Hydrogeological Study

The purpose of this document is to provide a term of reference for the preparation of a Hydrogeological Study, which may be required as part of the submission of an application for Official Plan Amendment, Zoning By-law Amendment/Community Planning Permit, Draft Plan of Subdivision/Condominium, Site Plan, Consent and Minor Variance.

A Hydrogeological Study is undertaken to assess matters such as: groundwater infiltration and recharge, groundwater discharge and baseflow, groundwater elevations and flow paths, water quality and temperature, cumulative watershed impacts, coldwater fisheries supported by groundwater discharge, and impacts to the District's drinking water sources.

Additionally, it reviews the subsurface hydrogeological conditions to identify development suitability, constraints and mitigation measures to be implemented.

Required by Legislation

Ontario Water Resources Act, R.S.O., 1990, c. O.40
For Permits to Take Water: Ontario Regulation 387/04, OWRA (Sections 34 and 98)
For Environmental Activity and Sector Registry: Environmental Protection Act (Part II.2), Ontario Regulation 245/11 (Part II.2 – General), Ontario Regulation 63/16
For Source Water Protection: Clean Water Act, O. Reg. 284/07

Who should prepare this study?

A Hydrogeological Report must be completed by a licensed, professional geoscientist or exempted engineer as set out in the Professional Geoscientist Act of Ontario and Professional Engineers of Ontario. All reports and drawings must be stamped, signed, and dated by a qualified professional, licensed in the Province of Ontario.

Why do we need this study?

A Hydrogeological Report is required to assess matters such as:

- Groundwater occurrence (unconfined and confined aquifers, aquitards, water table depth) and associated subsurface geology
- Surface water – groundwater interactions
- Groundwater infiltration or recharge, when water balances are required
- Groundwater baseflow and discharge
- Seasonal groundwater elevations and flow paths
- Groundwater quality and temperature
- Cumulative watershed impacts on groundwater
- Temporary and/or permanent dewatering intake, discharge, and zone of influence

- Identify dewatering impacts, including contaminant migration and impacts to existing and proposed private water wells (quality and quantity), and natural heritage features
- Identify mitigation measures and monitoring requirements of dewatering impacts
- Dewatering impacts to building foundations and road structural stability (potential settlement) associated with dewatering
- Evaluate dewatering, and development impacts on the municipal drinking water sources
- Groundwater discharge which supports cold-water fisheries, if required
- Compliance with applicable requirements from the Ministry of the Environment, Conservation and Parks (MECP), for Permits to Take Water or Environmental Activity and Sector Registry

How should this study be prepared?

The review area shall encompass the land area covering the largest possible zone of influence that could result from the proposed groundwater taking and/or source of contamination.

A Hydrogeological Report should at a minimum contain:

Introduction

- Address of the subject property
- General site location of the subject property
- Project Name (if applicable)
- Applicant and owner's contact information
- Author name, title, qualifications, company name and appropriate stamp
- Brief description of the proposed development
- Overview of the study area
- Purpose of the study
- Location and context map

Proposal Description and Context

- A description of the proposal, development stats (such as number of units, site area) type of development proposed, height, parking areas, access points, location of amenity areas, proposed phasing
- A description of the existing hydrogeological conditions on the site and within a 500-m study area as well as surrounding areas, roads, natural areas, buildings, parking areas
- Concept Plan for the development including building location, parking, access, amenity area, grading, natural features and any natural hazards

Minimum Investigation/Evaluation

- Existing Regional and Local Geology and Hydrogeology including surficial and bedrock geology, lithology and hydrostratigraphic units

- Description of Topography and Drainage (surface water features and functions), physiography, existing land use, and soils
- Test pits/boreholes logs that include water table elevations and lithology
- Monitoring Wells
- Single well response tests or pump test(s) for formations to be impacted by dewatering activities
- Private Well Surveys (as required)
- Hydrogeology: Aquifer properties, groundwater levels including areas of flowing artesian conditions, groundwater flow direction(s) hydraulic conductivity, vertical and/or horizontal gradients
- Pre-development groundwater quality
- Source Water Protection Plan (SPP) policies and vulnerable areas pertaining to the development. Ecologically Significant Groundwater Recharge Areas
- Water balance for sites as required by source water protection plans
- Infiltration testing for locations where Low Impact Developments are being considered and rely on design guidance for LIDs.

Impacts and Potential Short/Long Term Impact Assessment

- Potential impacts to groundwater levels/groundwater flow (Seasonally/Historically high groundwater levels and Four-season monitoring)
- Surface water system, other groundwater users, and land stability
- Potential impacts to groundwater recharge, baseflow, and discharge to natural heritage features
- Potential impacts to water supply wells
- Potential impacts to settlement of existing structures
- Pre and post-development water balance with and without mitigation
- D-5-4 (Onsite Sewage Systems)
- Source Water Protection: Wellhead Protection Area (WHPA), Highly Vulnerable Aquifer (HVA), Significant Groundwater Recharge Areas, Creation of a Transport Pathway, Significant Drinking Water Threats, Existing Conditions/Issues
- Quantity and quality of an aquifer used for drinking water supply
- Temporary and permanent dewatering, if required
- Contaminant migration flowing conditions, if required.

