levels in the Guelph/Eramosa wells are based on once a day manual water levels. In the case of the Cross Creek Well there are only three pumping water levels measured during a year of operation because the well only runs for approximately six hours every second day. It is our opinion that this data does not provide an adequate basis on which to compute an average water level.

The lack of suitable pumping water level information prevents the proper calculation of an average pumping water level. As a result, an automatic water level recorder (AWLR) was recently installed in the Cross Creek Well. In lieu of this data, we have reviewed the water level data and estimated acceptable average water levels and safe additional available drawdown values for each well as outlined below in Table 1.

	Grade Elevation (m amsl)	(2) Pump Intake (m amsi)	Pump Intake (m bgs)	Top of Casing (m agl)	(1) Operating Low WL (m amsl)	Report Average Pumping Water Level (m masl)	Report SAAD (m amsi)	Guelph/ Eramosa SAAD (m amsl)
Cross Creek Well	351.3	302.7	48.6	0.8	317	320.2	16.6	13.3
Huntington Well	338.1	302.6	35.5	0.5	314	321.6	17.6	10.4
Rockwood Well 1	361	328.3	32.7	0.5	344	348.5	23	14.7
Rockwood Well 2	361	329.6	31.4	0.5	345	350.6	27	14.4
Rockwood Well 3	360.4	321.3	39.1	0.8	331	333.9	16.2	8.7
Rockwood Well 4	367	320	47	0.8	327	a	•	6.0
Guelph/Eramosa SAAD calculated (1) - (2) - 1 m; Well 4 estimated based on pumping test data.								

Table 1: Recommended Safe Additional Available Drawdown for Guelph/Eramosa Wells

3.5.1 Matrix Response 5

The safe additional available drawdown for all Hamilton Drive and Rockwood municipal wells will be updated and used for the Risk Assessment based on the information summarized in Table 1 as provided by Burnside (2015a).

3.6 Burnside Comment 6 (Rockwood Well 4)

A test well called TW2-02 was constructed as part of the Rockwood Water Supply Environmental Assessment (EA) in 2002. The water supply EA was completed in 2002 and the preferred solution was the phased addition of two new wells on the south side of Rockwood. Rockwood Well 3 was added in 2005. The TW2-02 site was identified as the other future municipal well site for Rockwood Well 4 with a capacity of 683 L/min. This site has been included in all of the previous models leading up to the present Tier 3 study. The site will be permitted as Rockwood Well 4 in 2015 and has not been included in this study.

Rockwood Well 4 was constructed 20 m from the TW2-02 site in December 2014. The new well was tested in January 2015 and has a capacity of approximately 910 L/min. A permit was applied for in May 2015. The pump house for the site will likely be constructed allowing connection of the well to the Rockwood system in 2016. The current version of the Tier 3 study should include Rockwood Well 4 at its proposed pumping rate of 910 L/min. This issue has been reviewed by the project team and we understand that the report will be revised to include Rockwood Well 4.

It is expected that the water demand will rotate between Rockwood Wells 1 and 2 (1,365 L/min), Rockwood Well 3 (910 L/min) and Rockwood Well 4 (910 L/min). We therefore recommend a distribution of the committed rate of 40% for Rockwood wells 1 and 2 combined and 30% each for Rockwood Wells 3 and 4. This change as well as likely changes related to future demands will likely require changes to the model.

3.6.1 Matrix Response 6

Rockwood Well 4 will be included in the groundwater flow model applied to simulate the Risk Assessment scenarios and appropriate details will be added to the relevant text, tables and figures of the Risk Assessment report and its appendices. The suggested distribution of the Committed increase in demand amongst the four municipal wells will be documented in the Risk Assessment report and will be applied in the Risk Assessment scenarios.

The groundwater flow model was refined around Rockwood Well 4 and a transient calibration was conducted for the area surrounding Well 4 using the details of a 72-hour constant rate pumping test summarized by Burnside (2015b). Details of this calibration are provided in Attachment A.

3.7 Burnside Comment 7 (Report Name)

The name of the report does not properly identify the Township of Guelph/Eramosa as a primary stakeholder in this study. Based on recent meeting we have been advised that the report name is to be modified.

3.7.1 Matrix Response 7

The report name will be updated to identify the Township of Guelph/Eramosa as having a municipal system being assess under the Tier Three framework. Any appropriate text will also be updated.

4 **REFERENCES**

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ATTACHMENT A

NUMERICAL MODEL UPDATES AND LOCAL CALIBRATION

1 INTRODUCTION

The municipal review team identified two areas within the Guelph/Guelph-Eramosa Tier Three Assessment groundwater model domain where new data made available might help to refine the previous interpretations and improve the model. As a result, local-scale calibration efforts were undertaken to refine hydrogeologic parameters in these areas. Focus was given to the areas surrounding two municipal wells (i.e., Rockwood Well 3 and 4) including the Hidden Quarry site east of Rockwood, and the area near the Nestlé Waters Canada site in Aberfoyle. This attachment summarizes the specific concerns identified by the municipal review team and documents the efforts carried out by Matrix to address those concerns.

2 NUMERICAL MODEL UPDATES NEAR ROCKWOOD

2.1 Concerns Identified by Municipal Review

Municipal reviewers have identified the following concerns related to the application of the numerical model near the Town of Rockwood:

- 1) Reviewers identified that Rockwood Well 4 should be included in the Tier Three Assessment (Section 3.6 above). The well was constructed in December 2014, tested in January 2015, and a permit to take water was applied for in May 2015. It is expected that the well will be connected to the Rockwood water supply system in 2016 (Burnside 2015a).
- 2) Reviewers suggested that the Tier Three Assessment may be overestimating the extent of the Vinemount aquitard in the area east of Rockwood and towards the Hidden Quarry site (Sections Error! Reference source not found. and Error! Reference source not found. above). Borehole logs from TW3 (test well for the Town of Rockwood), MW15 (test well for Hidden Quarry) and several outcrops mapped by Telford suggest that the Vinemont aquitard is absent.

2.2 Matrix Response

With the identification of Rockwood Well 4 as a water supply source to be considered in the Tier Three Assessment, and the interpretation that the Vinemount aquitard is absent in the area, refinements were made to the groundwater flow model to ensure representative local, well field-scale response to pumping. These refinements included:

- Addition of a boundary condition to represent Rockwood Well 4 as a pumping well
- Refinement of the finite element mesh surrounding Rockwood Well 4 and Bernardi Well 3 to capture the steep hydraulic gradients induced by pumping

• Changing the bedrock units between the Eramosa River and Blue Springs Creek in the area of Rockwood and Hidden Quarry to have the Upper Gasport (vertical hydraulic conductivity, $K_v = 2 \times 10^{-7}$ m/s) as the upper-most bedrock unit. Previously, K_v ranged from 3 to 8 × 10⁻⁸ m/s

Data and documents reviewed as part of this model update process included:

- The original characterization data for the Tier Three project including picks of the Vinemount Member and Eramosa Formation, and picks of "black rock" in water well and other logs
- Results of the 2008, 2009 and 2010 Ontario Geological Survey (OGS) drilling programs in the Orangeville–Fergus area of southwestern Ontario (Burt and Webb 2013)
- Town of Rockwood Town of Guelph/Eramosa, New Rockwood Well 4 Category 3 PTTW Application (Burnside 2015b)
- Rockwood Environmental Assessment, Hydrogeologic Report, Construction and Testing of TW3/02, Proposed Rockwood Well 3, Township of Guelph/Eramosa (Burnside 2002)
- Level I and II Hydrogeological Investigation, Hidden Quarry, Rockwood, Ontario (Harden 2012)

Matrix conducted local-scale transient calibration at Rockwood Well 4 and Bernardi Well 3 to ensure the simulated response at these wells was appropriate following the revised hydrostratigraphic representation. This calibration effort is discussed in the following sections.

2.2.1 Calibration to Rockwood Well 4 Constant Rate Pumping Test

Water level response data from a constant rate test conducted on Rockwood Well 4 in early 2015 (Burnside 2015b) was used to refine the calibration of the model in this area. The test took place over a period of 72 hours at a rate of 1,244 m³/day (Burnside 2015b). Twenty-six wells were monitored during the test and the observed drawdown from these wells were used as calibration targets. Special attention was given to calibrating drawdown in the immediate vicinity of Rockwood Well 4 (i.e., OW2D/I/S located 20 m northeast of Well 4), as well as drawdown at wells near the Hidden Quarry site (i.e., M2, M15I/III/III located approximately 1.1 km east of Well 4). The simulated results for other wells monitored during the pumping test were examined to ensure the model was not overestimating drawdown, but these results are not reported here for brevity.

Hydraulic conductivity values were refined during model calibration, and the values assigned were guided by the interpreted range of conductivity and transmissivity values for those hydrogeologic units as presented in Golder Associates (2011), Burnside (2015b; 2002) and Harden (2012). The final range of hydraulic conductivity values applied to each refined area during model calibration is presented in Table A1 along with those values derived from previous studies.

Unit	Hydraulic Conductivit Studies (n	y from Previous 1/s) ¹	Area in Numerical	Simulated Hydraulic Conductivity (m/s)	
	Min	Max	Iviouei	Min	Max
Middle	6		Rockwood Well 4	3×10^{-5}	4×10^{-4}
Gasport	2×10^{-5}	1 × 10 °	Bernardi Well 3	3 × 10 ⁻⁶	4×10^{-4}
Golder Associate	es 2011, Burnside 2015b: 2002, ar	d Harden 2012			

Table A1 Summary of Bedrock Hydraulic Conductivity Values near Rockwood

The observed and simulated drawdown and recovery curves for seven monitoring wells and Rockwood Well 4 are presented in Figures 1 through 8. We achieved an excellent fit to the observed data at Rockwood Well 4 (Figure 1). The remaining wells show a good match between observed and simulated data, especially for monitoring wells at located within the same bedrock units (Figure 2 and 3) and monitoring wells located at Hidden Quarry (Figures 5 through 8).

The discrepancy between simulated and observed drawdown occurring at monitoring well OW21 (Figure 4) and OW2S (Figure 5) where the model predicted 1 to 1.5 m less drawdown than observed may be due to the model slightly underestimating the interconnection between the deeper aquifer and shallow monitoring zones. Given the complex nature of the fractured rock environment, this level of calibration is considered acceptable.

These results suggest that the updated model appropriately represents Rockwood Well 4 and is suitable to assess drawdown due to increased pumping in the Risk Assessment.

A portion of the drawdown observed in Rockwood Well 4 is caused by non-linear well losses due to well inefficiencies. The groundwater model does not explicitly simulate non-linear well losses within the well itself and thus the amount of drawdown due to non-linear well losses has been added to the simulated drawdown. This permits simulated and observed drawdown to be compared. Non-linear well losses were estimated for Well 4 using step test data (Burnside 2015b) and using the calculation method summarized in Appendix E of the draft Risk Assessment Report (Matrix 2014).





Figure 2. Simulated Drawdown Response at OW2D, 20 m from Rockwood Well 4



Figure 3. Simulated Drawdown Response at OW2I, 20 m from Rockwood Well 4



Figure 5. Simulated Drawdown Response at Hidden Quarry - M2, 1.2 km from Rockwood Well 4



Figure 4. Simulated Drawdown Response at OW2S, 20 m from Rockwood Well 4



Figure 6. Simulated Drawdown Response at Hidden Quarry - M15I, 1.3 km from Rockwood Well 4



Figure 7. Simulated Drawdown Response at Hidden Quarry - M15II, 1.3 km from Rockwood Well 4



Figure 8. Simulated Drawdown Response at Hidden Quarry - M15III, 1.3 km from Rockwood Well 4

2.2.2 Calibration to Bernardi Well 3 Constant Rate Pumping Test

Calibration of the model in the area surrounding Bernardi Well 3 was completed in a similar manner as Rockwood Well 4. Observed drawdown data from a 72-hour constant rate (1,175 m³/day) test of Bernardi Well 3, conducted in May 2002 (Burnside 2002), was used to calibrate the numerical model. Nineteen wells were monitored during the test and used as calibration targets. Special attention was given to calibrating drawdown in the immediate vicinity of Well 3 (i.e., OW3D, 4D and 5D located 300 to 500 m north of Well 3), as well as drawdown in domestic wells (e.g., Perkes located 480 m southeast of Well 3 and Hilts located 680 m east of Well 3).

The final hydraulic conductivity values applied in the area of Bernardi Well 3 were guided by the interpreted range of hydraulic conductivity and transmissivity values for those hydrogeologic units, as presented in Golder Associates (2011), Burnside (2015b; 2002) and Harden (2012). Both simulated and previously applied values of hydraulic conductivity are summarized in Table A1.

The observed and simulated drawdown and recovery curves for Bernardi Well 3 and the monitoring wells are presented in Figures 9 through 14. These figures show an excellent match between observed and simulated drawdown suggesting that the numerical model is appropriate to assess drawdown at Bernardi Well 3 for the Risk Assessment. As with the constant rate test at Rockwood Well 4, drawdown due to non-linear well losses at Bernardi Well 3 were estimated and added to the simulated results.

The discrepancy between simulated and observed drawdown occurring at the Perkes domestic well is likely due to the presence of a highly conductive fracture system that transmits drawdown more easily from Bernardi Well 3. Although the model does not replicate the amount of drawdown due to this site-specific feature, the drawdown at the other wells of similar distances from Well 3 are replicated by the model. Given the complex nature of the fractured rock environment, this level of calibration is considered acceptable for the application of the model to conduct the Risk Assessment scenarios.



Figure 9. Simulated Drawdown Response at Bernardi Well 3



Figure 11. Simulated Drawdown Response at OW4D, located 500 m from Rockwood Well 3



Figure 10. Simulated Drawdown Response at OW3D, located 420 m from Rockwood Well 3



Figure 12. Simulated Drawdown Response at OW5D, located 300 m from Rockwood Well 3

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Figure 13. Simulated Drawdown Response at Perkes (Domestic Well), located 480 m from Rockwood Well 3



Figure 14. Simulated Drawdown Response at Hilts (Domestic Well), located 680 m from Rockwood Well 3

3 NUMERICAL MODEL UPDATES NEAR NESTLÉ WATERS CANADA

3.1 Issue Identified by Municipal Review

Municipal reviewers identified the following concern related to the numerical model near Nestlé in Aberfoyle:

1) Municipal reviewers have requested verification that the Tier Three numerical model is adequately representing drawdown in the vicinity of Nestlé PTTW 7043-74BL3K (Section 2.4 above).

3.2 Matrix Response

Additional data was made available to Matrix including data provided by Nestlé Canada, whose PTTW represents a notable water taking in this area. These data were used to refine the groundwater flow model to ensure adequate local, well field-scale response to pumping. These refinements included:

- Horizontal relocation of the well boundary condition representing Nestlé pumping well, TW3-80, using more precise coordinates than those previously provided by the PTTW database.
- Refinement of the vertical placement of the well boundary condition representing TW3-80 based on well maintenance details (i.e., liner installation depths and depths where the open bedrock interval was sealed; CRA 2004).
- Refinement of the finite element mesh surrounding TW3-80 to capture the steep hydraulic gradients that will be induced by pumping.

New documents reviewed as part of this process included:

- Nestlé Waters Canada, Test Pumping Investigation, Supply Well TW3-80 (CRA 2004)
- Nestlé Waters Canada, 2010 Annual Monitoring Report (CRA 2011)
- Nestlé Waters Canada, Test Pumping Investigation for TW2-11 (CRA 2012)
- Meadows of Aberfoyle 2014 Annual Monitoring Report, Permit to Take Water No. 5626-7WLQ3W - Banks Groundwater Engineering Ltd. (Banks 2015)
- Royal Canin Canada, Hydrogeological Assessment and Pumping Test, Highway 401 and County Road 46, Puslinch, Ontario SNC Lavalin Engineers and Constructors Inc. (SNC Lavalin 2005)

Matrix conducted local-scale, transient calibration of the groundwater model around TW3-80 to ensure the model is appropriately responding to pumping in this area. This calibration effort is discussed in the following section.

3.2.1 Calibration to TW3-80 Constant Rate Pumping Test

A 40-day constant rate pumping test was conducted on TW3-80 at a rate of 3,542 m³/day from August to October 2010 (CRA 2011), and observed water levels in monitoring wells were used to calibrate the Tier Three Assessment model near the Nestlé Aberfoyle plant. Other constant rate pumping test data at the site were also reviewed (i.e., 3-day pumping test [CRA 2004] and 11-day test [CRA 2012]); however, the 40-day test was selected for model calibration as the long duration ensures a more complete development of the area of influence of the pumping well.

The observed 40-day drawdown cone based on monitoring water level data from bedrock wells completed within the reported "Amabel Formation" was used as a calibration target. Focus was given to calibrating drawdown centrally at TW3-80 and non-linear well losses were taken into account. The final hydraulic conductivity values applied in the area of Nestlé were guided by the range of interpreted hydraulic conductivity values for hydrogeologic units presented in Golder Associates (2011), CRA (2011; 2004) and SNC Lavalin (2005). Both simulated and field-derived values of hydraulic conductivity are summarized in Table A2.

Table A2	Summary of Bedrock Hydra	ulic Conductivity Values near Aberfoyle
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Unit	Hydraulic Previou	Conductivity from Is Studies (m/s) ¹	Area in Numerical	Simulated Hydraulic Conductivity (m/s)		
	Min	Max	Ividei	Min	Max	
Goat Island	9 × 10 ⁻⁸	4×10^{-4}	Nestlé / Royal Canin	5 × 10 ⁻⁶	2 × 10 ⁻⁴	
¹ CRA 2011; 2004	and SNC Lavalin 200)5.	· · · · · · · · · · · · · · · · · · ·			

The observed and simulated areal distribution of drawdown for the 40-day test at TW3-80 shows a good match between the observed (12.9 m) and simulated (13.7 m) drawdown at TW3-80 with non-linear well losses considered. With a difference of 0.8 m, the model slightly over predicts drawdown at the well, but the areal extent of the drawdown cone and the amount of drawdown radially away from TW3-80 is slightly under-predicted. In order to match the observed drawdown exactly, an increase in the complexity of zone of hydraulic conductivity is necessary in this fractured rock environment. As this is beyond the scope of the Tier Three Assessment, Matrix is satisfied that the calibration of the model in

this area is suitable and the model is considered appropriate for evaluation of the Risk Assessment scenarios.

4 SUMMARY

The Tier Three groundwater flow model was refined near the Town of Rockwood and near the operations of Nestlé in Aberfoyle. Water level response data from three constant rate pumping tests were used to improve transient model calibration near Rockwood Well 4 and Bernardi Well 3, as well as TW3-80 at Nestlé. These refinements have increased the confidence in the groundwater flow model in their respective areas and will increase the confidence in the Risk Assessment scenario results and the delineation of the WHPA-Q1, -Q2 and Water Quantity Vulnerable Areas.

GRAND RIVER CONSERVATION AUTHORITY

MEMORANDUM

TO: FROM:	Kyle Jame Regio	Davis, W s Etienno on (LESP	elling e, Lak R)	ton Source Water a Erie Source Pro	ection	DATE: FILE:	25 February 2016	
CC:	Martin Keller, Township of Puslinch, Township of Guelph-Eramosa, Town of Erin, County of Wellington, City of Guelph, MNRF, MOECC, Matrix Solutions Inc.							
RE:	Grano Prote	d River A ction Pla	ssess n Upo	sment Report and date	Sour	ce		
REMARKS:		Urgent	\boxtimes	For your review		Reply ASA		Please Comment

At a meeting to discuss the start-up of the Guelph/Guelph-Eramosa Risk Management Measures Evaluation Process (RMMEP), the project steering committee agreed that the June 19, 2015, Wellington Source Water Protection municipal peer review comments could be addressed in a revision of the Guelph/Guelph-Eramosa WQRA and that Matrix Solutions Inc. would work with the Townships of Guelph-Eramosa and Puslinch and the Town of Erin to produce the most up to date refinements of the WHPA-Q1 for sign-off of the WQRA. It was also agreed that Matrix would develop a Terms of Reference for the RMMEP which would also include a timetable, with input from the LESPR, on a stakeholder input process to review water quantity policy development for the Grand River Source Protection Plan.

In his approval letter of the Grand River Source Protection Plan from November 25, 2015, Minister Glen Murray included the following statement:

It is my understanding that the Tier 3 water budgets and related water quantity policy development are currently underway. I encourage you to complete this work as soon as possible and I look forward to receiving an amended plan as soon as possible once this work is completed, and no later than December 31, 2017.

The deadline of end of 2017 for the submission of an updated Assessment Report and Grand River Source Protection Plan has been incorporated into the process and timeline outlined below.

GRAND RIVER ASSESSMENT REPORT AND SOURCE PROTECTION PLAN UPDATE

The completion of the RMMEP, specifically the Threats Management Strategy, will provide options on how to address the significant water quantity drinking water threats. This will be the basis for the development of the water quantity policies.

A project team is proposed to be responsible for water quantity policy development. The aim is to have all municipalities who are directly affected by the policies being represented on the project team, together with Lake Erie Region staff. A broader stakeholder group comprised of neighbouring municipalities and representatives from other sectors such as agriculture, industry, business, development, and aggregate will have opportunities to comment at major milestones as part of the RMMEP and policy development process. On a regular basis work in progress (e.g., RMMEP, Threats Assessment Strategy, policy development) is presented to the Lake Erie Region Source Protection Committee who is responsible for the updates to the Grand River Assessment Report and Source Protection Plan.

