APPENDIX I
Provincial Peer Review Comment Record

Table 1. Characterization Report - Guelph Tier Three Peer Review Comments				
Reviewer	**Comment #**	**Section #**	**Comment**	**Response to Comment**
		Appendix A (Draft Characterization Report) - June 2010		
T. Lotimer	1	1.1	The last paragraph in Section 1.1 tends to undermine the value of all of the work described in the remainder of the report. This paragraph should be deleted or re-written.	Paragraph was re-written to address comment.
T. Lotimer	2	2.1	It appears that the two wells referred to in the last paragraph in Section 2.1 are municipal wells outside of the city of Guelph. Perhaps refer to them as such without the specific well names, which may be meaningless to many readers.	Revised text to remove reference to these wells.
T. Lotimer	3	4.1.2	It appears that the figure reference in Section 4.1.2 should be changed to Figure 13 (rather than 14). The additional test holes/monitoring wells described in this section represent perhaps the most significant source of new field information produced by the study. The report would benefit from more explanation as to the rationale for the specific locations chosen for these new wells.	Figure number and text was updated to incorporate suggestions.
T. Lotimer	4	5.2 and 5.5	Section 5.2 (page 38 of the report) describes the refinement of the hydrostratigraphic conceptual model and represents the start of the important parts of the report. This section states that the overburden layers in the previous conceptual model were not modified and that the work focused on improving the bedrock conceptual model. At first read, this approach seems questionable, as it is difficult to argue that the overburden sediments and hydrostratigraphy are not key to the groundwater flow system in the area. More explanation/rationale for adopting the approach taken with respect to the overburden conceptual model could be provided in the report. This section could also benefit from a discussion addressing the roles of porous media flow, fracture flow, and dissolution (karst-related) flow in the bedrock hydrostratigraphic units. The underlying assumption is that the groundwater flow system in the model domain can be represented as an equivalent porous media; the report(s) should have some discussion as to why this is so.	The text was revised in Sections 5.2 and 5.2.11 to provide more details about the overburden conceptualization effort for this study. Additional discussion regarding fracture flow and karst dissolution added to text in Section 5.5. A brief discussion of the equivalent porous media approach (EPM) used in the model to represent secondary permeability and porosity is found in Section 3.4.1 of the modelling report.
T. Lotimer	5	5.2.2	Section 5.2.2. The report includes three cross-sections, two that are oriented north- south and one oriented roughly east-west; the east-west cross-section only extends across about two thirds of the model domain. Although preparation of useful cross-sections may be time-consuming and labour-intensive, it is difficult to evaluate or comment on the hydrostratigraphy over such a large area with so few cross-sections.	Three additional cross-sections were added in the final draft to incease coverage of the study area for a total of six cross-sections. Revised text to refer to three new cross-sections (Figures 23, 24 and 26)
T. Lotimer	6	5.2.3 - 5.2.9	Sections 5.2.3 - 5.2.9 describe the characteristics of the bedrock hydrostratigraphic units included in the conceptual model. These units are based on the new stratigraphic framework developed by the OGS. The Gasport Formation appears to be the only formation that is subdivided into separate hydrostratipgraphic units (upper, middle, lower). A summary table should be provided with the list of hydrostratigraphic units and whether they are characterized as an aquifer, aquitard, or both. Brief reasons for the classifications could be included in the table.	Updates were made to Figures 11 and 16 to provide summaries of the conceptual hydrostratigraphic framework.
T. Lotimer	7	5.2.11	Section 5.2.11 Overburden. As noted previously, there is little change to the overburden hydrostratigraphy and conceptual model. From the information in this section, the reason appears to be a lack of suitable data. Perhaps this should be cited as a data gap(s) that remains.	This will be discussed in the Assessment Report under data gaps and recommendations for future work.

T. Lotimer	8	5.4.1	Section 5.4.1 discusses the 32 day pumping test performed as part of the southwest quadrant Class EA. A response in the Guelph Formation was considered evidence of a small increase in vertical seepage across the Vinemount, allowing the authors to estimate KV of the Vinemount at 10-9 m/s. From Section 5.5, it appears that this was done by way of transient model simulations performed under the EA project. Is there any evidence to support the occurrence of "windows" in the Vinemount aquitard that may have accounted for the observed response during the test. Is it possible that well bores open across both the Gasport and Guelph units could account for the response? Or is there sufficient evidence to rule out the occurrence of windows in the Vinemount aquitard? The numerical model may provide an opportunity to test these scenarios.	The strong hydraulic head separation between the Gasport and shallow bedrock (see Figure 34) indicates that there are no significant windows in the Vinemount across this area. As discussed in the report, the Goat Island and Reformatory Quarry units also act as an aquitard in some areas.
T. Lotimer	9	5.4.2	Section 5.4.2 - Sacco/Smallfield Test. The information presented here appears to suggest that the Guelph and Lower Gasport hydrostratigraphic units have a significant hydraulic connection in this area and that the Middle Gasport unit (the main regional aquifer) has a much less significant role in groundwater production. From the Draft groundwater flow model report (Section 3.3.4), it appears that this interpretation arose during the model calibration process. Municipal production well yields are generally lower in this area, compared with other parts of the city.	The data from the pumping test does support an interconnection between the Guelph and Gasport units, and that the Middle Gasport has a lower bulk permeability in this area. This conceptual model was incorporated into the groundwater flow model. No changes were made to this report.
T. Lotimer	10	5.5	Section 5.5 - Groundwater Flow System Characterization. This section provides important and useful information. The groundwater level elevations at the high quality (or more reliable) monitoring wells used in the preparation of Figure 30 should be provided, either in the figure itself, in a separate table, or in a set of other magnified figures. The time period for the measurements used (May/June 2007; June/July 2008 ?) should also be added into the Figure 30 legend. Similar potentiometric surface maps for the Guelph Formations and overburden units might also be useful. Was an attempt made to create these? The problems associated with the existing draft Figure 31 were discussed at the June meetings and are not repeated here.	The groundwater elevation data used to prepare the gw flow map is added as Appendix Table G.2 and the time period of the measurements is described in Section 5.5.
T. Lotimer	11		A concluding section with the main important points of the characterization/conceptual model, including areas of uncertainty and significant data gaps, would be useful.	Data gaps and conclusions are to be provided in the Risk Assessment overall report rather than the appendix.

