MOREY ASSOCIATES LTD.
CONSULTING ENGINEERS

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613.215.0605

March 17, 2025 File: 025025

Lockwood Brothers Construction
2010 Totem Ranch Road East
Oxford Station, Ontario
K0G 1T0

Attention: Michael Barkhouse, Construction Manager

RE: SLOPE STABILITY ASSESSMENT
EXISTING SINGLE FAMILY DWELLING
PROPOSED DECKS REPLACEMENT
51 HURD STREET, KEMPTVILLE
MUNICIPALITY OF NORTH GRENVILLE, ONTARIO

Dear Michael:

As requested by Lockwood Brothers Construction (client) this letter provides the results of a slope stability assessment carried out for the existing slope adjacent to the north side of the existing dwelling at the above noted site. The purpose of the slope stability assessment was to observe the condition of the existing subject slope at the site and based on an interpretation of the observations made and the results of slope stability analyses, to provide a limit of hazards lands if applicable, from a slope stability point of view, in consideration of the proposed replacement of the existing decks at the north and east sides of the subject dwelling. In addition to the above, an allowable bearing pressure for the design of spread footing foundations for the proposed replacement decks was to be provided.

The reader of this letter is referred to the 'Important Information And Limitations Of This Letter' which follows the text of this letter and forms an integral part of this letter.

PROJECT DESCRIPTION AND BACKGROUND

For discussion purposes Hurd Steet is considered to exist at the west side of the subject site (see attached Key Plan, Figure 1). The existing dwelling at the site is on the east side of Hurd Street with the South Branch of the Rideau River (Kemptville Creek) located at the north boundary of the site, see Key Plan, Figure 1. A review of a site plan provided to us by Lockwood Brothers Construction indicates that Kemptville Creek exists some 75 metres north of the existing dwelling/proposed replacement decks and that the 1:100 year flood plain established by the Rideau Valley Conservation Authority (RVCA) for Kemptville Creek at the site is located some 12 to 14 metres north of the existing dwelling/proposed replacement decks.

It is understood that plans are being prepared to replace an existing covered deck at the north side of the existing dwelling and an existing deck at the east side of the existing dwelling by a proposed covered and screened in deck at the north side of the existing dwelling and a deck at the east side of the existing dwelling. A review of drawings provided by Lockwood Brothers Construction for the proposed decks replacement indicate that the proposed covered and screened in deck at the north side of the existing dwelling (subject slope side) will be no closer to and possibly somewhat further back from the crest of the subject slope than the existing covered deck at the north side of the existing dwelling. The foundations for the proposed covered and screened in deck located at the north side of the existing dwelling are indicated to be a minimum of about 6.1 metres back of the subject slope crest.

The existing covered deck and the existing deck are, in general, supported by wood posts founded on concrete piers. It is understood, based on the above mentioned drawings, that the replacement covered and screened in deck at the north side of the existing dwelling and the replacement deck at the east side of the existing dwelling are proposed to be, in general, supported on isolated concrete pier spread footing foundations.

It is further understood that a replacement septic system leaching bed is proposed to be constructed at the east side of the existing dwelling.

The field work for this assessment was carried out by a member of our technical field staff between February 27 and March 14, 2025. A test pit, TP25-1, advanced using a track mounted excavator supplied and operated by the client, and an augerhole, AH25-1, put down using hand augering

equipment were advanced near the crest of the slope and near the slope toe, respectively, to check the soil and groundwater conditions at the subject slope (see attached Aerial Sketch Plan, Figure 2). At the time of the field work, measurements of the height and inclination of the steepest, tallest portion (based on visual observations) of the subject slope were carried out using Spectra SP60 GNSS surveying equipment. The state of erosion of the subject slope and any evidence of slope instability was visually assessed.

A review of the surficial geology map for the site area indicates that the slope at the site is underlain by till plains (Chapman & Putnam, 2007, Ontario Geological Survey), see attached Figure 3. The bedrock geology map for the site area indicates that the bedrock underlying the site consists of dolostone, minor shale, and sandstone of the Oxford Formation (2011, Ontario Geological Survey), see attached Figure 4. Drift thickness mapping published by the Ontario Geological Survey (2006) provides limited data points within relatively close proximity to the subject slope. The available data points within relatively close proximity to the subject slope indicate an overburden thickness between some 4.5 to 8.3 metres within the tableland at/near the site and about 3.0 metres in thickness beyond the subject slope toe (between the slope toe and Kemptville Creek).