The following draft process and timeline aims to outline the major milestones and parties involved in the process.

Task	Timeline
Introduction of broader stakeholder group (e.g., industry, aggregate, agriculture, developers) to RMMEP and policy development process. Opportunity to provide input into RMM scenarios (meeting #6)	July/August 2016
Stakeholder group input into Draft Threats Management Strategy (workshop #12 and meeting #13)	January/February 2017
RMMEP write up of updated Grand River Assessment Report (GRCA)	January and February 2017
Presentation of Draft Threats Management Strategy and updated Grand River Assessment Report to Lake Erie Source Protection Committee	March 2, 2017
Development of first draft water quantity policies (project team)	March/April 2017
Stakeholder group input into first draft water quantity policies	May 2017
Lake Erie Region Source Protection Committee considers first draft water quantity policies	June 1, 2017
Refinements of draft water quantity policies (project team)	June – August 2017
Stakeholder group input into revised water quantity policies	August 2017
Lake Erie Region Source Protection Committee considers revised draft water quantity policies	September 7, 2017
Finalisation of water quantity policies (project team)	September 2017
Lake Erie Region Source Protection Committee considers updated Grand River Assessment Report and Source Protection Plan and releases documents for formal public consultation	October 5, 2017
Formal public consultation (45 days). Public meetings proposed in City of Guelph and Guelph Eramosa and Puslinch Townships	October 10 to November 24, 2017
Lake Erie Region Source Protection Committee considers comments from public consultation process and releases final updated Grand River Assessment Report and Source Protection Plan to Grand River Source Protection Authority.	December 7, 2017
Grand River Source Protection Authority receives Updated Grand River Assessment Report and Source Protection Plan and releases documents for submission, together with any comments.	December 15, 2017
Submission of Updated Grand River Assessment Report and Source Protection Plan to MOECC.	December 31, 2017



Guelph/Guelph-Eramosa Tier 3 WQRA and RMMEP Municipal Peer Review Meeting

April 1, 2016, 10:00am to noon GRCA Head Office (400 Clyde Road, Cambridge)

Agenda

Meeting Objectives:

- Review Matrix responses to June 19, 2015 municipal peer review comments on the draft Tier 3 Water Quantity Risk Assessment (WQRA) report.
- Provide Matrix with direction to complete the WQRA.
- Review Terms of Reference for the Risk Management Measures Evaluation Process (RMMEP).
- Review proposed timing for RMMEP and water quantity policy amendments to the Grand River Source Protection Plan.
- Schedule meetings for finalizing the WQRA and commencing the RMMEP.

10:00 to 10:05	Welcome and Introductions	J. Etienne
10:05 to 11:00	 Responses to Municipal Peer Review Comments Town of Erin Township of Puslinch Township of Guelph-Eramosa 	P. Chin
11:00 to 11:45	Review Terms of Reference for the RMMEPRMMEP ScheduleWater Quantity Policy Development Schedule	P. Chin M. Keller
11:45 to 11:55	Upcoming meetings WQRA Sign-off RMMEP Start-up 	P. Chin J. Etienne
11:55 to 12:00	Next Steps	J. Etienne


























Puslinch Township Municipal (Harden) Review Response 1 Matrix reviewed various reports: Eramosa River - Blue Springs Creek Watershed Hydrogeology Component (Stantec 1999) Arkell Adaptive Management Reports (Stantec 2012, 2013a, 2015) Millpond Flowrate data (Harden 2014; Millpond Conservation Association Inc. 2015) - Sensitivity analysis with increased hydraulic connection between Eramosa and Middle Gasport Result was slightly increased GW discharge near Eden Mills and lower heads in Gasport Slightly decreased GW discharge upstream at Rockwood - Also adjusted river stage and representation of Eden Mill Pond Dam Result was no increased recharge in this area DRAFT FOR DISCUSSION ONLY 01/04/2016



Table 1 Impacts to Baseflow d River between Rockwood and Ark	ue to Changes in Be ell	drock Hydraulic Conduct	ivity of the Eran	nosa
Baseflow Calibration Location	Baseflow - Calibrated 2014 Model (L/s)	Change in Baseflow Due to Increased Hydraulic Conductivity {L/5}	% Change	
Eramosa River at Rockwood	792	-4.0	-1%	
Eramosa River at Wellington Rd 29	1,440	6.4	0%	
WSC Eramosa River above Guelph	1,520	6.6	0%	





















usiinch	Towns	hip Muni	cipal (Hard	en) Revi	iew		
Respons	<u>e 4a</u>						
– Updat	es to Tier	3 model incl	ude:				
1) LO	cation of Ne	estle well					
2) Ve	2) Vertical position of well						
3) Re hy	finement of draulic grad	f numerical me lients	esh surrounding T\	W3-80 to cap	oture steep		
4) Re	finement of Summary of Be	f K values appl	ied in the Goat Isla	and unit erfoyle			
4) Re Table A2	finement of Summary of Bea Hydraulic Bravious	f K values appl drock Hydraulic Cor Conductivity from	ied in the Goat Isla nductivity Values near Ab Area in Numerical	and unit erfoyle Simulated Conduct	d Hydraulic vity (m/s)		
4) Re Table A2 Unit	finement of Summary of Be Hydraulic Previous Min	f K values appl drock Hydraulic Cor Conductivity from s Studies (m/s) ¹ Max	ied in the Goat Isla nductivity Values near Ab Area in Numerical Model	and unit erfoyle Conducti Min	d Hydraulic ivity (m/s) Max		
4) Re Table A2 Unit Goat Island ⁴ CRA 2011; 2004	finement of Summary of Ber Hydraulic Previous Min 9 × 10 ⁻³ and SNC Lavalin 2005	f K values appl drock Hydraulic Con Conductivity from s Studies (m/s) ¹ Max 4 × 10 ⁻⁴	ied in the Goat Isla nductivity Values near Ab Area in Numerical Model Nestlé / Royal <u>Canin</u>	erfoyle Simulated Conducti Min 5 × 10 ⁻⁵	d Hydraulic ivitγ (m/s) Max 2 × 10 ⁻⁴		































tomatic W ues for eac	L record	ler data were es	a was i	review	ed and n	ew aver	age Wl	s and SA
Table 1: Reco			sundu	ed		0.1.1.1.5.		
	Grade Grade Elevation (m amsi)	(2) Pump Intake (m amsi)	Pump Intake (m bgs)	Top of Casing (m agl))rawdowπ for (1) Operating Low WL (m amsi)	Gueiph/Er. Report Average Pumping Water Level (m mesi)	Report SAAD (m amsi)	Guelph/ Eramosa SAAD (m amsi)
Cross Creek Well	351.3	3027	48.6	0.8	317	320.2	16.6	13.3
Huntington Well	338 1	302.6	35.5	0,5	314	321 6	17.6	10.4
Rockwood Well 1	361	328.3	327	05	344	348.5	23	14.7
Rockwood Well 2	361	329.6	31.4	0.5	345	350.6	27	14.4
Rockwood Well 3	360.4	321.3	39.1	0.8	331	333,9	16.2	8.7
Rockwood Well 4	367	320	47	0.8	327		-	6.0
Guelph Eramosa :	SAAD calculat	ed (1) - (2) -	1 m, Well 4	estimated	based on pumpin	g test data		
Rockwood Well 1 Rockwood Well 2 Rockwood Well 3 Rockwood Well 4 Guelph:Eromosa 1 Onse 5 AD values	361 360.4 367 SAAD calcutat	328.3 329.6 321.3 320 ed (1) - (2) -	327 314 391 47 1 m. Well 4	05 0.5 0.8 0.8 testimated	344 345 331 327 based on pumpin	348.5 350.6 333.9 9 test data unicipa	23 27 16.2 -	will k











25/05/2016





















Grand River Assessment and Source Protection P	t Report Plan Update	e
Task	Timeline	1
Introduction of broader stakeholder group (e _s g _s , industry, aggregate, agriculture, developers) to RMMEP and policy development process. Opportunity to provide input into RMM scenarios (meeting #6)	July/August 2016	
Stakeholder group input into Draft Threats Management Strategy (workshop #12 and meeting #13)	January/February 2017	
RMMEP write up of updated Grand River Assessment Report (GRCA)	January and February 2017	-
Presentation of Draft Threats Management Strategy and updated Grand River Assessment Report to Lake Erie Source Protection Committee	March 2, 2017	
Development of first draft water quantity policies (project team)	March/April 2017	
Stakeholder group input into first draft water quantity policies	May 2017	
Lake Erie Region Source Protection Committee considers first draft water quantity policies	June 1, 2017	
Refinements of draft water quantity policies (project team)	June – August 2017	
Stakeholder group input into revised water quantity policies	August 2017	

Grand River Assessment Report and Source Protection Plan Update

Task	Timeline
Lake Erie Region Source Protection Committee considers	September 7, 2017
revised draft water quantity policies	
Finalisation of water quantity policies (project team)	September 2017
Lake Erie Region Source Protection Committee considers	October 5, 2017
updated Grand River Assessment Report and Source Protection	
Plan and releases documents for formal public consultation	
Formal public consultation (45 days). Public meetings proposed	October 10 to November 24,
in City of Guelph and Guelph Eramosa and Puslinch Townships	2017
Lake Erie Region Source Protection Committee considers	December 7, 2017
comments from public consultation process and releases final	
updated Grand River Assessment Report and Source Protection	
Plan to Grand River Source Protection Authority.	
Grand River Source Protection Authority receives Updated	December 15, 2017
Grand River Assessment Report and Source Protection Plan and	
releases documents for submission, together with any	
comments.	
Submission of Updated Grand River Assessment Report and	December 31, 2017
Source Protection Plan to MOECC.	· · · · · · · · · · · · · · · · · · ·





Guelph/Guelph-Eramosa Tier 3 WQRA and RMMEP Municipal Peer Review Meeting

Friday April 1, 2016

Meeting Notes

Attendees: J. Etienne and M. Keller – Grand River Conservation Authority

D. Belanger and P. Rider – City of Guelph

- J. Baxter and D. Smikle R.J. Burnside (for Guelph-Eramosa Township)
- A. Salis Wellington County
- K. Davis Wellington Source Water Protection
- R. Blackport Blackport Hydrogeology (for Town of Erin)
- S. Denhoed Harden Environmental Services (for Puslinch Township)
- K. Baker and C. Doughty Ministry of the Environment & Climate Change
- S. Bates Ministry of Natural Resources & Forestry
- P. Chin and P. Meyer Matrix Solutions

1. Welcome and Introductions

J. Etienne introduced the meeting participants and reviewed the meeting objectives:

- Review Matrix responses to June 19, 2015 municipal peer review comments on the draft Tier 3 Water Quantity Risk Assessment (WQRA) report.
- Provide Matrix with direction to complete the WQRA.
- Review Terms of Reference for the Risk Management Measures Evaluation Process (RMMEP).
- Review proposed timing for RMMEP and water quantity policy amendments to the Grand River Source Protection Plan.
- Schedule meetings for finalizing the WQRA and commencing the RMMEP.

2. Responses to Municipal Peer Review Comments

P. Chin presented explanations of the Matrix Solutions responses to the municipal peer review comments submitted by Wellington Source Water Protection (WSWP) on June 19, 2015. Comments highlighted in grey in the following tables represent comments of concern identified by Harden Environmental Services Inc. and R.J. Burnside & Associates Ltd. that remain of significant concern following the meeting.

Guelph/Guelph-Eramosa Tier 3 WQRA and RMMEP Municipal Peer Review Meeting Meeting Notes – April 1, 2016

No.	Matrix Response	Consultant Response	
1	Matrix is completing both the Tier 3 Assessment and the RMMEP.	Comment addressed	
2a	There will not be duplication of Tier 3 Assessment scenarios.	Comment addressed	
2b	Matrix agrees with this comment.	Comment addressed	
2c	'Recharge' refers to water that moves from ground surface.	Comment addressed	
3	Matrix agrees with this comment.	Comment addressed	
4	Matrix agrees with this comment.	Comment addressed	

Table 2: Puslinch Township Comments, Harden Environmental Services

No.	Matrix Response	Harden Concern	Consultant Response
1	Previous conceptualization maintained.	Additional baseflow analysis in Eden Mills identified as data gap.	Comment unresolved
2	Bedrock units in area were re-interp formations based on new information	No further comment	
3	Tier 3 models are consistent betwee and ROW/Cambridge Tier 3.	No further comment	
4a	Conducted local-scale calibration of test data to ensure representative lo pumping.	No further comment	
4b	Given the review, the model is cons purposes of the Tier 3 and estimation	No further comment	
4c	PTTW for Meadows of Aberfoyle wi	No further comment	
4d	Kraus Nurseries PTTW removed fro	No further comment	
4e	Kats Okashimo Fish Farm PTTW re	emoved from the numerical model.	No further comment
5	5 municipal wells had drawdown that came within 1 m of safe water level in drought scenarios, suggesting a warranted elevated water quantity risk level for the City of Guelph water supplies.	Harden suggests it is important to consider all factors prior to finalizing Significant Risk Level assignment and emphasizes Comment 1 and 2.	Comment unresolved
6	These permitted SW takings will be ranking portion of the RMMEP.	examined during the threats	No further comment
7	Matrix agrees with this comment.		No further comment

Table 3: Guelph-Eramosa Township Comments, R.J. Burnside & Associates

Guelph/Guelph-Eramosa Tier 3 WQRA and RMMEP Municipal Peer Review Meeting Meeting Notes – April 1, 2016

No.	Matrix Response	Burnside Concern	Consultant Response
1	Previous conceptualization maintained.	Additional baseflow analysis in Eden Mills identified as data gap.	Comment unresolved
2	Matrix is confident with current conceptualization of bedrock valley.	Expression of bedrock valley east of Guelph maybe biased by interpolation of data.	Comment unresolved
3	Bedrock units in area were re- interpreted as Gasport and Goat Island formations based on new information provided.	The calibration of Wells 3 & 4 may indicate the hydraulic conductivity of shallow bedrock needs to be increased.	Comment unresolved
4	New rates have been received (20 and will be used in the revised Risk	No further comment	
5	SAAD values for Hamilton Drive a be updated in WQRA based on Tab	No further comment	
6	Well 4 will be added to the Tier 3 documentation will be updated.	No further comment	
7	Report name will be updated, as we	II as appropriate text.	No further comment

In discussion with the municipal consultants regarding their outstanding concerns regarding Eramosa River water loss in Eden Mills, the interpretation of the bedrock valley east of Rockwood, the drawdown between Guelph and Aberfoyle north of the Nestle water taking and the triggering of the Significant risk level, J. Etienne explained that the municipal peer review process allows for the amendment of the draft document to include new information and reassessment of model results. All municipal peer review comments and responses will be documented. J.Etienne noted, that per provincial peer review guidance documentation, any outstanding differences between comments and responses will be addressed as scientifically defensible or as opportunities for update in future work through the filling of data gaps. The municipal consultants, WSWP and the County all expressed concern that the outstanding concerns were unresolved.

With respect to the process and timing to finalize the risk level or WHPA-Q1 boundaries, K. Baker advised that the MOECC are finalizing their formal response to WSWP to address these questions. K. Baker also indicated that given the time and effort to date, the bar would be quite high for new data to trigger a change in the model during the RMMEP. The group also discussed the process of completing the peer review process and S. Bates confirmed that the term "sign-off" meant the peer reviewers were satisfied that their comments had been received, responded to and integrated into the Tier 3 Water Budget and Peer Review documentation. With respect to the municipal consultant peer review, it was not expected that "sign-off" would require formal Council approvals of the Tier 3 documentation. Finalization of the Guelph/Guelph-Eramosa WQRA with municipal peer review amendments proposed by the Townships of Puslinch and Guelph-Eramosa and the Town of Erin will include a final presentation to and sign-off by the Provincial Peer Review Team (D. Rudolph, H. Whiteley and T. Lottimer).

3. Review Terms of Reference for the RMMEP

Guelph/Guelph-Eramosa Tier 3 WQRA and RMMEP Municipal Peer Review Meeting Meeting Notes – April 1, 2016

The WSWP have expressed concerns about the ability to achieve completion of the WQRA, RMMEP and water quantity policies for the finalization of the amended Grand River Source Water Protection Plan by December 31, 2017, as requested by the MOECC. The MOECC will address this concern in their formal response to the WSWP. K. Baker suggested that the Province would like to maintain the December 31, 2017 target deadline to encourage all parties to use the best available time management approaches to keep the proposed project completion on time as opposed to setting new a deadline right away.

A. Salis noted that Wellington County stressed the importance that accurate data be collected and used, the final WQRA be technically defensible and that the WHPA-Q1 should not be "set in stone" if significant new information became available.

M. Keller added that RMMEP policy development within the WHPA-Q1 would focus on management of quantity rather than development constraint.

4. Upcoming Meetings and Activities

P. Chin proposed a list of due dates for completion of the WQRA and commencement of the RMMEP:

- April 30th WSWP provides comments on the March 4th and 7th response memos
- May 15th Matrix circulates the draft Amended WQRA
- May 31st Joint Municipal and Provincial Peer Review meeting
- May 31st RMMEP Kick-Off
- June 15th Matrix receives comments on the draft Amended WQRA
- June 30th Matrix circulates final Guelph/Guelph-Eramosa WQRA
- July 15th Peer Reviewer sign-off on Guelph/Guelph-Eramosa WQRA
- July 31st LESPR submits Peer Review Summary Report to MNRF

K. Davis and A. Salis indicated that they could not commit to a timeline during the meeting.

M. Keller confirmed that the policy leads would be the respective municipalities (ie Guelph for their jurisdiction and the Wellington County municipalities for their jurisdiction). M. Keller also indicated that the WQRA, RMMEP and policies would eventually go to the Lake Erie Source Protection Committee for review and approval.

5. Next Steps

J. Etienne will circulate a Doodle to schedule upcoming meetings. P. Chin will provide a redacted copy of the Powerpoint slides for circulation to the meeting participants. J. Etienne will prepare summary notes from the meeting for circulation to the meeting participants.

Ministry of the Environment and Climate Change

Source Protection Programs Branch 14th Floor 40 St. Clair Ave. West Toronto ON M4V 1M2

April 7, 2016

Ministère de l'Environnement et de l'Action en matière de changement climatique

Direction des programmes de protection des sources 14^e étage 40, avenue St. Clair Ouest Toronto (Ontario) M4V 1M2



Kyle Davis Risk Management Official Wellington Source Water Protection 7444 Wellington Rd 21 Elora, ON N0B 1S0

Dear Mr. Davis:

Thank you for your emails of February 19, 2016 and March 14, 2016 requesting clarity from the Province on the municipal consultation process for the Guelph/Guelph-Eramosa Tier 3 Local Area Risk Assessment (Tier 3). Specifically, you are seeking clarity around the role of municipalities in the review of the Tier 3 and Risk Management Measure Process (RMMEP) and have expressed concern that the Minister's expected completion date of December 31, 2017 does not allow enough time for fulsome municipal consultation.

The County of Wellington (Wellington) municipalities located within a Tier 3 impacted area have membership on the Tier 3 steering committee. Through their participation, the Wellington municipalities have had the opportunity to provide comment on the Tier 3 technical work to ensure that the municipality's local water resource knowledge is captured. The expectation is that the Lake Erie Source Protection Region (LESPR), which is leading the Tier 3 Peer Review and consultation process, will consider the concerns raised by the Wellington municipalities. While it is the ministry's expectation that the Wellington municipalities have confidence with the Tier 3 technical process and that their concerns were considered, it is the Peer Review team and the Province that evaluates and accepts the technical aspects of the process.

The Guelph Tier 3 was initiated in July 2008 and was provided to the peer review team in 2011 and 2013. The Tier 3 was expanded to include Guelph-Eramosa in July 2013. The initial review by the LESPR's Peer Review committee was completed in August 2014 with the LESPR's Peer Reviewers accepting the Tier 3 technical work. Additional commenting opportunities were given to Wellington municipalities in September 2014 and submitted to the LESPR in June 2015. In response to these comments, the LESPR incorporated the additional data sources identified (Matrix Solutions Inc., March 4, 2016 and March 7, 2016). Over the last year and a half, the LESPR has undertaken
additional consultation, beyond the requirements set out in regulation. It was never the Province's expectation that municipal councils would sign off on the technical aspects of any Tier 3 water budgets. As I mentioned above, the Province established a peer review process, which includes technical experts with significant experience in water budgets, to help the ministry assess the technical merits of each water budget.

Given this, it is my opinion that the consultation has been sufficient and that the team is now in the position to proceed to the RMMEP. The RMMEP terms of reference (TOR) (Matrix Solutions, February 25, 2016) lays out the anticipated timeline and associated milestones the Tier 3 team needs to adhere to meet the Minister's deadline. It is important that we move forward from the technical work on the water budgets itself and begin the next phase of the process that will end with the development of source protection plan policies to help ensure the long term sustainability of the Guelph and Guelph Eramosa drinking water systems.