Table 2. Groundwater Flow Model Report - Guelph Tier Three Peer Review Comments				
Reviewer	**Comment #**	**Section #**	**Comment**	**Response to Comment**
		Appendix B (Draft Groundwater Flow Model Report) - June 2010		
Tony Lotimer, July 5, 2010				
T. Lotimer	12	2.2.2	Section 2.2.2 discusses the hydrogeology, with considerable overlap and repetition of the material presented in the Appendix A draft report. On page 9 (middle paragraph), the model report notes that the previous overburden conceptual model layer structure was largely retained for the new model, with the exception of some local scale review and refinement in the southwest as part of the EA study. If the overburden refinements proved useful, it may be worth having a more detailed look at the overburden conceptual model elsewhere in the model domain, including the moraine areas to the south/southwest.	For the purposes of this study, it was decided to concentrate the regional characterization efforts on the bedrock conceptual model. In addition to the SW quadrant, limited local overbuden refinements have been undertaken for the Arkell Spring Grounds, Torrence Creek, and Hanlon Creek
T. Lotimer	13	2.2.2	A summary table with the hydrostratigraphic units and aquifer/aquitard classifications would also be useful in Section 2.2.2 (as per comment 6 above). At the June meetings, it was suggested that this could be expanded to include estimates of the hydraulic parameters associated with each unit (thickness, K, etc), with reference to the method(s) used to arrive at these estimates (i.e. model calibration, pumping test analysis, values reported elsewhere, etc.) - this would also be useful.	These suggestions have been incorporated into new figures and tables in both reports.
T. Lotimer	14		Figure 2-9 is reported as being based on all water well records with static levels "at depths of 25 m or more below surface". The label on Figure 2-9 is "Shallow Bedrock Potentiometric Surface (MOE Water Well Records). The meaning and value of this figure is not clear.	This figure was incorrectly labeled, and was actually a plot of statics from >25 m MOE calibration targets. As it was thus a duplication of the original Figure 2-10 (now the new Fig. 2-9), it was removed from the report and the text has been updated.
T. Lotimer	15		Table 2-2 on page 16 is useful and addresses comment 13, in part	Agreed - it has been updated as per comment 13 above
T. Lotimer	16		On page 19, is the small 'window' in the Vinemount in the northwest corner of the City (Figure 2-21) related to the results of the Sacco-Smallfield testing which showed hydraulic connection between the Gasport and Guelph units? If so, it may be useful to try a similar approach in other parts of the City where hydraulic response to pumping/shutdown of wells in the Gasport has been observed in the overlying Guelph unit.	The delineation of "windows" in the Vinemount was done during the geologic characterization through borehole picks. Further study of these "windows" is warrented and will be a recommendation in the Assessment Report for further work.
T. Lotimer	17	3.3.8	Estimates of the storage parameters for the overburden aquifers are provided in Section 2.4.4.2 (p. 21) but there are no estimates given for storage parameters in the bedrock aquifers in that Section. Further on, an estimate of the specific storage of the bedrock, obtained from the transient calibration in the southwest quadrant, is provided in Section 3.3.8 (p. 39).	Specific Storage for consolidated bedrock aquifer materials ranges from 1x10-8 to 1x10-6 /m. The text has been updated to include this.
T. Lotimer	18		Issues surrounding the compatibility of the recharge estimates used in the Halton/Hamilton Region portions of the study area and those used in the GRCA portion of the study area were discussed at length during the June meetings. Based on the presentations/discussions at the meetings, adjustments to the recharge rates are warranted to ensure that they are consistent across the watershed boundary and not an artifact of the different methods or models used by the different conservation authorities to estimate recharge within their respective domains.	The recharge has been adjusted and the report updated - see section 3.3.1 in Aug 2011 draft
T. Lotimer	19	3.2	In Section 3.2 (Calibration Targets), it is not comforting to know that the model calibration relied on hydraulic head levels inferred from static water levels in the MOE database. It might be useful to evaluate the model calibration using only the high quality well water level data and the streamflow data, leaving out the comparison with the static levels, if this has not already been done.	This was already done in the first draft
T. Lotimer	20	3.3.4	Section 3.3.4 (Northwest Quadrant). Are we to assume that the calibration problem occurs in several hydrostratigraphic layers or just the Middle Gasport unit? It is not clear whether the problem of the model underpredicting hydraulic heads by as much as 10 m was corrected with the Middle Gasport unit removed	The text has been updated to clarify that the model could not be improved within the scope of this project due to lack of data. The problems show up in ContactZone/Guelph and Gasport.

