



Luinstra Earth Sciences

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Professional Peer Review:

**Groundwater Vulnerability Assessment
Municipality of Huron East (Seaforth)**

Prepared for:
Ausable Bayfield Maitland Source Protection Region

Prepared by:
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Introduction

This report is a summary of the peer review of the Groundwater Vulnerability Assessment for the Municipality of Huron East (Seaforth Municipal Supply), completed by WESA Inc. for the Ausable Bayfield Maitland Source Protection Region, dated October, 2009. The intent of this peer review exercise is to determine if the completed work is in compliance with Technical Rules for development of the Assessment Report produced by the Ontario Ministry of the Environment under section 107 of the Clean Water Act, 2006 (Herein referred to as the "Technical Rules"). In addition, the peer review provides commentary on critical issues and deficiencies, technical editing and highlights opportunities for long-term improvement of these data sets.

Overall Professional Opinion

In the Peer Reviewer's professional opinion, the overall results appear reasonable and are consistent with the requirements outlined in the Ontario Ministry of Environment Technical Rules for completion of the Assessment Report under the Clean Water Act, 2006. The overall approach to the developing aquifer vulnerability and Well Head Protection Areas (WHPAs) are consistent with both the Technical Rules and with standard hydrogeological practices. The report is generally well written, and maps appropriate for the intended use of the information. Comments provided below are intended to strengthen the report.

Compliance with Technical Rules

This section is organized, by item, into three parts. Firstly, a review to determine if the report is in compliance with the Technical Rules, and secondly, a narrative intended to outline both the critical issues and deficiencies in the work as well as any long term opportunities to improve the work.

Table 1., below, outlines the overall compliance of the work to the Technical Rules and/or technical guidance provided by the MOE.

Groundwater Model Development and WHPA Delineation

The models produced for the area were originally developed as part of the Huron County Groundwater Study (IWS, 2006), which was not reviewed for this report. These models are considered appropriate for the purposes of delineating Well Head Protection Areas (WHPAs) for the Township. The methodology for delineating the WHPAs differed slightly from those used in the Huron County study, and are consistent with methodologies outlined in the Technical Rules.

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Table 1. Compliance with Technical Rules under the Clean Water Act, 2006.

Required Work	Technical Rule(s)	Compliance with Technical Rule (Dec 12, 2008)	Comments
Applicable Models & Methods	42	Yes	Computer based three-dimensional groundwater flow model is an acceptable methodology for this purpose
Delineating WHPAs (WHPA-A, WHPA-B, WHPA-C, WHPA-D)	47	Yes	Consistent with Technical Rules, additional comments in text
Aquifer Vulnerability delineation	37	Yes	ISI methodology consistent with Rules, additional comments in text
Aquifer Vulnerability Scoring	38	Yes	Consistent with Technical Rules
Preferential Pathways adjustment to Aquifer Vulnerability	39-41	No	Incomplete, see comments in Text
Assignment of Vulnerability Scores to WHPAs	82, 83	Yes	Consistent with Technical Rules
Uncertainty Assessment	13-15	Yes	Consistent with Technical Rules, additional comments in text
Managed Lands Determination	16	N/A	Insufficient detail provided in Report
Livestock Density Determination	16	No	Not consistent with current Technical Rules
Impervious Surfaces Determination	16,17	N/A	Not in Report
Issues Evaluation	114-117	Yes	Consistent with Technical Guidance, additional comments in text

This section of the report lacks significant detail. It is understood that the model grid was refined and expanded in certain areas but a number of questions remain:

1. In order to complete the ISI update, it is mentioned that wells completed since 2003 were reviewed, and geological and hydrogeological understanding gained since 2003 have been incorporated, has this been included in the model?
2. It would be appropriate to have a map outlining the changes in the model grid incorporated into the report.
3. The model was re-calibrated – calibration statistics should be included in the report.
4. Pumping rates used for modeling purposes. It is the understanding of the Peer Reviewer that pumping rates used for development of the WHPAs were based on sound projections of future growth by 2018. This is not consistent with the

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requirements of the Technical Rules. Furthermore, reference is made to the different scenarios included in the 2008 report. More information on these scenarios should be included in this report.

5. Effective porosity for the groundwater model. Effective porosity for the bedrock layers appears high for the bedrock layers, based on the experience of the reviewer in areas with similar (fractured and potentially karstic bedrock) geology. This is particularly the case with the bedrock layer in the model. Effective porosity has such a large impact on time-of-travel WHPA delineation that some documentation of these values should be provided to support those values.
6. Incorporation of large, permitted and non-permitted groundwater takings in the model. Were large permitted water takers included in the model? Additionally, large livestock operations are exempt from the requirement for a permit to take water. These large operations may impact groundwater flow and should be incorporated (where possible) into the model.