The Ministry of the Environment, Conservation and Parks (MECP) well records for three drilled wells located within about 150 metres of the subject site were obtained from the Province of Ontario, Map: Well Records website and are attached as Appendix A. One of those wells is located about 80 metres east of the subject slope. The three drilled wells were constructed as test wells for a hydrogeological investigation carried out for the proposed residential subdivision located immediately adjacent to the east side of the subject site. The MECP well records indicate that the overburden thickness at the drilled wells is between some 4.3 to 5.5 metres and the native overburden materials encountered by the well drillers at those wells is indicated to consist of clay and hard pan. The bedrock underlying the overburden material at the drilled wells is indicated by the well drillers to consist of limestone.

OBSERVATIONS

The measurements of the subject slope carried out by a member of our technical field staff indicate that the subject slope at the site is some 2.8 to 3.8 metres high and has an overall inclination of about 21 to 26 degrees to the horizontal. The face of the subject slope is inclined between about 13 and 26 degrees to the horizontal. The tableland south of the slope crest is inclined at a gentle

downward gradient (about 1 percent) towards the slope crest. A relatively flat floodplain exists at the bottom of the subject slope, from about the toe of the slope to some 60 metres to the edge of the Kemptville Creek.

The ground cover of the subject slope at the time of the field work consists, in general, of some grass, shrubs and occasional young to mature trees. The ground cover of the above mentioned floodplain at the time of the field work consists, in general, of grass, shrubs and young to mature trees with some cobble and boulder patches. Some pooled water was observed within the flood plain at the time of the field work.

No evidence of major slope instability was observed at the time of the field work. No evidence of active or previous erosion at the subject slope toe was observed. The Kemptville Creek was measured to be some 60 metres from the subject slope toe.

A description of the subsurface conditions encountered at the above mentioned test pit and augerhole is provided in the attached Table I – Record of Test Pit and Augerhole and the approximate locations of the test pit and augerhole are provided on the attached Aerial Sketch Plan, Figure 2. From the ground surface at the test pit about a 1.2 metre thickness of fill materials was encountered. The fill materials, in general, consist of topsoil, sand, silt and clay and an occasional cobble and piece of wood. The fill materials were underlain by a deposit of grey brown silty clay with a trace of sand and gravel. The test pit was terminated within the silty clay material at a depth of some 3.1 metres below the existing ground surface. Based on tactile examination and on the difficulty to advance the test pits within the silty clay material, the silty clay material encountered at the test pit is considered to be very stiff in consistency. No groundwater was observed in the test pit at the time of the field work on February 27, 2025.

From the ground surface at the augerhole about a 0.2 metre thickness of branches and cobbles was encountered over about a 0.6 metre thickness of silty clay. The test pit was terminated below the silty clay material at a depth of some 0.8 metres below the existing ground surface on refusal to auger on a possible boulder. Tactile examination of the recovered auger cuttings indicated that the auger cuttings were moist.

A sample of the native silty clay material obtained from the test pit was delivered to a soils laboratory for grain size distribution testing. The results of that laboratory testing are provided in Appendix B and indicate that the silty clay sample tested consists of 1.6 percent gavel, 7.1 percent sand, 62.3 percent silt and 29.0 percent clay.

A Slope Stability Rating Chart provided as Table 4.2 from Section 4.3.2 of the Ministry of Natural Resources Technical Guide, River & Stream Systems: Erosion Hazard Limit (MNR Technical Guide) was completed for the subject slope (specifically, for the below mentioned analyzed slope section A-A) and is provided in the attached Appendix C. The completed Slope Stability Rating Chart resulted in a rating value of 26. Based on the MNR Technical Guide slope stability rating, values between 25 and 35 are categorized as “Slight Potential”.

Three photographs showing the site are provided in the attached Appendix D. Photographs 1 and 2 were taken at the time of the above mentioned field work on March 14, 2025, at which time the subject site was snow covered. It is pointed out that snow was removed by hand shovel by a member of our technical field staff at the time of the field work at spot check locations on the tableland, slope crest, slope face, slope toe and floodplain for ground surface observations of the subject slope. Photograph 3 obtained from the Google Street View Website (photograph date November 2024) shows the site without snow cover.