Reviewer	Comment #	Section #	Comment	Response to Comment
T. Lotimer	21		Problems with the model calibration of baseflow in the subwatersheds (Hopewell Creek, Cox Creek, Swan Creek) in the west side of the model domain were discussed in detail at the June meetings. This calibration problem does not appear to be specifically acknowledged in the draft report text. Based on the outcome of the meetings, adjustment (decreases) of the recharge rates appears to be warranted to improve the baseflow calibration in these areas.	The recharge has been adjusted and the report updated - see section 3.3.1 in Aug 2011 draft
David Rudolph, June 27, 2010				
D. Rudolph	1a	2.2	In Section 2.2, updates to the conceptual models are presented. With respect to the GAWSER model, a clear list of specific updates and implications of those updates is presented, which is very useful to the reader in understanding the value of the extra work that was undertaken. In the case of the groundwater conceptual model, significant detailed work has been completed in order to update the geologic model yet it is not completely clear what the implications of these changes are for the updated numerical model. Initially, it would be very useful for the reader to see a generalized conceptual diagram of the hydrostratigraphic model early on in Section 2.2.2. This figure should indicate both the geologic units and their classification as an aquifer or aquitard. For example, enhancements of Figure 2.6 to include information on unit hydrogeologic classification, range of bed thickness and general lateral continuity, along with ranges in hydraulic conductivity and storage coefficients would be very useful. Some of the information contained in Table 2.2 would be useful earlier in the section for instance....With this available, the reader will find it easier to go through the detailed explanations of the different bedrock units and understand the role they play in the groundwater flow system	These suggestions have been incorporated into new figures and tables in both reports.
D. Rudolph	1b		Incidentally, I did not find a list of the storage coefficients or any information on vadose zone parameters in the text. An additional comment on the vadose zone representation follows in this report.	Specific Storage for consolidated bedrock aquifer materials ranges from 1x10-8 to 1x10-6 /m. The text has been updated to include this.
D. Rudolph	1c		In the descriptions of the different rock units there needs to be more consistency in the explanations by including thickness ranges for all of the units (provided for some but not all). As this section is entitled Hydrogeology, one would have expected information on relative hydraulic parameters of the different units as noted for inclusion in the updated Figure above. Having a more complete presentation of the final hydrogeologic conceptual model right up front in the report will help the reader follow the model development better	These suggestions have been incorporated into new figures and tables in both reports.
D. Rudolph	1d		One parameter that appears to become a key calibration variable later on is anisotropy in hydraulic conductivity. It would be valuable to provide some indication of the anisotropic characteristics of the different units prior to encountering it later in the text related to calibration.	Report updated to incorporate a discussion of anisotropy
D. Rudolph	1e		At the end if Section 2, a short list of key updates that were incorporated into the hydrogeologic conceptual model and the implications of these updates on the flow representation would be useful, much like as done for the updates to the GAWSER model on P. 8. The occasional reference to the fact that very detailed information is available in the southwest quadrant and that this information proved valuable in the development of the final conceptual model is a bit disconcerting as it implies that if we had this type of information in the other 3 quadrants, the model might be very different. This comes up again when the detailed work completed at the University of Guelph research field site is noted to be different than the surrounding area with respect to the continuity of the Eramosa aquitard. It is not possible to continually collect field data, but it might be worthwhile to state whether there would be value in further data collection in the other quadrants or if there is enough confidence to accept the existing conceptual model.	Updates were made to the Characterization Report

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D. Rudolph	2		I am not sure what is meant by the second sentence in Section 2.2.3 stating that only data from water wells with static levels greater than 25 m is used to construct the potentiometric surface. Is the water table not shallower than this in places? Figure 2-8 is not labelled with a figure number.	This figure was incorrectly labeled, and was actually a plot of statics from >25 m MOE calibration targets. As it was thus a duplication of the original Figure 2-10 (now the new Fig. 2-9), it was removed from the report and the text has been updated. The shallow piezometric surface, and water table closely mimic the ground surface topography and figures done at the regional scale do not add helpful information for the purposes of this report.
D. Rudolph	3		The comment that some large water takers were excluded from the model due to their proximity to the escarpment raises a bit of a flag. There should be a brief comment on the potential significant (or lack thereof) of excluding these water takings.	We have now accounted for the escarpement quarries' water takings through recharge adjustments and they were not excluded from the model.
D. Rudolph	4		Figure 2.11 is a misleading diagram. Firstly, it appears to be a plot of the head different between the near surface environment and deeper production aquifers. It is not truly a vertical gradient map if the separation distances at each point are not included in the calculation. The legend uses the term “Groundwater Contours Difference Amabel”. This is difficult for the reader to understand directly. Also, we are moving away from the use of the term “Amabel” for the main aquifer.	Updates were made to both reports. Contour label in Modelling report need to be updated to "Gasport"
D. Rudolph	5		It seems as though as more detailed stratigraphic information becomes available, the more irregular the Eramosa aquitard unit becomes. (e.g. discontinuous in the immediate are of the University of Guelph.). This aquitard unit is arguably one of the most important strata controlling groundwater flow in the area and it would be useful if the consultants (including the team that developed the detailed Appendix A: Site Characterization Report) could provide an opinion on the potential for more of these “windows” in the aquitard to be encountered in the future and their significance. This is really a point for discussion as we will never have enough data to map them all out. The potentiometric data may help to reassure us that we have not missed a major window.	A key recommendation from this Tier Three study will be that the City continues to characterize the Vinemount aquitard to gain further insight. We will address this as an uncertainty in the final characterization report and will also discuss implications on the risk assessment in the final risk assessment report.
D. Rudolph	6a		As the model domain overlaps with several adjacent areas that are also developing models it would seem logical to determine how well the new conceptual models compare with those in the adjacent watersheds. For instance, how does the geologic model compare with that developed in the Halton region?	In the final release of the conceptual model we will address the fit with adjacent areas. This topic is much easier to address now that the Halton Tier 3 and Region of Waterloo Tier 3’s are in the final stages.
D. Rudolph	6b		Also in looking at Figure 2.26, the recharge rates and distribution vary drastically on each side of the Grand River Watershed boundary. It is understood that those recharge values were derived from the adjacent modeling work but considering the potential importance of lateral boundary flow across the Grand River Watershed Boundary, this recharge distribution should be reassessed and made consistent across the boundary	Recharge distribution has been updated and the text details the process.
D. Rudolph	7		One parameter that is critical to the evaluation of the time of travel maps developed for the final capture zones is the effective porosity. Considering how variable the hydraulic conductivity is over the region, particularly in the Gasport production aquifer, much of which is based on the nature of the secondary porosity, one would expect fairly significant differences in the effective porosity. Often it is correlated to K and the University of Guelph may have some insight on this. There needs to be more detailed discussion on justifying the selection of this parameter and how sensitive it might be in the overall risk assessment. With all of the care taken on the recharge function and the K distributions, one would not want to be overly conservative on the selection of the effective porosity value.	Time of travel maps are not required under the scope of the Tier Three risk assessment.

