REVISED REPORT

Geotechnical Slope Assessment

Proposed Reflection Shores Development, Municipality of Lambton Shores, Ontario

Submitted to:

Sifton Properties Ltd.

1295 Riverbend Road, Suite 300
London, Ontario
N6k 0G2

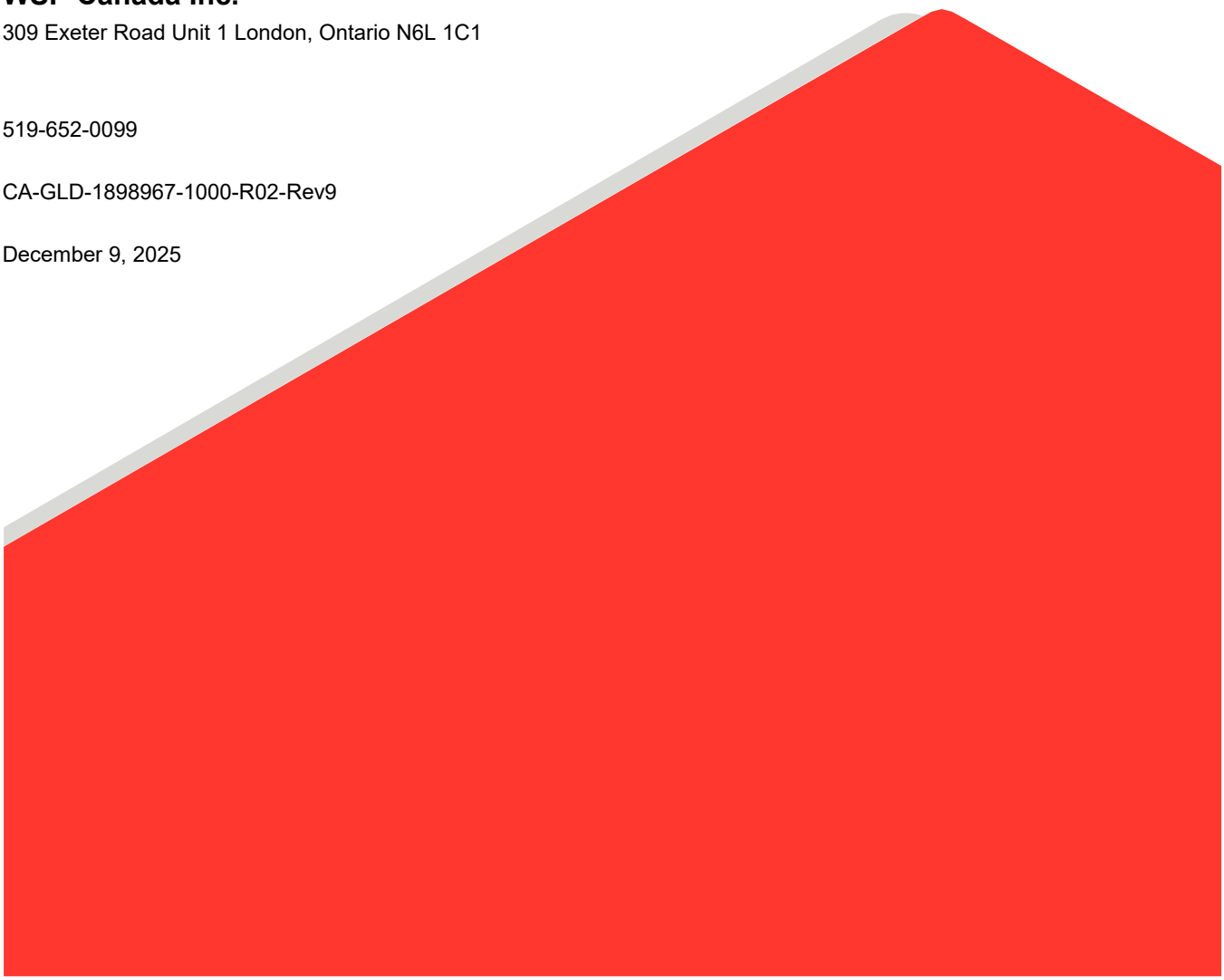
Submitted by:

WSP Canada Inc.
309 Exeter Road Unit 1 London, Ontario N6L 1C1

519-652-0099

CA-GLD-1898967-1000-R02-Rev9

December 9, 2025



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1.0 INTRODUCTION

This revised report presents the results of the slope stability assessments carried out for the proposed Reflection Shores development to be located in the Municipality of Lambton Shores, Ontario. The location of the site is shown on the Key Plan, Figure 1. Geotechnical slope assessments were carried out by WSP Canada Inc. (WSP), previously WSP Golder and Golder Associates Ltd. (Golder) along the lakeshore bluff slope within the west portion of the site.

The geotechnical slope assessments are intended to evaluate the stability of the existing slope and provide recommended geotechnical setback limits for the proposed subdivision. The assessment was carried out in general accordance with our proposal letter dated April 6, 2018. Authorization to proceed with the geotechnical slope assessment was provided by Sifton Properties Limited (Sifton) on April 10, 2018. Sifton provided an updated digital plan of the proposed subdivision development on December 1, 2025. Sifton requested revisions to this report and authorization to proceed with these revisions was provided by Sifton on December 2, 2025, Change Order CO-3.

This report should be read in conjunction with the attached document “Important Information and Limitations of This Report”, which comprises an integral component hereof. The reader’s attention is specifically drawn to this material, as it is essential for proper use and interpretation of the information presented and discussed herein.

2.0 METHODS OF SLOPE ASSESSMENT

The slope stability assessment consisted of a desktop review of the available information for the site followed by a site reconnaissance and preliminary slope stability analyses. The desktop review involved examination of the available geological and topographical mapping for the area of the site and the results of the geotechnical explorations carried out at the site. Trueline Services Inc. completed a topographic survey of the site on April 27, 2021 and Sifton Properties Ltd. provided Golder with a digital copy of the survey data on May 18, 2021 for inclusion in this report.

Golder’s geotechnical engineering staff carried out the slope inspection along the Lake Huron bluff slope on April 18, 2018 and on April 8, 2020. A subsequent visual inspection was carried out by Golder on March 23, 2021. The inspections included a walkover of the slopes to make observations of vegetation, soil type, seepage conditions, to carry out slope measurements, and to document evidence of erosion. The site observations along two representative sections of the slopes are summarized in Table I, and slope stability assessments using the Ontario Ministry of Natural Resources (MNR) Slope Stability Rating Chart were completed, the results of which are provided in Table II, attached. The slope stability ratings were based on visual inspections of the slope, approximate slope inclinations estimated using an Abney hand level and heights and distances measured with a GPS unit and referenced to available topographic mapping. Soil classifications at the site were based on observations of exposed soils within the slope faces during the inspections and the soil conditions encountered in the boreholes drilled within the area of the slope as part of previous and current geotechnical exploration programs. The Record of Borehole sheets for the boreholes drilled in close proximity to the slopes are provided in Appendix A and the approximate borehole locations are shown on the Location Plan, Figure 1. Photographs of significant site features were taken, and selected site photographs are presented in Appendix B. The slope section locations, and the locations, directions and identification of the photographs are also shown on the Site Photograph Location Plan, Figure 2.

Preliminary slope stability analyses were carried out to assess the stability of the existing slopes based on the available subsurface data and our experience with similar ground conditions. Slope stability analyses were carried out using SLOPE/W, a limit equilibrium analysis program produced by GEO-SLOPE International.

3.0 BACKGROUND INFORMATION REVIEW

3.1 Site Conditions

Based on the conceptual plan provided to Golder by Sifton, the proposed Reflection Shores development is located on the tablelands adjacent to the top of the Lake Huron bluff slope. The development will connect to Cedar Point Line at the south end and to the existing driveway to the cottage at the Lake Huron shoreline at the north end of the site. The Lake Huron slope is located immediately west of the proposed development. The proposed development is located within the St. Clair Region Conservation Authority's (SCRCA's) jurisdiction. The results of the geotechnical exploration for this project are provided under separate cover (Golder Project Report No. 1898967-1000-R01).

The proposed development includes three phases and the installation of new services including a wastewater treatment plant and the development of single residential lots and the construction of a local street network. Proposed sewer invert and outlet depths had not been provided at the time of the preparation of this report.

The western portion of the site is located on the tablelands of the Lake Huron bluff slope. In general, the slope is heavily vegetated with mature trees. Paths have been constructed down the Lake Huron slope to access the beach and a cottage is located near the northern site limit. A storage structure is also located at the top of the slope near the northern site limit.

The property slopes gently to the west from about elevation 200 metres at the east property line to about elevation 196 metres at the top of the Lake Huron slope along the west end of the site. Several drains from the adjacent farm fields outlet onto the lakeshore bluff slope as identified on the Location Plan, Figure 1.

3.2 Previous Explorations

Golder has previously carried out subsurface explorations and geotechnical slope assessments within the southern property and the results of these studies were provided in the following reports:

- Golder Report No. 891-3341 titled "Geotechnical Investigation, Proposed Subdivision, Lot 76 L.R.W., Township of Bosanquet, County of Lambton, Ontario", dated October 1989; and
- Golder Report No. 07-1130-135-0 titled "Geotechnical Comments, Slope Stability and Setback Issues, Reflection Shores Development, Lambton Shores, Ontario", dated August 14, 2007.

The results of a concurrent geotechnical exploration carried out by Golder for the proposed Reflection Shores development are provided under separate cover in Golder Report No. 1898967-1000-R01. The locations of the previous and concurrent boreholes and test pits advanced within the site are shown on the Location Plan, Figure 1 and the Records of Borehole and Test Pit Sheets are provided in Appendix A for reference.