LESPR will continue to engage the Wellington municipalities through the RMMEP and policy development processes. Funding will be provided from the Province through the LESPR for the participation by the Wellington municipalities, with you as their representative, as laid out in the RMMEP TOR. Should the Wellington municipalities elect to continue their consultation process through their respective councils it would be above and beyond the requirements set out in regulation.

Prior to the completion of the RMMEP, if the Wellington municipalities become aware of new information, it may be considered if its inclusion will have a **significant** impact on the Tier 3 results. The Province has always envisioned that there will be a continuous improvement process for the Tier 3 water budget models to ensure that they remain relevant and continue to provide information for municipalities and the Province to manage potential impacts from water quantity threats on municipal drinking water supplies.

I trust this addresses the concerns of the municipalities you represent.

Sincerely,

Heather Malcolmson Director

Copy: Martin Keller, Project Manager, Grand SPA James Etienne, Sr. Water Resource Engineer, Grand SPA Wendy Lavender, SPP Manager, MOECC Elizabeth Forrest, Liaison Officer, MOECC Kathryn Baker, Hydrogeologist, MOECC Scott Bates, Water Budget Analyst, MNRF



May 17, 2016

James Etienne, P. Eng. Senior Water Resources Engineer Grand River Conservation Authority 400 Clyde Road Cambridge, ON, N1R 5W6

Heather Malcolmson, P.Geo. Director Source Protection Programs Branch Ontario Ministry of the Environment and Climate Change 40 St. Clair Avenue West, Floor 14 Toronto, ON, M4V 1M2

Via Email and Regular Mail

Dear Mr. Etienne and Ms. Malcolmson,

RE: Wellington County Municipal Peer Review Response Regarding Water Quantity Risk Assessment Report (Tier 3) – City of Guelph and Guelph / Eramosa Township Water Systems

On behalf of Guelph / Eramosa Township, the Township of Puslinch, the Town of Erin and the County of Wellington, please find enclosed memorandums by the Township and Town hydrogeologists in response to the Matrix Solutions Inc. letters dated March 4 and 7, 2016 on the draft Tier 3 Water Budget and Local Area Risk Assessment for the City of Guelph and the Communities of Rockwood and Hamilton Drive (Water Quantity Risk Assessment report). The Matrix Solutions Inc. letters were in response to the review package submitted by our municipalities dated June 19, 2015 and form part of the municipal peer review process of the Water Quantity Risk Assessment Report that was initiated in May 2014 for Guelph / Eramosa Township and fall 2014 for the Township of Puslinch, Town of Erin and County of Wellington. We appreciate the opportunity to participate as a peer review for this study and with this letter and enclosed memorandums wish to once again express our concerns regarding the Water Quantity Risk Assessment.

As you are aware, our June 19, 2015 review package raised serious concerns regarding the science underpinning the Tier 3 model especially as it relates to the delineation of

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WELLINGTON Source Water PROTECTION Weilingtonwaterca

the Well Head Protection Area – Quantity (WHPA Q1 / Q2) extent and significance level. These concerns remain following our review of Matrix Solutions Inc.'s response. Therefore, our municipalities strongly request that the hydrogeological studies and / or modelling necessary to address our outstanding review comments, be completed prior to the finalization of the Water Quantity Risk Assessment. Our reviewers have raised substantive concern, on a number of technical issues that directly affects the delineation of the WHPA Q1 / Q2 extent and significance level. Our concern is to ensure that the Tier 3 model is an accurate representation of field conditions and based on the best available science. The impact of inappropriately categorizing the significance level or from overestimating the extent of the WHPA -Q1 / Q2 could have long term consequences for our municipalities.

The Province has indicated that "Prior to the completion of the RMMEP, if the Wellington municipalities become aware of new information, it may be considered if its inclusion will have a significant impact on the Tier 3 results." Our opinion is that our outstanding concerns are that new information and therefore it should be considered now prior to the completion of the Water Quantity Risk Assessment.

Our concerns are as follows:

- 1. It is established that the Eramosa River is a karst environment and that surface water / groundwater interactions are not fully understood. It is our opinion that the current response by Matrix Solutions Inc. does not adequately address the concerns presented by our reviewers especially in regards to complexity of the Eramosa River's interaction with the municipal aquifer and the documented surface water loss. The change in significance level in 2014 from moderate to significant shows that the Tier 3 model is sensitive to changes proximal to the Arkell Spring Grounds. The area in question is closer to the Arkell Spring Grounds then the Rockwood data that led to the 2014 changes. Additionally, our initial analysis demonstrates that depending on the river volume loss, the area of potential WHPA-Q1 decrease could be significant and still maintain agreement on the water budget. The range of WHPA-Q1 decrease is calculated between 1,577 to 15,768 hectares depending on the river volume loss. In our view, this area is substantial and gives us great concern.
- 2. Further to our concern related to the Eramosa River surface water / groundwater interactions, we formally request that the Lake Erie Source Protection Region, Grand River Conservation Authority and / or the Province

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begin in 2016, the data collection necessary to verify the stream flow conditions documented by our municipal peer reviewers. Our municipalities feel that the collection of this stream flow rate data would assist in providing the best available and current science for the Tier 3 model. We note that the Grand River Conservation Authority and the MOECC have the necessary field staff and resources to conduct this type of study. We understand that Dr. Hugh Whiteley, a member of the Provincial Peer Review team, made a similar request in 2015.

- 3. In addition to the Eramosa River concern, our municipalities also have the following, outstanding concerns:
 - a. Expression of the Bedrock valley on the east side of Guelph
 - b. Geological interpretation outside of the City limits
 - c. Verification of drawdown by City of Guelph wells near Aberfoyle
 - d. Accounting for reduced municipal pumping during drought scenarios
- 4. Prior to a final determination on our municipal peer reviewers' concerns, our municipalities request an opportunity to present our concerns directly to the Provincial Peer Review team. In preparation for that, we would expect that the Provincial Peer Review team will be provided the entire history of our municipal peer review including previous memorandums and responses.
- 5. The Province has indicated that, in their opinion, consultation has been sufficient and, in order to meet the Minister's deadline of December 31, 2017, that the next technical phases of the Guelph / Guelph Eramosa Tier 3 project should begin (the Risk Management Measures Evaluation Project (RMMEP) and policy development). At this time, we respectfully disagree with that conclusion. Our municipalities remain concerned regarding the Minister's deadline of December 31, 2017 for completion of all technical work and policy development. We feel that this date sets an artificial and rushed deadline for completion of this important work. Although we recognize that the City of Guelph, GRCA and Province have been working on the Tier 3 model since 2008, our municipalities were first involved only in 2014. This late involvement, in our opinion, has directly led to our outstanding concerns. This six year delay in our municipal involvement was an oversight that the Province noted in 2015. If our municipalities had been involved earlier, our concerns could have been

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6. Our municipalities also request clarification on access and ownership of the Tier 3 model, once final. We understand that discussions are ongoing between the Province, the City of Guelph and Lake Erie Source Protection Region. We further understand, through our participation on the screening tool working group, that the Province is working on screening tools that may partially address this question. Our municipalities will need access to the Tier 3 model for the review of certain development applications and for management of the Guelph/ Eramosa Township municipal water supply.

In the current context, to properly address our outstanding concerns and to allow sufficient time to complete the finalization of the Water Quantity Risk Assessment, Risk Management Measures Evaluation Process and policy development, a deadline of December 31, 2017 does not seem realistic. In particular, we strongly feel that council, public and industry consultation should not be rushed. As you are aware, there is a significant interest by the public, our Councils, our residents and non-governmental organizations regarding water taking in Wellington County in part due to the density of existing, commercial and industrial water users. These factors result in the need for a thorough consultation process. All of these efforts will take time, time that is in short supply if the December 31, 2017 deadline is to be met. We respectfully request that the Minister reconsider the timeline that has been set for this project.

We respectfully request that if the Province must finalize the Water Quantity Risk Assessment under their current timeline that the Province considers accepting it with a moderate risk level until such a time that the outstanding concerns can be addressed. It is noted within the draft Water Quantity Risk Assessment Report that the original significance level established was a moderate risk. The risk level was raised to significant due to a high level of uncertainty related to the ability of one municipal well (Arkell 1) being able to meet its allocated rate. The report notes (page 133) that for the majority of municipal wells that the uncertainty with respect to pumping allocated rates is low and that the allocated rates are sustainable. Therefore, we note that, without this high uncertainty for Arkell 1, the risk level would be moderate under the Technical Rules. Our preference, as stated above, would be to complete the necessary work to address our reviewers' concerns prior to the Water Quantity Risk Assessment acceptance, however, acceptance with

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a moderate risk level could be equally effective to allow further work during the Risk Management Measures Evaluation Process to confirm the appropriate risk level. Our interpretation of Technical Rule 109 is that the factors that shall be considered in the uncertainty analysis include the relevance of the available input data and the ability of the methods and models used to accurately reflect the hydrologic system. Our opinion is that our reviewers have identified additional input data that should be considered as well as identifying that the current model does not appear to accurately reflect the hydrologic system, especially in the Eramosa River / Blue Springs Creek area. As outlined by our reviewers, this may have the effect of increasing the recharge for the area around Arkell 1 which would, in turn, lower the uncertainty. Given these differing opinions, we feel it would be appropriate to closely consider the uncertainty analysis.

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We are aware of the efforts of Lake Erie Source Protection Region staff to develop a work plan for the remaining phases of the Tier 3 project (finalization of the Water Quantity Risk Assessment, Risk Management Measures Evaluation Process and policy development). Our municipalities are committed to our continued engagement in this process, including participation on the steering committee, and look forward to continued discussion. In particular, we wish to confirm the process and timeline for council, public and industry consultation including the opportunity for stakeholder and public input. This is an important report that has long term impacts for City and County residents and as such, our municipalities will continue our involvement in the review of the technical work and in development of water quantity policy.

If you require further information, please contact Kyle Davis at 519-846-9691 ext 362.

Regards,

Ian Roger, P. Eng. Chief Administrative Officer Guelph / Eramosa Township

Karen Landry Chief Administrative Officer / Clerk Township of Puslinch

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Kathryn Ironmonger Town Manager / Chief Administrative Officer Town of Erin

Ky Warn

Kyle Davis Risk Management Official Wellington Source Water Protection

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c.c. Via E-mail Gary Cousins, Director of Planning – County of Wellington Martin Keller – Grand River Conservation Authority Dave Belanger – City of Guelph Peter Rider – City of Guelph Kathryn Baker – Ontario Ministry of Environment and Climate Change Scott Bates – Ontario Ministry of Natural Resources and Forestry Dale Murray – Lake Erie Source Protection Committee

Attachments Memorandums – RJ Burnside, Harden Environmental and Blackport Hydrogeology

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Blackport Hydrogeology Inc.

Memo

То:	Kyle Davis, Township of Centre Wellington			
From:	Ray Blackport, Blackport Hydrogeology Inc.			
CC:	Kathryn Ironmonger, Town of Erin			
Date:	May 16, 2016			
Re:	Comments, City of Guelph, Tier 3 Water Quantity Risk Assessment and the Guelph/Wellington County Water Quantity Risk Management Work Plan			

Note- Comments were originally provided June 10, 2015 on behalf of the Town of Erin. Matrix Solutions Inc. (Matrix) provided a response, dated March 7, 2016, on behalf of the City of Guelph and Lake Erie Source Protection Region. Comments were discussed in a meeting of all parties on April 1, 2016. All comments were addressed in the meeting, as highlighted below.

1.0 Background and Scope of Review

Background

The City of Guelph conducted a Tier Three Water Budget and Local Area Risk Assessment (Tier Three Assessment) as a requirement under the Clean Water Act for the Province of Ontario. Previous water quantity studies, completed at the watershed scale, classified the local subwatershed as having a moderate to significant water demand due to high water supply usage. The findings of the Guelph/Guelph-Eramosa Tier Three Water Quantity Risk Assessment concluded that there is a "significant" water quantity risk level encompassing a large area of City of Guelph, the Townships of Guelph/Eramosa and Puslinch and the Town of Erin. Three areas were identified as being vulnerable to water quantity threats, two being groundwater vulnerable areas (WHPA-Q1 and WHPA-Q2) and one being a surface water vulnerable area (IPZ-Q). The WHPA-Q1 area is the cone of influence of each municipal well, including the cones of influence of wells the each well it intersects. The WHPA-Q2 area is the land area where recharge has the potential to have a measurable impact on water levels at the municipal wells. The IPZ-Q area is the drainage area and associated recharge area that contribute to a surface water intake.

Several meetings were held to discuss the findings of the Draft Tier Three Assessment. Concerns were raised at the March 24th, 2015 meeting with respect to the decision to apply a "significant"

water quantity risk designation to the Guelph water supply in the Tier Three Assessment. The Grand River Conservation Authority (GRCA) provided a summary of the chronology of the investigations and technical reassessments of the Risk Assignment in a Memo dated April 20, 2015.

Scope of Review

The primary focus of this review is to provide comments, on behalf of the Town of Erin, with respect to the Draft Tier 3 Water Quantity Risk Assessment (WQRA) Report for the City of Guelph Water system, as related to potential water quantity concerns within the geographic area of the Town of Erin. It was also requested that a review of the Work Plan for the "Water Quantity Risk Management Measures Evaluation Process" (RMMEP) be completed. It is noted that with respect to the Town of Erin, there are no WHPA-Q1 and WHPA-Q2 areas for the City of Guelph and Village of Rockwood water supply systems, which extend into the geographic boundaries of the Town of Erin. Only the surface water quantity area (IPZ-Q) extends into the geographic limits of the Town and as such the scope of review is limited to reviewing the WQRA report in relation to the IPZ-Q and to providing general comments on the RMMEP Work Plan.

1. Water Quantity Risk Assessment

a. Groundwater i. Geology/Hydrogeology

From the perspective of the Town of Erin, there are no groundwater related water quantity concerns within the Town boundaries, related to the Guelph WQRA Tier Three Assessment. The groundwater capture areas of the municipal water supply wells for the City of Guelph do not extend into the Town of Erin and, as such, an assessment of the geology and hydrogeology was not conducted. It is noted that extensive testing of the Arkell Spring grounds municipal well field has been conducted over the last three years and the findings show that the capture zones do not extend into the Town of Erin. It is also noted that a characterization update was conducted for the area around Rockwood, as part of the Tier 3 Water Budget and Local Area Risk Assessment. No update on the Wellhead Protection zones was provided; however, based on the previous information found in the Grand River Source Protection Plan (2013), the Wellhead Protection Zones are shown to extend into the Town of Erin but there are no water quantity threats with the Town.

ii. Municipal Wells

Not applicable for the Town of Erin.

iii. Delineation of WHPA – Q1 and Q2 – Application of Technical Rules This is beyond the scope of review for the Town of Erin as the WHPA-Q1 and WHPA-Q2 do not extend into the Town of Erin.

b. Surface Water

The IPZ-Q for the City of Guelph water supply is interpreted to be the entire Eramosa-Blue Springs Creek watershed upstream of the Arkell Spring Grounds Intake on the Eramosa River (Figure 5-4 of the Tier Three Assessment Report). Since the intake is on the Eramosa River, all of the upstream drainage area and associated recharge area of the Eramosa River and Blue Springs Creek is considered to contribute to the surface water intake. The surface water pumped from the Eramosa River is not directly fed into the municipal drinking water system but is diverted into an artificial recharge system where the water is "stored" in the shallow aquifer and then pumped out, treated and made available for the municipal supply system. The water taking from the surface water is constrained, based on a specified river flow rate required to maintain sufficient flow for operation of the wastewater treatment plant.

i. Hydrology

The hydrology and flow rates in the Eramosa River have been investigated in detail for decades. In recent years discharge at the Eramosa intake has fallen below the threshold level (for operation of the Waste Water Treatment Plant on several occasions; however, this has not impacted the drinking water quantity as make up water, if needed, can be derived from storage within the artificial recharge system and from water supply wells at the Arkell Spring Grounds.

ii. Delineation of IPZ-Q – Application of Technical Rules

Part VI.7 of the Technical Rules was applied (page 94 of the Tier Three Assessment Report) appropriately. Simulated particle tracking was used to assess potential recharge to the watershed, through the groundwater system outside the watershed boundaries. Given the uncertainty in the groundwater divide and the limited recharge contribution in this area, this additional area was removed, to constrain the IPZ-Q to within the Grand River watershed boundary.

Additional Considerations

It was noted in the Tier Three Assessment Report (page 99) that the Surface Water Vulnerable Area (IPZ-Q) was assigned the same Risk Level as the groundwater vulnerable area containg the groundwater collector system (Glen Collector) at the Arkell Spring Grounds, where the surface water used in the system is discharged. This was done since the water pumped from the Eramosa intake is not fed directly into the drinking water system but into the groundwater collector, which was included in the Risk Assessment for groundwater. Although the same Risk Level is assigned across the large drainage area upstream of the Arkell surface water intake, there will be a highly variable level of "real risk" across this area, especially in the upstream areas of the watershed.

2. Water Quantity Risk Management Measures Evaluation Process Work Plan

As indicated in the Work Pan, the Risk Management Measures Evaluation Process (RMMEP) the water quantity polices must address one of the prescribed drinking water threats, and, as a result may or may not address some of the factors considered in setting the risk level for a local area. There are two water quantity prescribed drinking water threats:

- an activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body; and,
- an activity that reduces recharge to the aquifer.

As indicated in the introduction to the Water Quantity RMMEP, the objective of the RMMEP is to provide a methodology to select risk management measures that would manage significant threat activities so that they cease to become significant drinking water threats. The following comments are provided with respect to the RMMEP Work Plan.

Task 1: Review - Identification of Drinking Water Quantity Threats

I generally agree with the proposed work plan; however, it is important that whomever is undertaking the RMMEP is familiar with the existing Tier 3 assessment, as it may be overkill for the consultant to update and refine threats, identify additional wells/intakes for impact assessment etc., given how much work has gone into the Tier 3 assessment (i.e. was that not the point of the Tier 3 assessment?).

Matrix Response – agreed, and it was indicated that Matrix will be completing both tasks.

Task 2: Where Required, Identify Percentage Impacts and Rank the Tier 3 Local Area Significant Threats

- Have not some of the scenarios presented in Table 1 already been performed as part of the Tier 3 assessment (e.g. modelling pumping at the permitted rates)?
- Realistic consumptive and non-consumptive use should be refined, where possible, for many of the scenarios in Table 1. For example, most rural non-permitted water taking (e.g. private wells) is non-consumptive; water is typically removed from the lower bedrock aquifer and returned via septic systems to the shallow aquifer. In the case of the Guelph WQRA, (i.e. IPZ-Q, surface water only risks in the Town of Erin), the potential impact from this type of water taking within the Town of Erin, would be minimal and

would in fact potentially enhance discharge to the surface water, as recharge to the shallow groundwater is effectively increased.

• Part of the risk ranking and potential level of water quantity impact will depend on the location or distance from the municipal well or intake and local and regional geologic conditions (e.g. where is the main recharge area of the municipal wells and the distance this is from the wells). Is the use of the term "recharge" referring to recharge to the water supply aquifer (e.g. there is big difference between local recharge to an unconfined shallow aquifer and regional recharge to a deeper confined aquifer). It is noted for example, in the Conclusions (page viii of the Tier 3 Assessment report) that: "Recharge reductions in response to future land developments, have a minimal impact on water levels at the Tier Three municipal pumping wells. The Gasport aquifer is protected in most area by the Vinemount aquitard which reduces the impact of reduced groundwater recharge on water levels in the aquifer. With respect to the City of Guelph and community of Rockwood, future land developments generally occur around the periphery of these communities with minimal increase in imperviousness over the Local Area."

<u>Matrix Responses</u> – Bullet 1 - There will not be a duplication of Tier 3 Assessment scenarios. Bullet 2 – Matrix agrees with the comment, that there would be minimal impact to water quantity within the IPZ-Q zone from activities within the Town of Erin. Bullet 3 – Recharge is simply defined as water entering the groundwater system at ground surface.

Task 3: Select Preliminary Risk Management Measures (RMMs) and Evaluate the Risk Management Measures

• It would appear that there are two components to this that should be explored together. The operational aspects are important, as purely from an operational risk perspective there may be operational procedures to optimize the city-wide water system, while there may be Risk Management measures to aid in maintaining overall recharge to the aquifer system or decrease withdrawal from the aquifer system.

Matrix Response - Matrix agrees with the comment.

Task 4: Prepare a "Draft Threats Management Strategy" to discuss with Municipalities and Stakeholders.

• The key will be consultation throughout the previous tasks to ensure there is a reasonable consensus moving forward.

Matrix Response – Matrix agrees with the comment.

3. Conclusions

Implications for the Town of Erin

There are no groundwater related concerns regarding the Tier Three Assessment for the City of Guelph, given that the capture zones for the Guelph system do not extend into the Town of Erin and there are no groundwater quantity threats. From a surface water perspective, the Surface Water Vulnerable Area (IPZ-Q) extends into the Town of Erin upstream of the Arkell Spring Grounds Intake. It is not expected that that there would be any impact on water quantity from activities within the Town of Erin, given several factors:

- Any increase in impervious areas as a result of development, which will be a substantial distance upstream of the intake, would potentially increase surface water flow rather than decrease surface water flow.
- Most rural wells obtain water from the deeper aquifer system and "recycle" the water via septic systems to the shallow groundwater system, increasing the overall recharge to the shallow groundwater system and the potential discharge to the surface water system.
- The Town of Erin is the most upstream portion of the watershed and least developed so it is unlikely that would be an impact on the surface water system that could be measured downstream at the Arkell Spring Grounds Intake.