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D. Rudolph	8		Previously, discussion amongst the review group and consultants focussed on the selection of water consumptive factors for the various water uses. There has been significant debate on the value that should be used for quarry and pit operations throughout the province and the recognition that this might be very site specific. Considering the importance of the water takings from this particular use (Table 8 Appendix B.2) these values should be revisited and the decision to use 0.15 everywhere clearly justified. Other areas, including Halton and Hamilton are considering local values in the 0.35 range depending on how the term “consumptive” is defined.	we now use 100% consumptive for quarries which is a conservative estimate
D. Rudolph	9		Considering that the recharge function is so critical to the risk assessment and that many of the main municipal wells are located close to the urban area, it may be valuable to assess in some extra degree of detail whether the recharge rates and distribution beneath the urban footprint are appropriate and how significant they are in the overall assessment. This may be of particular concern when evaluating future scenarios where impacts on surface water features become a major consideration. Although an attempt has been made to enhance the urban recharge function, it would be of value to the reader to have a more detailed discussion on the certainty, variability and significance of the recharge in the urban area overall.	A sensitivity analysis was done as part of the NW Guelph calibration and the impact of urban recharge was found to be limited. This was reported to the Peer Review Team in a technical memo dated July 20, 2010 "Groundwater Recharge Adjustments, City of Guelph FEFLOW Numerical Model".
D. Rudolph	10		The approach to handling groundwater flow through the extensive vadose zone in the model domain is not explained in any detail. It would be useful for some readers to understand the way the vadose zone was represented both during the steady and the transient state simulations and how the hydraulic parameters were obtained and used. This has significance in the risk assessment with times of travel and extends of capture zones.	Section 2.4.4.4 has been added to address the unsaturated zone representation.
D. Rudolph	11		A variety of values for hydraulic conductivity were derived through the activities of the Site Characterization consultant and their collaborators. These tend to be very scale dependant, which is logical. The modeling report should include a short section that reviews the recent results from the Site Characterization report related to the updated range on hydraulic parameters and assess how well the final calibrated values used in the model relate to those collected in the field. It is not clear how and if the final results of the Site Characterization report are incorporated into the final model development.	A comparison of the modelled and field hydraulic parameters now appears in Table 3-7
D. Rudolph	12		Considering all of the detailed, local scale work done in concert with the Site Characterization program, can any additional insight into the magnitude and distribution of the effective porosity values be derived from this work for use in the risk assessment?	Effective porosity and TOT and extents of capture zones are not required for the Risk Assessment. Only drawdown is required for the Delineation of the Local Area.
D. Rudolph	13		Can recommendations for additional field work or data collection be made by the Site Characterization consultants that would significantly influence the model development at this stage? Based on some of the observations in the Site Characterization Report, a few additional considerations may be useful. For instance:	This will be addressed in the Assessment Report under data gaps
D. Rudolph	13a		a). The extent of the Gasport aquifer connection to the south and the interaction between the Guelph and Cambridge municipal groundwater supply systems is an evolving issue and may be a significance, particularly for the future scenarios assessment.	This will be addressed in the Assessment Report under data gaps
D. Rudolph	13b		b). The quantification of the leakage flux through the Eramosa aquitard units, as estimated by the Site Characterization consultants should be compared to what is calculated by the regional model to ensure they are similar. This leakage flux is one of the main controlling factors in the risk assessment and future groundwater development program.	This is a very relevant question. We have not identified estimates of leakage flux through the aquitard, but we will address this in the water budget section of the risk assessment report.