3.3 Geological Mapping

The western portion of the site along the lakeshore slope is located in the physiographic region of Southwestern Ontario known as the Huron Fringe and the eastern portion of the site is located within the St. Clair Clay Plains.[1] The Huron Fringe is a narrow fringe of land along Lake Huron extending from Sarnia to Tobermory and is comprised of sands and sand and gravels, originating from wave-cut terraces of glacial Lake Algonquin and Lake Nipissing which is underlain by cohesive soils of the St. Joseph Till. The St. Clair Clay Plain is described as a glacial till plain that has been smoothed by shallow deposits of lacustrine clay which settled in depressions in the surface of the till. The prevailing soil type is reportedly the Brookston clay.

Based on the Ontario Geological Survey Preliminary Map P.2222 titled “Quaternary Geology of the Sarnia-Brights Grove Area” Southern Ontario, the geologic deposits in the project area consist of predominantly clayey silt till.

The sub-cropping bedrock is reported to consist of shale of the Kettle Point Formation based on the Geological Survey of Canada, Department of Energy, Mines and Resources, Map 1262A, Geology, Toronto-Windsor Area, Scale 1:250,000, dated 1969. The bedrock surface is reported to be at a depth of approximately 28 to 32 metres below ground surface or about elevation 168 metres based on the Ontario Geological Survey Preliminary Map No. P.2206 titled “Bedrock Topography, Sarnia-Brights Grove Area”, dated 1979.

3.4 Lake Huron Water Level

Historical Lake Huron water level data were reviewed for the preliminary slope stability analysis. Based on the Great Lakes and Montreal Harbour Monthly Bulletin prepared by the Canadian Hydrographic Service Department of Fisheries and Oceans, dated April 2021, the recorded average monthly Lake Huron water level for April 2021 was 176.95 metres (International Great Lakes Datum (IGLD)). Eight (January to August) of the twelve months in 2020 were reported as the maximum monthly readings recorded since 1918.

3.5 Review of Existing Boreholes

The subsurface conditions encountered in the existing boreholes and test pits drilled and excavated within the site, as shown on the Location Plan, Figure 1, are shown in detail on the attached Record of Borehole and Test Pit sheets provided in Appendix A.

Topsoil was encountered at the ground surface in all boreholes. The topsoil ranged in thickness from about 90 to 150 millimetres with an average thickness of about 120 millimetres. Materials designated as topsoil in this report were classified based solely on visual and textural evidence. Testing of organic or nutrient content was not carried out. Accordingly, materials classified as topsoil herein cannot necessarily be relied upon for support and growth of landscaping vegetation without supplemental soil nutrient analyses.

Silty clay was encountered beneath the topsoil in BH-202 to BH-204. The silty clay was about 1.2 to 2.0 metres thick, had N[2] values of 8 to 19 blows per 0.3 metres and water contents of about 16 to 26 per cent, with an average water content of about 21 per cent.

Beneath the topsoil or silty clay, an extensive deposit of silty clay glacial till was encountered in the boreholes. Where fully penetrated, the cohesive till was 3.1 to 4.2 metres thick. With the exception of BH-201, the boreholes

[1] The Physiography of Southern Ontario; Ontario Geological Survey, Special Volume 2. By Chapman and Putnam, 1984.

[2] The SPT N value is defined as the number of blows required by a 63.5 kilogram hammer dropped from a height of 760 millimetres to drive a split spoon sampler a distance of 300 millimetres into the soil after having first penetrated 150 millimetres.

were terminated in the cohesive till after exploring the deposit for some 0.1 to 18.1 metres. The cohesive till had N values of 9 to 50 blows per 0.3 metres and water contents of about 13 to 26 per cent, with an average water content of about 16 per cent. The results of one Atterberg limits test, provided on Figure 4, indicated plastic and liquid limits of about 16 per cent and 29 per cent, respectively, signifying an inorganic silty clay of low plasticity. A grain size distribution curve for a sample of the silty clay till is provided in Appendix A.

Cobbles were indicated within the cohesive till in BH-201, BH-202 and BH-204 and the presence of boulders should also be anticipated within the cohesive till strata.

Granular layers, consisting of sand and gravelly sand, were encountered within the cohesive till in BH-201 and BH-203. Borehole BH-201 was terminated in the granular layer after exploring it for 0.8 metres. The granular layer in BH-203 was about 0.5 metres thick. The granular layers had N values of 23 and 31 blows per 0.3 metres and water contents of about 8 to 18 per cent. A grain size distribution curve for a sample of the gravelly sand is provided in Appendix A.

Groundwater levels were observed in the boreholes during drilling and the encountered groundwater levels are shown on the Record of Borehole sheets. Groundwater seepage was encountered within the granular layers in BH-201 and BH-203 at depths of 4.0 to 4.3 metres below ground surface, or at about elevations of 193.4 to 192.5 metres. Groundwater levels at the site should be expected to fluctuate seasonally and in response to significant precipitation events.

As indicated on the Record of Borehole and Record of Test Pit sheets included in Appendix A, the subsurface conditions encountered in the previous borehole and test pits completed by Golder in 1989 (Golder Project No. 891-3341) are consistent with the current boreholes completed for this project.

4.0 SITE RECONNAISSANCE AND VISUAL SLOPE ASSESSMENTS

Golder's geotechnical engineering staff carried out slope inspections along the Lake Huron bluff slope within the site boundaries on April 18, 2018, April 8, 2020 and March 23, 2021. Physical measurements of the slopes and general slope inclinations were measured using a GPS unit and an Abney level. Further, observations of vegetation, soil types, erosion, seepage and general stability conditions of the slopes were noted. A summary of the observations made during the slope inspections is presented in Table I and the approximate locations of the slope sections are shown on Figures 1 and 2. Selected site photographs taken during the site visits are provided in Appendix B. The locations and directions of the site photographs are shown on Figure 2.

For the purposes of field classification, the following broad categories or terms are used to describe the stability of slopes based on a visual assessment:

- Stable: no evidence of surficial or deep-seated movements, an abundance of vegetation and a well-protected toe of slope.
- Marginally Stable: slope has undergone discernible changes in geometry resulting either from toe erosion or from regression of sliding surfaces up the slope. Slope is very steep but typically vegetated with small trees, shrubs and/or grasses.
- Unstable: slope has undergone substantial changes in geometry with loss of most vegetation and significant active erosion.

Two slope sections (Sections A-A' and B-B') were selected along the Lake Huron bluff slope within the site and were assessed for stability. The locations of the slope sections and measured slope geometries are shown on Figures 1 to 3. The site observations along the sections are summarized in Table I. Slope stability assessments of these two sections were carried out using the Ontario Ministry of Natural Resources (MNR) Slope Stability Rating Chart and the results are provided in Table II. Soil classifications at the site were based on visual observation and the results of the boreholes drilled as part of the geotechnical exploration for the design of the proposed subdivision and existing boreholes and test pits from previous explorations in the area of the site. The slope sections for the Lake Huron slope received ratings of 23, indicating that the slope sections have a 'low' potential for instability.

4.1 Lake Huron Bluff Slope

Based on a review of the topographic mapping available for the site and the results of our field inspection and evaluation of Sections A-A' and B-B', the lakeshore bluff slope along the west end of the site has inclinations of about 17 and 18 degrees to the horizontal or about 3.3 horizontal (H) to 1.0 vertical (V). The slope ranged in total vertical height from about 16 to 19 metres. Several drain pipes, from the adjacent farm fields, outlet onto the top of slope and have resulted in erosion gullies due to uncontrolled drain flows following precipitation and snowmelt events. The locations of the drains are shown on the Location Plan, Figure 1.

In general, the subject section of the slope is heavily vegetated with mature vertical trees. Two pathways have been constructed down the slope to access the beach at the toe of slope. A cottage is also located at the toe of slope and a storage building is located at the top of slope north of Section B-B'. Toe erosion was not observed along the subject section of the slope and a grassed area and/or sandy beach is located west of the toe of slope to the lake. During a subsequent inspection on March 23, 2021, active erosion was noted along the bank of Lake Huron at the north end of the property as shown in Photograph 24 in Appendix B; however, no other signs of toe erosion were noted along the bank to the south. Although the localized erosion gullies are considered to be unstable without proper erosion control, no tension cracks, seepage, previous slope failures or signs of global instability were evident during the slope inspections and the slope is considered to be stable.

5.0 SLOPE STABILITY ANALYSES

Preliminary slope stability analyses were carried out to evaluate the factor of safety for slope failure. Slope stability analyses were carried out using SLOPE/W, a limit equilibrium analysis program produced by GEO-SLOPE International. A factor of safety for slope stability is defined as the total forces or moments acting to resist failure divided by the total forces or moments acting to destabilize the slope. A factor of safety of unity indicates incipient failure since the destabilizing and stabilizing forces are equal. The analyses were conducted to assess the stability of the existing lakeshore and ravine slopes based on the geological soil data, the existing topographic information and the field data. The table below provides a range of factors of safety for the terms used in this letter.

Term	Factor of Safety
Stable	Equal to or greater than 1.3
Marginally Stable	Between 1.0 and 1.3
Unstable	Equal to or less than 1

The subsurface conditions and soil properties used in the analyses were based on the results of the boreholes drilled in close proximity to the subject slopes as part of the geotechnical exploration for the design of the subdivision, previous explorations as noted in Section 3.2 and our knowledge of the range of mechanical properties of these soil types.

Soil Type	Unit Weight (kN/m^3)	Effective Cohesion Intercept, c' (kPa)	Effective Angle of Internal Friction, ϕ' (degrees)
Firm to Stiff Silty Clay	20	0	28
Stiff to Hard Silty Clay Till	20	0	32

Groundwater seepage was encountered within the granular layers encountered in BH-201 and BH-203 at depths of 4.0 to 4.3 metres below ground surface, or at about elevations of 193.4 to 192.5 metres. All other boreholes and test pits drilled or excavated for this project encountered no free water during drilling.

