



Requirements for completion of hydrogeological studies to facilitate Conservation Halton's reviews

Conservation Halton

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to facilitate Conservation Halton’s reviews**

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1. Purpose and Introduction

Conservation Halton is a public commenting body under the Planning Act and as such, is circulated municipal policy documents and planning applications for review and comment. In addition, Conservation Halton provides technical review for projects approved under other legislation and plans such as the Niagara Escarpment Plan and related Development Permit Applications, Parkway West Belt Plan, Greenbelt Plan, Environmental Assessment Act, Drainage Act and Aggregate Resources Act. Conservation Halton also provides technical review on large-scale planning projects such as watershed studies, subwatershed studies, subwatershed impact studies, provincial plans and related technical studies.

Conservation Halton also administers the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation (Ontario Regulation 162/06) under the Conservation Authorities Act. This regulation specifies that permission from CH is required to:

- develop in or adjacent to river or stream valleys, wetlands and adjacent lands (i.e., other areas where development could interfere with the hydrologic function of a wetland), shorelines or hazardous lands;
- alter a river, creek, stream or watercourse; or
- interfere with a wetland.

The administration of the regulation is guided by Conservation Halton Board-approved policies (Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning (August 11, 2011)). These policies complement the Ontario Provincial Policy Statement, Section 3.0 – Protecting Public Health and Safety and were developed with input from watershed municipalities and other stakeholders before they were approved.

This document is a starting point for undertaking hydrogeological studies in support of development/permit applications that will be reviewed by Conservation Halton. It identifies minimum requirements for most projects. Professional judgment and pre-consultation are encouraged to scope the work to specific site and project conditions. The scope of hydrogeologic work required by Conservation Halton will be based on the risk of impact from the proposed work/development on the natural environment dependent on groundwater. Sufficient detail should be provided to Conservation Halton in reports to facilitate a review of the characterization, analysis and conclusions drawn. If hydrogeological reports and studies follow the requirements laid out in this document, the timelines for Conservation Halton review of the hydrogeological components of an application should be significantly reduced.

In general, Conservation Halton may require a hydrogeology study for the following types of activities:

- Development of parcels of land greater than two hectares
- Activities in the vicinity of sensitive surface water features and sensitive ground water features, i.e. areas that are particularly susceptible to impacts from activities or events including, but not limited to, water withdrawals, reduction in recharge, additions of pollutants. These areas

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include wetlands, watercourses, waterbodies, vernal pools, significant wildlife habitat, significant recharge areas, buried bedrock valleys, karst areas, etc.

- Activities that may affect baseflow
- Activities in the vicinity of habitat for species at risk
- Activities in the vicinity of headwater streams
- Activities that may reduce recharge and/or lower groundwater levels
- Activities that will extend deep underground and/or may affect groundwater flow patterns

Studies may be required in other circumstances as well to address issues such as cumulative impacts.

1.1 Qualifications

Hydrogeological studies must be completed by or under the guidance of qualified persons as set out in Ontario's Professional Geoscientist Act, 2000. The qualified professional must sign and stamp a completed report, and shall take professional responsibility for its content and the accuracy of the information contained therein.

2. Guiding Principals

A hydrogeological study in support of a proposal for development or permit application must establish that the activity will not cause unacceptable groundwater quantity and/or quality impacts which may affect the natural environment, and if impacts are expected, that they can be mitigated in a sustainable way.

In support of the proposal, the hydrogeological study must be comprehensive and multi-disciplinary. The scope of work must include an assessment of

1. Study area – the lands included in the proposal plus the extent of potential impact, as well as an assessment of upgradient and downgradient existing and proposed activities that could influence decisions made on the current proposal
2. Existing conditions – site characterization including physical and human aspects
3. Proposal – a detailed accounting of what is proposed for the study site
4. Future conditions – characterization of the site if the proposal was approved
5. Potential impacts – a detailed assessment of all impacts that are expected from the changes made to the activities on the study site, both during construction and into the future
6. Mitigation – a discussion of options for mitigation of the potential impacts and their expected effectiveness based on site conditions

For clarity, a hydrogeological study must answer the following questions:

1. What is occurring in the study area presently?
2. What currently influences groundwater flow and levels in the area and how do flows and levels change with changing seasons and weather patterns?