Reviewer	Comment #	Section #	Comment	Response to Comment
D. Rudolph	13c		c). The clear and rapid response of the deep Gasport aquifer system to the January 2008 melt and precipitation event illustrates to hydraulic connection between the ground surface and the deeper aquifer system and the overall sensitivity of the system to regional recharge. Can a transient analysis of the system to a large recharge event be simulated with the current model to ensure that the deep system indeed responds in a reasonable fashion to such an event? Considering the large extent of the area of influence in the Gasport aquifer and this rapid response to recharge in the deep system, it is possible that the future water use scenarios may result in impacts on the surface water features well outside of the urban footprint. This possibility needs to be considered as the final risk assessment simulations are conducted.	Aquifer response to this melt event is insightful. However, early simulations indicated that there may not be success in trying to replicate these hydraulic head observations using the model. We do note that the observed response in hydraulic head does not necessarily reflect a significant amount of recharge in a fractured rock system. This may be due to gaps in the conceptual model and/or numerical representation of the shallow system and we will recommend future studies.
Hugh Whiteley, July 13 2010				
H. Whiteley	1		As suggested at the follow-up meeting of the peer reviewers with the study team the recharge rates used in the model should be reviewed for the Halton area in the south east using the best available estimates based on soils and topography, and with special attention to areas of shallow soil or exposed bedrock. For this surface condition different recharge rates should be used for dry (upland) conditions (higher recharge), intermediate conditions, and wet (saturated or near saturated) low-lying segments (zero recharge).	These suggestions have been incorporated into a new recharge distribution and the text has been updated accordingly
H. Whiteley	2		As suggested at the follow-up meeting the recharge amounts for the tributaries of the Grand River in the northwest quadrant of the model should be reviewed. If justified by changes in the soil texture and topography it seems appropriate to reduce recharge amounts from east to west across the upper portion of the model area due to increasing content of fine silt and clay and decreasing hummocky features in the east to west transect. Such a reduction is justified by measured low baseflow conditions in streams across the Grand River to the west.	These suggestions have been incorporated into a new recharge distribution and the text has been updated accordingly
H. Whiteley	3		As noted above I recommend that a pre-settlement baseline run of the model be used as the starting point for assessment of (cumulative) effects of abstractions in terms of changes in water quantity and flowrates in the flow system.	While this assessment would be very insightful, the Risk Assessment framework requires us to compare planned conditions against current conditions. It is only within our scope to compare to current conditions.
H. Whiteley	4		I recommend that specific attention be given in assessments of effects to changes in interchange between groundwater and streams in reaches where such changes are appreciable.	This recommendation will be incorporated into the final risk assessment report as a sensitivity analysis
H. Whiteley	5		I recommend the use of a more systematic approach to incorporation of spot “baseflow” observations in model calibration. I attach a summary of baseflow analyses I have made in the Grand River watershed that demonstrate the variability in annual-mean recharge and baseflow. This report also includes a methodology that could be tried to make use of baseline information from long-term gauged locations in the interpretation of spot flow measurements as indicators of long-term mean baseflow at the spotflow location.	Effort was devoted to testing the methodology proposed by the reviewer, but this was met with limited success for this current study. In discussion with Dr. Whiteley, it was decided to revisit this recommendation in future work.
		Appendix B (Draft Groundwater Flow Model Report) - Aug 2011		
Hugh Whiteley, Jan. 2, 2012				
H. Whiteley	6	2.1	Geographic coverage should mention the interface with the RMOW modelling and the checking on boundary conditions for each model to ensure compatibility of the results from the two models. Further discussion of this is needed in 2.4.5.3.	For the final modelling and risk assessment reports, consistencies with the ROW model (and others if possible) will be described. Influences of any gaps will be addressed.