<u>Matrix Response</u> – Matrix agrees that "there are limited implications for the Town of Erin and the Town should be consulted to assess the need and implications of measures that are recommended that could impact land use or land use activities".

4. Recommendations

It is not anticipated that any activity within the Town of Erin could measurably impact the quantity of surface water at the Arkell Spring Grounds Intake. If measures are recommended for the RMMEP that could potentially impact land use or land use activities in the Town of Erin the Town should be consulted to assess the need and the implications.

R.J. Burnside & Associates Limited 292 Speedvale Avenue West Unit 20 Guelph ON N1H 1C4 CANADA telephone (519) 823-4995 fax (519) 836-5477 web www.rjburnside.com



May 10, 2016

Via: Email

Mr. Kyle Davis Risk Management Official County of Wellington 7444 Wellington Road 21 Elora ON N0B 1S0

Dear Kyle:

Re: Comments on the Draft City of Guelph/Township of Guelph/Eramosa Tier Three Water Quantity Risk Assessment Project No.: 300036495.0000

R.J. Burnside & Associates Limited (Burnside) was requested by the Township of Guelph/Eramosa to review the Matrix Solutions Incorporated (Matrix) Draft City of Guelph and Communities of Rockwood and Hamilton Drive Tier Three Water Budget and Local Area Risk Assessment. Our response to the draft report was provided in May 2015. As a follow up to this initial review Burnside received and reviewed responses from Matrix in a memorandum dated March 4, 2016. The following are our comments on the Matrix memorandum dated March 4, 2016.

3.1 Surface water leakage into Bedrock Aquifer

The response provided by Matrix is similar to those provided on the same issue as raised by Harden Environmental Services Ltd. (Mr. Stan Denhoed, M.Sc., P.Eng.). Matrix indicates that an attempt was made to adjust the model to the observed water losses noted by Mr. Denhoed, however they were unable to replicate these losses in the model. Matrix then goes on to suggest that there may be other hydrogeological explanations for the noted occurrence. Matrix uses the fact that their model is calibrated to known target data to suggest that the calibration is itself an indicator that the model is correct. We note that a well calibrated model is one that matches reality in both a quantitative sense where the water balance and water levels match observed levels and also qualitatively where known discharge and recharge areas and flow directions are maintained. In light of the inability of the model to match the loss of water in the river we are unable to support Matrix's conclusion that the model is correct while ignoring the fact that it does not represent a significant occurrence that has been documented in the field versus an opposite estimated occurrence in a computer model.

We note that a paper presented by Messrs. Frank Brunton and David Belanger at the 60th Canadian Geotechnical Conference in 2007 included the following Figure 1. It is an idealized cross section through the area of the Eramosa River that is in question. It shows the potential for rapid movement from the surface into deeper sections of the carbonated bedrock aquifer as part of the documented Karst topography in the area of the Eramosa River. The caption for this figure states "Key recharge areas are located to the east and northeast of Guelph where precipitation/runoff quickly penetrate into the Amabel bedrock aquifers".



Figure 1. Idealized cross-section of Niagara Escarpment (view to NNE) showing regional relationships of Silurian caprock carbonate succession and resultant cuesta profiles of eastern Michigan Basin (west to east transect, Guelph-Milton, approx. 10-40 km across). The Amabel Formation forms the caprock and prominent cliffs of Niagara Escarpment margin in Ontario. The City of Guelph, located west of the escarpment margin, possesses much less pronounced cuestas of Guelph and Eramosa rock units. Overburden thickness (not depicted in diagram) is highly variable in this region with extensive areas of exposed bedrock and/or thin-drift cover (<3 m thick) to east of Guelph. Relative thicknesses of rock units are not to scale – in study area the Amabel Fm averages 38 m; the Eramosa Fm averages 18 m; and the Guelph Fm averages 20 m. Key recharge areas are located to east and northeast of Guelph where precipitation/runoff quickly penetrate into the Amabel bedrock aquifers and follows the karst-influenced stratigraphic plumbing system down dip (southwesterly) to eventually flow more southerly towards Lake Erie. Preliminary conodont biostratigraphic analyses indicates Fossil Hill Fm correlates with Meritton Fm to south, and the Lions Head Mbr of Amabel Fm corrrelates with Rockway Fm (Appalachian Basin stratigraphic nomenclature after Blair and McFarland 1992 and Brett et al. 1995). Recent mapping in Rockwood area, southeast of Guelph, suggests that Vinemount equivalent shales are present between the Amabel Fm and basal Eramosa Fm lithofacies.

Source Brunton F.R. Belanger D. Dibiase S. Yungwith G and Boonstra G. 2007. Caprock carbonate stratigraphy and bedrock agrider character of the Nagara Escarpment – City of Guebh Region southern Cotaco in Proceedings. 80th Canadian Geotechnical Conference and the 8th joint CGS-AH Conference. Canadian Geotechnical Society, Ottawa. Ontario. Canada.o. 372

This interpretation of the geology would support the observed loss in flow in the Eramosa River that has been documented by Mr. Stan Denhoed. The impact of the loss of flow in the Eramosa River is important to the hydrogeology of the area and we believe that the impact of the loss needs to be included in the model in light of previously demonstrated sensitivity of the model to input parameters in this area as outlined below.

Page 3 of 5

The significance of the loss of flow from the Eramosa River to the aquifer in this area is important to the designation of the water quantity risk level as "significant' instead of "moderate". In a memorandum dated April 20, 2015, James Etienne of the GRCA indicated that the following changes were made to the model:

- The top of bedrock surface was refined in the area surrounding Rockwood and to the northeast (in the direction of the previous 2006 capture zones for the Rockwood wells).
- There is a buried bedrock valley to the west of Rockwood that stretches to the northeast beneath Erin. The characterization of the buried valley was adjusted close to Rockwood based on the new bedrock surface noted above. The material infilling this valley was refined from the first study based on OGS drilling information. In most places this resulted in coarser material which changed the interaction between the bedrock aquifers and the overburden and surface water system. This led to a slight decrease in water levels in Rockwood and slight increases in groundwater discharge in the Eramosa River.
- Pumping rates for Rockwood were revised with updated data and Well 3 was added. The first draft model used data from 2002 that was reported in the Wellington County Groundwater Protection Study (Golder, 2006)-Rockwood Wells 1 and 2 were pumped at a total of 751 m³/d and that pumping rate was held constant for the future scenario. With the GET Tier Three update, the current condition pumping rates for the three Rockwood Wells increased to 2009/2010 pumping rates for a total of 967 m³/d, and the future (allocated) rates were set at 1,152 m³/d. Thus there was a total increase of 401 m³/d in the Rockwood Wells under the future conditions in the final Guelph/GET Tier Three WQRA as compared to the draft Guelph Tier Three WQRA.
- Other geologic refinements were made for the area north of Hamilton Drive that impacted results in the north of the city-e.g., Emma Well.

The memorandum concludes that the updates made to the GET Tier Three model combined to change the supply of water such that under the drought scenario, water levels were lower in the Arkell 1, Carter, Emma and Water Street Wells. It is our understanding that the Arkell 1 well is the main trigger for the 'significant' designation. In the context of the demonstrated sensitivity of the model to changes in the Rockwood area the suggested leakage from the river would present a change to the model that is more proximal to the Arkell 1 well than any of the changes that caused the change of designation to significant. It is therefore counter intuitive to the modelling process to suggest that these changes would be insignificant when other changes have proven to require a change in designation.

In light of the above, we remain unconvinced that the model adequately addresses the losses of water from the Eramosa River and are also unconvinced that the correct inclusion of this change will result in no changes to the model output.

3.2 Expression of the Bedrock Valley on east side of Guelph

The Matrix response indicates that there were no restrictions introduced to the model by the interpolation method and that in fact the extent of the valley may have been overestimated. In our opinion, the overestimation of the extent of the valley is no more accurate than the underestimation of the valley. As we suggested in our previous comments the fact that the valley has undulations that match the road network indicate that the form of the valley was determined based on available data (and lack of it in the wider areas). As interpreted, the valley does not represent a natural feature as natural features are not known to have undulations that match the road network. As part of our review we have examined the Ontario Geologic Survey's Groundwater Resources Report 15 (OGS, 2016) and have noted that the OGS report supports a more linear interpretation for the bedrock valley.

3.3 Eramosa Formation Aquitard

The extent of the Eramosa Formation in the area of Rockwood has been reduced so that the hydraulic conductivity of the upper bedrock has been increased from 3 to 8 x 10^{-8} m/s to 2 x 10^{-7} m/s. Response of the shallow bedrock formations to pumping of Rockwood Wells 3 and 4 continues to be underestimated by the model. This may indicate a further increase in the shallow bedrock hydraulic conductivity in the local area is warranted.

3.4 Existing Plus Committed Demands and Allocated Rates

Updated information has been included and we have **no further comment**.

3.5 Safe Additional Available Drawdown (SAAD)

The SAAD for the Guelph Eramosa Wells provided by Burnside based on a detailed interpretation of the water level response in the production wells has been adopted for use in the revised Tier Three report as required in the Tier Three rules. **No further comment**.

3.6 Rockwood Well 4

The Rockwood Well 4 was included in the 2001 Rockwood Water supply EA and was constructed in 2015. This well was included in the GRCA Assessment Report for water quality threats and has now been added to the Tier Three assessment as requested. **No further comment.**

3.7 Report Name

The name of the report has been changed from *City of Guelph, and Communities of Rockwood and Hamilton Drive Tier Three Water Budget and Local Area Risk Assessment to City of Guelph/ Township of Guelph/Eramosa Tier Three Water Quantity Risk Assessment, as requested.* No further comment.

Summary

The municipalities surrounding Guelph were invited into the Tier Three study in January 2014. The work completed prior to this date focused on the City of Guelph. Work completed since January 2014 was an effort to fit the data from the surrounding municipalities into the Guelph Model. We are aware of the tremendous level of effort and detail that went into the model within the boundaries of the City of Guelph and are concerned that a similar level of effort is not apparent for work in the surrounding townships which are in our opinion, equally as important to the groundwater regime.

Throughout the process of our review Matrix has pointed out that the model is defensible and has sought to present information that 'defends' the model. In our opinion a carefully constructed model that adequately represents actual field conditions is its own defense and does not need to be 'defended'. It is important to note the argument that the model is correct because, the water balance matches is a circular argument based on conditions all internal to the model and the assumed conditions that it represents. Not being able to match environmental conditions does not in our mind suggest that we should ignore nature or seek to explain it away. In our minds the correct response to observed field data is a two-step process:

1. Verify the observations.

2. Update the conceptualization based on the verified data.

This approach has clearly been completed within the City of Guelph prior to 2011; a similar level of effort has not been completed in the surrounding municipalities.

We note that there has been a request made by the Risk Management Official (Kyle Davis) via email on April 18, 2016 to have data necessary to address the concerns regarding potential water loss to the Eramosa River collected in 2016. The provision of this data would support the fulfillment of the aims of the Tier Three Water Budget and Local Area Assessment as outlined in the <u>"Water Budget & Water Quantity Risk Assessment Guide-Drinking Water Source Protection Program,"</u> MNR and MOECC, 2011. Which states:

"The Tier Three water budget uses detailed groundwater and/or surface water numerical models on a more local scale. These models should be developed with the accuracy and refinement needed to evaluate hydrologic or hydrogeologic conditions directly at a water supply well or surface water intake..." (page 79)

The guidance further states that:

"The modelling should also simulate impacts from water takings, related to permitted water users and non-permitted water use where significant. The approach must be able to consider land use and projected land use changes as they affect recharge to groundwater, and should represent groundwater discharge to stream and any other relevant groundwater/surface water interactions." (page 83)

In our opinion the guidance suggests that the Tier Three is intended to be a sound model that adequately represents the existing conditions on a more local scale. In light of the above, we trust that moving forward the model will be updated with the best possible information to improve calibration. Localized adjustment of hydraulic conductivity similar to work completed in Guelph and Rockwood Well 3 should be completed in the surrounding municipalities to better represent areas where there may be above average aquifer recharge related to the karst topography. We are willing to attend a technical meeting with the modelling team and discuss the conceptualizations of the hydrogeology of the area along with other supporting materials and data in order to ensure that the model is based on the best available data.

We trust this review is suitable. If you have any questions, please contact the undersigned,

Yours truly,

R.J. Burnside & Associates Limited

Dwight Smikle, P.Geo. Senior Hydrogeologist DS/JB:mp

Enclosure(s)

Jim Baxter, P.Eng. Groundwater Resource Engineer

cc: Mr. Ian Roger, Township of Guelph-Eramosa (enc.) (Via: email)

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Groundwater Studies

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Harden Environmental Services Ltd. 4622 Nassagaweya-Puslinch Townline R.R. 1, Moffat, Ontario, L0P 1J0 Phone: (519) 826-0099 Fax: (519) 826-9099

Geochemistry	File: 1417	
Phase I / II	April 22, 2016	
Regional Flow Studies		
Contaminant Investigations	To: Kyle Davis	
OMB Hearings	From: Stan D	
Water Quality Sampling		
Monitoring	Re: City of	
Groundwater Protection Studies	Drive 1	
Groundwater Modelling	2.1 Eramos	
Groundwater Mapping		

o: Kyle Davis – Risk Management Official – County of Wellington

From: Stan Denhoed, P.Eng. – Harden Environmental Services Ltd.

Re: City of Guelph and Communities of Rockwood and Hamilton Drive Tier 3: Matrix Solutions Inc. Letter of March 4, 2016

2.1 Eramosa River as Groundwater Discharge Zone

The response provided by Matrix Solutions does not resolve the issue of the measured loss of river water in the Eramosa River between Indian Line and the Eden Mill Pond Association Station 3 just upstream of the confluence of the Eramosa River and Blue Springs Creek. The response acknowledges that the measured recharge via the river to the aquifer cannot be replicated by the model. It is postulated that the water re-emerges elsewhere upstream of Watson Road where the model is said to provide reasonable match to baseflow and overall water budget.

Streamflow measurements obtained on July 18, 2013 are very similar to the baseflow calibrated 2014 model with 800 L/s upstream of Eden Mills and 1500 L/s at Watson Road. However, the streamflow measurements provide greater detail and show that 250 L/s are lost from the river upstream of the confluence with Blue Springs Creek. This is not accounted for in the model. Also, with respect to overall water budget, there are many ways to satisfy the overall water budget such as balancing river losses with infiltration. The significance of the method of groundwater recharge is presented in Table 1 which estimates the required area of the WHPA-Q1 needed to compensate for the unaccounted recharge in the river. This evaluation is based on a recharge value of 200 mm/year occurring to the Gasport aquifer where it subcrops.

River Volume Loss	Compensating Area	Compensating Area
(L/s)	(ha)	(km²)
100	1,577	1.6
250	3,942	3.9
500	7,884	7.9
1000	15,768	15.8

Table 1:	Area Needed 1	o Compensate for	r Unaccounted R	iver Volume Loss
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Depending on the river volume loss, the area of potential WHPA-Q1 decrease could be significant and still maintain agreement on the water budget.

We are not discussing a 100 m reach of the river as Scott Bates said in the April 1, 2016 meeting. This is a discussion of a significant volume of water that is not presently accounted for in the model that has important influence on the size, shape of the WHPA-Q1 and the risk level assignment.

On August 8, 2015 Dr. Hugh Whiteley, a provincially appointed peer reviewer of the Tier 3 study, presented evidence to the GRCA, City of Guelph and Matrix Solutions Inc. that there are significant losses measured in the Eramosa River upstream of Watson Road and suggested that verification of the flow losses be confirmed. For relatively little expenditure of money, detailed information on the flow loss could be obtained such as which reach of the river the greatest loss occurs. Dr. Whiteley's estimated loss of up to 1150 L/s is a significant volume of water and as shown above, results in a significant change to the size of the WHPA-Q1. We understand that the Water Services Canada gauge was not accurate at this time, however, a significant loss of water still occurs.

Neither the inability of the model to replicate this loss nor the supposition that the water follows a hyporheic pathway returning to the river somewhat downstream adequately addresses the issue. Paul Chin stated that the Eramosa River was modelled as a fixed head stream boundary and the March 4 letter stated that increasing the hydraulic conductivity beneath the river resulted in greater flow from groundwater to the river. In order for the river to lose water, the hydraulic head beneath the river must be less than the river stage (specified head). If the potentiometric surface of the Gasport Aquifer is elevated above the river stage in areas outside of the river valley, then the only explanation for river loss to the aquifer is if there the hydrostratigraphic units directly beneath the river have lower hydraulic potential than the river. The simulation does not appear to have achieved this.

From the County of Wellington's perspective, the observed loss in the Eramosa River is significant and should either be replicated by the model, or proven to return to the river

COUNTY OF WELLINGTON April 22, 2016 Page 3

in a methodology as suggested by Dr. Whiteley. We also understand that the risk level assignment to Arkell Well No. 1 is sensitive to changes in the model in this area and therefore suggest that this issue be adequately addressed before the risk level is assigned.

2.2 Vinemount

No further comment.

2.3 Cambridge Overlap

No further comment.

2.4 Influence of Nestle Waters Canada taking

Based on draft figures provided by Matrix Solutions to us on March 16, 2015, the simulated drawdown in the Gasport aquifer at County Road 34 without pumping by Nestle Waters Canada (but including City of Guelph wells, Guelph Limestone Quarry and other takers in Aberfoyle), is somewhat less than two metres. Therefore, even a small drawdown created by Nestle Waters Canada at County Road 34 will result in the WHPA-Q1 boundary moving significantly southward. According to recent well shut-in measurements, the impact of Nestle Waters Canada taking is at least 0.5 metres in the vicinity of County Road 34. Therefore, provided that the estimate of drawdown by the City of Guelph wells and other permit holders is reasonably predicted by the groundwater model, the inclusion of the Nestle Waters Canada area of influence in the Gasport aquifer is warranted.

2.5 Influence of Burke Well

The influence of the Burke well on Gasport potentiometric surface is shown to be relatively small given that 95% of water in the Burke well is derived from the upper aquifers. Therefore, the aforementioned modelled drawdown of approximately two metres at County Road 34 (and Brock Road) results from combined influence of the Downey Road Well, University Well, Arkell Springs wells and other permit holders. These wells are at least six kilometers distant, are not in the same groundwater shed and yet are predicted to have significant influence on water levels near Aberfoyle. The influence of the City of Guelph wells at this distance is impossible to confirm with monitoring as there are no historical records of water levels in the Gasport aquifer in this area. In comparison, the Nestle Waters Canada well is located only 1.5 km downgradient and has an impact of approximately 0.5 metres which is reasonable.

COUNTY OF WELLINGTON April 22, 2016 Page 4

It is our opinion that verification of drawdown by the City of Guelph wells near Aberfoyle remains to be a significant data gap as the predicted drawdown in the model by the City wells coupled with that of the predicted drawdown from water taking in the Aberfoyle area results in the significant enlargement of the WHPA-Q1. It is impossible to verify that historical drawdown has occurred, thereby confirming the model results. A recent review of data available from Well VPV-01¹ located at the Victoria Park Valley Golf Course completed with Westbay Casing in the Gasport Aquifer, shows a daily perturbation of less than five centimeters, presumably from a City well. There is daily recovery of drawdown. The Matrix Tier 3 model predicts a drawdown of between 3 and 5 metres in this area.

2.6 Meadows of Aberfoyle

No further comment

2.7 Kraus Nurseries

No further comment

2.8 Okashimo Fish Farm

No further comment

2.9 Assignment of Significant Risk Level

The significant risk designation is assigned because of the high uncertainty that Arkell 1 can meet the allocated rate. The other five municipal wells within one metre of the safe water level do not trigger the significant risk assignment and in fact the Matrix Tier 3 report mentions that uncertainty with respect to the majority of municipal wells is low. Therefore, the mentioning of the other five wells is not pertinent to the assigned risk level.

There are two other issues that have come out of discussions with the County of Wellington and were raised at the April 1, 2016 meeting. These are;

1) Treatment of 20% Reduction of Water Taking During Level III Low Water Response Condition

It was confirmed in Friday's meeting that the City of Guelph and all holders of PTTW's are required to reduce taking by 20% during a Level III Low Water Response condition.

¹ Installed by University of Guelph a the Victoria Park Valley Golf Course in 2011

COUNTY OF WELLINGTON April 22, 2016 Page 5

It was also conveyed to us that this reduction was not taken into account in the drought scenario modelled. The question that arises is; it is likely that the drought scenario as used in the model would trigger a Level III Low Water Response Condition. Could the required reduction in taking by the City of Guelph be accommodated by reducing taking from Arkell 1 and thus avoid the significant risk level?

2) The Reduction of Significant Water Taking

All existing permits to take water were included in the model scenarios and projected to the year 2031. It is possible that a large water taker such as the Guelph Limestone quarry will cease to take water. Is it therefore reasonable to run a scenario without the large water taking and reassign the risk level and size and shape of the WHPA-Q1 in that event? Should this be done now or at the RMMEP stage?