SLOPE STABILITY ANALYSES

Computer slope stability analyses were carried out for what is considered the steepest/highest portion of the subject slope at the site using GeoStudio 2018 Slope/W software package produced by GEO-SLOPE International Ltd., in order to determine a factor of safety of the slope against overall rotational failure (global slope stability analysis). The slope section used in the analyses was chosen by Morey Associates Ltd. based on slope geometry, slope height and the location of the slope section relative to the proposed replacement decks at the site. The approximate location of the slope section analyzed (A-A) is shown on the attached Aerial Sketch Plan, Figure 2.

The soil conditions used for the slope stability analyses were based on the above described subsurface information. It is pointed out that the bedrock was considered impenetrable from a critical slip surface point of view.

The slope stability analyses parameters used for the existing fill material are:

Cohesion, c' = 0.5 kilopascals
Internal Friction Angle, ϕ' = 30 degrees
Unit Weight, γ = 16.5 kilonewtons per cubic metre

The slope stability analyses parameters used for the possible septic sand fill material are:

Cohesion, c' = 0 kilopascals
Internal Friction Angle, ϕ' = 30 degrees
Unit Weight, γ = 18 kilonewtons per cubic metre

The slope stability analyses parameters used for the native silty clay material are:

Cohesion, c' = 10 kilopascals
Internal Friction Angle, ϕ' = 33 degrees
Bulk Unit Weight, γ = 17 kilonewtons per cubic metre

The slope stability analyses parameters used for the native glacial till are:

Cohesion, c' = 1.5 kilopascals
Internal Friction Angle, ϕ' = 35 degrees
Unit Weight, γ = 20.5 kilonewtons per cubic metre

The above parameters used in the analyses are based on experience with similar soil types in the Ottawa Valley and surrounding area as well as information published by the City of Ottawa and Ministry of Natural Resources (MNR) relating to the subsurface conditions described above.

In view of the presence of the existing/proposed replacement decks at the slope section analyzed and the above mentioned proposed septic system leaching bed near the slope section analyzed, the following was included in the computer slope stability analyses.

- Point loads in relation to the decks foundations and as per the foundation sizes/locations/level indicated in the above mentioned drawings provided by Lockwood Brothers Construction (and as per the allowable soil bearing pressure discussed below).

- Septic sand fill grade raise in relation to the proposed replacement septic system leaching bed and as per the size/location indicated in the above mentioned drawings provided by Lockwood Brothers Construction. It is point out the height of the septic sand fill grade raise was estimated at 1 metre above the existing ground surface, which is considered conservative based on discussion with the replacement septic system designer from Lockwood Brothers Construction.

No groundwater was observed in the above mentioned test pit which was put down at the subject slope to a depth of some 3.1 metres below the existing ground surface. However, for a conservative approach and based on the location of the replacement septic system and for a septic system leaching bed sand mantle extending to the existing slope crest, the slope was assumed to be nearly fully saturated with a groundwater level at or within about 0.1 metres of the existing ground surface.

Slope stability analyses for the subject slope were carried out for both static conditions and pseudo-static (seismic) conditions. Based on the material comprising the slope and the subject site setting it is considered that a pseudo-static analysis is adequate for the purposes of this present slope stability assessment. For a conservative approach a conventional pseudo-static analysis was carried out as opposed to a two stage pseudo-static analysis since typically a two stage pseudo-static analysis will result in a higher factor of safety.

The peak (horizontal) ground acceleration (PGA) for the subject site was obtained from the 2015 National Building Code Seismic Hazard calculation (website), see Appendix E. The PGA for the subject site is indicated to be 0.28 for a 2 percent probability of exceedance in 50 years. A seismic coefficient, k, was used for the above mentioned pseudo-static analysis, where k is equal to 0.5PGA.

For the purposes of this assessment, a factor of safety of 1.5 or greater is considered to indicate long term stability for static conditions and a factor of safety of 1.1 or greater is considered to indicate adequate slope stability for pseudo-static conditions.