Mitigation Measures and Monitoring Plan

- Mitigate impacts to infiltration/recharge
- Mitigate impacts associated with groundwater quality
- Conduct Groundwater Quantity Monitoring Program, for discharge evaluation
- Assess temporary dewatering needs
- Eliminate or reduce permanent dewatering needs
- Design and implement Contingency Plans for dewatering, quantity, and quality concerns
- Install sentry wells within municipal boundaries to assess and monitor impacts associated with dewatering to private/public wells, as applicable

- Carry out a ground settlement monitoring program during dewatering
- Conduct surface water quality monitoring (as required)
- Monitor groundwater and/or surface water level fluctuations associated with dewatering activities
- Monitor groundwater dewatering volumes (for compliance with EASR/PTTW or requirements from MECP)
- Use engineering measures to reduce/eliminate dewatering volumes (e.g., waterproofing, soldier piles and lagging, caisson walls, sinking shafts, etc.)
- Plan for pre-treating water before discharge in the storm sewer system (as required)

If it has been determined that there will be a negative impact to the natural environment, municipality's sewage works, or the land stability because of groundwater taking and discharging, the Review shall identify the following:

- The extent of the negative impact
- Details of the existing or pre-construction state of all the infrastructure, municipal sewage works and natural environment within the affected zone
- The proposed mitigation and monitoring plan

If any potential settlement due to dewatering activities is identified, the Applicant will be required to submit a pre-construction survey (including photos) and CCTV of any municipal infrastructure identified in the hydrogeology report as potentially susceptible to settlement due to the dewatering activities.

If a proposed mitigation plan is recommended, subsequently, a follow-up report is required confirming that the affected zone has been returned to its pre-development/existing conditions prior to the groundwater taking and discharge

Recommendations

- Proposal of actions to support the development and any special considerations or conditions that should be imposed
- Any recommendations or conditions that should form part of the development approval

Drawings and Supporting Information

- Figures supporting the narrative in a report
- Results of MECP water well records' search
- Results of water well surveys
- Borehole logs
- Hydrogeological cross-sections
- Groundwater and/or surface water monitoring results
- Datalogger plots
- Results of pumping test analysis and/or single-well response test analysis
- Laboratory certificates of analysis
- Dewatering spreadsheets

- Drawings supporting the application
- Infiltration test analysis
- Settlement analysis reports
- Water balance calculations (as required)
- Correspondence with Conservation Authorities or MECP (as required)

What else should we know?

The scope of the study should be discussed with the district and/or area municipal planning staff and or other staff or agencies as part of the consultation process.

The study area should include the land surface area covering the largest possible area of influence that could result from the proposed taking. This may include potential influences to water level, flow direction and water quality.

The level of detail required in the hydrogeological study is normally expected to be commensurate with the level of risk posed by the taking, and level of uncertainty of the available information.

Additional Terms

To be identified by the District and/or Area Municipality where proposed development is located.

Study Submission Instructions

To be identified by the District and/or Area Municipality where proposed development is located.

What other resources are there?

Clean Water Act, 2006, c.22
Environmental Protection Act, R.S.O. 1990, c. E.19
Ontario Ministry of Environment and Energy:
Guide to Permit to Take Water Application Form
Source Protection Information Atlas
Stormwater Management Planning & Design Manual (March 2003)
Technical Guidance Document for Hydrogeological Studies in Support of Category 3 Applications
Water Management: policies, guidelines, provincial water quality objectives
Ontario Ministry of Environment and Energy, Ontario Ministry of Natural Resources (April 1995):
MOECC Hydrogeological Technical Information Requirements for Land Development Applications
Ontario Regulation 63/16: Registration under Part II.2 of the Act – Water Taking
Ontario Regulation 245-11
Ontario Regulation 284/07, Source Protection Areas and Regions
Ontario Regulation 387/04: Water Taking and Transfer
Ontario Water Resources Act, R.S.O., 1990, c.O.40

Professional Geoscientists Ontario
Professional Engineers of Ontario
District Municipality of Muskoka Design Criteria and Standards Manual
Ontario Professional Planners Institute (OPPI) – Hire an RPP
Ontario Planning Act, R.S.O. 1990
Provincial Planning Statement 2024 (PPS)
Muskoka Official Plan (MOP)
Applicable Area Municipal Official Plans:
Town of Huntsville Official Plan
Town of Bracebridge Official Plan
Town of Gravenhurst Official Plan
Township of Lake of Bays Official Plan
Township of Muskoka Lakes Official Plan
Township of Georgian Bay Official Plan

About these Terms of Reference

The need and scope for this study will be decided by the District and/or Area Municipality during initial pre-consultation process with input from partner agencies. This pre-consultation process may include:

- Determination if this study is applicable
- Confirmation of criteria within these Terms of Reference that are appropriate for your development project
- Identification of specific technical components that need to be addressed
- Identification of detailed standards to be met

Notes:

If the proposed development is revised, the study/report shall reflect the revisions by an updated report or letter from the author indicating the changes and whether or not the recommendations and conclusions are the same (Note: this is subject to the extent of the revisions).

A peer review may be required. The cost of the peer review will be borne by the applicant.

If the submitted study is incomplete, is authored by an unqualified individual or does not contain adequate analysis, the applications will be considered incomplete and returned to the applicant.