In addition to these scenarios, has the City of Guelph considered optimizing other wells during the drought to avoid the 'significant' risk assignment? Excluding the five wells that are within one metre of their safe available drawdown, are there no other wells that can be pumped at greater rates or for longer periods to avoid the significant risk assignment?

The City of Guelph in their Water Supply Master Plan, undertook to concentrate conservation efforts and new water supplies within the City limits and only look at new wells in the surrounding Townships at a later stage of the master plan. Is it reasonable to expect that a similar undertaking will be made with respect to prospective RMMEP policies?

2.10 Threats Ranking

No further comment

2.11 Water Quantity Risk Management Measures Evaluation Process List of Tasks

No further comment

Sincerely,

Stan Denhoed, P.Eng., M.Sc. Senior Hydrogeologist Ministry of the Environment and Climate Change

Source Protection Programs Branch

14th Floor 40 St. Clair Ave. West Toronto ON M4V 1M2

June 13, 2016

Ministère de l'Environnement et de l'Action en matière de changement climatique

Direction des programmes de protection des sources

14^e étage 40, avenue St. Clair Ouest Toronto (Ontario) M4V 1M2



Kyle Davis Risk Management Official Wellington Source Water Protection 7444 Wellington Rd 21 Elora, ON N0B 1S0

RE: Wellington County Municipal Peer Review Response Regarding Water Quantity Risk Assessment Report (Tier 3) – City of Guelph and Guelph/Eramosa Township Water Systems

Dear Mr. Davis:

Thank you for your letter of May 17, 2016 on behalf of Guelph/Eramosa Township, the Township of Puslinch, the Town of Erin and the County of Wellington (Wellington SWP) outlining your continued concerns related to the Guelph/Guelph-Eramosa Tier 3 Local Area Risk Assessment (Tier 3) and the municipal review process. The letter identified a number of technical and process related concerns:

Technical Concerns

- 1. How the Tier 3 captures the groundwater surface water interactions around Arkell Spring Grounds.
- 2. The need to collect stream flow rate data in 2016 in the Eramosa River around the Arkell Spring Grounds to better inform the Tier 3 model.
- How the Tier 3 captures the bedrock valley on the east side of Guelph; geological interpretation outside the City limits; verification of drawdown by the City's wells near Aberfoyle; and, the effects of reduced municipal pumping during drought scenarios.

Process Concerns

- Wellington SWP would like an opportunity to present concerns directly to the Tier 3 Peer Review committee.
- 5. The timeline for Wellington's municipal review and consideration of the concerns raised through that process does not seem sufficient given the Province's deadline of December 31, 2017 for the submission of the Lake Erie Source Protection Region's (LESPR) updated source protection plan for the Grand River Source Protection Area.

6. Future access for Wellington SWP to Tier 3 model and ownership arrangements for the Tier 3 model.

I have discussed these concerns with James Etienne and Martin Keller at the LESPR and my staff, and I am responding on behalf of the LESPR and the ministry.

There is a peer review process in place to address technical concerns and I understand the Peer Review committee will be meeting June 15, 2016 to consider any outstanding comments, including those presented by Wellington SWP, and to make recommendations on next steps. I am happy to see one of your concerns has already been addressed in that you are being provided an opportunity to present your outstanding concerns to the peer review team. I understand that LESPR submitted a package on May 26, 2016 to the Peer Review committee for their review and comment. The package includes a brief summary along with a full chronology of the municipal peer review process of the Tier 3, including the letters provided by Wellington SWP.

When the Peer Review committee considers Wellington SWP's outstanding comments, they will need to weigh the comments against the program purpose. The Peer Review Water Budget Interim Direction, Version 2.0 (DRAFT) (dated August 9, 2005) outlines the objectives of the peer review as follows:

- To ensure that water budgets are scientifically defensible;
- To ensure consistency with the expectation of the water budget guidance; and,
- To validate the water budget deliverables.

The Ministries of Environment and Climate Change and Natural Resources and Forestry (Province) look to the Peer Reviewers for each Tier 3 for concurrence that Tier 3 is "fit for purpose" as a regional scale water budget model. In our experience, the peer review process is most insightful and informative when the Peer Reviewers engage in discussion about the results and outstanding concerns with the Tier 3 team and municipal reviewers.

Once the Peer Review committee has met, the Peer Reviewers will provide written comments to LESPR either providing their acceptance of the Tier 3 or directing the Tier 3 team to undertake further work to address outstanding concerns. As we have with other water budgets, I will rely on the peer review team to determine if your technical concerns need to be addressed before we move forward. If acceptance is provided, the Tier 3 team will move on to undertake the Risk Management Measures Evaluation Process (RMMEP) this summer. If additional technical work is required before acceptance, the Tier 3 team will take appropriate action based on the Peer Reviewer's recommendations. I hope that Wellington SWP will continue to provide supporting input to that process no matter the outcome of the peer review meeting.

As you know, continuous improvement is fundamental to the source protection program, and as the Tier 3 models are updated, new information will be integrated. For the Grand River source protection area, the conservation authority is required to submit a work plan to the Minister in November 2019, outlining where their assessment report and source protection plan need to be updated. Any work not required before acceptance by the Peer Reviewers can be re-evaluated through the program processes, and integrated into future updates as needed.

The ministry recognizes Wellington SWP's continued concerns around the timeline for municipal review of the Tier 3 and the RMMEP. A significant amount of time has been spent developing the water budgets, and if the Peer Reviewers are satisfied with the technical aspects, the process needs to move forward and identify how risks to the Guelph system should be managed. LESPR has proposed a schedule to meet the Minister's deadline. I would ask that Wellington SWP use the schedule to plan their consultation and internal discussions to ensure their feedback is provided to LESPR in a timely manner.

The ministry shares Wellington SWP's concerns about future access to the Tier 3 model. The Province is currently funding the Toronto and Region Conservation Authority and LESPR to develop recommendations for model management, which includes consultation with municipalities and the Province. The ministry has an interest in the models being accessible as we will face challenges requiring the regulated community to consider Tier 3 results if the models are not widely accessible through a transparent process.

In summary, the Province will look to the Peer Reviewers to determine if the model is "fit for purpose", based on their direction the Tier 3 team will move on to the RMMEP or complete additional technical work required for acceptance. If the peer reviewers indicate the additional technical work is not required at this time, and they recommend it be considered in future updates, we will look to the LESPR to include this in their November 2019 work plan outlining the future plan updates. It is important that we not delay the December 2017 timelines and work towards ensuring actions are taken to ensure the longer term sustainability of the Guelph system.

Sincerely Heather Malcolmson Director

Copy: Martin Keller, Project Manager, Grand SPA lan Roger, CAO, Guelph/Eramosa Township Karen Landry, CAO/Clerk, Township of Puslinch Kathryn Ironmonger, Town Manager/CAO, Town of Erin Gary Cousins, Director of Planning, County of Wellington Dave Belanger, Water, City of Guelph Peter Rider, RMO, City of Guelph Dale Murray, Lake Erie Source Protection Committee Wendy Lavender, SPP Manager, MOECC Elizabeth Forrest, Liaison Officer, MOECC Kathryn Baker, Hydrogeologist, MOECC Scott Bates, Water Budget Analyst, MNRF **Appendix D**

Concluding the Municipal an Provincial Peer Review Process

June 15, 2016 through March 2017

Grand River Conservation Autro

400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6

Phone: 519.621.2761 Toll free: 866.900.4722 Fax: 519.621.4844 Online: www.grandriver.ca

June 9, 2016

To all participants

Re: City of Guelph and Guelph-Eramosa Tier 3 Water Quantity Risk Assessment Peer Review Meeting June 15, 2016

Dear all,

In preparation for the June 15, 2016 peer review meeting, James Etienne circulated the peer review package to all participants on May 26, 2016. The package includes:

- Guelph/Guelph-Eramosa Tier 3 WQRA Peer Review Process Summary of Activities (2013-2016)
- Appendix A: Guelph/Guelph-Eramosa Tier 3 Water Quantity Risk Assessment Report Preparation – May 2013 through July 30, 2014
- Appendix B: Municipal Peer Review Comments (GET, Puslinch, and Erin) July 28, 2014 through June 19, 2015
- Appendix C: Response to Municipal Peer Review Comments June 25, 2015 through May 17, 2016

Enclosed you will find the agenda for the peer review meeting. I have invited Wendy Wright-Cascaden, Acting Chair of the Lake Erie Region Source Protection Committee, to chair the meeting. The objectives of the meeting are threefold:

- Review and discuss outstanding municipal concerns on Guelph/Guelph-Eramosa Tier 3 WQRA
- Present and discuss the revised Tier 3 WQRA results and WHPA-Q1 mapping
- Determine next steps towards finalizing the Tier 3 WQRA and commencing the RMMEP

We are proposing an issue by issue discussion of the outstanding concerns, which are listed in the attached summary sheet. Following a brief outline of a concern by R.J. Burnside, Harden or WSWP and a brief response by Matrix Solutions Inc. (Matrix), the Peer Reviewers may ask questions and the issue will be discussed. The aim is to determine next steps towards finalising the Tier 3 WQRA for each issue before moving to the next. Some comments are not of a technical nature and will be discussed by the broader group.

After the issue by issue discussions, Matrix will present the revised WQRA results and WHPA-Q1 mapping. Following any discussions and questions, the aim is to determine next steps towards finalising the Tier 3 WQRA so that Matrix can write up the draft final Tier 3 WQRA report for circulation.

In accordance with the peer review process, all municipal peer review comments, responses from the technical team, comments from the Peer Reviewers, as well as any revisions which may result from those comments will be documented in the Peer Review summary document, which will form part of the submission package together with the WQRA report.

If you have any questions about the June 15, 2016 peer review meeting, please feel free to contact me at 519-620-7595 or by e-mail at <u>mkeller@grandriver.ca</u>.

Sincerely,

1/Kelle

Martin Keller, MSc. Source Protection Program Manager

Encl.



Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment Peer Review Committee Meeting

Wednesday, June 15, 2016 9:30am to 12:30pm GRCA Head Office (400 Clyde Road, Cambridge)

Agenda

Meeting Objectives:

- Outline and discuss outstanding municipal concerns on Guelph/Guelph-Eramosa Tier 3 WQRA
- Present and discuss the revised Tier 3 WQRA results and WHPA-Q1 mapping
- Determine next steps towards finalizing the Tier 3 WQRA and commencing the RMMEP
- 9:30 to 9:40 Introductions/Meeting Objectives/Meeting format (W. Wright-Cascaden)

9:40 to 11:00 Outline and review of outstanding municipal concerns on Guelph/Guelph-Eramosa WQRA Municipal Peer Review overview (M. Keller)

Issue by issue discussion (see attached list of outstanding concerns)

- Brief outline of concerns (R.J. Burnside, Harden, WSWP)
- Brief outline of response (Matrix Solutions)
- Questions by Peer Reviewers
- Discussion
- Next steps

11:00 to 12:00 Revised WQRA results and WHPA-Q1 mapping

Presentation (Matrix) Discussion (All)

12:00 to 12:30 Summary and next steps (M.Keller)



Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment

List of Outstanding Municipal Concerns

Peer Review Committee Meeting June 15, 2016

R.J. Burnside Concerns (Guelph-Eramosa Township) – Letter Dated May 10, 2016

- 1. Surface Water Leakage into Bedrock Aquifer
- 2. Expression of Bedrock Valley on east side of Guelph
- 3. Eramosa Formation Aquitard
- 4. Collection of necessary data in 2016 to address concerns regarding potential water loss to Eramosa River
- 5. Update model with best possible information at a local scale to improve calibration

Harden Concerns (Puslinch Township) – Letter Dated April 22, 2016

- 1. Eramosa River as Groundwater Discharge Zone (see 1 above).
- 2. Influence of other drawdowns Nestle/Burke/Aberfoyle
- 3. Treatment of 20% reduction of water taking during Level III Low Water Response Condition
- 4. Reduction of Significant Water Taking Guelph Limestone Quarry

Other Wellington Source Water Protection (WSWP) Comments – Letter Dated May 17, 2016

- 1. Request to present comment to Provincial Peer Review Team
- 2. Disagree with commencement of RMMEP at this time
- 3. Clarification on access and ownership of Tier 3 model
- 4. December 31, 2017 deadline to complete RMMEP too rushed
- 5. If Province must finalize WQRA under current timeline....consider accepting it with a moderate risk until such time that the outstanding concerns can be addressed.... because of uncertainty




























Eramosa	River	at Eden	Mills
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Date	12-Jun-13	02-Jul-13	18-Jul-13	09-Aug-13	29-Aug-13	19-Sep-13	09-Oct-13	21-Oct-13	29-Oct-13	
Time	1000h	1200h	1300h	1500h	1400h	1000h	1000h	1300h	1300h	
Technician	Denhoed	Rodie	Rodie	Rodie	Rodie	Denhoed	Denhoed	Denhoed	Denhoed	
Station 1 Upstream m3/s	4.38	0.86	0.77	1.1	0.6	0.57	4.05	2.47	2.36	
Station 2 East m3/s	0.66	0.04	0.05	Too Slow	Too Slow	Too Slow	0.71	1.31	0.38	
Station 3 downstream m3/s	3.84	0.56	0.51	0.89	0.46	0.27	3.59	2.03	1.92	
GRCA Gauge at Watson Rd m3/s	5.9	1.37	1.54	2.92	1.42	1.09	6.12	4.06	3.92	
Flow 3/Flow 1	0.88	0.65	0.66	0.81	0.77	0.47	0.89	0.82	0.81	
% Loss btw Sta 1 and Sta 3	12.1	34.6	33.9	19.1	23.1	53.3	11.4	17.8	18.9	
Loss (m3/s)	0.53	0.30	0.26	0.21	0.14	0.31	0.46	0.44	0.45	
Flow 3 - Flow 2 (m3/s)	3.18	0.52	0.46				2.87	0.73	1.53	
% Flow going through Pond (St1 -St2/St1)	0.849	0.95	0.939				0.824	0.472	0.838	
Eramosa River Assessment										
GRCA Gauge at Watson Rd m3/s	5.9	1.37	1.54	2.92	1.42	1.09	6.12	4.06	3.92	
Station 3 downstream m3/s	3.84	0.56	0.51	0.89	0.46	0.27	3.59	2.03	1.92	
Blue Springs Creek (SW1-1 + SW1-2) (m3/s)	1.376	0.541	0.618	0.795	0.592	0.436	1.356	0.895	0.904	0.835
Station 3 + BSC (m3/s)	5.216	1.101	1.128	1.685	1.052	0.706	4.946	2.925	2.824	
GRCA Gauge at Watson - (Sta 3 + BSC) (m3/s)	0.684	0.269	0.412	1.235	0.368	0.384	1.174	1.135	1.096	0.751
										Average
GRCA Gauge at Watson - (Sta 1 + BSC) (m3/s)	0.144	-0.031	0.152	1.025	0.228	0.084	0.714	0.695	0.656	0.407
										ŀ.







Arkell Study - May 2007 Heads – Shallow and Deep



Arkell Daily Pumping 2007 - 2014

Year	Daily Pumping (m ³ /d)		
2007	12,240		
2008	11,900	Tier 3 S	tudy Year
2009	9,110		
2010	11,960		
2011	20,770		
2012	22,580		
2013	23,230		
2014	20,100		
Average	16,640		

Arkell Studies - Deep Bedrock Heads 2007 vs 2014









Eramosa River Subwatershed Water Balance at Watson Gauge

- Can the Eramosa be losing 500L/s at Eden Mills, while maintaining expected subwatershed water balance?
 - Drainage area = 236 km²
 - 0.5 m³/s of loss equals ~ 70 mm/yr of watershed yield
 - 1990 to 2015 Watson Rd Yield = 2.52 m³/s or 340 mm/yr
 - Ignores City of Guelph Eramosa taking (~7 mm/yr)
 - Watson Rd Yield + Eden Mills loss = 410 mm/yr
 - 2015 Shand Dam Precipitation = 866 mm/yr
 - Estimated ET would be 460 to 470 mm/yr
 - Lower than published watershed estimates
 - May suggest that portions of the lost water is returning to the Eramosa upstream of Watson Rd.













Gasport Recharge Scenarios

- What are sensitivity of WHPA-Q1 and Arkell 1 results if we assume that recharge from Eramosa River at Eden Mills was getting down to Gasport Fm at rates observed as losses in streamflow?
- Using G2 Scenario 123,000 m³/s total pumping in model (vs. 2008 pumping of 93,800 m³/d)
- Arkell Pumping 22,700 m³/d (vs. 2008 pumping of 12,000 m³/d)
- Scenarios with a source of water in Gasport under Eden Mills Dam (simulated as an injection well)

















Gasport Recharge Impact at Arkell 1

Scenario	Change in Drawdown
100 L/s recharge to Gasport	0.0 m
200 L/s recharge to Gasport	0.0 m
500 L/s recharge to Gasport	0.1 m less drawdown

Conclusions:

- Simulated increases of 100 to 500 L/s recharge directly to Gasport did not significantly impact WHPA-Q1 or Arkell 1 results.
- 95% of injected volume returns to Eramosa River above Watson Rd. gauge.
- Resultant heads in Gasport not observed in field.



Summary (cont...)

- 5) Watershed would need to yield more water to sustain an additional 500 L/s, Does ET become unreasonable?
- Model is calibrated to baseflow at WSC Gauges and 2008 spotflows. It already accounts for net recharge/discharge on a larger scale than observations.
- 7) Modelled heads match observed heads in Gasport.
- Simulated increases of 100 to 500 L/s recharge directly to Gasport did not significantly impact WHPA-Q1 or Arkell 1 results. Resultant heads in Gasport are not observed in field.
- 9) For the purposes of the Tier 3 with long-term temporal scale and large spatial scale, the water budget of the subwatershed is considered suitable for making longterm aquifer sustainability predictions





GET Municipal (Burnside) Review

<u>Response 2</u>

- The data and interpolation routine (Natural Neighbour) leads to a bedrock width that is follows data with higher location confidence
- Control points were added between high quality picks along interpreted thalwag which increase continuity (and depth) of the valley





OGS 2016 Bedrock Surface OGS bedrock surface Many control points (black dots) OGS conceptual model bedrock valley formed by a *fluvial*source (Megaflood) Valley base declines towards the lake basins Matrix has different conceptual model Fluvial or combination of glacial and fluvial erosion

Buried Bedrock Valley

- OGS = one conceptual model
- Matrix bedrock surface is less biased; honours other potential interpretations of bedrock lows
- *Not all bedrock lows/valleys were formed fluvially*
- Bedrock > 300 million years old; oldest overburden sediments ~35,000 years old
- Are we confident ONE river carved the valley in ~300 million years?



Buried Bedrock Valley

- OGS = one conceptual model
- Matrix bedrock surface is less biased; honours other potential interpretations of bedrock lows
- *Not all bedrock lows/valleys were formed fluvially*
- Bedrock > 300 million years old; Oldest overburden sediments ~35,000 years old
- Are we confident ONE river carved the valley in ~300 million years?



















Drawdown at Burke Well (6,000 m³/d) Transient WHPA-Q1 Evolution

- Is it possible to observe the effects of this cumulative drawdown over short-term / seasonal basis? Can one compare field-observed fluctuations in water levels with drawdown used to delineate the WHPA-Q1?
- How does drawdown for the WHPA-Q1 delineation evolve over time?
- Model scenario method:
 - Change steady-state model to transient model with initial condition as the no-pumping scenario.
 - Apply future pumping rates in model (123,000 m³/d).







Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment Peer Review Committee

Meeting Summary Notes

Date: June 15, 2016 – 9:30am to 12:30pm

Location: GRCA Head Office, Cambridge

Attendees: Chair

Wendy Wright-Cascaden, Acting Chair, Lake Erie Region SPC

Peer Reviewers

Hugh Whiteley – University of Guelph (UofG) Dave Rudolph – University of Waterloo (UW) Tony Lotimer – ARL Groundwater Resources Ltd. (ARL)

Participants

Stephanie Shifflett, Martin Keller, Sonia Strynatka, Ilona Feldmann – GRCA Kathryn Baker – MOECC Eric Hodgins, Richard Wootton – Region of Waterloo Kyle Davis – Wellington Source Water Protection (WSWP - a partnership of Wellington County municipalities) Peter Rider, Dave Belanger – City of Guelph Dwight Smikle, Jim Baxter – R.J. Burnside (on behalf of Guelph / Eramosa Township and WSWP) Stan Denhoed – Harden Environmental (on behalf of Township of Puslinch and WSWP)

Consulting Team

Paul Chin, Patty Meyer, Paul Martin – Matrix Solutions Inc.

Introductions/Project Status

W. Wright-Cascaden started the meeting with introductions and outlining the meeting objectives.

1) Meeting Objectives:

- Outline and discuss outstanding municipal concerns on Guelph/Guelph-Eramosa Tier 3 WQRA
- Present and discuss the revised Tier 3 WQRA results and WHPA-Q1 mapping
- Determine next steps towards finalizing the Tier 3 WQRA and commencing the RMMEP

NOTE: Peer Reviewer questions and comments have been highlighted in bold text.