The result of the slope stability analysis for the subject slope for static conditions at the slope section analyzed indicates that the slope has a factor of safety against failure of about 1.8, see attached Figure 5. The result of the slope stability analysis for the subject slope for pseudo-static conditions at the slope section analyzed indicates that the slope has a factor of safety against failure of about 1.2, see attached Figure 6.

SLOPE SETBACKS AND LIMIT OF HAZARD LANDS

As per the Ontario Ministry of Natural Resources (MNR), for unstable slopes the “Limit of Hazard Lands” should be determined based on a stable slope allowance, a slope toe erosion allowance, and an erosion access allowance in order to provide a safe setback line for development.

As previously mentioned, the stable slope allowance is the distance from the slope crest to the point at which a factor of safety against failure of 1.5 is calculated for static conditions, or the distance from the slope crest to the point at which a factor of safety against failure of 1.1 is calculated for pseudo-static conditions, whichever is greater. As the results of the above mentioned slope stability analyses for the subject slope gave values for static conditions and pseudo-static conditions greater than 1.5 and 1.1, respectively, no stable slope allowance for the subject slope is required.

As previously mentioned, the toe of the slope is some 60 metres from the Kemptville Creek. No evidence of active or previous erosion at the subject slope toe was observed at the time of the field work. Based on the observations made at the time of the field work and on the subject site setting it is considered that the subject slope toe is not located in an area prone to toe erosion. Based on the above, it is considered that no significant future erosion should occur at the slope toe of the subject slope. Based on the above no toe erosion allowance for the subject slope is required.

The MNR technical guide includes a 6 metre erosion access allowance beyond the toe erosion allowance to allow for access by equipment to repair a possible failed slope. The access allowance is measured back from (or added to) the stable slope allowance.

The MNR technical guide indicates the three main principles to support the inclusion of an erosion access allowance are:

- *"Providing for emergency access to erosion prone areas;"*
- *"Providing for construction access for regular maintenance and access to the site in the event of an erosion event or failure of a structure; and"*
- *"Providing protection against unforeseen or predicted external conditions which could have an adverse effect on the natural conditions or processes acting on or within an erosion prone area of provincial interest."*

As mentioned above, it is considered that the subject slope toe is not located in an area prone to toe erosion and that no significant future erosion should occur at the slope toe of the subject slope. Based on the above, it is considered that the three main principles to support the inclusion of an erosion access allowance are not applicable to the subject slope/subject site. It is pointed out that the subject site is already developed, and the proposed replacement decks are located no closer to the slope crest than the existing decks they are replacing. Based on the above, it is considered that no erosion access allowance is required.

Based on the results of the slope stability analyses and the slope setback requirements mentioned above it is considered that no limit of hazard lands for the subject slope at the site is required, from a slope stability point of view.

CONCLUSIONS

Based on the results of this slope stability assessment, the subject slope at the site, with consideration for the above described proposed replacement decks and proposed replacement septic system leaching bed, is adequately stable and no limit of hazard lands for the subject slope at the site is required, from a slope stability point of view.

Based on the above calculated factors of safety against slope failure, it is considered that the above described proposed site development, is not in danger of a global slope failure.

Based on the limited observations within the test pit put down for this assessment, the proposed spread footing foundations supporting the proposed replacement decks founded as mentioned

above on the native, very stiff, undisturbed, grey brown silty clay, should be designed using an allowable bearing pressure of 95 kilopascals SLS and 140 kilopascals for a factored bearing resistance at ultimate limit states, ULS.

To ensure that the foundations for the proposed replacement decks are founded on a competent and suitably prepared subgrade, it is considered that prior to foundation formwork placement, a subgrade evaluation should be carried out by qualified geotechnical engineering personnel. A subgrade evaluation is considered a common construction site evaluation.

From a slope stability assessment point of view, it is considered that the extended sand mantle for the above mentioned proposed septic system leaching bed could extend to the crest of the subject slope.

The existing surficial topsoil and vegetation material on the slope should be maintained or be suitably reinstated should it be disturbed during construction, in order to mitigate the potential for surficial erosion. No concentrated surface water flow should be directed towards the slope. Surface water drainage directed towards the slope, if needed, should be minimal sheet flow drainage. Should eavestrough drainage for the proposed replacement covered deck directed towards the slope, the eavestrough drainage should be directed to “splash pads/splash blocks” that promote sheet flow drainage and protect from surficial erosion. No regrading of the existing subject slope should take place that steepens the current inclination of the subject slope or increases the height of the subject slope.