Reviewer	Comment #	Section #	Comment	Response to Comment
H. Whiteley	7	2.4.5.1	There should be discussion of the recharge assigned to wetland areas. Any upland wetland areas that can be identified as seldom if ever overflowing (no recognized channel exiting the wetland) can be assigned steady-state recharge of about 200 mm/y). Wetlands connected to recognized intermittent –flow channels would lhave zero recharge (discharge conditions) during periods with streamflow exiting the wetland but could have recharge during periods when watertables are recovering from seasonal lows and thus might have small positive values for recharge for steady-state representations. Riparian wetlands adjacent to perennial streams would have zero recharge.	We will incorporate these comments into an expanded discussion on the recharge assigned to wetland areas. Our methodology did account for the differences between riparian and non-riparian wetlands. The areal extent of individual non-riparian wetlands and non-riparian complexes is relatively small compared to the scale of the model and the size of the elements, and thus the contributions were incorporated into the bulk area-weighted average recharge on an element-by-element basis. For transient / seasonal contributions of recharge by wetlands connected to intermittent flow channels, given the scale of the model, it would be computationally expensive to incorporate these transient responses for wetlands into this groundwater model. An integrated surface/groundwater model would be an excellent tool to address these transient SW/GW interactions and will be part of our recommendations for future work.
H. Whiteley	8a	3.3.4	The low simulated bedrock levels should be re-examined. The results from detailed studies conducted in this area by Beth Parker's group at the University of Guelph should be used to better define bedrock layer properties.	We acknowledge that the University of Guelph has conducted very detailed and relevant studies in the northwest area of Guelph. However, these studies were completed at a very local level and the results were not made available to the Tier 3 team at the time the conceptual and numerical model was being developed. We will recommend that the City update the conceptual and numerical models with the University's results in the future.
H. Whiteley	8b	3.3.4	Also higher recharge for this area than 80 mm/y are conceivable. The stormwater system is partly open channel ditches with low gradients in this sector, especially north of Woodlawn. This provides opportunity for recharge during recession and the substantial impervious area produces lots of water (low evapotranspiration) in the summer when watertables are below the bottom of the ditches and hence during periods when recharge is possible from the ditches.	We conducted a sensitivity analysis of increasing the recharge in this area in July 2010 after the first draft of the reports were reviewed and the peer review team raised the question of the impact of leaky urban infrastructure. This was documented in the technical memo dated July 27, 2010. In that analysis, we raised the recharge from an average of 82 mm/y up to 123 mm/y (a 50% increase). There was up to 6 m increase in the hydraulic heads in the shallow bedrock (Guelph), but only a maximum of 1 m increase in head in the deeper bedrock (Gasport formation). The conclusion is the current calibrated model is relatively insensitive at depth to recharge changes in the northwest quadrant of the city, and that further adjustments of recharge (within reason) would not be able improve the calibration in that quadrant.
H. Whiteley	9		In the final version of the water balance for the Speed River there should be some commentary on possible water transfers between watersheds than influence the evapotranspiration. In a separate attachment I summarize my findings about possible transfers than effect the Blue Springs station, the Eramosa Station and the Speed below Guelph station.	This will be addressed in the Assessment Report in the Water Balance discussion.
MNR, Sept. 12, 2012				
MNR	1		The recharge estimation used for the Halton and Hamilton Area in the southeast quadrant of the model domain needs to be adjusted and refined to remove inconsistencies across the watershed boundary.	The recharge rate of the Wentworth Till on the Paris Moraine was increased by 100 mm/year to 220 mm/year to match the GRCA values and adjusted PRMS estimates were used for bedrock recharge rates depending on the depth to the piezometric surface (giving a range of 120 – 400 mm/year on bedrock).

Reviewer	Comment #	Section #	Comment	Response to Comment
MNR	2		The definition of WHAPA-Q1 is: the combined area that is the cone of influence of the well and the whole of the cones of influence of all other wells that intersect that area. Slide 49 of the May 11 peer review meeting illustrating the drawdown from no pumping at Guelph and other wells with allocated pumping rates and the figure 2-27 of the GW flow model report illustrating the model boundaries suggests there are some Region of Waterloo municipal well drawdowns that may intersect with the Guelph WHAPA-Q1 drawdown. Question 1: Is the western model boundary conditions reflective of the potential influences of the Waterloo systems?	The western model boundary conditions are reflective of the Grand River in the overburden, and the observed static water levels in the deep bedrock (Gasport). The latter reflects the historical influences of the Waterloo systems on the piezometric surface.
MNR	3		Question 2: Can boundary conditions be set to reflect the influences of the Guelph and Waterloo systems and other wells to be able to conduct separate risk assessments	The Guelph model boundary was chosen to be sufficiently beyond of the influence of the Guelph municipal wells. The Waterloo Region and other wells on the east side of the Grand River are not of sufficient density or pumping rates to create drawdown cones that reach either westerly across the Grand River, or easterly between the Grand River and the drawdown cone of the Guelph systems. This effectively isolates the Waterloo and Guelph systems as well as other wells allowing us to conduct separate risk assessments.
MNR	4		Question 3: If separate risk assessments are possible, how will the threats ranking assessment be conducted to include the Region of Waterloo and Guelph systems?	To be addressed in the risk assessment
MNR	5		Question 4: Per the definition of the WHAPA-Q1 should there be a collaborative risk assessment of the Region of Waterloo and Guelph systems and other uses?	To be addressed in the risk assessment
MNR	6		Slide 16 from the May 11 peer review meeting suggested that the recharge value associated with the Arkell recharge system was 3,400 mm/year. The GW flow model report does not address this specific recharge rate over a very small area in either of these two sections listed or section 3.3.1 adjustments to groundwater recharge. Question 5: Has the model been altered to address this out of scale value?	The issues with the Arkell Recharge System were addressed without the use of the out of scale value for recharge near Blue Springs Creek. The top of bedrock within the Arkell Glen buried valley was adjusted according to detailed borehole logs.
MNR	7		The recharge sensitivity analysis, slides 5 and 6 of the May 11 peer review meeting and the GW flow model report provide a consistent description of the needed alterations of the recharge values from the Halton PRMS to match those of the GAWSER model and GW characterization. Question 6: How does the adjusted recharge of the Guelph model domain compare to the recharge from the Halton MIKE SHE Halton model domain?	Comparison was not done due to data not being available at the time

Table 3. Local Area Risk Assessment Report - Guelph Tier Three Peer Review Comments					
Reviewer	**Comment #**	**Page**	**Section #**	**Comment**	**Response to Comment**
			Draft Report - May 2013		
Tony Lotimer, Aug 7, 2013					
T. Lotimer	1	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	3	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 15 (from Paul Chin 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	55	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 capacity.	This table, now Table 3-7, has been updated with the most current permit details and estimated well capacities as suggested.
T. Lotimer	5			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	6	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. Lotimer	7	80	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.
T. Lotimer	8	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 being off-line for significant periods of 2008. The typical pumped rates are used in Scenario C in order to simulate the in-well water levels 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.

