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A geotechnical investigation may be required to identify the Existing Top-of-Slope (ETOS) and determine the Long-Term-Stable Top-of-Slope (LTSTOS). Because of the complexities of site development and soil conditions, the development proposal should be discussed in advance with TRCA technical staff to confirm the level of study required. Typically, comprehensive assessments are required for development projects close to major features such as the Scarborough Bluffs and steep ravines, while less detail may be required for minor works near shallower slopes. The assessment of the LTSTOS is to be completed following the MNR's *Technical Guide on River and Stream Systems: Erosion Hazard Limit* (2002) and should be accompanied by a detailed slope stability analysis. The LTSTOS must be plotted on a topographic site plan and the minimum Factor of Safety required by TRCA for slope stability analysis is 1.5.

## **OBJECTIVE**

The objective of the investigation, if required, is to determine if the proposed development and/or associated construction activities related to the development will cause or have the potential to cause erosion or slope instability problems on the lands being developed and/or adjacent lands and infrastructure.

## **SUBMISSION REQUIREMENTS**

Where required, a solution based on sound technical data should be recommended to minimize or eliminate the impact of the development and associated activity, and at the same time ensure that the development will be safe for a design period of 100 years. Alternatives should be considered, and a final solution recommended and justified by comparing it to the alternatives. The basic requirements are as follows:

- Determine the existing subsoil conditions and pertinent geotechnical parameters for the entire height of the slope;
- Model the slope conditions and assess its stability. Determine the stable slope inclination corresponding to a minimum Factor of Safety of 1.5; and
- Provide and assess mitigation strategies, where required.

The following report outline provides a general guide for the documentation and calculations required by TRCA. The level of detail required for a specific submission will depend on factors such as:

- Slope characteristics (e.g., height, angle, and distance from watercourse);
- Distance of development from the slope;
- Local soil conditions; and
- The type of development proposed.

## **Comprehensive Geotechnical Report Outline**

The investigation should provide definitive, factual information that verifies the final recommendations and should include the components listed below. Technical terms used in the report should be defined. All drawings must include a table defining the symbols used, and must be stamped by a professional engineer.

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## **1.0 Introduction**

- 1.1 Site Location
  - street map
  - adjacent property ownership
  - site photos
- 1.2 Site Characteristics
  - property boundaries
  - scaled contour map
  - existing infrastructure (on-site and on adjacent properties)
- 1.3 Description of Proposed Development/Activity
  - located on scaled contour map
  - existing and proposed structures
  - plan and cross-section views

## **2.0 Subsurface Investigation Results**

- 2.1 Investigation
  - borehole location plan
  - borehole logs
  - monitoring well construction details
  - water level measurements
  - laboratory testing
- 2.2 Physiography
  - significant topographic features
  - adjacent and nearby watercourses
- 2.3 Geotechnical Conditions
  - stratigraphy
  - seepage zones
  - position and nature of existing bank
  - failure planes (where possible)
  - groundwater levels

## **3.0 Engineering Evaluation**

- 3.1 Soil Parameter Evaluation
  - cohesion
  - liquid/plastic limits
  - water content
  - angle of friction
  - unit weights
- 3.2 Slope Stability Assessment
  - documentation of previous and existing slope failures (mechanism of failure, type, and extent)
  - factor of safety results
  - stable slope allowance
  - recommended setbacks

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- 3.3 Toe Erosion Assessment
    - documentation of existing toe erosion
    - evaluation of toe erosion allowance
  - 3.4 Erosion Access Allowance
    - Top-of-Slope Runoff Erosion
    - Top-of-Slope Recession Allowance
  - 3.5 Long-Term-Stable Top-of-Slope
    - total geotechnical allowance
    - setback recommendations based on comparison of ETOS with LTSTOS

#### **4.0 Summary and Conclusions**

- 4.1 Mapping
  - ETOS and LTSTOS lines on a scaled topographic map of the site including the layout of proposed development
  - cross-sections through the slope and proposed structures, indicating both the ETOS and LTSTOS limits
- 4.2 Assessment
  - summary of existing geotechnical conditions
  - summary of post-development geotechnical conditions
  - sufficient geotechnical data to ensure that the proposed development is technically sound and will not contribute to soil instability in the immediate and surrounding area
- 4.3 Mitigation (if required)
  - design and geotechnical data to support proposed remedial measures
  - revised factor of safety and setback calculations

#### **5.0 References**

- 5.1 Document all references used in the calculations and assessment