Should changes to the proposed site development be considered from that described in this present letter, Morey Associates Ltd. should be retained to review the proposed changes to ensure compatibility with any engineering guidelines and conclusions contained in this letter.

We trust the above information is sufficient for your present purposes. If you have any questions concerning this letter, please do not hesitate to contact our office.

Yours truly,
Morey Associates Ltd.

D. G. Morey, P.Eng.
Principal | Consulting Engineer

Attachments: Important Information And Limitations Of This Letter
Figures 1 to 6
Table I – Record of Test Pit and Augerhole
Appendices A to E

File: 025025

IMPORTANT INFORMATION AND LIMITATIONS OF THIS LETTER

This letter provides a summary of work that was carried out with generally accepted professional standards at the time and location in which the services were provided and in a manner consistent with a level of care and skill normally exercised by other professional engineering firms practicing under similar conditions and subject to the time limits and financial and physical constraints applicable to the services. No other warranty, expressed or implied, is made.

This letter was prepared for the exclusive use of Lockwood Brothers Construction. This letter may not be relied upon by any other person or entity without the express written consent of Lockwood Brothers Construction and Morey Associates Ltd. Any party that relies on services and/or work carried out by Morey Associates Ltd. and/or on a letter prepared by Morey Associates Ltd. without Morey Associates Ltd. express written consent, does so at their own risk. Morey Associates Ltd. specifically disclaims any liability and disclaims any responsibility to any such party for any loss, damage, expense, fine, penalty or other such thing which may arise or result from the use of any information, recommendation or other matter arising from the services, work or letters provided by Morey Associates Ltd.

It is understood based on instruction given to Morey Associates Ltd. by the client and/or by other design professionals associated with and retained by the client for this project and/or by municipal/county/provincial/ regulatory approval agency personnel that this letter may be used for guidance of the designers of the project and submitted for a specific site development permit application process. Any other use of this letter by the client and/or by others is prohibited and is without responsibility of Morey Associates Ltd. Further, Morey Associates Ltd. cannot be responsible for use of only portions of this letter by the client and/or by others without reference to the entire letter.

This letter is of a summary nature and is not intended to stand alone without reference to the instructions given to Morey Associates Ltd. by the client and/or by other design professionals associated with and retained by the client for this project and/or by municipal/county/provincial/regulatory approval agency personnel. This letter has been prepared based on our interpretation of the instructions given to Morey Associates Ltd. by the client and/or by other design professionals associated with and retained by the client for this project and/or by municipal/county/provincial/regulatory approval agency personnel only. Regulatory agency requirements may change in real time during a development permit application process and regulatory agency requirements are subject to interpretation and these interpretations may change over time. As such, no warranty, expressed or implied, is made by Morey Associates Ltd. that this letter meets others' interpretations of any regulatory agency requirements.

It is stressed that the information presented in this letter is provided for the guidance of the design professionals associated with and retained by the client for this project and is intended for this project only. The use of this letter as a construction document is neither intended nor authorized by Morey Associates Ltd.

Contractors bidding on or undertaking works related to the proposed project at the subject site should examine the factual results of the assessment, satisfy themselves as to the adequacy of the information for construction, which may require the contractor(s) to carry out additional investigation(s) and reporting, as it affects their construction techniques, schedule, safety and equipment capabilities.

Any letter recommendations/engineering guidelines are applicable only to the project described in the letter. Any changes in the scope of the project will require a review by Morey Associates Ltd. to ensure compatibility with any letter recommendations/engineering guidelines contained in this letter.