Based on the results of our analyses, the Lake Huron bluff slope is considered to be stable in its existing configuration with an estimated factor of safety against a global rotational failure of 1.3 or greater. Based on the results of the analyses, a maximum overall slope inclination of 2.5H:1V is indicated for a long-term stable slope. The circular failure mode is justified based on the homogeneous nature of the soil strata (native silty clay) and the fact that the failure circles generated do not intersect preferential slip surfaces (very soft layers or previous failure zones) or anomalously strong materials such as bedrock.

6.0 DISCUSSION

The following section includes general/preliminary geotechnical comments on slope stability at the site. These comments are based on our interpretation of the factual information gathered during the desktop study, site reconnaissance, geotechnical explorations and preliminary slope stability analyses.

6.1 Lake Huron Bluff Slope

Stability ratings of 23 were judged appropriate for the sections of the lakeshore bluff slope that were analyzed and indicate that the slope has a 'low potential' for instability according to the MNR guidelines. Erosion at the toe of the lakeshore bluff slope was not indicated. Based on the results of the Lake Huron Shoreline Management Plan Update – 2011 report completed by Baird and Associates, dated December 5, 2011, the subject Lake Huron bluff slope is within Reach 31 and has an average annual shoreline recession rate (AARR) of 0.08 metres per year (m/yr.). Thus, the 100-year erosion allowance for the lakeshore bluff slope is 8.0 metres. Based on our observations during the shoreline slope inspection on April 18, 2018 and April 8, 2020, the AARR provided by Baird is considered to be appropriate for this site and without development of toe erosion protection measures, the AARR would be applied to the geotechnical setback limit as discussed below. Based on Golder's inspection of the toe of slope on April 8, 2020, drift wood and debris were noted to be pushed up closer to the toe of slope compared to our April 2018 inspection, due to recent record high Lake Huron water levels; however, toe erosion was not observed.

Based on the results of the preliminary slope stability analysis, the subject section of the Lake Huron bluff slope is considered to be generally stable in its current configuration and an overall slope inclination of 2.5H:1V would be

required to achieve a long-term stable slope with a factor of safety of 1.3 or greater. The top of stable slope can be determined by adding the appropriate 100-year toe erosion allowance to the current toe of slope and using a line drawn upward from that point at an inclination of 2.5H:1V from the horizontal. As shown on Figure 3, since the existing top of slope line is further inland than the line representing the toe erosion allowance plus the stable slope inclination, the top of stable slope is taken as the existing top of slope. Consistent with Figure 122 of "Technical Guide - River and Stream Systems: Erosion Hazard Limit" published by the Ontario Ministry of Natural Resources, the third component comprises a 6 metre wide erosion access allowance to be applied upslope from the top of the stable slope. The geotechnical setback limit, thus, corresponds to a line drawn 6 metres from the top of the stable slope as shown on Figures 1 to 3.

6.2 Proposed and Existing Stormwater Sewer Outlets

It is understood that the storm sewer system is to outlet within the proposed storm block immediately north of Borehole BH-202 into the existing drain within the Lake Huron bluff slope. The invert elevation at the pipe outlet was not available at the time of preparation of this report; therefore, the following generic recommendations are provided. Based on the results of the exploration, the excavations for the storm outlet will most likely encounter competent cohesive soils that will be suitable for open cut installations. As noted above, drains from the adjacent farm field outlet onto the lakeshore slope and the flows from these drains have developed erosion gullies down the slope . Erosion gullies within the Lake Huron bluff slope were also noted at the south end of the site and along the north ditch at Cedar Point Line due to stormwater flows. The approximate locations of the drains that were observed during our slope inspection on April 18, 2018 and April 8, 2020 are shown on the Location Plan, Figure 1.

It is considered that the proposed development works at the site may disrupt the existing drainage systems within the farm fields and thus reduce flow directed into the gullies. Rehabilitation of the existing gullies by controlling the erosion could be addressed by removing the loosened and saturated materials from within the gulley and placing sufficient well-graded rip rap in the gullies with a robust non-woven geotextile between the rip rap and native soil to protect the channels. The existing drainage pipes could be extended sufficiently down the slope and within the gullies to the toe. The pipes must be fully encapsulated in 19-millimetre crushed stone within a robust non-woven geotextile surround.

Alternatively, if the drains are removed, approved native cohesive backfill should be used to fill the gullies. Erosion control blankets would need to be installed along the slope face and vegetal growth established. Prior to backfilling the gullies, the subgrades soils must be cleared of organic, wet, loose, or any deleterious materials and inspected by the geotechnical engineer. The backfill material must be placed in loose lifts not exceeding 300 millimetres in thickness and uniformly compacted to at least 95 per cent of standard Proctor maximum dry density (SPMDD).

It is understood that Sifton will be removing the existing drains and backfilling the gullies so as to rehabilitate the slope as noted above. This proposed work will locally shift the top of slope line, top of stable slope line and corresponding geotechnical setback limit to the west in the areas of the existing drains as shown on Figure 1A, attached. The backfilled areas are not considered suitable for settlement sensitive structures such as buildings, sewers, and roads and should be developed as areas where post-construction settlements are acceptable.

Site grading and drainage for the proposed subdivision should be designed to prevent the uncontrolled discharge of water over the slopes which would assist in reducing the seepage observed within the slope face. All proposed

work should be carried out with the consent of the SCRCA, where required, and abide by all local and regional by-laws and regulations.

6.3 Review of Natural Hazard Shoreline Policy

A review of SCRCA's natural hazard shoreline policy was completed by Golder as part of the geotechnical slope assessment. In general, the erosion hazard is based on a sum of 100 times the average annual recession rate (AARR) plus the stable slope allowance. As per the policy, the AARR must be based on at least 35 years of reliable recession information. Based on the Lake Huron Shoreline Management Plan Updated – 2011 report (Baird 2011), the development is located within Reach 31 and based on Table 4.2 in that report, the SCRCA Board approved an average annual recession rate of 0.08 m/year for Reach 31.

The Technical Guide (MNR, 2001a) recommends using a stable slope allowance of 3H:1V (three times the bluff height, measured from the toe of slope) unless a geotechnical engineer provides a detailed site study. Golder completed site specific boreholes along the top of slope and prepared geotechnical exploration and slope assessment reports and completed slope stability analyses of the Lake Huron bluff slope based on the results of the boreholes to assess the stability of the slope. Based on Golder's analyses, the Lake Huron bluff slope was considered to be stable in its existing configuration and a maximum overall slope inclination of 2.5H:1V was indicated for a long-term stable slope. In addition, an erosion access component was added to the top of stable slope to determine the geotechnical setback limit.

7.0 GEOTECHNICAL INSPECTIONS AND TESTING

A regular program of geotechnical inspections and materials testing should be carried out during construction to confirm that the conditions encountered are consistent with the results of the boreholes, to verify that the intent of the design recommendations provided is being met and that the various project and material specifications are consistently achieved.

We trust that this revised report provides sufficient information for your present requirements. Should any point require clarification, please contact this office.

Signature Page

WSP Canada Inc.

Mark Demelo, P.Eng.
Geotechnical Engineer

Peter Giuliani, MEM, P.Eng.
Lead Geotechnical Engineer

MD/PG/ms

https://wsponline.sharepoint.com/sites/gld-24164g/deliverables/r02-slope/rev9 - revised/ca-gld-1898967-1000-r02-rev9 (revised) geo slope assess reflection shores_09dec2025.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: WSP Canada Inc. (WSP) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to WSP by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. WSP cannot be responsible for use of this report, or portions thereof, unless WSP is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without WSP's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, WSP may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to WSP. The report, all plans, data, drawings and other documents as well as all electronic media prepared by WSP are considered its professional work product and shall remain the copyright property of WSP, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of WSP. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of WSP's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to WSP by the Client, communications between WSP and the Client, and to any other reports prepared by WSP for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. WSP can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, WSP does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that WSP interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: WSP will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client’s expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of WSP's report. WSP should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of WSP's report.

During construction, WSP should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of WSP's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in WSP's report. Adequate field review, observation and testing during construction are necessary for WSP to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, WSP's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that WSP be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that WSP be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. WSP takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

TABLE I

SUMMARY OF FIELD OBSERVATIONS

Geotechnical Slope Assessment
Proposed Reflection Shores Development
Municipality of Lambton Shores, Ontario

SLOPE SECTION	RELEVANT PHOTOGRAPHS	APPROXIMATE SLOPE ANGLE (° to horizontal)	TOE EROSION	OVERALL SLOPE CONDITION	REMARKS
A-A’	1 to 7	17	No	Stable	Slope vegetated with mature vertical trees. Multi-tiered slope with horizontal bench at about mid-height. No seepage, failure zones or toe erosion. No signs of global instability.
B-B’	8 to 14	18	No	Stable	Slope vegetated with mature vertical trees. Multi-tiered slope with pathway within upper portion of slope. Some fill materials consisting of sand and gravel and pieces of asphalt have been used to construct the pathway. No seepage, failure zones or toe erosion. Wide grassed area and beach at toe of slope. No signs of global instability.

NOTES:
1. See Location Plan and Schematic Sections, Figures 1 to 3, for approximate locations of slope sections and typical slope geometry.
2. Slope inspection carried out on April 18, 2018 and April 8, 2020.
3. Table to be read in conjunction with accompanying report.