2) Outstanding Municipal Concerns

Surface Water Leakage into bedrock aquifer/Eramosa River as Groundwater discharge Zone (R.J. Burnside and Harden Concern #1)

- The following discussion took place between 9:40am and 11:45am.
- S. Denhoed presented outline of concern: an unaccounted measured and observed loss of water in 1.5 km long reach of Eramosa River at Eden Mills Pond. S. Denhoed questioned what the implications may be to the WHPA Q1.
- H. Whiteley agreed that there is an obvious loss of water leaving Eden Mills Pond but does not see satisfactory end points of that water.
- D. Rudolph asked if the loss was relatively recent or whether it has occurred for a longer period of time.
- H. Whiteley responded that in 2008, the Eden Mills Group noticed that water was being lost and concluded that the loss is a relatively recent phenomenon. The summer water level in the Eden Mills Pond that previously was able to be sustained can now not be achieved. Activities in the Mill Pond, e.g., dredging, may have contributed to greater water loss in this karst environment.
- D. Belanger explained that pumping rates decreased from 2002 to 2011. Starting in 2011, a pumping test was undertaken at the Arkell Well Field and the wells were pumped at the maximum permitted rate which was almost double the rate that was pumped in the period before 2011. This increased pumping rate did not show any measurable change in the water levels in the Eramosa River at Eden Mills. Several multi-level observation wells located between the Arkell grounds and Eden Mills to the north also support the conclusion that the Guelph takings do not take any, or much, river water in the Eden Mills area. The observed river water loss is interpreted to re-enter the Eramosa River further downstream or south of Eden Mills at Blue Springs Creek. D. Belanger acknowledged that increased pumping at Arkell, however, does cause the horizontal drawdown cone from the Arkell wells to get a little larger and expand towards the Blue Springs Creek area.
- P. Chin responded to the concern by reviewing various reports and providing the results of a sensitivity analysis conducted using the calibrated model. Matrix confirmed that the simulated water levels at the wells and Eden Mills Pond were consistent with the observed water levels and supported Guelph's conclusion that the loss of water at Eden Mills is not due to pumping at Arkell. The FEFLOW model was well calibrated in the Eden Mills Pond area. The water budget of the subwatershed is considered suitable for making long-term aquifer sustainability predictions for the municipal water supply wells of interest within the study area.
- S. Denhoed reiterated the concern that if there is a loss of water not accounted for in the model that it would change the size and shape of the WHPA-Q. P. Meyer/P. Chin responded that the loss of water from the Eramosa River at Eden Mills may be a local phenomenon, and that the water is interpreted to discharge locally within the same subwatershed. Updating the model to represent this local scale feature (i.e., recharge the groundwater system at Eden Mills and enhance surface water discharge further downstream) would not result in a different WHPA-Q1 size or shape or change the results of the long-term sustainability of the groundwater resources at Arkell.
- D. Rudolph commented that if the loss of water were a recent phenomenon, then

the Watson Gauge should show a change, i.e. a loss. P. Chin responded that for the 15 years prior to 2005 (1990-2005) compared to the ten years after (2006-2015), the Watson gauge showed no loss, in fact there was an increase in monthly flows. D. Rudolph replied then either the loss has always been occurring or there is only a loss in one section with the water reappearing upstream of Watson Gauge.

- H. Whiteley commented that there is adequate basis for confirming the Tier 3 study as it stands and that questions regarding the Eramosa River and future field work should be addressed under "remaining uncertainties" and if deemed relevant, it could be captured in future implementation phases. H. Whiteley indicated that two hypotheses should be studied: shallow transfer to Blue Springs Creek versus deep recharge to Gasport aquifer.
- K. Baker suggested that the additional work (necessary to reduce this uncertainty) is likely a "nice to have" rather than a "need to have" for the model's purpose under the *Clean Water Act, 2006*.
- The Peer Reviewers expressed that they received sufficient information to comment. J. Baxter requested that the comments be more formal in nature for delivery to their client municipalities.
- Next steps included providing the revised WQRA report including the 2015 Stantec report referenced by D. Belanger. Also, provincial Peer Reviewers to provide formal comments that include recommendations on whether further field study is necessary and timing (i.e., before RMMEP is finalized or in the 2019 work plan for an update of the Assessment Report).

Expression of Bedrock Valley on east side of Guelph (R.J. Burnside concern #2)

- P. Meyer presented the differences between the Matrix and Ontario Geological Survey (OGS), 2016 conceptualizations in the buried bedrock valley delineation. P. Meyer explained that the Matrix interpretation of the geologic information differs from the OGS interpretation, which interprets a steep sided, constantly downward dipping base of the valley. Matrix interprets the base of the valley to have more topographic variability and the interpretation more closely aligns with the available data and field observations. The same data has been used by both in their interpretations. Matrix's interpretation indicates fluvial and glacial sources to the valley (including the possibility of multiple channels) while OGS indicates one fluvial source. This results in the OGS interpretation being narrower in width than Matrix's interpretation.
- P. Meyer indicated that the Matrix interpretation errs on the side of caution as if the valley is wider, it would transmit more water.
- H. Whiteley asked what is known about the valley fill.
- P. Meyer indicated Catfish Till and coarser sediments. Matrix did increase the conductivity for one area in the south based on the comments.
- H. Whitely asked what the impact of this change was on the WHPA-Q.
- P. Chin indicated that the change shifts where the losing and gaining areas of the Eramosa River are but did not change the overall WHPA-Q.
- The Peer Reviewers expressed that they received sufficient information to comment.
- J. Baxter indicated that this comment was not a make it or break it issue for Burnside but

more of a comment to understand the interpretation since Burnside had not been involved in the development of the model.

Influence of other drawdowns - Nestle/Burke/Aberfoyle (Harden concern #2)

- S. Denhoed explained the Township of Puslinch's concern that there is not a lot of good data that supports that level of drawdown in the Gasport aquifer; concern is about the size and extent of the WPHA-Q1 in the Township. Matrix presented sensitivity analysis that uses the current steady-state model and the future 2031 scenario for municipal takings with progressively "turning off" all groundwater takings to map the drawdown cones from groups of takings. Combined, this gives a picture of the individual impacts of groups of takings and supports the extent of the current WHPA-Q1. K. Baker confirmed the approach used (intersections of drawdown cones) followed the Technical Rules.
- The Peer Reviewers expressed that they received sufficient information to comment.

<u>Treatment of 20% reduction of water taking during Level III Low Water Response Condition</u> (Harden Concern #3)

 S. Denhoed outlined that in the future, the Guelph Limestone Quarry may reduce or cease to take water and that this should be taken into account in the future scenario runs. K. Baker explained that the technical rules don't allow for possible future reductions in water takings to be considered in the Tier Three Risk Assessment scenarios, mainly because there is no reliable way to foresee non-municipal future takings, unlike future municipal takings, which are documented in Municipal Water Supply Master Plans.

3) Next Steps and Process Discussion

The Peer Review Committee discussed next steps and what is needed to complete the Peer Review process:

- It was agreed that another meeting is needed to complete the discussion of the remaining agenda items
- Meeting notes from both Part I and II of the Peer Review meetings will then be issued
- Based on the Peer Review meeting notes, Provincial Peer Reviewers will comment on the outstanding issues of concern and decide whether Matrix can proceed with revising the WQRA
- If a green light is given, Matrix to issue a memo with the changes to the WQRA Report since the 2014 version (likely through an additional appendix that documents the changes and new information included in the last two years).
- Peer Reviewers will then sign off on the Matrix model update memo
- Matrix to finalize the WQRA Report. The revised WQRA Report and Peer Review Summary Report will then be submitted to MNRF for their technical acceptance (*this was not part of meeting discussion but would be next step*).

W. Wright-Cascaden adjourned the meeting at 12:45pm.



Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment Peer Review Committee Meeting – Part 2

Thursday, June 30, 2016 9:00am to 12:00pm

Matrix Solutions Inc. 31 Beacon Point Court, Breslau, Ontario N0B 1M0

Agenda

Meeting Objectives:

- Outline and discuss outstanding municipal concerns on Guelph/Guelph-Eramosa Tier 3 WQRA
- Present and discuss the revised Tier 3 WQRA results and WHPA-Q1 mapping
- Determine next steps towards finalizing the Tier 3 WQRA and commencing the RMMEP
- 9:00 to 9:10 Introductions/Meeting Objectives/Meeting format (W. Wright-Cascaden)
- 9:10 to 10:30 Outline and review of outstanding municipal concerns on Guelph/Guelph-Eramosa WQRA Municipal Peer Review overview (M. Keller)

Issue by issue discussion (see attached list of outstanding concerns)

- Brief outline of concerns (R.J. Burnside, Harden, WSWP)
- Brief outline of response (Matrix Solutions)
- Questions by Peer Reviewers
- Discussion
- Next steps
- 10:30 to 11:30 Revised WQRA results and WHPA-Q1 mapping

Presentation (Matrix) Discussion (All)

11:30 to 12:00 Summary and next steps (M.Keller)



Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment

List of Outstanding Municipal Concerns

Peer Review Committee Meeting – Part 2 June 30, 2016

R.J. Burnside Concerns (Guelph-Eramosa Township) – Letter Dated May 10, 2016

- 1. Surface Water Leakage into Bedrock Aquifer (no further discussion needed)
- 2. Expression of Bedrock Valley on east side of Guelph (no further discussion needed)
- 3. Eramosa Formation Aquitard
- 4. Collection of necessary data in 2016 to address concerns regarding potential water loss to Eramosa River *(confirm discussion outcome)*
- 5. Update model with best possible information at a local scale to improve calibration

Harden Concerns (Puslinch Township) – Letter Dated April 22, 2016

- 1. Eramosa River as Groundwater Discharge Zone (see 1 above) (no further discussion needed)
- 2. Influence of other drawdowns Nestle/Burke/Aberfoyle (confirm discussion outcome)
- 3. Treatment of 20% reduction of water taking during Level III Low Water Response Condition *(confirm discussion outcome)*
- 4. Reduction of Significant Water Taking Guelph Limestone Quarry (confirm discussion outcome)

Other Wellington Source Water Protection (WSWP) Comments – Letter Dated May 17, 2016

- 1. Request to present comment to Provincial Peer Review Team
- 2. Disagree with commencement of RMMEP at this time
- 3. Clarification on access and ownership of Tier 3 model
- 4. December 31, 2017 deadline to complete RMMEP too rushed
- 5. If Province must finalize WQRA under current timeline....consider accepting it with a moderate risk until such time that the outstanding concerns can be addressed.... because of uncertainty
- 6. Uncertainty level and significant risk level assignment (Arkell)











- Rockwood Well 4 was constructed in December 2014 and connected to the Rockwood system in 2016
- Recommended distribution of the Committed rate at 40% for Rockwood Wells 1 and 2 combined, and 30% each for Wells 3 and 4

2. Revision of Allocated Rates for Rockwood

- GET supplied revised Allocated Rates based on updated growth predictions for Rockwood
- 2026 avg. day flow of 1,907 m³/day

Municipal Well	Existing Demand (Average 2009 to 2010)	2020 Demand – Allocated Rates (m ³ /day) used for 2014 Draft Risk Assessment	Allocated Rates (m ³ /day)	
		Average or Drought Conditions	Average or Drought Conditions	
	Rockwood			
Station St. 1	283	345	396	
Station St. 2	262	324	367	
Bernardi Well 3	422	483	572	
Rockwood Well 4			572	
Total:	967	1,152	1,907	



- Previous estimates used sparse manual WL data
- Automatic WL recorder data was reviewed and new average WLs and SAAD values estimated
- Using Operating Low WL
































6. Calibration of Nestle Waters Well in Aberfoyle

• Reviewed:

- Nestle Waters Canada Test Pumping Investigations for TW3-80 and TW2-11 and 2010 Annual Monitoring Report (CRA 2004, 2011, 2012)
- Meadows of Aberfoyle 2014 Annual Monitoring Report (Banks 2015)
- Royal Canin Canada Hydrogeological Assessment and Pumping Test (SNC Lavalin 2005)
- Model checked against reported K estimates and details from borehole logs
- Local-scale calibration to 40-day constant rate test to ensure representative local, well-field scale response to pumping







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06/15/2016



			FEFLO'	W Groundwat	er Model Sce	nario Drawdow	/n (m)		
		А	Average Climate			Drought			
	Safe Additional Well	G(1)	G(2)	G(3)	D	H(1)	H(2)	H(3)	
Well Name	Drawdown (inc. Wel Losses)	Recharge Reduction, Increased Demand	Increased Demand	Recharge Reduction	Existing Recharge, Demand	Recharge Reduction, Increased Demand	Increased Demand	Recharge Reduction	
		City of Guelph							
Arkell 1	1.9	0.2	0.2	0.0	1.3	1.8	1.8	1.3	
Arkell 14	10.9	7.6	7.5	0.1	1.1	10.2	10.2	1.2	
Arkell 15	11.1	7.6	7.6	0.1	1.2	10.3	10.3	1.2	
Arkell 6	14.4	7.3	7.3	0.1	1.1	9.9	9.9	1.2	
Arkell 7	12.7	7.2	7.2	0.1	1.2	9.8	9.8	1.2	
Arkell 8	10.4	7.4	7.3	0.1	1.2	9.8	9.8	1.2	
Burke	4.3	1.3	1.0	0.3	2.9	4.1	4.0	3.0	
Calico	17.3	6.1	6.0	0.1	1.1	6.8	6.8	1.2	
Carter Wells	2.3	0.7	0.6	0.1	1.1	2.0	2.0	1.1	
Clythe Creek	13.7	9.3	9.2	0.1	1.2	10.9	10.9	1.2	
Dean Ave.	10.0	4.3	4.3	0.1	1.0	5.6	5.6	1.0	
Downey Rd.	13.6	4.4	4.2	0.2	1.3	5.8	5.8	1.4	
Emma	4.7	- 1.6	- 1.8	0.1	1.3	4.0	3.9	1.3	
Helmar	7.9	3.8	3.7	0.1	1.1	5.6	5.6	1.1	
Membro	11.8	4.6	4.6	0.1	0.8	5.7	5.7	0.8	
Paisley	15.2	4.6	4.3	0.2	1.4	7.4	7.3	1.5	
Park 1 & 2	8.5	3.2	3.1	0.1	1.3	7.1	7.0	1.3	
Queensdale	11.4	15.1	14.8	0.3	1.5	14.2	14.0	1.7	
Sacco	29.4	10.7	10.4	0.2	1.7	12.3	12.2	1.8	
Smallfield	39.9	11.7	11.4	0.6	2.2	13.3	13.2	2.3	
University	13.4	4.3	4.2	0.1	1.3	5.7	5.7	1.4	
Water Street	9.3	5.8	5.7	0.1	1.1	7.3	7.3	1.1	
			Rockwood						
Station Street Well 1	14.7	2.8	2.7	0.0	1.7	4.5	4.5	1.8	
Station Street Well 2	14.4	2.8	2.7	0.0	1.7	4.5	4.5	1.8	
Bernardi Well 3	12.8	3.3	3.1	0.0	8.3	12.3	12.3	8.5	
Rockwood Well 4	32.7	9.4	9.2	-0.2	5.:	16.4	16.3	5.4	
			Hamilton Driv	e					
Cross Creek Well	13.3	1.7	1.6	0.1	1.2	3.0	2.9	1.2	
Huntington	104	1.5	1.4	0.1	1.3	2.7	2.7	1.2	

Maximum Drought Drawdown Changes at Guelph Wells and RW/HD:							
	Well Name	Safe Addit Availab Drawdov (inc. We Losses	onal le vn ell	Previous Simulated Maximum Drawdown (m)	New Simulated Maximum Drawdown (m)		
		_					
Less than 1 m SAAD Remaining	Arkell 1	1.9		1.8	1.8		
	Burke	4.3		3.9	4.1		
	Carter Wells	2.3		2.1	2.0	_	
	Emma	4.7		4.2	4.0	New	
	Queensdale	11.4		7.6	14.2		
	Water Street	9.3		8.6	7.3	LACEEUS SAAD	
	Station St. 1	14.7		3.2	4.5		
	Station St. 2	14.4		3.2	4.5		
	Bernardi 3	12.8		6.4	12.3		
	Rockwood 4	32.7			16.4]	
	Hamilton Drive						
	Cross Creek	13.3		2.9	3.0		
	Huntington	10.4		2.6	2.7		



















Impacts to Other Water Uses Reduced Groundwater Discharge (>=10%)

Surface Water Course	Description	Previous Baseflow Reduction % [Scenario G(2)]	Previous Risk Level	New Baseflow Reduction % [Scenario G(2)]	New Risk Level
Blue Springs Creek	South Branch — At 28 th Side Rd.	30 %	Significant	27 %	Moderate
Chilligo/Ellis Creek	At Kossuth Rd.	10 %	Low	10 %	Moderate
	At Wellington Rd. 32	39 %	Significant	32 %	Moderate
Hanlon Creek	At Waterfowl Park	13 %	Moderate	22 %	Moderate
	At Hwy 6	9 %	Moderate	15 %	Moderate
	South Trib. At Hwy 6	17 %	Low	31 %	Moderate
Torrance Creek	At Stone Rd.	41 %	None (not coldwater)	41 %	None (not coldwater)

Questions / Discussion

Next Steps

1. Issue Draft Risk Assessment Report (end–June)

- Receive Peer Review comments on draft Risk Assessment (end-July)
- Finalize Tier Three Risk Assessment Report (mid-Aug)
- Peer Review sign-off on Tier Three (end-Aug)
- 2. Kick-Off Meeting for RMMEP (Sept)
- 3. Meeting to review Threats Ranking results and develop preliminary RMM scenarios (Oct)
 - Memo detailing preliminary RMM scenarios to be conducted
- 4. Telecon. to agree on preliminary RMM scenarios (end-Oct)





Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment Peer Review Committee

Meeting Summary Notes

Date: June 30, 2016 – 9:00am to 12:00pm

Location: Matrix Solutions Inc., Breslau

Attendees: Chair Wendy Wright-Cascaden, Acting Chair, Lake Erie Region SPC

Peer Reviewers

Hugh Whiteley – University of Guelph (UofG) Tony Lotimer – ARL Groundwater Resources Ltd. (ARL)

Participants

Martin Keller, Sonia Strynatka, Ilona Feldmann – GRCA Kathryn Baker, Cynthia Doughty – MOECC Eric Hodgins – Region of Waterloo Kyle Davis – Wellington Source Water Protection (WSWP - a partnership of Wellington County municipalities) Peter Rider, Dave Belanger – City of Guelph Dwight Smikle – R.J. Burnside (on behalf of Guelph / Eramosa Township and WSWP) Stan Denhoed – Harden Environmental (on behalf of Township of Puslinch and WSWP)

Consulting Team

Paul Chin, Patty Meyer, Paul Martin, Jeff Melchin – Matrix Solutions Inc.

Introductions/Project Status

W. Wright-Cascaden started the meeting with introductions and a re-emphasis on the meeting objectives. This meeting is a continuation of the meeting held on June 15, 2016.

1) Meeting Objectives:

- Outline and discuss outstanding municipal concerns on Guelph/Guelph-Eramosa Tier 3 WQRA
- Present and discuss the revised Tier 3 WQRA results and WHPA-Q1 mapping
- Determine next steps towards finalizing the Tier 3 WQRA and commencing the RMMEP

NOTE: Peer Reviewer questions and comments have been highlighted in bold text.

2) Outstanding Municipal Concerns

Surface water leakage into bedrock aquifer and expression of bedrock valley on east side of Guelph (R.J. Burnside concern #1 and #2)

• Committee confirmed that no further discussion was needed.

Eramosa Formation aquitard (R.J. Burnside and Harden concern #3)

• D. Smikle and P. Chin indicated that issue will be addressed as part of the WQRA update.

Collection of necessary data in 2016 to address concerns regarding potential water loss to Eramosa River (R.J. Burnside concern #4)

- K. Davis and M. Keller expressed that they would like the Provincial Peer Reviewers to provide comment on the need for additional data regarding the loss of water from the Eramosa River at Eden Mills.
- H. Whiteley commented that one should be cognizant of local scale data versus a regional model; T. Lotimer agreed with this comment.
- H. Whiteley suggested that this issue is essentially posed as two questions: 1) whether this issue is reason to pause the process and collect any data deemed necessary before continuing the study and; 2) whether this item should be addressed to reduce uncertainty through the continuous improvement process as part of a future model update, i.e., what follow-up activities are recommended for future work particularly regarding the future use of the model? Is this a local-scale study vs. regional-scale study?
- Provincial Peer Reviewers to comment on these two questions.

<u>Update model with best possible information at a local scale to improve calibration (R.J.</u> <u>Burnside concern #5)</u>

• D. Smikle indicated that this issue will be addressed as part of the WQRA update.

Surface Water Leakage into bedrock aquifer/Eramosa River as Groundwater discharge Zone (R.J. Burnside and Harden concern #1)

- The committee reviewed outstanding concerns from the June 15, 2016 meeting and agreed that they will wait for the Provincial Peer Reviewers to submit their comments. D. Belanger commented that the 2015 field data conducted by Stantec is replicated by the steady-state groundwater flow model completed by Matrix. This data included a calibration to water level elevations in multi-level wells throughout the Arkell area and calibration to baseflow at the available stream gauges.
- The Peer Reviewers expressed that they received sufficient information to comment.