T. Lotimer	9	110	5.5.2.1	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, May 6, 2013 (as comments to preliminary version of Draft RA)					
M. Garraway	4	v		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	8	1		Need to discuss the surface water….noted 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 IPZ-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…I 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	33	62		[Dolime Quarry modelling] Can you explain this a little more…i.e. what heads and what rate of consumptive pumping. Not sure what portion of total pumping is from surface water and groundwater…how 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 masl; 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	65	4.0	Is 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 steady-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 change 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	39	90		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 causing the reduction in GW discharge will be ranked higher than likely the Cambridge wells ect… Also, it would be helpful to know the risk classification of the Cambridge local area …might 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	53	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/yr 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 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.
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 *Significant* and *Moderate*)
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	77	144	8.1.1	was going to ask the same question…if 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
Items from Peer Review Meeting Minutes, May 23, 2013					
			3) Estimate Allocated Quantity of Water		This section has been revised using the suggestions of the peer reviewers
Committee	1			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			o 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	3			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) Delineate 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 Risk Scenarios		
Committee	5			Eramosa IPZ 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	6			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	7			o Calculate water budgets on subwatershed basis	This has been completed and is now summarized in new Figure 4-9 - 'Water Budget'
Committee	8			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	9			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	10			§ 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	11			§ Update Water Quantity Threats	These have been updated.
Committee	12			Finalize Guelph Water Budget and Local Area Risk Assessment Report in conjunction with the release of the RMOW WQRA report.	This has been done.

Paul Chin

From: A.R. (Tony) Lotimer <alotimer@rogers.com>
Sent: Monday, August 25, 2014 10:52 AM
To: James Etienne
Subject: RE: Guelph Tier Three - Risk Assessment Update

Hello James

I have examined the material sent through last month as the latest iteration of the Guelph Tier 3 report. I have no meaningful comments to add at this time and provide sign-off by way of this email. Please advise if you need something more formal.

One minor thing. Under affiliations, mine should be ARL Groundwater Resources Ltd. (not ARL consulting).

Best regards
Tony

A.R. (Tony) Lotimer, M.Sc., P.Geo., ARL Groundwater Resources Ltd., Ayr, ON Office: (519) 632 – 9887, Mobile: (519) 729 - 3897

From: James Etienne [mailto:jetienne@grandriver.ca]
Sent: August 20, 2014 1:45 PM
To: 'Dave Rudolph'; 'Hugh R Whiteley'; 'A.R. (Tony) Lotimer'
Subject: Guelph Tier Three - Risk Assessment Update

Good afternoon gentlemen:

I have a Tier 3 status update meeting this meeting and I am also preparing the September Water Quantity report to the Source Protection committee.

Can you please let me know if it will be possible to get sign-off on the Guelph WQRA by August 25th?

Thanks!

James

From: James Etienne
Sent: August-05-14 1:39 PM
To: Paul Chin; Dave Rudolph; Hugh R Whiteley; 'A.R. (Tony) Lotimer'; Bates, Scott (MNR); Martin Keller
Cc: David Van Vliet
Subject: RE: Guelph Tier Three - Risk Assessment Update

Thanks Paul for circulating the revised Guelph WQRA while I was away.

I realize that it is prime vacation season but I was hoping that we could get Peer Reviewer sign-off by August 25th. If this is a concern for any of you, please let me know.

Sincerely,

James

Paul Chin

From: David Rudolph <drudolph@uwaterloo.ca>
Sent: Thursday, August 28, 2014 4:13 PM
To: James Etienne
Subject: Re: Guelph Tier Three - Risk Assessment Update

Hi James,
I am currently in a van driving back to Waterloo in Texas. I had completed the review of the Guelph Tier 3 and I am satisfied that the report can be finalized. I am willing to sign off with the email. Please let me know if this is sufficient for your needs at this time.

Best regards
Dave

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: James Etienne
Sent: Thursday, August 28, 2014 3:04 PM
To: David Rudolph
Subject: FW: Guelph Tier Three - Risk Assessment Update

Hi Dave:

Will you be able to sign-off on the Guelph Tier 3 report this week?

Sincerely,

James

From: James Etienne
Sent: August-20-14 1:45 PM
To: 'Dave Rudolph'; 'Hugh R Whiteley'; 'A.R. (Tony) Lotimer'
Subject: Guelph Tier Three - Risk Assessment Update

Good afternoon gentlemen:

I have a Tier 3 status update meeting this meeting and I am also preparing the September Water Quantity report to the Source Protection committee.

Can you please let me know if it will be possible to get sign-off on the Guelph WQRA by August 25th?

Thanks!

James

From: James Etienne
Sent: August-05-14 1:39 PM
To: Paul Chin; Dave Rudolph; Hugh R Whiteley; 'A.R. (Tony) Lotimer'; Bates, Scott (MNR); Martin Keller

James B. Etienne, P.Eng.
Senior Water Resources Engineer
Grand River Conservation Authority
400 Clyde Road, Cambridge, ON N1R 5W6
August 24 2014

Re: ***City of Guelph and communities of Rockwood and Hamilton Drive Tier 3 Water Budget* and Local Area Risk Assessment**

James:

I have now reviewed the July 2014 draft of the City of Guelph and communities of Rockwood and Hamilton Drive Tier 3 Water Budget and Local Area Risk Assessment. I am satisfied that the comments of the peer reviewers, including my comments, on an earlier draft have been fully addressed and that the study and its technical are fully satisfactory and that it should be accepted for transmission to the appropriate authorities for approval.