In addition, opportunities for long term improvement in the models and WHPAs are presented:

1. Incorporation of boundary conditions from existing water budget models. Recharge and boundary flux conditions could be better approximated utilizing existing groundwater and surface water models which have been developed as part of the water budget exercise undertaken by the Ausable Bayfield Maitland Source Protection Region. Specifically, the incorporation of a groundwater flux along the northern and southern boundaries of the model would improve the modeling results, and provide a more realistic water balance than the existing constant head boundary. Details on the eastern and western boundaries were not included in the report. Recharge values of 10 mm/year are extremely low in comparison to those used in the regional-scale water budget models.
2. Equivalent Porous Media (EPM) Approach. Although, to date, the implementation of the EPM approach to developing groundwater models and WHPAs are a standard practice in hydrogeology, some consideration should be given to the appropriateness of it's application on fractured (and potentially karstic) bedrock systems. In order to strengthen this report, some references to previously completed studies in similar geological settings which utilized the EPM approach should be added.

Aquifer Vulnerability Mapping

Aquifer vulnerability was mapped using the Intrinsic Susceptibility Index (ISI) methodology that is consistent with Technical Rules. No critical issues or deficiencies were identified in the review. Assignment of aquifer vulnerability scores is consistent with Technical Rules. It would be beneficial to the report to include a map of the new ISI in the study area, with the specific locations where ISI was calculated identified and values presented.

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Preferential Pathway Adjustments to Aquifer Vulnerability Scores

No preferential pathway adjustments to the aquifer vulnerability scores have been included in this report. It is understood that the areas with potential pathways are already highly vulnerable, however, these pathway adjustments should be completed for future reference. There are a few critical issues identified:

1. Preferential pathway adjustment for private wells. It is the opinion of the reviewer that areas with a high density of private wells should be included, particular in older residential areas which likely predate municipal water systems. These areas were likely formerly supplied by individual wells and, implementing a conservative approach, should have adjustments to aquifer vulnerability unless information is available to suggest that an adjustment is not warranted.
2. Preferential pathway adjustment for former brine wells. Areas with potential Brine wells should have transport pathway adjustments.

Uncertainty Assessment

An uncertainty assessment for the aquifer vulnerability mapping and WHPA delineation has been provided and is consistent with the technical rules. The uncertainty assessment properly characterizes the inherent uncertainty in the numerical modeling process. However, a few issues and deficiencies are presented:

1. The report identifies a number of limitations with respect to the data available to generate models and WHPAs, and would seem to lead to a conclusion that uncertainty is high, rather than moderate.
2. ISI uncertainty is difficult to evaluate for an external reader due to the lack of presented ISI mapping and values. The Report would benefit from inclusion of such a map.

Livestock density

Nutrient Units (Livestock density) were calculated utilizing out of date (at the time of review) guidance from the MOE and are inconsistent with the Technical Rules. Impervious surfaces and were not calculated.

Managed Lands

Insufficient information was provided on the methodology used to develop the percentage managed lands. More detail is required.

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Issues Evaluation

Under the Technical Rules, an issues evaluation is required for all municipal water supplies. The work completed in the report is consistent with these expectations, however, there is a lack of detail regarding what thresholds were used to evaluate these issues. Other than that fact, there are a single critical issue identified:

1. The presence of radionuclides in the former supply well. Based on the report, raw water from this source consistently exceeds the Ontario Drinking Water Standard. It is understood that this has not been recorded in the new supply wells, however, given the relative short period of time these wells have been under operation, it would suggest that these exceedances meet the standard established in the technical rules for a Drinking Water Source Protection Issue. The conclusion that these radionuclide exceedances are not an issue should be reconsidered, as they are clearly present *in the WHPA* at a concentration which could interfere with the ability of the well to be used as a source of drinking water.

Threats Assessment

The Threats Assessment for the supply is consistent with the requirements of the Technical Rules.

Limitations

This report is a summary of the peer review of the Groundwater Vulnerability Assessment for the Municipality of Huron East (Seaforth Municipal Supply), completed by WESA Inc. for the Ausable Bayfield Maitland Source Protection Region, dated October, 2009. This report should only be read in conjunction with the aforementioned report, and is for the exclusive use of the Ausable Bayfield Maitland Source Protection Region. Interpretations of any and all legal documents are those of the author, and are not legal opinions.

References

WESA Inc., 2009. Groundwater Vulnerability Assessment for the Municipality of Huron East (Seaforth)

IWC Ltd., 2003. Huron County Groundwater Study.

Ontario Ministry of the Environment, 2009. Technical Rules: Assessment Report, Clean Water Act, 2006. December 12, 2008.

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Respectfully Submitted,

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