Additional discussion around water loss at Eden Mills

 S. Denhoed indicated his desire to look at the new data presented by Matrix during the June 15, 2016 meeting. P. Chin presented additional modeling work where Matrix modelled a hypothetical injection well into the Gasport aquifer at 100 to 500 L/s to illustrate potential changes to WHPA-Q1 and potential impacts to the drawdown in the Arkell wells. While the boundary of WHPA-Q1 changed locally (shrinking approximately 500 m when 100 L/s was injected and approximately 1km when 500 L/s was injected), it was considered insignificant at the scale of the full WHPA-Q1 as the majority of the changes were in the Arkell area. There was minimal change in drawdown at Arkell 1 (less than 0.1 m when water was injected into the deep groundwater flow system at 500 L/s). Injecting water at this rate was simulated to cause hydraulic head in the Gasport Formation to rise far above the ground surface elevation, suggesting the bedrock formations are not transmissive enough or the volume of water injected exceeds the capacity of the bedrock formations. The conductivity values of the bedrock formations are consistent with the conceptual understanding of the geologic units on a broader scale, and were guided by pumping test interpretations. In summary, the observed loss of water at Eden Mills is interpreted to have a minor impact on the water level at Arkell 1 and the size of the WHPA-Q1 in this area.

- D. Belanger explained that the Stantec 2015 report covers the 2013 field data in addition to the 2011/12 data that is available through the City of Guelph website. The 2015 report was provided to Burnside and Harden. D. Belanger also stated that the field data (i.e., multi-level observation wells) confirms the modeling in that the non-accounted water loss does not reach the municipal supply aquifer and that the most likely scenario is that this water resurfaces downstream.
- The committee discussed how difficult it is to capture 100% of streamflow in fractured bedrock conditions such as around Eden Mills, as some flow most likely will be in shallow sub-surface and won't be able to be measured easily through streamflow measurements.
- The committee also discussed that the Tier 3 model represents an average steady state condition based on many factors including long-term stream gauge information and water level monitoring and that seasonal variations, e.g. seasonal stream flows, would not be adequately captured. This is an indication that the stream may be losing in most summer months and may be gaining in winter and spring.
- H. Whiteley indicated that he had heard sufficient information to render a decision. He also noted that Matrix has demonstrated on a regional scale that the model representation is close but that the model doesn't show local flow conditions in this area.
- K. Davis, D. Smikle and S. Denhoed have expressed that they had wanted Matrix to model this issue, which they have now done.

Influence of other drawdowns - Nestle/Burke/Aberfoyle (Harden concern #2)

P. Chin provided results from a transient example of how the drawdown used to delineate the WHPA-Q1 evolves when starting with no pumping in the model and then pumping at the future Allocated Rates, which are used to delineate the WHPA-Q1. Drawdown is predicted to take 10 to 20 years to fully evolve, and the amount of drawdown each year in the periphery of the WHPA-Q1 where drawdown is approximately 1 to 3 m, will be masked by seasonal water level fluctuations that are observed to vary from 1 to 2 m. P. Chin noted that one cannot compare shorter term daily or seasonal fluctuations to the full drawdown predicted under the WHPA-Q1 scenario due to the seasonal variability, and also because the City and surrounding permitted water takers have not historically pumped at the future pumping rates assessed in this study in the Risk Assessment. The committee discussed that it will be

difficult to verify the modelling exercise with field data because the modelled scenarios pump more water than the current pumping. S. Denhoed was satisfied with the explanation provided and suggested that the installation of monitoring wells through the proposed, University of Guelph South Wellington study, may help.

<u>Treatment of 20% reduction of water taking during Level III Low Water Response Condition</u> (Harden concern #3)

- Confirmation that reduction of water takings during low water response conditions are categories of risk management measures and cannot be included in the Risk Assessment as per the Provincial Technical Rules, which is designed to identify intrinsic risk to the municipal water supplies. S. Denhoed was satisfied with the explanation provided.
- A 20% reduction could be added as a scenario in the RMMEP if the Technical Committee desired.

Reduction of Significant Water Taking – Guelph Limestone Quarry (Harden concern #4)

• Confirmation that the Technical Rules do not consider possible future changes to nonmunicipal water takings. Also, there is currently no information available (within the time horizon (31 years) of the Tier 3 study) that would indicate the quarry status would change. S. Denhoed was satisfied with the explanation provided.

Request to present comment to Provincial Peer Review Team (WSWP concern #1)

- K. Davis noted that the concern was being addressed through the meeting.
- Committee confirmed that no further discussion was needed.

Disagree with commencement of RMMEP at this time (Wellington Source Water Protection (WSWP) concern #2)

• See discussion under WSWP #4

Clarification on access and ownership of Tier 3 model (WSWP concern #3)

• K. Davis agreed that it was not necessary to address the issue at this meeting; the issue is an outstanding concern.

December 31, 2017 deadline to complete RMMEP too rushed (WSWP concern #4)

- W. Wright-Cascaden asked what kind of timeline would be acceptable. K. Davis replied that it depends on the results/findings of the peer review process. Wellington municipalities could provide an answer later in the summer once the RMMEP/policy Terms of Reference has been reviewed in more detail.
- W. Wright-Cascaden recommended that a framework be established for the RMMEP timeline. K. Baker asked Matrix how far off they were from the original draft RMMEP schedule; P. Chin shared that the RMMEP is off by about two months but that it can be compressed with shorter intervals between technical committee meetings.
- M. Keller commented that preliminary water quantity policy development discussions could begin in parallel to the RMMEP; K. Davis agreed but also noted it that it would depend on the outcome of the peer review process. M. Keller stated that a revision of the Terms of Reference for the RMMEP will be started and circulated to the group for comment.

If Province must finalize WQRA under current timeline....consider accepting it with a moderate risk until such time that the outstanding concerns can be addressed.... because of uncertainty (WSWP #5)

• K. Baker indicated that WQRA cannot be finalized with a moderate risk assignment under the current framework of the Technical Rules. Outstanding concerns need to be addressed within current technical framework.

Uncertainty level and significant risk level assignment (ARKELL) (WSWP #6)

- W. Wright-Cascaden referred to the cover letter dated May 17, 2016. P. Chin indicated that under the Technical Rules, Arkell-1 does not trigger a significant risk level because of an exceedance of the Safe Additional Available Drawdown (SAAD) according to Rule 98(3), but because of the results of the uncertainty analysis under Rules 100 and 108. P. Chin then gave an overview of the Safe Additional Available Drawdown calculation at Arkell 1 to show that the evaluation was not overly conservative, and there was room to be more conservative. If Matrix were more conservative, the Safe Additional Available Drawdown value would have been exceeded for the existing condition; thus the assessment at Arkell 1 is considered reasonable. P. Chin also indicated that if Matrix were less conservative for Arkell-1, then one should also be less conservative for Rockwood Well 3 which would then trigger the significant risk level for the Rockwood Well 3 WHPA-Q (which is not joined to the larger Guelph WHPA-Q).
- H. Whiteley indicated that there is reason to be conservative as it takes 20 years to show pumping changes in the aquifer.
- K. Davis was concerned that the whole area (WHPA-Q1) becomes significant as a result of one well being triggered. P. Chin indicated that Matrix was not being too conservative, and that due to the uncertainty with respect to the recharge and overburden characterization in the area, as per the Technical Rules, a classification of high uncertainty in the result requires that the area be designated as under significant water quantity risk.
- T. Lotimer indicated that in his opinion, Matrix had not overstated the case to push Arkell-1 into the significant risk level.
- H. Whiteley indicated there appeared to be justification for lowering the Safe Available Drawdown, triggering the significant risk level in drought scenarios.
- K. Davis accepted the explanation provided.

W. Wright-Cascaden left the meeting at 10:30am and M. Keller took over to chair the meeting.

3) Revised Tier 3 WQRA results and WHPA-Q1 mapping

P. Chin presented the revised WQRA and WHPA-Q1 mapping, and highlighted eight updates since the 2014 Risk Assessment:

- 1. Inclusion of Rockwood Well 4 in Risk Assessment
- 2. Revision of allocated rates for Rockwood
- 3. Revision of safe available drawdown for Rockwood and Hamilton Drive wells
- 4. Removal of Vinemount formation east of Rockwood
- 5. Calibration of Rockwood wells 3 and 4

- 6. Calibration of Nestle Waters well in Aberfoyle
- 7. Removal of two expired/ non-existent permits in Puslinch
- 8. Dolime Quarry representation and update

4) Next Steps

The committee discussed the next steps to complete the peer review process. P. Chin explained that the revisions to the Tier 3 Water Budget model over the last couple of years as a result of the municipal peer review process will be captured in an additional appendix to the Water Quantity Risk Assessment (WQRA) Report. K. Davis asked the committee if there were a role for municipal peer reviewers to provide comments on the revised model update appendix. K. Baker indicated that this meeting as part of the municipal peer review process is the opportunity for municipal comments - the next stage of the review rests solely with the Provincial Peer Review Team. H. Whitely suggested that the municipal focus should now be on the RMMEP.

The committee confirmed that the conclusion of the municipal peer review process is for Provincial Peer Reviewers to make a determination whether the Tier 3 study needs to be paused for additional data/information to be collected and/or refinements to Tier 3 model, based on discussions from June 15 and 30 meetings and presentation material to be circulated.

The next steps will be as follows:

- Meeting notes from both the June 15 and June 30, 2016 meetings, together with the presentations will be circulated to the committee (Matrix, GRCA)
 - Provincial Peer Reviewers comment on whether there is a need to pause the Tier 3 study, based on the meeting discussions, notes and material presented (Provincial Peer Reviewers)
- Model Update Appendix provided to provincial peer reviewers (Matrix)
 - Provincial Peer Reviewers comment on Model Update Appendix (Provincial Peer Reviewers)
 - Provincial Peer Reviewers comment on whether there are additional recommendations for future work, particularly regarding the future use of the model, i.e., local-scale studies vs. regional study (Provincial Peer Reviewers)
- Revised Water Quantity Risk Assessment (WQRA) report provided in draft (Matrix)
 - Provincial Peer Reviewers comments on draft WQRA Report (Provincial Peer Reviewers)
- Peer Review Summary Report (GRCA)
 - A summary report including all comments and responses from both the provincial and municipal peer review process will be included in final WQRA Report

M. Keller adjourned the meeting at 12 noon.

ARL Groundwater Resources Ltd. 13 Douglas Drive, Ayr, ON N0B 1E0

August 4, 2016

To:	Martin Keller, M.Sc. Source Protection Program Manager Grand River Conservation Authority
From:	A.R. (Tony) Lotimer, M.Sc., P.Geo. Principal Hydrogeologist
Subject:	Guelph/Guelph-Eramosa Tier 3 Study Peer Review Comments

I have prepared the following brief comments regarding the concerns raised with respect to the Guelph/Guelph-Eramosa Tier 3 study results.

Based on the information presented and discussed at the two peer review meetings that I attended in June 2016, and the material forwarded to the provincial peer review team following those meetings, it is my opinion/position that there is no need to pause the Tier 3 Guelph/Guelph-Eramosa study. The Tier 3 process can move forward.

The water loss at the Eramosa River (at Eden Mills) was perhaps the most significant of the issues raised in the municipal peer review comments from the Townships. However, the technical response provided by the project team (Matrix), together with the familiarity and insight related to that issue provided by Hugh Whiteley and others at the June meetings, indicates that the issue does not significantly undermine the quality of the Tier 3 study results.

Please advise if you need any clarification regarding the above.

Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment Provincial Peer Review of Municipal Peer Review Concerns related to the Tier 3 Study

Comments by: David L. Rudolph, Provincial Peer Reviewer

August 5, 2016

Introduction

A series of technical concerns regarding the results and outcomes of the Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment report were submitted by a Municipal Peer Review team. The team reviewed the report on this work on behalf of the municipal authorities in Guelph/Eramosa Township, Township of Puslinch, Town of Erin and the County of Wellington. At the request of the Grand River Conservation Authority (GRCA) and the Ontario Ministry of the Environment and Climate Change (MOECC), the consultants responsible for the project were asked to consider and address these technical concerns. The nature of these concerns and the corresponding responses by the consulting team were reviewed by the Provincial Peer Review team and discussed with all interested parties in several meetings (June 15 and 30, 2016).

The GRCA and MOECC specifically requested the Provincial Peer Review team to consider the concerns raised by the Municipal Peer Reviewers and the responses of the consultants. Based on the information presented and available data and evidence, the Provincial Peer Reviewers were asked to recommend whether the Tier 3 process should be temporarily paused until supplementary information and data were collected to provide additional insight in the resolution of the concerns, or whether the process should continue as scheduled. Many of the initial concerns presented by the Municipal Peer Reviewers were addressed and a mutual understanding was achieved through discussions between the Municipal Reviewers and the consulting team. These were not discussed in any detail at the two June 2016 meetings and did not require additional input from the Provincial Peer Reviewers. Two issues remained unresolved, which could influence the conclusions of the Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment. These issues were the primary focus of the Provincial Peer Review committee. The issues included 1); the potential influence of recently observed surface water flow losses in the vicinity of the Eden Mills Pond north of Guelph and 2); the southern extent of the WHPA-Q1, which is influenced by significant commercial groundwater takings in this area. A brief assessment of both issues is presented below along with an evaluation of the potential influence the issue may have on the conclusions of the Tier 3 assessment and whether additional information is required at this time in order to proceed with finalizing the Tier 3 process.

1). Loss of Surface Water from the Eramosa River in the Vicinity of Eden Mills Pond

Field measurements of streamflow both upstream and downstream of the Eden Mills Pond illustrate that a substantial amount of surface water flow is lost in this reach and presumably recharged to the groundwater system. These data were collected during a field study program completed in 2013. Verbal evidence and observations provided at the June 15th, 2016 meeting indicated that summer water levels in the Eden Mills Pond are not sustainable at historical levels in recent years following a dredging operation of the pond that may have resulted in the removal of a lower permeability layer of the pond floor exposing more permeable pathways for water loss to the subsurface. Indeed there have been documented observations of surface water infiltrating below the pond floor by the water managers. As such, there appears to be clear evidence that there is a loss of water from the Eramosa River to the subsurface in the vicinity of the Eden Mills Pond. Without historical data, it is not clear whether this loss is a recent phenomenon or if it is the result of the dredging operations. It is also not clear if these losses from the Eramosa River occur year round as the gauging data were collected in the summer and fall months. Examination of the vertical hydraulic gradients in the subsurface near the pond suggest that there are downward groundwater flow conditions in the near surface environment, which supports infiltration or groundwater recharge beneath the pond. The current version of the groundwater flow model developed by the consultants for the Tier 3 study does not capture this local infiltration feature and the question posed by the Municipal Peer Reviewer was whether these water losses to the subsurface needed to be accounted for within the model in order to correctly define the WPHA-Q1 and the risk assessment of the City of Guelph groundwater supply.

In reviewing the available data, evidence and the additional numerical analysis completed by the consulting team, several observations can be made regarding the potential significance of the surface water loss to the subsurface near Eden Mills Pond:

1). Historical stream flow data within the Eramosa River collected from the Watson Rd. gauge, further downstream from where the evidence of surface water losses were recently measured, show a substantial gain in flow (equal to and often greater than the losses near the Pond) likely due to significant groundwater discharge to the Eramosa River and the Blue Springs Creek area. The stream reach from the upstream gauge at Indian Trail Rd. to the Watson gauge is a net groundwater discharge region. Based on available data and discussions during the June 15th meeting, it would appear that this has been a long term condition and that it continues to be an overall discharge reach even after the evidence of losses from the Eden Mill pond were documented. This would suggest that the groundwater-surface water interaction is spatially variable along the Eramosa River, which is a common condition along natural streams, particularly in a fractured rock environment. Considering the local scale of these variations, they are likely smaller than what is anticipated to be captured within the regional scale modeling framework employed within the Tier 3 process. The model does, however correctly indicate that this overall reach of the Eramosa River is a region of groundwater discharge, as observed in the field. Overall, this would suggest that net groundwater recharge along this reach of the Eramosa River is small and that water entering the subsurface at Eden Mills Pond likely returns as discharge to

the Eramosa River and surrounding streams locally downstream, and likely prior to the Watson Road gauge.

2). If a significant increase in groundwater recharge to the Gasport formation occurred relatively recently, the local and regional piezometric surface would show a gradual change from historical trends. No evidence of significant changes in the piezometric data are obvious from the available data. This would only be a relevant observation if the increased infiltration phenomenon was recent.

3). In examination of the hydraulic head data collected both in the vicinity of the Eden Mills Pond and around the Arkell Well Field, several observations can be made. The vertical gradients in the Gasport formation beneath the Eden Mills pond are close to or equal to zero, even after an extended increase in pumping from the Guelph wells. This suggests there is a very low component of vertical groundwater flow or direct recharge to the Gasport in this area, although there could still be some infiltration reaching the Gasport locally from this area. There is no evidence of a significant groundwater mound around the pond area or obvious influence on the regional piezometric surface that might be anticipated if significant local groundwater recharge were occurring in this area. In fact the regional piezometric surface is relatively concentric around the Guelph wells (Arkell Well Field) based on the field data and the modeling, suggesting the aquifer is being recharged in a regional sense as opposed to being significantly influenced by a local source of intense recharge. It should also be noted that the Eden Mills Pond is situated at the boundary of the WPHA-Q1 where vertical gradients generated by the pumping of the Guelph wells would be relatively low. Results from the additional modeling experiments provide further insight to this issue as discussed below.

4). The consulting team provided experimental simulations where progressively increasing volumes of recharge, up to the maximum potential losses based on the recent stream monitoring data, were injected into the Gasport Formation beneath the Eden Mill Pond area. The results of this modeling showed that the vast majority of this additional recharge returned to surface as discharge to the Eramosa River relatively near Eden Mills Pond. In addition, the increased recharge did not significantly influence the extent or shape of the WPHA-Q1 or the groundwater levels at Arkell 1. In addition, if this volume of water was infiltrating at this location, a substantial groundwater mound would develop to conduct the water downward to the aquifer. As noted above, there is no evidence of a groundwater mound beneath the Eden Mills Pond based on data from the monitoring well network.

5). Overall, the Tier 3 model replicates the piezometric conditions throughout the simulation domain very well, based on comparison to measured hydraulic head data. In addition, the overall water balance appears reasonable and local comparison to surface water flow data are also fairly well reproduced. This would suggest that the overall net recharge within the existing Tier 3 model is relatively representative of natural conditions at the regional scale.

Considering all of the observations noted above, it does not seem likely that there is a significant component of groundwater recharge entering the Gasport Formation in the vicinity of the Eden Mills Pond. The observations provided by the Municipal Peer Review team are logical and founded in physical observation. It is likely that as time goes on and additional studies are completed within the WHPA –Q1

for many of our Source Water Protection areas that new evidence will be discovered that will support adjustment of the WHPA-Q1 and consequently the assessment of the sustainability of the relevant groundwater sources in the future. **Based on my overall assessment, I would recommend that the Tier 3 process continue on schedule.**

2). Southern Extent of the WHPA-Q1: Influenced by Significant Commercial Groundwater Takings

The influence of significant commercial groundwater takings from the region south of the City of Guelph results in the merging of regional drawdown cones from several pumping centers and consequently the development of a large combined WHPA-Q1 associated with the Guelph system. The combined areas of influence from the different pumping centers are delineated based almost entirely on the results of the Tier 3 model, calibrated to hydraulic head and isolated stream flow measurements. Importantly, the combined WPHA-Q1 represents an average steady state area that would take an extended time period to develop. This is of course theoretical, as all capture zones are, and difficult if not impossible to verify based on direct field measurement. The approach is fairly conservative in nature, which is appropriate considering the degree of uncertainty associated with any regional groundwater flow model. However, as noted above, the model is well calibrated and is based on logical physical information. It should also be noted that based on the recent transient model runs developed by the consultant to better understand the nature of the capture zones from the different well fields, very long time frames are required to ultimately reach steady state conditions (several decades). As such, the influence of relatively short term pumping tests would not likely be of direct utility in determining the long term lateral extent of the capture zones. Although the combined WHPA-Q1 delineated here for the City of Guelph wells is not without a degree of uncertainty and does not represent transient and seasonal changes in the capture zones, it is considered to be a representative estimation of the physical system within the scope of the Tier 3 guidelines and I do not see an immediate reason to suggest specific modifications to the modeling approach at this time. Following the review of the final modelling report that will be provided in the near future, there may be an opportunity to suggest additional priority field investigations and potential applications of the model that could be undertaken in the future following the completion of the Tier 3 process. At this point, I would recommend that the Tier 3 process continue on schedule and that the combined WHPA-Q1 appears reasonable.

Martin Keller Source Protection Program Manager Grand River Conservation Authority 400 Clyde Road PO Box 729 Cambridge ON N1R 5W6

August 8 2016

Dear Mr Keller

RE: City of Guelph/Guelph-Eramosa Township Tier Three Water Budget and Local Area Risk Assessment

Background

Subsequent to the peer review by the three appointed technical reviewers of the Guelph Risk Assessment in May 2013 and of the supplemental Guelph/Eramosa Risk Assessment of July 2014 concerns were raised in July 2014 by Wellington County and the municipalities of Guelph-Eramosa and Puslinch, through their respective technical reviewers, regarding possible deficiencies in the Guelph/Guelph-Eramosa Tier 3 Water Budget and Local Area Risk Assessment process.