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3. What groundwater/surface water interactions occur in the area and how do they change with changing seasons and weather patterns?
4. What is being proposed to occur on the subject lands and over what time period?
5. Is this proposed activity expected to impact groundwater levels and flows and the natural features and their functions?
 - 5.1. If so, in what way and to what extent? Are these unacceptable impacts?
6. What can be done to mitigate the impacts and to what degree are the measures expected to be successful?

To assess whether the proposal will have unacceptable impacts the proponent must characterize the study area in detail and provide clear support for conclusions drawn.

3. Report Structure

Hydrogeological studies will vary in scope, level of detail, and methodologies depending upon project scale and the study objectives. No matter the size of the project, sufficient detail as determined by Conservation Halton must be provided in the report to facilitate a thorough review of the hydrogeological conditions, analysis and conclusions.

The following is provided as guidance on the structure of the report of findings to be submitted to support a proposal. A consistent report format will assist with the review, however, we understand that the data/information and findings of a hydrogeological study may be a component of a larger document, for example a subwatershed impact study. In that case, it would be helpful if similar section titles are used in the report to guide Conservation Halton's review, or Form A, included in Appendix A, is submitted with the document to help us locate the relevant information/data.

The suggested report format and main section headings are as follows:

1. Introduction
2. Background
3. Methodology
4. Characterization
5. Analysis and Impact Assessment
6. Mitigation
7. Summary and Conclusions
8. Recommendations
9. References

4. Report Content

Provided below are detailed explanations of what should be included within each section of the hydrogeological report. Professional judgement should be used to identify other relevant information/data that should be included in the report to assist Conservation Halton's review. Conservation Halton requires the report in both printed and digital forms.

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Introduction

This section should identify and briefly describe who completed the hydrogeological assessment and when, the owner of the lands, the study area, the purpose of the proposal, and the scope of work performed.

Background

- a. Study area description – Background information on the regional area should be collected from all available sources, including but not restricted to the following:
 - Planning documents such as subwatershed studies, natural heritage system reports, etc.
 - Published topographic mapping, aerial photography, geology maps
 - Regional groundwater studies and site specific technical reports, pumping tests, geophysical surveys, etc.
 - Soils reports and geotechnical investigations
 - Surficial soils, Quaternary geology and bedrock geology reports
 - Existing well records, groundwater level and quality datasets (e.g. MOE Water Well Record Information Database, Provincial Groundwater Monitoring Network, geotechnical borehole data, etc.)
 - Groundwater taking and use datasets (e.g. MOE Permit to Take Water Database, Water Taking Reporting System Database, etc.)
 - Surface water flow and use datasets (e.g. MOE Permit to Take Water database, Water Survey of Canada HYDAT database, etc.)
 - Reports of contamination and complaint files (MOE)
 - Drinking Water Source Protection Assessment Report and Source Protection Plan for the Halton Region Source Protection Area
 - Environment Canada and local weather station datasets

A list of the documents/maps reviewed should be included in the report along with a description of the regional context.

- b. Proposal – an overview of the proposal should be provided with an appropriate level of detail to facilitate an assessment of activities that could affect the natural environment.

Methodology

Once the background review is complete and there is a general understanding of the study area, data and knowledge deficiencies for existing and proposed site conditions should be determined and a field investigation program designed to remedy these deficiencies. The program developed should emphasize the requirement to support the proposed site changes with no unacceptable impacts on groundwater dependent features.