I attach on a separate page some small editorial improvements that could be made in the text of the report.

Yours truly

H R Whiteley

H.R. Whiteley P.Eng.

City of Guelph and communities of Rockwood and Hamilton Drive Tier 3 Water Budget **and Local Area Risk Assessment**

Editorial Correction Suggestions by H.R. Whiteley August 24 2014

(1) The report would be improved in appearance by the consistent use of the correct SI useage for time symbols. The correct useage is "y". "d" and "s" as the symbols for year day and second viz m^3/y m^3/d m^3/s .

(2) The location on Hanlon Creek at Hwy 6 referred to on pages vii, 121 and 126 and elsewhere should be either simply Hanlon Creek at Hwy 6, or if one of the tributaries of Hanlon Creek is intended, by the lettered tributary name as given in the State of the Watershed report 2004 (tributaries are given the letters A through H)

(3) On p 33 I suggest the following wording be used. "~~In general,~~ Recharge is the residual portion of precipitation left after the subtraction of water returned to the atmosphere by evapotranspiration, or transferred to stream channels by overland flow and interflow above the groundwater system. The amount of groundwater recharge is influenced by the infiltrability of the ground surface, land use or vegetation, the depth, hydraulic conductivity and soilwater-storage characteristics of surficial overburden layers, and slope of the topography (if extremely steep).

(4) On p 74 and 79 there is reference to "potential" (as an highlighted addition) I think the reference is to "gradients of potential in the bedrock"

(5) On p 80, and perhaps elsewhere, there are numerical values given for model-result quantities that suggest higher accuracy than is appropriate. Results from modelling should be limited to two, or at the most three significant figures and all results should be rounded to this limit to avoid exaggerated implied accuracy.

(6) On p 125 I suggest removing the sentence " It is likely that the South Branch was utilized for passage of trout to access reaches of Blue Springs Creek in the North (main) Branch that provide more preferential conditions for trout spawning as opposed to actual trout spawning." As far as I know the South Branch of Blue Springs Creek does not connect the lower portion of Blue Springs Creek to the upper portion of the main stem of Blue Springs Creek and thus this sentence does not make sense.

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.

Concerns

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.

Adjustments

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

H.R. Whiteley P.Eng.

ARL Groundwater Resources Ltd.
13 Douglas Drive
Ayr ON N0B 1E0 *(519) 632-9887*

December 16, 2016 Reference: 009 - 001

MEMORANDUM

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

Appendix E: 2016 Groundwater Flow Model Updates

Dear Mr. Keller

I have reviewed the draft report (Appendix E) describing the groundwater flow model updates undertaken in 2016 (draft report prepared by Matrix Solutions Inc. and dated September 2016).

I am satisfied that the additional hydrogeological information described in the report has been incorporated into the groundwater model in an acceptable manner. The work has improved the overall understanding of the hydrogeological and hydrological conditions within the study area.

I concur with the proposed plan to update the local area risk assessment using the updated groundwater flow model.

From: David Rudolph [mailto:drudolph@uwaterloo.ca]
Sent: Friday, December 23, 2016 08:36
To: Martin Keller
Subject: RE: PLEASE RESPOND: Guelph-GET Tier 3 WQRA Peer Review

Hi Martin,
Thank you for forwarding the report:
CITY OF GUELPH AND TOWNSHIP OF GUELPH/ERAMOSA TIER THREE WATER BUDGET AND LOCAL AREA RISK ASSESSMENT

APPENDIX E: 2016 GROUNDWATER FLOW MODEL UPDATES
Prepared by Matrix Solutions, September 2016.

I have reviewed the document and I am confident that the consultants completely addressed all questions and suggestions I had made during the last review period and I recommend that the update version of the model be accepted for the continued work on the local area risk assessment. I have no further comments at this time.

Thanks for the opportunity to review this model update and I look forward to our next steps.

Sincerely,
Dave Rudolph

Martin Keller
Source Protection Program Manager
Grand River Conservation Authority
400 Clyde Road PO Box 729
Cambridge ON N1R 5W6

December 12 2016

Dear Mr Keller

RE: City of Guelph/Guelph-Eramosa Township Tier Three Water Budget and Local Area Risk Assessment: Appendix E 2016 Groundwater Flow Model Updates

I have reviewed Appendix E :2016 Groundwater Flow Model Updates by Matrix Solutions Inc. dated September 2016 and am fully satisfied that the adjustments made in the groundwater model correctly incorporate the now-available new information and that the results from the 2016 model strengthen and confirm the Local Area Risk Assessment results that I previously sign-off on.

I have discussed with Paul Chin two recommendations I make on editorial changes to Appendix E. One change is to explain the use of an integrated modelling approach in the first paragraph of Appendix E to set the 3D groundwater model within the context of integrative modelling. The other change is to review the explanation of discrepancies between model and observed results for drawdown in Rockwood well 1 to include 2012 as well as 2011 in the explanation. Paul has agreed to consider these changes in the final version of Appendix E.

I understand that will Appendix E completed the final version of the Risk Assessment can now be completed.

Yours truly

H R Whiteley

H.R. Whiteley P.Eng.

ARL Groundwater Resources Ltd.
13 Douglas Drive
Ayr ON N0B 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.

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 Surface Water Vulnerable Area. 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.

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

H R 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 **"streamflow-generation 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.

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

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Ontario

M E M O R A N D U M

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