In order to address the concerns expressed the Source Protection Program Manager initiated an exchange of information among the municipalities and the project team. The results of this exchange of information, and of the adjustments made to the model and the report by the study team, was presented to the municipalities and the appointed technical reviewers at meetings held on June 15 and June 30th 2016.

<u>Concerns</u>

Some of the concerns of the municipalities were related to the interpretation of the technical rules concerning the classification of level of concern for a WHPA-Q1 on status of individual wells and the merging of cones of influence in the delineation of the boundary of a WHPA-Q1. I understand that these concerns were resolved by discussion with the Program Management staff.

The principal municipal concerns of a technical nature as identified at these meetings were as follows:

Outstanding Municipal Concerns

- Effect of observed losses of water from Eramosa River in the vicinity of the Eden Mills pond on regional flow system as represented in the model
- Representation in the model of Rockwood-area buried valley
- Influence of pumped wells south of Guelph on WHPA-Q1 boundary

In response to these concerns, and to take advantage of new information made available since 2013, the study team made a number of adjustments to the regional model and reassessed well performance for a number of wells and made adjustments to the WHPA-Q1 boundary.

<u>Adjustments</u>

The adjustments in system representation made by the study team in response to the concerns were described as follows at the two meetings:

Rockwood Area:

- Removal from model of Vinemount aquitard layer for area east of Rockwood
- Inclusion of Rockwood Well 4 in risk assessment and calibration of Rockwood wells 3 and 4 in model
- Revision of allocated rates for Rockwood and revision of safe available drawdown for Rockwood and Hamilton Drive wells

Guelph/Puslinch Area

- Calibration in model of Nestle Waters well in Aberfoyle
- Removal of expired water-taking permits in Puslinch
- Update model for Dolime quarry representation
- Recalibration of City of Guelph wells for drawdown
- Use transient model to evaluate evolution of drawdown for delineation of WHPA-Q1

Changes to risk assessment

The results of these adjustments were presented at the meeting of June 30 2016. The revised boundary for the WHPA-Q1 is almost identical to that presented in earlier reports. The only appreciable difference is the removal of a southern tongue-like extension of the Guelph/Guelph-Eramosa WHPA-Q1 into the buffer region between the Guelph WHPA-Q1 and the Cambridge WHPA-Q1. It has already been agreed that in this buffer region effects from both Guelph and Cambridge would be evaluated in any policy decisions. Removal of this tongue thus has no effect on policy development.

The only adjustment in well classification as a result of the update was the reclassification for the City of Guelph Queensdale well. The new drought-period drawdown exceeded the Safe Available Additional Drawdown for that well. This reappraisal is added confirmation of a significant risk level assignment to the WHPA-Q1.

Conclusions

Based on my review of the response to the expressed municipal concerns I am satisfied that there is no need for further review of the City of Guelph/Guelph-Eramosa Township Tier Three Water Budget and Local Area Risk Assessment and recommend that it be finalized in its current form and submitted to MOECC for review for approval.

The municipal concerns regarding the representation of the buried valley in the model were discussed in detail and the study team presented a good rationale for their choice of representation. In any case the details of the representation of the buried valley that differ between the one chosen and that of the OGS are unlikely to have any appreciable effect at the scale of a regional model. In future uses of the model at a more detailed scale revisions to this representation could be considered but would require more field data to support any changes.

The effects of the observed diversion of flow of the Eramosa River to the groundwater system in the vicinity of the Eden Mills pond have been shown to have no appreciable effect at a regional scale. This demonstration of no appreciable effect is convincing because, in the fully integrated surface and groundwater flow representation used in this study, mass balance using outflow calibration is an integral part of calibration.

There is unresolved uncertainty about the interaction of the flow entering the groundwater system at Eden mills from the Eramosa River and the local groundwater system between Eden Mills and Arkell. In the ongoing model adjustments that are anticipated to support implementation of source-water protection strategies it is important to further refine the model to represent these local effects. Confirmation of effects through continued streamflow monitoring along the Eramosa River and Blue Springs Creek would be important to this model-adjustment.

The technical issues raised by the municipalities were relevant and the response of the study team has strengthened and improved an already impressive analysis. Of particular relevance to the understanding of the groundwater system under review, and of other similar groundwater systems, is the use in this addendum of transient analysis to establish the evolution of drawdown to changes in withdrawal rate. It is noteworthy that adjustments in drawdown to increased withdrawal may occur over periods as long as 20 y. This finding should be recognized and considered in all analyses of groundwater system response in Ontario.

Yours truly

HR Whiteley

H.R. Whiteley P.Eng.

Paul and Martin,

Thank you for the opportunity to review the final draft version of the City of Guelph and Township of Guelph / Eramosa Tier 3 Water Budget and Local Area Risk Assessment report dated January 2017. My apologies for my late response. It is understood that the draft copy of the report was provided to the Township of Guelph / Eramosa as an owner of a water system included in the study and the draft report was only provided to owners of the water system (the Township and City of Guelph) for comment. As you are aware, my position reports not only to the Township of Guelph / Eramosa but also the Town of Erin, Township of Puslinch and County of Wellington (and other Wellington municipalities). These three municipalities are municipalities affected by the Tier 3, however, do not own water systems within the Tier 3 study area. My comments, therefore, reflect my shared position as it relates to all Wellington municipalities in this Tier 3 project. On February 21, 2017, comments by Burnside were provided, on behalf of the Township of Guelph / Eramosa, on this report as a final review of the documentation not as a peer review. Please note my comments are not a technical review and are focused instead on process or documentation in the main report. I did not review the Appendices except for context. Appendix A and B are previously finalized reports, Appendix Cand D were part of Burnside's review

1/ As noted in the Burnside comments and documented in the report, the Townships of Puslich, Guelph / Eramosa, Town of Erin and County of Wellington provided municipal peer review comments and have outstanding technical concerns. The report does not mention these concerns nor do they indicate that the outstanding issues are recommendations for further work, which what was agreed to at the peer review meetings. I would recommend adding a section in section 8 and corresponding Executive Sumary sections that outline the recommendations for further work that arose from the municipal peer review. If that is not possible, some reference to the municipal peer review should appear in the report directing readers to the companion peer review reports.

2/ I do not see the peer review report(s) as part of the package provided for review. This report is important as it not only outlines the provincial peer review process but also the process for Wellington municipal review. I would ask for the opportunity for our municipalities' to review the peer review report. My understanding is it outlines the peer review comments (municipal and provincial) but also outlines the process for Wellington involvement. As noted in my following comment, the Tier 3 report does not accurately reflect our municipal involvement as peer reviewers instead characterizing our involvement as the project team. It is important that our involvement is accurately documented in both the Tier 3 report and peer review report.

3/ Section 1.1 - similar to Burnside comments, the Township of Guelph / Eramosa, the Township of Puslinch, Town of Erin, County of Wellington, Wellington Source Water Protection were not project team members. Our involvement was assigned to be municipal peer reviewers and should be reflected as such in Section 1.1 and other sections.

Section 9 - Project team - my name is listed in the project team membership, however, as Burnside pointed out, the Wellington municipal role was that of peer reviewers not the project team. Also, the other members of the Wellington review team are missing (ie Dwight Smikle, Jim Baxter, Stan Denhoed, Ray Blackport, Harry Niemi, Mark Paoli and others). The Wellington involvement should be accurately reflected in the report and appendices as municipal reviewers not project team.

4/ Section 2.6.2 - Official Plan - note there is a typo (Office Plan). Also, please note that a new OPA was approved in 2016, however is under appeal related to growth numbers. I believe the Tier 3 is a snapshot in time (ie there is a defined model year) but please be aware of the new OPA related to growth. Further information can be provided by the County Planning Department if required.

I trust that these comments are useful. I am happy to discuss them further at your convenience.
Regards,

Kyle

Kyle Davis | Risk Management Official

Wellington Source Water Protection | 7444 Wellington Road 21, Elora, ON, NOB 1S0 519.846.9691 x362 | kdavis@centrewellington.ca<<u>mailto:kdavis@centrewellington.ca</u>> | www.wellingtonwater.ca<<u>http://www.wellingtonwater.ca/</u>> Toll free: 1-844-383-9800

Wellington Source Water Protection is a municipal partnership between the Townships of Centre Wellington, Guelph / Eramosa, Mapleton, Puslinch, Wellington North, the Towns of Erin and Minto and the County of Wellington created to protect existing and future sources of drinking water.



February 15, 2017

Via: Email

Mr. Kyle Davis Risk Management Official County of Wellington 7444 Wellington Road 21 Elora ON N0B 1S0

Dear Kyle:

Re: Comments on the Guelph, Guelph/Eramosa Risk Assessment Report Project No.: 300036495.0000

R.J. Burnside & Associates Limited (Burnside) was requested by the Township of Guelph/Eramosa to review the Matrix Solution Incorporated (MSI) City of Guelph and Township of Guelph/Eramosa Tier 3 Water Budget and Local Area Risk Assessment report prepared for the Lake Erie Source Protection Region and dated January 2017. We understand that this is not a peer review but a final review of the documentation completed for the study in between 2014 and 2016. This letter provides Burnside's comments on the report and accompanying appendices.

Technical Concerns regarding the Model

In 2015 and 2016 Burnside, in the role of peer reviewer for the Township of Guelph/Eramosa provided comments on the draft Guelph and Guelph\Eramosa Tier 3 Water Quantity Risk Assessment. Comments provided by Burnside related to local issues that focused on the well sources and the approach to water taking at each well. Several areas of concern regarding the conceptual and numerical model that was used for the study were also presented. While the majority of issues were addressed it was agreed through discussions with provincially appointed peer reviewers that some of the concerns could be addressed in the next stage of the source protection study (likely to be initiated in 2018) and the Tier 3 report should be finalized.

Township Participation

The report attempts to include the Township as a study partner based on the existence of municipal wells within the Township that were included in the study. In Section 1.1 the report lists the Township as one of the organizations that directed the study. This is not the role that the municipalities and their consultants played in this project. The involvement of;

- Burnside for the Township of Guelph/Eramosa,
- Harden Environmental for the Township of Puslinch,
- Blackport Hydrogeology for theTown of Erin and
- Kyle Davis the Risk Assessment Officer for the County of Wellington (representing all of the municipalities surrounding the Guelph/Eramosa and Guelph study area).

would be more accurately documented as peer reviewers for the project. This is the role that we were assigned in comments made by Scott Bates of the Ministry of Natural Resources and Forests (MNRF) at a steering committee meeting in June 2015.

We note that the peer review role, along with Wellington County's role should be included in the acknowledgements section.

Report Structure and Nomenclature

The study area of the report is defined to include the Township of Guelph/Eramosa and its municipal supply wells in Hamilton Drive and Rockwood. Much of Section 2 of the report does not seem to acknowledge the fact that the Township surrounds much of the City of Guelph and descriptions such as those of surface water flows don't provide any indication of how these features relate to the Township. As part of the study area, the interactions of features within the Township should be acknowledged in order to provide the same context as for the City of Guelph.

The report and associated appendices should seek to correctly present the municipal structure where Guelph / Eramosa is the Township that maintains water supply wells in Rockwood and Hamilton Drive. This relationship is not always clear in the report as some references seem to suggest that these are "communities" with municipal water supply systems. The relationship can be illustrated by an analogy with the City of Guelph where the City is the municipality that operates wells that are located over a large geographical area. The same is true for the Township with the exception that the wells are not located within a contiguous urban area.

The references are also inconsistent and vary from "Rockwood" to "Village of Rockwood" to "Town of Rockwood" in various locations. Hamilton Drive is also referred to as a community and occasionally as a subdivision. A global replacement of the term "Rockwood and Hamilton Drive" with Guelph / Eramosa would resolve many of the naming issues.

We understand that the well names in Guelph / Eramosa have been inconsistent in historical documents. This has been resolved during the peer review of the project and we recommend that the well names be as follows:

- Rockwood Well 1
- Rockwood Well 2
- Rockwood Well 3
- Rockwood Well 4
- Huntington Well
- Cross Creek Well

It is reasonable that Rockwood Wells 1 and 2 be referred to as the wells at the Station Street pumphouse, Rockwood Well 3 at the Bernardi pumphouse and Rockwood Well 4 at the Seaton pumphouse. The Huntington Well and Cross Creek Wells are individual wells at pumphouses of the same name.

Ownership of Report and Appendices

The status of the report as it pertains to ownership should be clarified. The main report and figures include a disclaimer that indicates that the report was prepared for the City of Guelph and that use or reliance on the report should not be done without permission and written consent of Matrix and the City of Guelph. Appendix C (Characterization Update - Hamilton Drive and Rockwood) indicates that the report was prepared for the Lake Erie Source Protection Region. Clarification should be sought on whether the Township should be included as one of the owners of the report and therefore should also be named in the disclaimers.

Table 3-5 and 3-6 Aquifer Description

The aquifer units for the Guelph / Eramosa wells is shown as either "Upper to Middle Gasport" or "Middle Gasport" while the Guelph wells are shown as either "overburden" or "bedrock". We assume that the aquifer intervals for each well has been defined and this should be reflected in Table 3-5.

Section 3.2.4 Reference

The future demand estimates for Rockwood were obtained from a Burnside Technical Memorandum dated October 24, 2013. We have attached a copy of this document and this should be used as the reference to replace the "Baxter 2015, pers. Comm." reference.

Mapping

The geology map presented in the figures for the main report is not the same as that presented in Appendix C. The maps represent two separate interpretations of geology, one after Golder 2006 and the second after Brunton 2009. Both report and appendix should be consistent in mapping.

The location maps provided as part of Appendix C for Community of Hamilton Drive and Village of Rockwood (Figures 2-1 and 2-2) are very pixelated and are inconsistent with the details provided in all other figures.

We trust this review is suitable. If you have any questions please contact the undersigned.

Yours truly,

R.J. Burnside & Associates Limited

Dwight Smikle, P.Geo. Senior Hydrogeologist DS/JB:js

Jim Baxter, P.Eng. Groundwater Resource Engineer

Enclosure(s) Infrastructure

Infrastructure Phasing Memo

Mr. Ian Roger, Township of Guelph Eramosa (enc.) (Via: Email)
 Mr. Harry Niemi, Township of Guelph Eramosa (enc) (Via: Email)
 Ms. Jackie Kay, R.J. Burnside & Associates (enc) (Via: Email)

036495 Guelph Tier 3 Final Report review Letter.docx 15/02/2017 10:09 AM

From: David Rudolph [mailto:drudolph@uwaterloo.ca]
Sent: February 17, 2017 3:55 PM
To: Martin Keller
Subject: RE: PEER REVIEW: City of Guelph and Township of Guelph-Eramosa, Tier Three Water Budget and Local Area Risk Assessment Report Draft (Matrix 15072-527)

Hi Martin,

I stayed at home today to get caught up on things and went through the edits to the final Guelph-Eramosa Tier 3 Report.

I believe that the team has addressed all of the suggestions I had provided and I do not have any additional comments at this time and I recommend acceptance of this final version of the report.

Best regards, Dave Rudolph Martin Keller Source Protection Program Manager Grand River Conservation Authority 400 Clyde Road PO Box 729 Cambridge ON N1R 5W6

February 21 2017

Dear Mr Keller

RE: City of Guelph and Township of Guelph/Eramosa Tier Three Water Budget and Local Area Risk Assessment - Final Draft

I have reviewed the Final Draft of the City of Guelph and Township of Guelph/Eramosa Tier Three Water Budget and Local Area Risk Assessment by Matrix Solutions Inc. dated January 2017 and I am fully satisfied that the adjustments made in this document correctly incorporate the now-available new information and adjustments in the model results, interpretations and conclusions that were presented to the peer reviewers in 2016.

In my opinion this document is complete and is ready to be forwarded to MOECC for review.

I attach recommendations I make for editorial changes in the document to add clarity, none of the changes relate to any of the findings in the report.

Yours truly

HR Whiteley

H.R. Whiteley P.Eng.

Recommended Editorial Changes H.R. Whiteley

"City of Guelph and Township of Guelph/Eramosa Tier 3 Water Budget And Local Area Risk Assessment"

Throughout replace the term "surface water model" as a description of GAWSER with "streamflowgeneration model"

EXPLANATION FOR CHANGE GAWSER models groundwater not just surface water using a simplistic lumped representation of the groundwater flow system. The justification for using GAWSER-based recharge as an input into the groundwater model within an integrated (coupled) modelling approach depends on GAWSER estimates of recharge being tested within the GAWSER model by comparison of GAWSER estimates of baseflow with baseflow-from-groundwater as measured in the field..

- p viii replace "just over" with "about"
- **p xi** either remove the following sentence or add as shown: The Gasport Formation aquifer is protected in most areas by the Vinemount aquitard which reduces the impact of reduced groundwater recharge occurring at locations near the production well on water levels in the aquifer.

2nd last par The steady-state-model results show decreases in groundwater discharge in to applicable cold water streams

- p 29 Within the Study Area, the Vinemount Member was interpreted to have been removed by erosion eroded, including in an area near the Town of Rockwood, between Blue Springs Creek and the Eramosa River.
- **p 81** Within this area the aquitard impedes the flow of groundwater even in as shown by the presence of a strong large vertical gradients of potential.
- **p.86** Estimates of the water budget components were examined for the Upper Speed River Assessment Area and for the period 19XX to 20XX are summarized in Table 4-1 for the complete system including surface and groundwater components.

ARL Groundwater Resources Ltd. 13 Douglas Drive Ayr ON NOB 1E0

(519) 632-9887

February 28, 2017

Reference: 009 - 001

To:	Martin Keller, Source Protection Program Manager, Grand River Conservation Authority
From:	A.R. (Tony) Lotimer, P.Geo. Peer Review Team Member
Subject:	City of Guelph and Township of Guelph/Eramosa Tier 3 Water Budget and Local Area Risk Assessment

Dear Mr. Keller

I have reviewed the draft final report for the City of Guelph and Township of Guelph/Eramosa Tier 3 Water Budget and Local Area Risk Assessment (prepared by Matrix Solutions Inc. and dated January 2017).

I am satisfied that the report meets the requirements of the project and the Technical Rules governing the Tier 3 studies in Ontario. The report is well done and represents a significant contribution towards the understanding of water resources within the study area.

Some minor suggestions to improve the clarity and understanding of some of the information in the report are provided as an attachment.

of this

Attachment

1. Executive Summary page v. It is not clear from the last 2 sentences dealing with Planned Conditions why a 29% average demand is considered a significant potential stress whereas a 35% maximum demand is only considered a moderate potential stress. Some additional clarification may be useful to further explain these findings.

2. Executive Summary pages vi and vii. It is not clear why the simulations showing that the Queensdale Well being unable to meet the allocated rate (during average climate and drought conditions) results in a Significant Risk level to the <u>Surface Water Vulnerable Area</u>. Additional clarification may be helpful to explain these findings.

3. Executive Summary page viii. The first paragraph appears to suggest that results from the Cambridge model were used to determine the southwest boundary of the Guelph vulnerable area A. Perhaps better wording would be to say that results from both the Guelph and Cambridge models account for the location of the southwest boundary.

4. Report text page 29 - last sentence of first paragraph. Perhaps edit this to note that although the Vinemount Member has been eroded over a wide area it is still present and has an important role in some parts of the study area.

5. Report text page 123. The simulation results at the Queensdale Well and the Arkell Well 1 result in a *Significant* Risk level being assigned to the Groundwater vulnerable area A and the surface water vulnerable area. According to the report the allocated rates for these two wells account for less than 5% of the total allocated rates for all of the water sources in the City of Guelph system.

Ministry of the Environment and Climate Change

Source Protection Programs Branch 14th Floor 40 St. Clair Ave. West Toronto ON M4V 1M2 Ministère de l'Environnement et de l'Action en matière de changement climatique

Direction des programmes de protection des sources 14^e étage 40, avenue St. Clair Ouest Toronto (Ontario) M4V 1M2



MEMORANDUM

Date:	March 23, 2017
TO:	Martin Keller, Project Manager, Lake Erie Source Protection Region
FROM:	Kathryn Baker. P.Geo. Hydrogeologist

SUBJECT: Acceptance of the Guelph – Guelph Eramosa Township Tier 3 Water Budget & Local Area Risk Assessment

This memorandum confirms that the Ministry of the Environment and Climate Change has accepted, on behalf of the Province, the Guelph – Guelph / Eramosa Township Tier 3 Water Budget and Local Area Risk Assessment Report and the associated Municipal Peer Review and Peer Review Record documentation for the City of Guelph and Guelph / Eramosa Township municipal systems.

Source Protection Programs Branch would like to acknowledge the tremendous level of effort and many years of dedication from source protection authority staff, municipal representatives and consultants to produce this important technical report.

I look forward to continuing to work with the project team on the Risk Management Measures Evaluation Process.

Sincerely,

Kathryn

Copy:

Dave Belanger, Water Supply Program Manager, City of Guelph Harry Niemi, Director of Public Works, Guelph / Eramosa Township Kyle Davis, Risk Management Official, Wellington Source Water Protection Scott Bates, Ministry of Natural Resources and Forestry