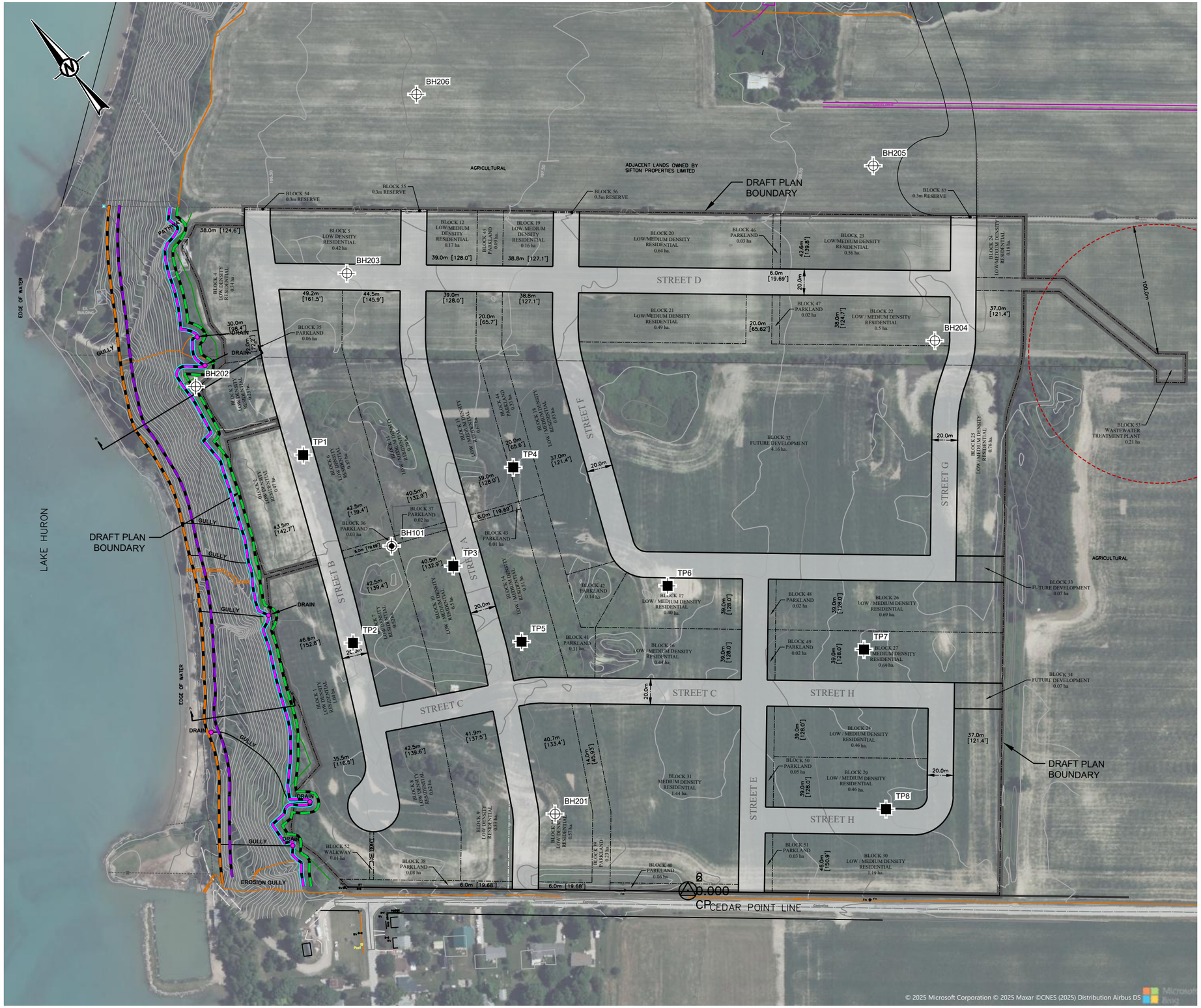
Prepared By: DB
Checked By: MAS

TABLE II

SLOPE STABILITY RATING CHART

Site Location: Reflection Shores, Lambton Shores, ON Property Owner: Sifton Properties Inspected By: D. Babcock, P.Eng.		Project No.: 1898967-1000 Inspection Dates: April 18, 2018 and April 8, 2020 Weather: 4 degrees, partly cloudy and 10 degrees, clear	
1. SLOPE INCLINATION Degrees horizontal: vertical a) 16 or less 3:1 or flatter b) 16 to 26 2:1 to 3:1 c) 26 or more steeper than 2:1		Rating Value (select one) A- A' 0 >6< 16	 B-B' 0 >6< 16
2. SOIL STRATIGRAPHY a) Shale, Limestone (bedrock) b) Sand, Gravel c) Till d) Clay, Silt e) Fill		A-A' 0 6 >9< 12 16	B-B' 0 6 >9< 12 16
3. SEEPAGE FROM SLOPE FACE a) None or near bottom only b) Near mid-slope only c) Near crest only or from several levels		A-A' >0< 6 12	B-B' >0< 6 12
4. SLOPE HEIGHT a) 2m or less b) 2.1 to 5m c) 5.1 to 10m d) more than 10m		A-A' 0 2 4 >8<	B-B' 0 2 4 >8<
5. VEGETATION COVER ON SLOPE FACE a) Well vegetated: heavy shrubs or forested with mature trees b) Light vegetation: mostly grass, weeds, occasional trees, shrubs c) No vegetation, bare		A-A' >0< 4 8	B-B' >0< 4 8
6. TABLE LAND DRAINAGE a) Table land flat, no apparent drainage over slope b) Minor drainage over slope, no active erosion c) Drainage over slope, active erosion, gullies		A-A' >0< 2 4	B-B' >0< 2 4
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE a) 15 metres or more from slope toe b) Less than 15 metres from slope toe		A-A' >0< 6	B-B' >0< 6
8. PREVIOUS LANDSLIDE ACTIVITY a) No b) Yes		A-A' >0< 6	B-B' >0< 6
SLOPE INSTABILITY RATING	RATING VALUES TOTAL INVESTIGATION REQUIREMENTS Toe Erosion?	Total A-A' 23 No	Total B-B' 23 No
1. Low potential 2. Slight potential 3. Moderate potential	<24 25-35 >35	Site Inspection only, confirmation, report letter. Site inspection and surveying, preliminary study, detailed report. Borehole investigation, piezometers, lab tests, surveying, detailed report.	
NOTES: a) This chart does not apply to rock slopes or to Leda Clay slopes (Ottawa area). b) Choose only one from each category and compare total rating with above requirements. c) If there is a water body (stream, creek, river, pond, bay, lake) at the slope toe, the potential for toe erosion and undercutting should be evaluated in detail and, protection provided if required.			

Reference: Table 4.2, Technical Guide – River & Stream Systems: Erosion Hazard Limit. Ontario Ministry of Natural Resources.



LEGEND

- BOREHOLE (GOLDER 1898967)
- BOREHOLE (GOLDER 894-3341)
- TEST PIT (GOLDER 894-3341)
- GROUND SURFACE CONTOUR (m amsl)
- APPROXIMATE TOP OF SLOPE
- APPROXIMATE TOE OF SLOPE
- APPROXIMATE TOE EROSION ALLOWANCE
- APPROXIMATE TOP OF STABLE SLOPE
- APPROXIMATE GEOTECHNICAL SETBACK LIMIT

NOTE(S)

1. FOR CROSS-SECTION, REFER TO FIGURES 4.
2. COORDINATE SYSTEM: UTM NAD83 ZONE 17.

REFERENCE(S)

1. DEVELOPMENT PLAN AND TOPOGRAPHY PROVIDED BY SIFTON ON DECEMBER 1, 2025, FILE NO. DP 1 Dec 2025 DCP.dwg.

0 50 100
1:3,000 METRES

CLIENT
SIFTON PROPERTIES LIMITED

PROJECT
GEOTECHNICAL SLOPE ASSESSMENT
PROPOSED REFLECTION SHORES DEVELOPMENT
MUNICIPALTY OF LAMBTON SHORES, ONTARIO

TITLE
LOCATION PLAN

CONSULTANT

YYYY-MM-DD	2025-12-03
DESIGNED	
PREPARED	JM
REVIEWED	MD
APPROVED	MD

PROJECT NO.	CONTROL	REV.	FIGURE
CA0045443.1180	0002	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

LEGEND

- BOREHOLE (GOLDER 1898967)
- BOREHOLE (GOLDER 894-3341)
- TEST PIT (GOLDER 894-3341)
- GROUND SURFACE CONTOUR (m amsl)
- APPROXIMATE TOP OF SLOPE
- APPROXIMATE TOE OF SLOPE
- APPROXIMATE TOE EROSION ALLOWANCE
- APPROXIMATE TOP OF STABLE SLOPE
- APPROXIMATE GEOTECHNICAL SETBACK LIMIT

NOTE(S)

1. FOR CROSS-SECTION, REFER TO FIGURES 4.
2. COORDINATE SYSTEM: UTM NAD83 ZONE 17.

REFERENCE(S)

1. DEVELOPMENT PLAN AND TOPOGRAPHY PROVIDED BY SIFTON ON DECEMBER 1, 2025, FILE NO. DP 1 Dec 2025 DCP.dwg.

0 50 100
1:3,000 METRES

CLIENT
SIFTON PROPERTIES LIMITED

PROJECT
GEOTECHNICAL SLOPE ASSESSMENT
PROPOSED REFLECTION SHORES DEVELOPMENT
MUNICIPALTY OF LAMBTON SHORES, ONTARIO

TITLE
LOCATION PLAN - PROPOSED FILLING OF DRAINS

CONSULTANT

YYYY-MM-DD	2025-12-03
DESIGNED	
PREPARED	JM
REVIEWED	MD
APPROVED	MD

PROJECT NO.	CONTROL	REV.	FIGURE
CA0045443.1180	0002	0	1A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

Path: \\corp.pb.wan.net\CA\CAM\IS300\CTX_Data\SIM\Clients\Sifton Properties Limited\London_Lambton_Shores\99_PROJ\CA0045443.1180\40_PROD\0002_Geotech\ | File Name: CA0045443_1180-0002-BG-0001A.dwg | Last Edited By: gld_jmconnell Date: 2025-12-03 Time:2:28:51 PM | Printed By: gld_jmconnell Date: 2025-12-03 Time:2:29:03 PM

