

Chapter 8 - Topics for Additional Research

8.1 Summary of Data Gaps

This *Assessment Report* represents our use of the best available information at this time. Research for the report was constrained by *data gaps* that are described in detail by **Appendix ‘K-1’**. *Data gaps* exist where it was not possible to fulfil a requirement of the Technical Rules: Assessment Report (MOE, 2009)(see **Appendix ‘L-1’**) in this edition of the report. They can be sorted into three general categories:

- topics for which data may exist but are not currently accessible
- topics for which there are no existing data, and where data will likely need to be collected by others
- topics for which there are no existing data, but data could be collected in the future by the Cataraqui Region Conservation Authority (CRCA) and its partners in eastern Ontario.

The Cataraqui Source Protection Committee and CRCA will work with the Province of Ontario to fill as many of the gaps as possible over the coming years. In the interim, the Committee will be mindful of the precautionary approach when addressing topics for which there is uncertainty.

8.2 Anticipated Improvements for Subsequent Assessment Reports

The science of *drinking water* source protection will continue to improve over time. There will be opportunities in subsequent versions of this report to improve the volume and certainty of the findings. The following sections and **Appendix ‘K-2’** describe potential improvements related to the collection and analysis of data, within the existing scope of the Technical Rules.

8.2.1 Water Budget

In some cases, there were not enough data to fully account for some variables of the *water budget*. More data particularly for *precipitation*, *evapotranspiration* and groundwater water levels would improve the *water budget* results. These data would also be helpful for identifying and mapping *significant groundwater recharge areas* (SGRA), *highly vulnerable aquifers* (HVA) and *wellhead protection areas* (WHPA).

8.2.2 Significant Groundwater Recharge Areas & Highly Vulnerable Aquifers

A majority of the improvements for SGRA delineations would come through field work. It would include confirmation of *recharge* and *discharge areas*. This could be done through a variety of methods. It could encompass taking specific location samples with a soil auger to confirm the surficial materials within the SGRAs that are identified in Chapter 5. Similar information could be used to confirm *highly vulnerable aquifers*, as the depth of the material is an important input for making that designation.

An additional possibility that appears to provide worthwhile results for *groundwater discharge* is radon testing of the water. Work along these lines has been conducted by researchers at Queen's University in the Tay River *watershed* (Gleeson et al., 2009) in the Mississippi-Rideau Source Protection Region. Some work has also been conducted by CRCA staff in conjunction with Queen's researchers at a few locations in the CSPA. This method of *discharge* testing appears to be a reasonable option for field validation of *groundwater discharge* in *streams*, and could be used to pinpoint specific *discharge* locations.

There is a challenge with one of the most important data sets used for both SGRA and HVA mapping, the Water Well Information System (WWIS). The precise geographic location of some of the wells in this database is known to be uncertain, and there are inconsistencies in the descriptions of the soil and rock materials in the well logs.

Both of these aspects could be improved over time. If there is a requirement to update the location of the well whenever work is done on the well (for example; pump maintenance), this could be added to the database to provide much better location information of all wells across the province. A pilot project in the Quinte Conservation area (XCG Consultants Ltd., 2003) made this recommendation, and estimated that if this practice were adopted, within ten years all active wells in the province would have updated location information. The remaining wells lacking updated information could then be inventoried; as they may be unused, or have long ago been abandoned or decommissioned.

With respect to the well log material, this problem might never be completely solved. However, guidelines could be established for the material descriptions used by well drillers, and training could be made available on the appearance and behaviour of particular materials. In addition, down-hole video footage of selected wells could be helpful to confirm the soils, rock, and fractures that they pass through.

8.2.3 Wellhead Protection Areas

The WHPA delineation work completed as part of the *drinking water* source protection initiative, and prior to it, has some of the same constraints as the regional-scale groundwater research, including the challenges associated with the WWIS data.

Specifically, more work on the soil depth, and the soil make-up in the vicinity of the WHPA will help with *recharge* estimates, and with the assessment of potential vulnerability. Two of the most important parts of a WHPA model are the *permeability* and *transmissivity* estimates. These can be estimated using multiple pumping/packer tests on the *monitoring* wells of the area. The variability of these values, especially in fractured *bedrock*, can make a substantial difference to the overall model, and the area the water comes from to supply the wells.