The field investigation should include a subsurface investigation including drilling, installation of groundwater level and quality monitoring equipment, and data collection/analysis, etc. as necessary. Spatial and vertical distribution and locations of the groundwater monitors should be sufficient to understand groundwater quantity, flow and quality across the proposed lands and groundwater/surface water interaction (vertical gradients) in the vicinity of wetlands, streams and other features that may be dependent on groundwater discharge.

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At a minimum the methodology section should describe methods used for the following:

- Assessment to identify groundwater dependent features
- Installation of groundwater and surface water monitors
- Aquifer and/or soil hydraulic properties testing
- Groundwater levels and flow determination
- Surface water levels and flow determination in relation to discharge areas
- Assessment of groundwater and surface water quality, including temperature
- Assessment of the suitability of soil conditions for stormwater low impact development and best management practices
- Development of pre and post-development water balances

Characterization

The characterization section should combine the information/data gained through the background review with the findings from the on-site field program and present a comprehensive characterization of the study area. The study area characterization should be sufficient to help the reviewer understand geological and hydrogeological conditions in the area, to determine the key characteristics of the bedrock and overburden systems and their functions in terms of controlling water movement, availability, and quality within the local setting. An integral component of the study is to assess the interaction between the groundwater and surface water systems and to determine the overall role or function of this interaction in an ecosystem context. An assessment of the site location in relation to the vulnerable areas delineated through Source Water Protection studies for the Halton Region Source Protection Area should also be completed.

The characterization section should include, but not be limited to, the following:

- Identification and rationale for the study area chosen
- Discussion of the physical and human aspects of the study area
- Maps of local physiography, topography, overburden and bedrock geology including buried bedrock valleys
- Map of hydrology with topography or direction of flow and known groundwater dependent features within and adjacent to the area and with associated discussion
- Discussion of hydrostratigraphy
- Map of private water well, monitoring well, production well, and borehole locations
- Cross-sections showing stratigraphy, well construction, water table
- Map showing groundwater elevation, flow direction and quality
- Discussion of spatial and temporal assessments of groundwater conditions including vertical gradients
- Available borehole and test pit logs
- Data and analysis of hydraulic testing
- Identification of all known groundwater receptors within and adjacent to the area
- Identification of existing recharge areas
- Quantification of groundwater contribution to baseflow and to the natural systems (wetlands, streams, etc.)
- Assessment of groundwater quality in the area prior to development
- Assessment of soil conditions and potential for implementation of low impact development measures

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- Monthly water balance for pre-development conditions including data used, citation of their source, and rationale for their use

Analysis and Impact Assessment

A thorough and integrated analysis based on the information and data obtained and generated for the study and the predicted site conditions following development must be undertaken and documented in the hydrogeological report. The proponent should demonstrate their understanding of site conditions pre and post-development and assess and document the expected impacts to recharge, groundwater/surface water interactions, groundwater quality, and the form and function of groundwater dependent features from the proposed development. The purpose of the analysis is to:

- a. map areas where shallow water table may be impacted by foundation drains, sump pumps, utility trenches, site servicing, etc. based on the proposed grading plan and temporal variability of groundwater conditions
- b. determine the quantity and quality of groundwater resources in pre, during and post development scenarios - consider using numerical groundwater flow modelling tools for the assessment
- c. calculate a monthly water balance post-development and provide a comparison table showing the differences between the pre-development and post-development conditions for all components of the water budget
- d. based on the expected reduction in recharge due to development, set targets for infiltration aiming to maintain pre-development groundwater levels
- e. identify recharge sites which are suitable for urban stormwater infiltration (i.e. maintain groundwater levels but avoid contamination that could impact groundwater receptors)
- f. determine how to protect groundwater quality from degradation by surface activities, artificial recharge, or mixing of aquifer waters
- g. predict impacts on form and function of natural features dependent on groundwater

The following are required as part of this section:

- text and supporting data and calculations
- profiles of creeks when proposed for relocation or realignment showing existing and final grade, geology, boreholes, monitors, water table
- maps showing locations of interest
- comparison table for pre and post-development water balance noting changes predicted
- targets for infiltration to off-set reduction in recharge
- map of potential recharge areas for mitigation measures
- assessment of development impacts on groundwater resources and groundwater/surface water interaction including the form and function of natural features dependent on groundwater

All data used in the analyses must be included within the report to assist the reviewer.