LEGEND

3 — PHOTOGRAPH LOCATION, VIEWING DIRECTION, AND PLATE NUMBER

GROUND SURFACE CONTOUR (m amsl)

NOTE(S)

1. FOR CROSS-SECTION, REFER TO FIGURES 4.
2. COORDINATE SYSTEM: UTM NAD83 ZONE 17.

REFERENCE(S)

1. DEVELOPMENT PLAN AND TOPOGRAPHY PROVIDED BY SIFTON ON DECEMBER 1, 2025, FILE NO. DP 1 Dec 2025 DCP.dwg.

0 50 100
1:3,000 METRES

CLIENT
SIFTON PROPERTIES LIMITED

PROJECT
GEOTECHNICAL SLOPE ASSESSMENT
PROPOSED REFLECTION SHORES DEVELOPMENT
MUNICIPALTY OF LAMBTON SHORES, ONTARIO

TITLE
SITE PHOTOGRAPH LOCATION PLAN

CONSULTANT

YYYY-MM-DD	2025-12-03
DESIGNED	
PREPARED	JM
REVIEWED	MD
APPROVED	MD

PROJECT NO.	CONTROL	REV.	FIGURE
CA0045443.1180	0002	0	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

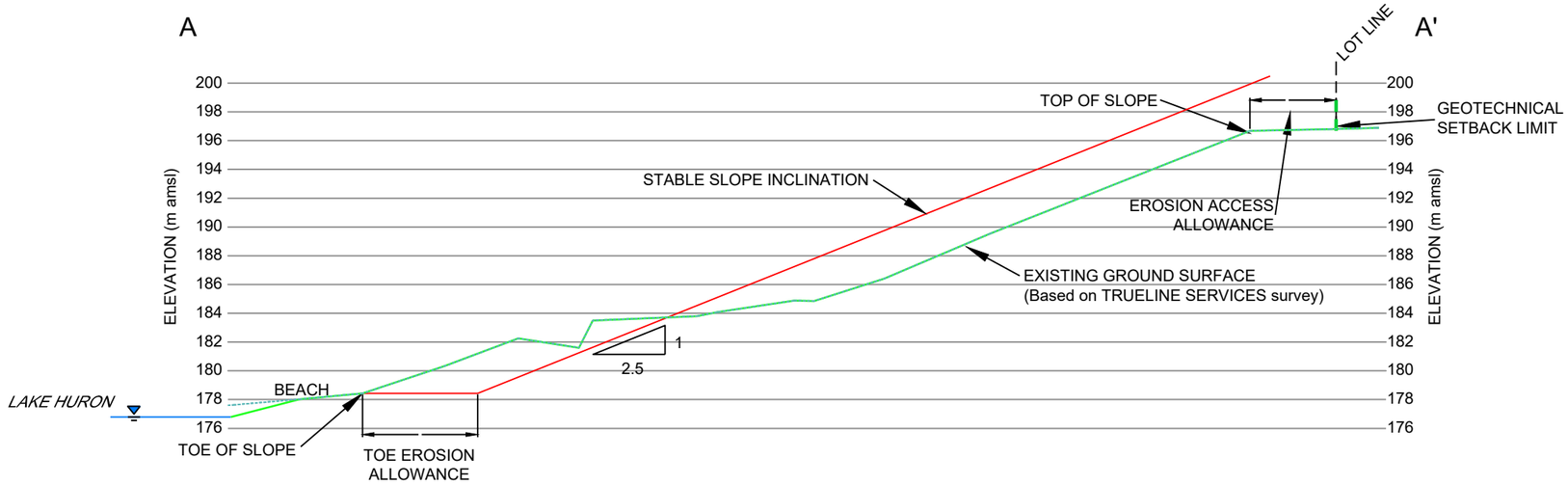
0 25 mm

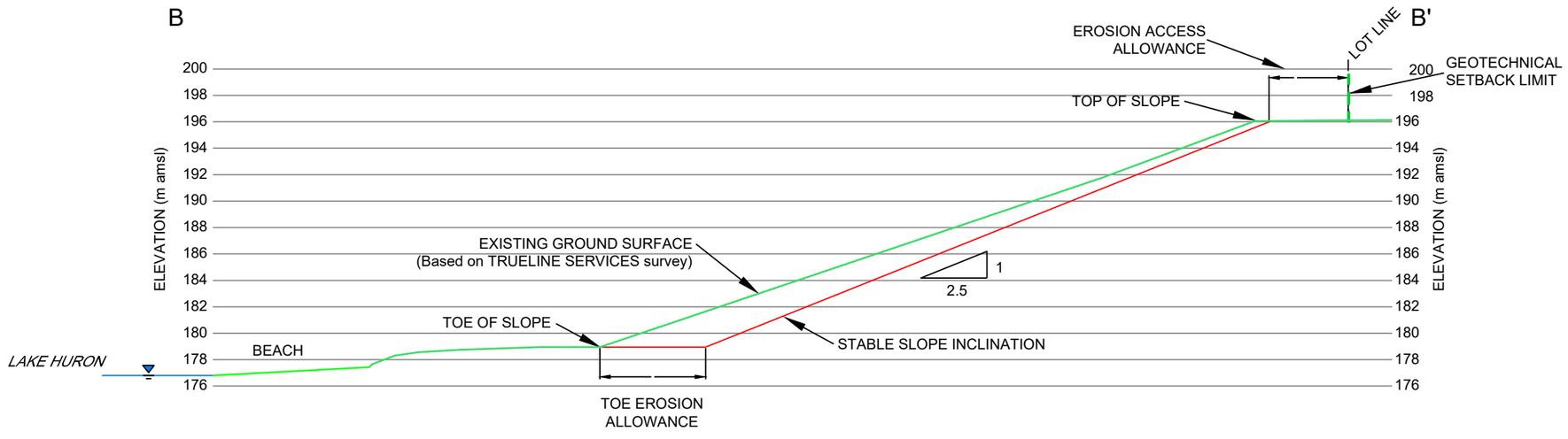
NOTE(S)

1. FOR CROSS-SECTION LOCATIONS, REFER TO FIGURE 1.

REFERENCE(S)

1. DEVELOPMENT PLAN AND TOPOGRAPHY PROVIDED BY SIFTON ON DECEMBER 1, 2025, FILE NO. DP 1 Dec 2025 DCP.dwg.





0 10 20
1:400 METRES

CLIENT
SIFTON PROPERTIES LIMITED

PROJECT
GEOTECHNICAL SLOPE ASSESSMENT
PROPOSED REFLECTION SHORES DEVELOPMENT
MUNICIPALTY OF LAMBTON SHORES, ONTARIO

TITLE
SECTIONS A-A' AND B-B'

CONSULTANT

YYYY-MM-DD	2025-12-03
DESIGNED	
PREPARED	JM
REVIEWED	MD
APPROVED	MD

PROJECT NO.	CONTROL	REV.	FIGURE
CA0045443.1180	0002	0	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

APPENDIX A

Records of Previous Boreholes, Test Pits and Laboratory Test Results (Golder Project Nos. 1898967-1000-R01 and 891-3341)

RECORD OF BOREHOLE 101

SHEET 1

LOCATION SEE PLAN FIGURE 1

BORING DATE OCT. 5, 1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

PROJECT 891-3341

(Golder Report No. 891-3341)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ● rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		197.01							
		Black clayey TOPSOIL		0.00							
				196.71							
				0.30							
	POWER AUGER 115mm DIAM. (UNCASED)				1	50 DO	14				
					2	50 DO	25				
2					3	50 DO	34				
					4	50 DO	31				
4					5	50 DO	17				BOREHOLE DRY DURING DRILLING OCT 5, 1989
		Stiff to very stiff brown becoming grey at about elev. 194.9m SILTY CLAY (TILL)			6	50 DO	20				
					7	50 DO	13				
6					8	50 DO	10				
					9	50 DP	14				
					10	50 DO	11				
8					11	50 DO	11				
					12	50 DO	10				
				187.41							
		END OF BOREHOLE		9.60							
10											

0 15 10 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 60

Golder Associates

LOGGED D.J.M.

CHECKED

RECORD OF TEST PIT 1

LOCATION SEE FIGURE 1 | DATE SEPT. 22, 1989 | DATUM GEODETIC

PROJECT 891-3341

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (Wp W Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0		GROUND SURFACE		197.09							
		Black clayey TOPSOIL		196.79 / 0.00							
				0.30							
1					1	CS	-				TEST PIT DRY DURING EXCAVATION SEPT. 22, 1989
2		Brown mottled SILTY CLAY trace sand occ. gravel, cobble becoming grey at about elev. 194.04m (TILL).									
					2	CS	-				
3				194.04							
		END OF TEST PIT		3.05							
4											
5											
6											
7											
8											
9											

(Golder Report No. 891-3341)

0 / 16 ◆ 6 / 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED D.J.M.

CHECKED

RECORD OF TEST PIT 2

LOCATION SEE FIGURE 1 | DATE SEPT. 22, 1989 | DATUM GEODETIC

PROJECT 891-3341

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, CM/SEC	SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ● rem.V.- ⊕ U.- O)	WATER CONTENT, PERCENT (Wp W Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0	GROUND SURFACE		197.01									
	Black clayey TOPSOIL		0.00 / 196.71									
			0.30	1	CS	-				o		SEEPAGE INTO TEST PIT AT ELEV. 195.49m DURING EXCAVATION SEPT. 22, 1989
1												
	Brown mottled SILTY CLAY trace sand occ. gravel (TILL), becoming grey at about elev. 194.42m sand pocket at elev. 195.49m											
2												
				2	CS	-				o		
3			193.96									
	END OF TEST PIT		3.05									
4												
5												
6												
7												
8												
9												

(Golder Report No. 891-3341)

0 / 16 / 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED D.J.M.