Having longer term records of the water level in wells (Provincial Groundwater Monitoring Network, supply, and *monitoring*), and how they change with time, and with *climate* (*precipitation* events, season) will make a substantial difference in how the WHPA model is prepared, and the results.

Similar to the SGRAs and HVAs, the location of *recharge areas* is also very important to the WHPA model. Improvements to our knowledge of those areas would therefore also benefit the WHPAs.

8.2.4 Intake Protection Zones

The delineation of *intake protection zones* (IPZ) would also benefit from additional data and further research.

Having extensive field data over a long period of record improves the accuracy of the *models* that are used to delineate IPZ. For the work on eastern Lake Ontario and the upper St. Lawrence River in Chapter 6, two years of field data were used. These data were used to extrapolate to a range of field conditions; greater certainty would be achieved with additional data. A more detailed *model* would also help to refine the IPZ delineations, but the existing *model* used the maximum available computing power.

Transport pathways were estimated using mapping of pipe, stream and ditch locations. In the future, more complete pipe data (particularly diameter and slope) could be used to more accurately calculate the extent of *transport pathways*, as it can be used to estimate flow velocity in the pipes. The same type of information could be used for *streams* and ditches to estimate how far up a stream a *transport pathway* should be considered, given the time for a spill to travel to the intake.

In addition to the field data, additional consideration of the time between a spill occurring and it being reported could be included in future IPZ work. Consideration for the storage time in the system (hours or days of water available), and the time needed to fill that storage, would be useful for the emergency management coordinators at each municipality. It would help them know what next steps to take should a spill occur near an intake, and whether the intake would need to be shut off.

The existing IPZ work on the Lake Ontario and St. Lawrence River intakes in the CSPA was based on field data collected during ice free situations. The findings therefore do not fully address the ice cover situations, which occur in most years. The researchers at Queen's University who completed the IPZ *modeling* for these intakes are working on a modified method that accounts for ice cover. Once it is ready, additional IPZ work could be conducted for the Cataraqui intakes. It is expected that the delineated IPZs (under ice cover) might be smaller than those delineated in ice free situations, and also that they may extend in different geographic directions.

8.2.5 Source Water Quality Issues and Threats

There currently is minimal information on *raw water* quality at the water treatment plants. *Raw water* testing is only required a few times a year, and the samples are only analysed for a short list of parameters. Additional testing, with more scheduled testing throughout the year, and extra sites would allow for more complete *raw water* analyses. Sampling the *raw water* at the intake, prior to chlorination, would also help to identify bacterial/*pathogenic drinking water issues*.

As discussed in Chapters 5 and 6, efforts to target sources of a *contaminant* contributing to a *drinking water issue* would be aided with up-gradient and upstream sampling for *contaminant* concentrations (this could lead to the delineation of *issue contributing areas*).

With respect to *watershed*-wide water quality information, groundwater quality *monitoring*, analysis and planning have been relatively inactive in the past decade. A sampling program, with emphasis on identified *vulnerable areas*, would assist in the identification of *drinking water issues* on the landscape. This sampling program could include water quality sampling at private wells or the establishment of *monitoring wells* for water quality analysis.

The assessment of non-prescribed (local) *threats* related to conditioning salts and transportation corridors is ongoing. Also, continuing investigation of *conditions* in the CSPA may result in the identification of associated *drinking water threats*. It is anticipated that findings related to these topics will be included in an updated edition of the *Assessment Report* that will be published in 2011.

8.2.6 Imagery Analysis/Mapping

This *Assessment Report* uses Digital Raster Acquisition Project for the East (DRAPE) imagery from 2008. However, no comprehensive analyses of the imagery have been completed to date. For the purposes of Technical Rule 16 (mapping of managed lands and impervious surfaces) (MOE, 2009) in particular, *land cover* classification/analysis of the imagery would provide better estimates of impervious surface, and would improve estimates of managed lands.