Mitigation

The impact assessment results should be used to generate development scenarios that incorporate infiltration opportunities and water conservation techniques to enhance or maintain groundwater levels and quality. Primarily, underground servicing and building foundations should be kept away from aquifers where possible, and construction techniques should minimize or eliminate interference with local aquifers. If impacts from the proposed development are anticipated and expected to be

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unacceptable to preservation of baseflow and the form and function of the groundwater dependent features, mitigation strategies must be proposed.

The aim of mitigation measures is to maintain clean recharge on the subject lands to support groundwater resources with minimal effects on the natural environment. Conservation Halton encourages the use of low impact development measures and best management practices. All mitigation opportunities should be evaluated and effective measures proposed based on site conditions. The discussion should be fulsome and provide rationale for suggested measures and not others.

The monthly water balance must be re-calculated including mitigation measures and a table of values included in the report. If the recommended mitigation does not off-set predicted impacts an evaluation of the effect on baseflow and groundwater dependent features is required.

The areas on the subject lands that are susceptible to ground water contamination, if any, should be identified and recommendations made on what land use or management practices should be applied to these areas.

Summary and Conclusions

The proponent should provide a brief overview of the work plan and study results as discussed in the previous sections. The emphasis of this section should be on answering the questions posed in Section 2 above. The data and analyses presented in the report must support conclusions drawn here.

Recommendations

The proponent should consider the uncertainty of their studies and the level of risk from the proposed development on the natural environment and make recommendations for programs to reduce the uncertainty and lower the risk. For example, a monitoring program should be proposed that will increase the understanding of pre-development site conditions and mitigation effectiveness during and post-development. The program should provide long-term data, including pre and post-development, for analysis of impacts realized, if any, to groundwater levels and flow, baseflow, and the form and function of surface water features. It should allow for adaptive management measures.

The proponent should also propose a contingency plan, which would identify steps to be taken if unacceptable impacts occur due to development activities. This plan will be required to address unforeseen unacceptable impacts if extensive dewatering is expected during construction.

References

Include a listing of all reference manuals, reports, documents, etc. used to reach the conclusions.

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Appendix A

Form A – Hydrogeological Report Content Checklist

To facilitate a more efficient and effective review of the attached hydrogeological report for the following study, the required information/data can be found as noted in the table below.

Report Title _____

Prepared by _____

Date of Report _____

Information / Data / Map	Section	Page Number
Signatory Page		
Introduction - who completed the hydrogeological assessment and when - the owner of the lands - the study area - the purpose of the proposal - the scope of work performed		
Background - study area description - proposal description		
Methodology - groundwater dependent features - groundwater and surface water monitors - hydraulic testing - groundwater levels and flow determination - surface water levels and flow determination in relation to discharge areas - groundwater and surface water quality - soil conditions - pre and post-development water balances		
Characterization - study area - physical characteristics		

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Information / Data / Map	Section	Page Number
<ul style="list-style-type: none"> - human characteristics - hydrostratigraphy - maps - cross-sections - data - water balance 		
<p>Analysis and Impact Assessment</p> <ul style="list-style-type: none"> - text and supporting data and calculations - profiles of creeks when proposed for relocation or realignment - maps showing locations of interest - comparison table for pre and post-development water balance - map of potential recharge areas for mitigation measures - assessment of development impacts on groundwater resources and groundwater/surface water interaction 		
<p>Mitigation</p> <ul style="list-style-type: none"> - mitigation strategies and rationale - table of water balance with mitigation 		
<p>Summary and Conclusions</p>		
<p>Recommendations</p> <ul style="list-style-type: none"> - monitoring program - contingency plan 		
<p>References</p>		