CHECKED

RECORD OF TEST PIT 3

LOCATION SEE FIGURE 1 | DATE SEPT. 22, 1989 | DATUM GEODETIC

PROJECT 891-3341

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, CM/SEC	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0		GROUND SURFACE		197.12							
		Black clayey TOPSOIL		0.00							
				196.75							
				0.37							
1											
2		Brown mottled SILTY CLAY trace sand occ. gravel (TILL), becoming grey at about elev. 194.38m.			1	CS	-				TEST PIT DRY DURING EXCAVATION SEPT. 22, 1989
3					2	CS	-				
				193.46							
		END OF TEST PIT		3.66							
4											
5											
6											
7											
8											
9											

SHEAR STRENGTH Cu, kPa — nat.V.- + Q.- ● rem.V.- ⊕ U.- ○

WATER CONTENT, PERCENT — Wp, W, Ws — 10 20 30 40

(Golder Report No. 891-3341)

0 / 16 / 10 — 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED D.J.M.

CHECKED

RECORD OF TEST PIT 4

LOCATION SEE FIGURE 1 | DATE SEPT. 25, 1989 | DATUM GEODETIC

PROJECT 891-3341

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ●, rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0	GROUND SURFACE		198.35							
	Black silty TOPSOIL		0.00							
			197.89							
	Brown SAND occ. gravel.		0.46							
			0.61							
1				1	CS	-		o		TEST PIT DRY DURING EXCAVATION SEPT. 25, 1989
2	Brown mottled SILTY CLAY (TILL).									
			195.45	2	CS	-		o		
3	END OF TEST PIT		2.90							
4										
5										
6										
7										
8										
9										

(Golder Report No. 891-3341)

0 / 15 ◆ 5 PERCENT AXIAL STRAIN AT FAILURE / 10

DEPTH SCALE 1 : 50

Golder Associates

LOGGED D.J.M.

CHECKED

RECORD OF TEST PIT 5

LOCATION SEE FIGURE 1 | DATE SEPT. 25, 1989 | DATUM GEODETIC

PROJECT 891-3341

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ●, rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp, W, Wl; 10, 20, 30, 40)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0		GROUND SURFACE		198.13							
		Black silty TOPSOIL.		0.00 197.76							
1		Brown mottled CLAYEY SILT TO SILTY CLAY (TILL), occ. boulder.		0.37	1	CS	-		o		TEST PIT DRY DURING EXCAVATION SEPT. 25, 1989
2					2	CS	-		o		
3				194.99							
		END OF TEST PIT		3.14							
4											
5											
6											
7											
8											
9											

(Golder Report No. 891-3341)

0 / 15 ◆ 5 PERCENT AXIAL STRAIN AT FAILURE / 10

DEPTH SCALE 1 : 50

Golder Associates

LOGGED D.J.M.

CHECKED

RECORD OF TEST PIT 6

LOCATION SEE FIGURE 1 | DATE SEPT. 25, 1989 | DATUM GEODETIC

PROJECT 891-3341

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3M
0	GROUND SURFACE		198.29			
	Black clayey TOPSOIL		0.00 / 197.99			
			0.30	1	CS	-
1	Brown mottled SILTY CLAY (TILL), occ. cobble and boulder					
2						
3			195.24	2	CS	-
	END OF TEST PIT		3.05			
4						
5						
6						
7						
8						
9						

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m

HYDRAULIC CONDUCTIVITY, k, CM/SEC

SHEAR STRENGTH Cu, kPa — nat.V.- + Q.- ● rem.V.- ⊕ U.- O

WATER CONTENT, PERCENT — Wp W Wl — 10 20 30 40

ADDITIONAL LAB. TESTING

GROUNDWATER CONDITIONS

(Golder Report No. 891-3341)

TEST PIT DRY DURING EXCAVATION SEPT. 25, 1989

16 (0 / 10) 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED D.J.M.

CHECKED

RECORD OF TEST PIT 7

LOCATION SEE FIGURE 1 | DATE SEPT. 25, 1989 | DATUM GEODETIC

PROJECT 891-3341

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, CM/SEC	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0		GROUND SURFACE		199.61				SHEAR STRENGTH Cu, kPa nat.V.- + Q.- ● rem.V.- ⊕ U.- O	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)		
		Black clayey TOPSOIL		199.37							
				0.24							
1		Brown mottled SILTY CLAY (TILL).			1	CS	-		o		TEST PIT DRY DURING EXCAVATION SEPT. 25, 1989
2				197.17	2	CS	-		o		
		END OF TEST PIT		2.44							
3											
4											
5											
6											
7											
8											
9											

(Golder Report No. 891-3341)

0 / 16 ◆ 6 / 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED D.J.M.

CHECKED

RECORD OF TEST PIT 8

LOCATION SEE FIGURE 1 | DATE SEPT. 25, 1989 | DATUM GEODETIC

PROJECT 891-3341

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ● rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0		GROUND SURFACE		199.44							
		Black clayey TOPSOIL		0.00 199.14							
		Brown fine to medium SAND occ. gravel.		0.30 0.46							
1		Brown mottled SILTY CLAY (TILL).			1	CS	-		o		TEST PIT DRY DURING EXCAVATION SEPT. 25, 1989
2				196.70	2	CS	-		o		
3		END OF TEST PIT		2.74							
4											
5											
6											
7											
8											
9											

(Golder Report No. 891-3341)

0 / 15 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE / 10

DEPTH SCALE 1 : 50

Golder Associates

LOGGED D.J.M.

CHECKED

PROJECT: 1898967

RECORD OF BOREHOLE BH-201

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: April 20, 2018
DRILLING CONTRACTOR: London Soil Test Ltd.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	ELEVATION	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 2, 4, 6, 8) / HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 20, 40, 60, 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10, 20, 30, 40)	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
0	POWER AUGER 57mm ID HOLLOW STEM	GROUND SURFACE		197.68				198				
		TOPSOIL, clayey; brown		0.00 0.09								
1		(CL) **SILTY CLAY**, some sand, trace gravel, with cobbles; brown to grey at about 195.40m, **TILL**; very stiff			1	SS	17	197	ND			
					2	SS	23	196	ND			
2												
					3	SS	24		ND			
3								195				
					4	SS	28		ND			
4								194				
					5	SS	28		ND			
				193.41 4.27								
		(SW-GW) gravelly **SAND**, some silt; grey; dense			6	SS	31	193	ND		MH	Enc WL ▽ Groundwater encountered at about elev. 193.4m during drilling on April 20, 2018
5		END OF BOREHOLE		192.65 5.03				192				
6												
7												
8												
9												

DEPTH SCALE
1 : 50

GOLDER

LOGGED: SR
CHECKED:

LDN_BHS_07 1898967.GPJ GLDR_LON.GDT 10/05/18 14:21 DATA INPUT: ZJB

PROJECT: 1898967

RECORD OF BOREHOLE BH-202

SHEET 1 OF 3

LOCATION: REFER TO LOCATION PLAN

BORING DATE: April 20, 2018
DRILLING CONTRACTOR: London Soil Test Ltd.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	ELEVATION	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected) 2 4 6 8 / HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected) 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} / WATER CONTENT PERCENT Wp W Wl 10 20 30 40	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
0	POWER AUGER 83mm ID HOLLOW STEM	GROUND SURFACE		196.14				197			
		TOPSOIL, clayey; brown		0.00							
				0.15				196			
1		(CL) **SILTY CLAY**, some sand, trace gravel; mottled brown and grey; stiff to very stiff			1	SS	11		ND	○	Borehole dry during drilling on April 20, 2018
								195			
2					2	SS	19		ND	○	
				194.01				194			
				2.13	3	SS	28		ND	○	
3											
					4	SS	50/150mm		ND	○	
4					5	SS	25	192	ND	○	
					6	SS	28		ND		
5		(CL-CI) **SILTY CLAY**, some sand, trace gravel, with cobbles; brown to grey at about elev. 192.5m, **TILL**; stiff to hard						191			
					7	SS	24		ND	○	
6								190			
					8	SS	19		ND	○——	MH
7								189			
					9	SS	9		ND	○	
8								188			
9		*--- CONTINUED NEXT PAGE ---*									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: SR
CHECKED:

LDN_BHS_07 1898967.GPJ GLDR_LON.GDT 10/05/18 14:21 DATA INPUT: ZJB

PROJECT: 1898967

RECORD OF BOREHOLE BH-202

SHEET 2 OF 3

LOCATION: REFER TO LOCATION PLAN

BORING DATE: April 20, 2018
DRILLING CONTRACTOR: London Soil Test Ltd.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	ELEVATION	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected) 2 4 6 8 / HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected) 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} / WATER CONTENT PERCENT Wp W Wl 10 20 30 40	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		--- CONTINUED FROM PREVIOUS PAGE ---										
9	POWER AUGER 83mm ID HOLLOW STEM	(CL-Cl) **SILTY CLAY**, some sand, trace gravel, with cobbles; brown to grey at about elev. 192.5m, **TILL**; stiff to hard			10	SS	10	187	*ND*			
10								186				
11					11	SS	13	185	*ND*			
12					12	SS	11	184	*ND*			
13								183				
14					13	SS	22	182	*ND*			
15								181				
16					14	SS	18	180	*ND*			
17					15	SS	21	179	*ND*			
18								178				
19					16	SS	22		*ND*			
		--- CONTINUED NEXT PAGE ---										

DEPTH SCALE
1 : 50

GOLDER

LOGGED: SR
CHECKED:

LDN_BHS_07 1898967.GPJ GLDR_LON.GDT 10/05/18 14:21 DATA INPUT: ZJB

PROJECT: 1898967

RECORD OF BOREHOLE BH-202

SHEET 3 OF 3

LOCATION: REFER TO LOCATION PLAN

BORING DATE: April 20, 2018
DRILLING CONTRACTOR: London Soil Test Ltd.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	ELEVATION	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 2 4 6 8) / HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		--- CONTINUED FROM PREVIOUS PAGE ---									
19		(CL-Cl) **SILTY CLAY**, some sand, trace gravel, with cobbles; brown to grey at about elev. 192.5m, **TILL**; stiff to hard						177			
20					17	SS	26		*ND*		
				175.87				176			
		END OF BOREHOLE		20.27							
21								175			
22											
23											
24											
25											
26											
27											
28											
29											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: SR
CHECKED:

LDN_BHS_07 1898967.GPJ GLDR_LON.GDT 10/05/18 14:21 DATA INPUT: ZJB

PROJECT: 1898967

RECORD OF BOREHOLE BH-203

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: April 20, 2018
DRILLING CONTRACTOR: London Soil Test Ltd.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	ELEVATION	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected)	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected)	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
0	POWER AUGER 57mm ID HOLLOW STEM	GROUND SURFACE		196.45				197					
		TOPSOIL, clayey; brown		0.00									
				0.15									
1		(CL) **SILTY CLAY**, some sand; mottled brown and grey; firm			1	SS	8	196	ND				
				195.08									
				1.37				195					
2					2	SS	26		ND				
								194					
3		(CL) **SILTY CLAY**, some sand, trace gravel; brown to grey at about elev. 193.6m, **TILL**; very stiff			3	SS	29		ND				
					4	SS	21		ND				
								193					
4					5	SS	22		ND				Enc WL ▽ Groundwater encountered at about elev. 192.5m during drilling on April 20, 2018
				192.03				192					
				4.42									
		(SP) **SAND**, medium, trace silt; brown; compact			6	SS	23		ND				
5				191.49									
		(CL) **SILTY CLAY**, some sand; grey, **TILL**; very stiff		5.03				191					
		END OF BOREHOLE											
6													
7													
8													
9													

DEPTH SCALE
1 : 50

GOLDER

LOGGED: SR
CHECKED:

LDN_BHS_07 1898967.GPJ GLDR_LON.GDT 10/05/18 14:21 DATA INPUT: ZJB

PROJECT: 1898967

RECORD OF BOREHOLE BH-204

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: April 20, 2018
DRILLING CONTRACTOR: London Soil Test Ltd.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

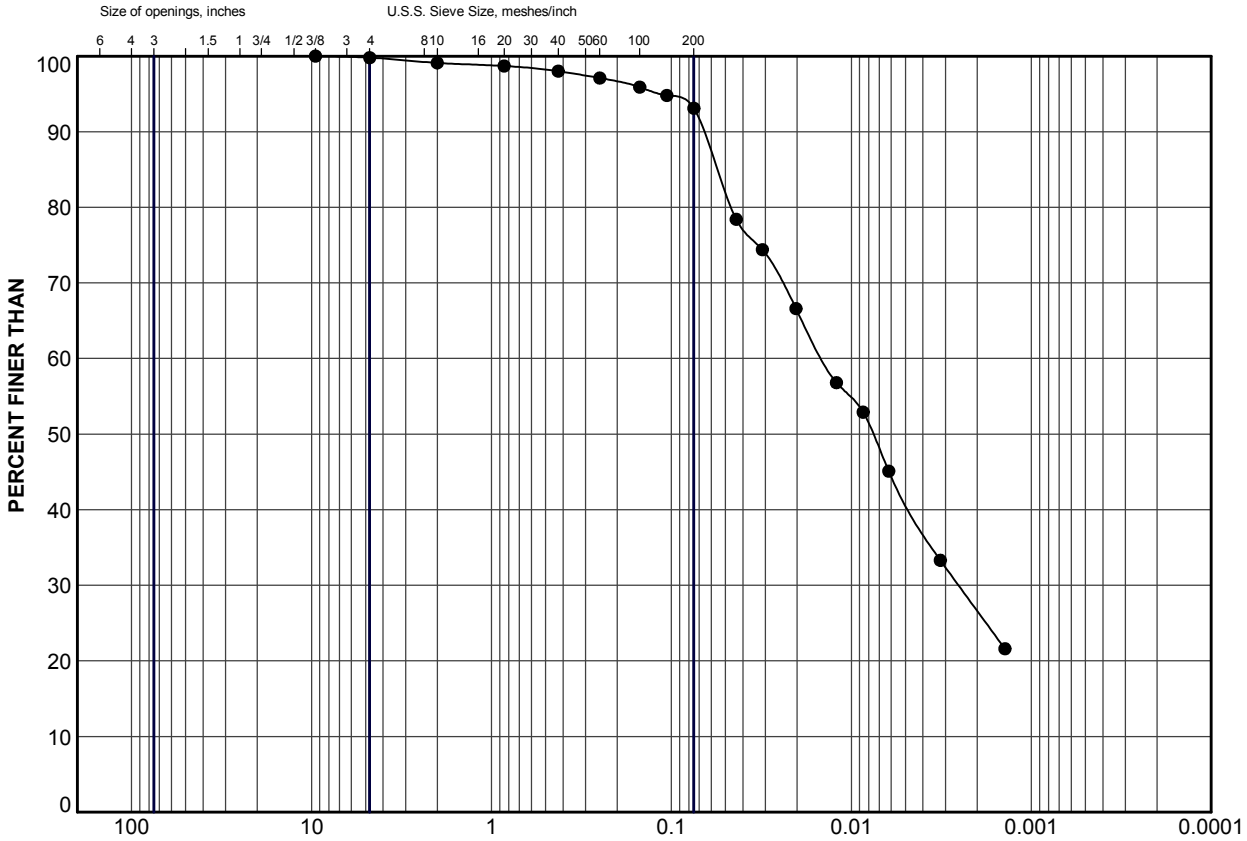
DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	ELEVATION	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected)	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected)	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
0	POWER AUGER 57mm ID HOLLOW STEM	GROUND SURFACE		198.96				199					
		TOPSOIL, clayey; brown and black		0.00 0.10									
1		(CL) **SILTY CLAY**, some sand; mottled brown and grey; firm			1	SS	8	198	ND				Borehole dry during drilling on April 20, 2018
				197.59 1.37	2	SS	27		ND				
2								197					
					3	SS	31		ND				
3		(CL) **SILTY CLAY**, some sand, trace gravel, with cobbles; brown to grey at about elev. 196.8m, **TILL**; very stiff to hard						196					
					4	SS	23		ND				
4					5	SS	19	195	ND				
					6	SS	18		ND				
5		END OF BOREHOLE		193.93 5.03				194					
6								193					
7													
8													
9													

DEPTH SCALE
1 : 50

GOLDER

LOGGED: SR
CHECKED:

LDN_BHS_07 1898967.GPJ GLDR_LON.GDT 10/05/18 14:21 DATA INPUT: ZJB



Cobble Size	coarse	fine	coarse	medium	fine	SILT AND CLAY
	GRAVEL SIZE		SAND SIZE			

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH-202	8	189.8

PROJECT

GEOTECHNICAL EXPLORATION
PROPOSED REFLECTION SHORES DEVELOPMENT
MUNICIPALITY OF LAMBTON SHORES, ONTARIO

TITLE

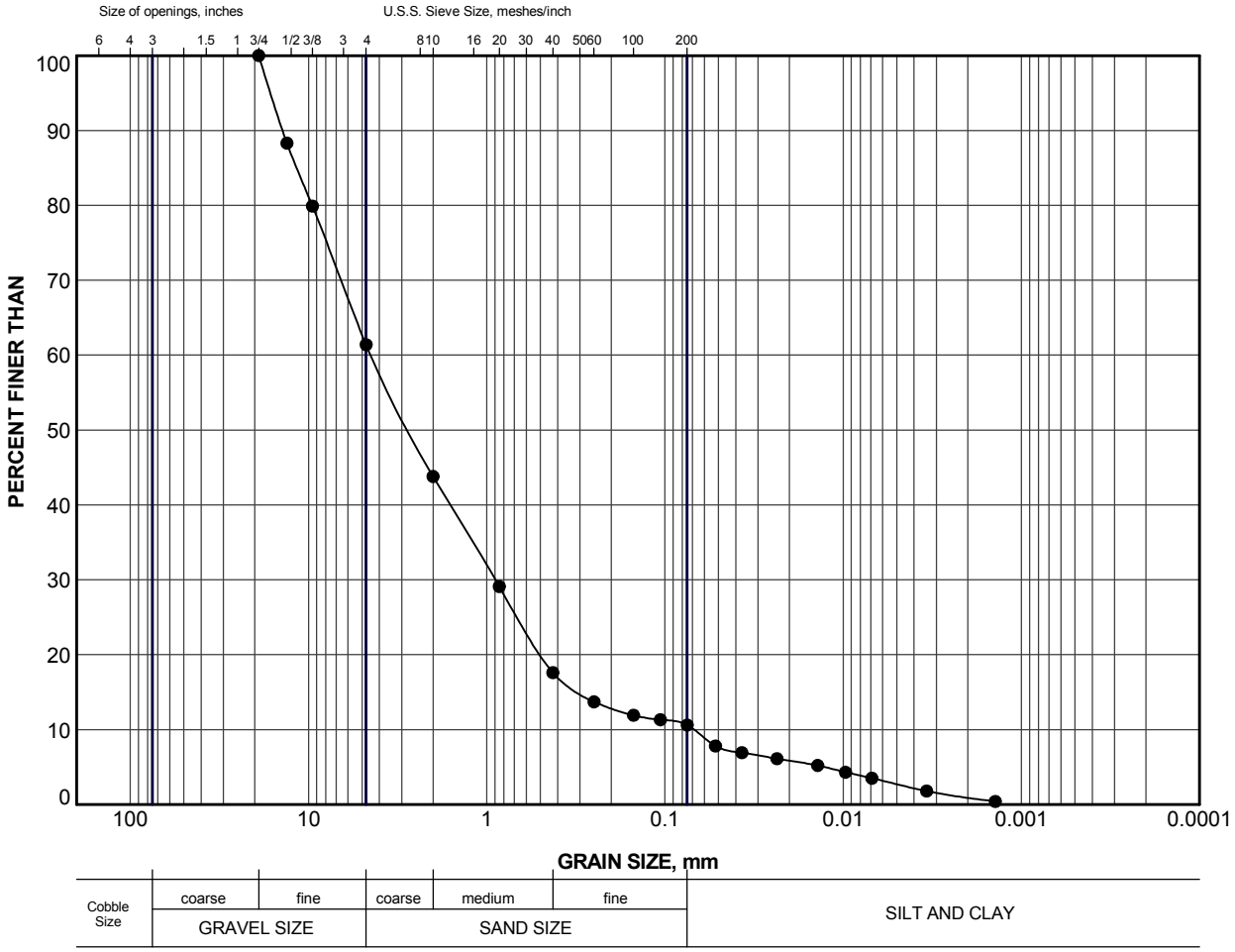
GRAIN SIZE DISTRIBUTION

SILTY CLAY TILL

GOLDER

PROJECT No.			1898967	FILE No.	1898967-R01002
				SCALE N/A	REV.
DRAWN	ZJB	May 04/18			
CHECK				**FIGURE 2**	

LDN_GSD GLDR_LDN.GDT 03/05/18 10:42



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH-201	6	192.9

PROJECT

GEOTECHNICAL EXPLORATION
PROPOSED REFLECTION SHORES DEVELOPMENT
MUNICIPALITY OF LAMBTON SHORES, ONTARIO

TITLE

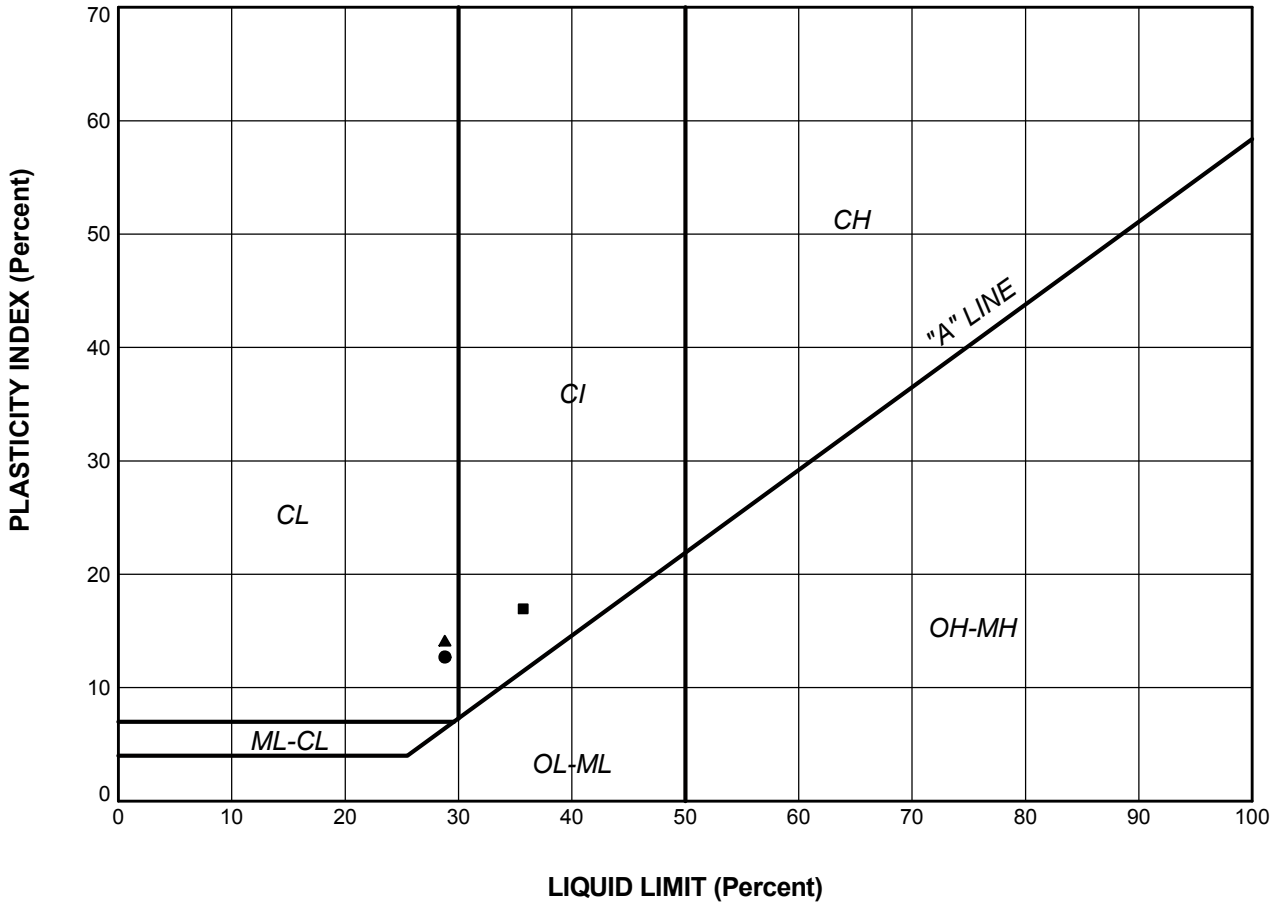
GRAIN SIZE DISTRIBUTION

gravelly SAND

GOLDER

PROJECT No.		1898967	FILE No.	1898967-1000-R01003	
			SCALE	N/A	REV.
DRAWN	ZJB	May 04/18			
CHECK			FIGURE	3	

LDN_GSD GLDR_LDN.GDT 03/05/18 10:42



SOIL TYPE
C = Clay
M = Silt
O = Organic

PLASTICITY
L = Low
I = Intermediate
H = High

LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	BH-202	8	28.8	16.1	12.7

PROJECT
GEOTECHNICAL EXPLORATION
PROPOSED REFLECTION SHORES DEVELOPMENT
MUNICIPALITY OF LAMBTON SHORES, ONTARIO

TITLE
PLASTICITY CHART

GOLDER

PROJECT No.		1898967	FILE No.	1898967-1000-R01004
			SCALE N/A	REV.
DRAWN	ZJB	May 04/18		
CHECK			FIGURE	4

LDN_PI_GLDR_LON.GDT 03/05/18 10:42

APPENDIX B

Site Photographs

Photograph 1a: Lakeshore slope south of Section A-A'. No toe erosion on April 18, 2018.

Photograph 1b: Lakeshore slope south of Section A-A'. No toe erosion. April 8, 2020.

Photograph 2a: Section A-A' at beach looking south. No toe erosion on April 18, 2018.

Photograph 2: Section A-A' at beach looking south. No toe erosion on April 8, 2020; however, recent higher water levels have moved driftwood and debris landward compared to April 18, 2018 condition above.

Photograph 3a: Section A-A' at beach looking upslope. No toe erosion on April 18, 2018.

Photograph 3b: Section A-A' at beach looking upslope. No toe erosion on April 8, 2020; however, recent higher water levels have moved driftwood and debris landward compared to April 18, 2018 condition above.

Photograph 4: Section A-A' at mid-slope looking upslope.

Photograph 5: Section A-A' at about mid-slope looking north.

Photograph 6a: Section A-A' at top of slope looking downslope on April 18, 2018.

Photograph 6b: Section A-A' at top of slope looking north on April 8, 2020.

Photograph 7a: Section A-A' at top of slope looking north on April 18, 2018.

Photograph 7b: Section A-A' at top of slope looking north on April 8, 2020.

Photograph 8a: Section B-B' at toe looking south on April 18, 2018.

Photograph 8b: Section B-B' at toe looking south on April 8, 2020. Note higher Lake Huron water level on April 8, 2020, compared to April 18, 2020, however, no erosion at the slope toe was observed.

Photograph 9: Section B-B' at toe looking south on April 18, 2018.

Photograph 10a: Section B-B' at path looking north on April 18, 2018.

Photograph 10b: Section B-B' at path looking north on April 8, 2020.

Photograph 11a: Section B-B' at path looking north on April 18, 2018.

Photograph 11b: Section B-B' at path looking north on April 8, 2020.

Photograph 12a: Section B-B' at top of slope looking north on April 18, 2018.

Photograph 12b: Section B-B' at top of slope looking north on April 8, 2020.

Photograph 13: Section B-B' at beach looking east on April 18, 2018.

Photograph 14: Section B-B' at beach looking south on April 8, 2020. No erosion at toe of slope; however, evidence of higher Lake Huron water levels close to the toe of slope.

Photograph 15: Wooden staircase between Section A-A' and Section B-B' looking south. No erosion noted on April 8, 2020.

Photograph 16: Small gulley south of the wooden staircase looking east on April 8, 2020.

Photograph 17: Large erosion gully at south property line looking upslope on April 8, 2020. Gully caused by surface flows from north ditch along Cedar Point Line.

Photograph 18: Large erosion gully at south property line looking north on April 8, 2020. Gully caused by surface flows from north ditch along Cedar Point Line.

Photograph 19: Gully at south end of property looking west on April 8, 2020. Gully caused by drainage at the southwest corner of farm field.

Photograph 20: Gully south of the wooden staircase looking west on April 8, 2020. Gully caused by drain from farm field.

Photograph 21: Wooden staircase from top of slope looking west on April 8, 2020. Staircase in good condition.

Photograph 22: Erosion gully at north end of site looking west on April 8, 2020. Gully caused by drain from adjacent farm field.

Photograph 23a: Gulley at north end of site looking west. Gully caused by seepage from farm field drain pipe at top of slope on April 18, 2018.

Photograph 23b: Gulley at north end of site looking west. Gully caused by seepage from farm field drain pipe at top of slope on April 8, 2020.

Photograph 24: Active erosion within grassy area west of the toe of slope near north end of property looking south on March 23, 2021.

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