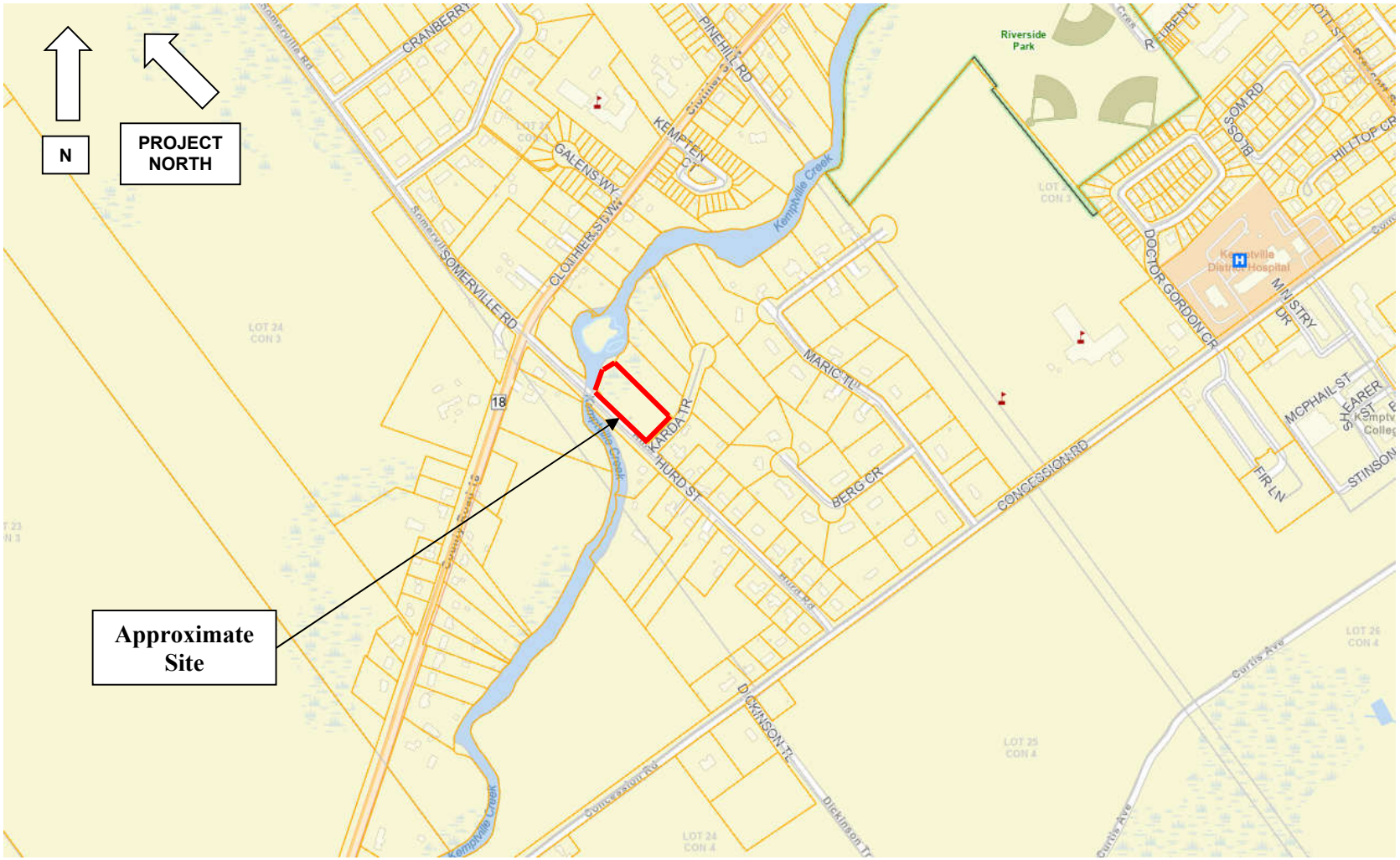
IMPORTANT INFORMATION AND LIMITATIONS OF THIS LETTER (continued)

The professional services for this project include the slope stability aspects of the assessment described above/in the letter only. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities at this site or adjacent properties, and/or resulting from the introduction onto the site of materials from offsite sources are outside the terms of reference for this letter and have not been addressed.

The engineering guidelines provided in this letter are based on subsurface data obtained at the specific test hole locations only. Boundaries between zones on the logs are often not distinct but transitional and were interpreted. A geotechnical (subsurface) assessment is a limited sampling of a site. Experience indicates that the subsurface soil and groundwater conditions can vary significantly between and beyond the test hole locations. Should any conditions at the site be encountered which differ from those at the test hole locations, Morey Associates Ltd. should be notified to carry out a review regarding the encountered conditions as they relate to the engineering guidelines/recommendations contained in this letter.

KEY PLAN

FIGURE 1



Reference: Leeds Grenville Public Map Viewer GIS website

NOT TO SCALE

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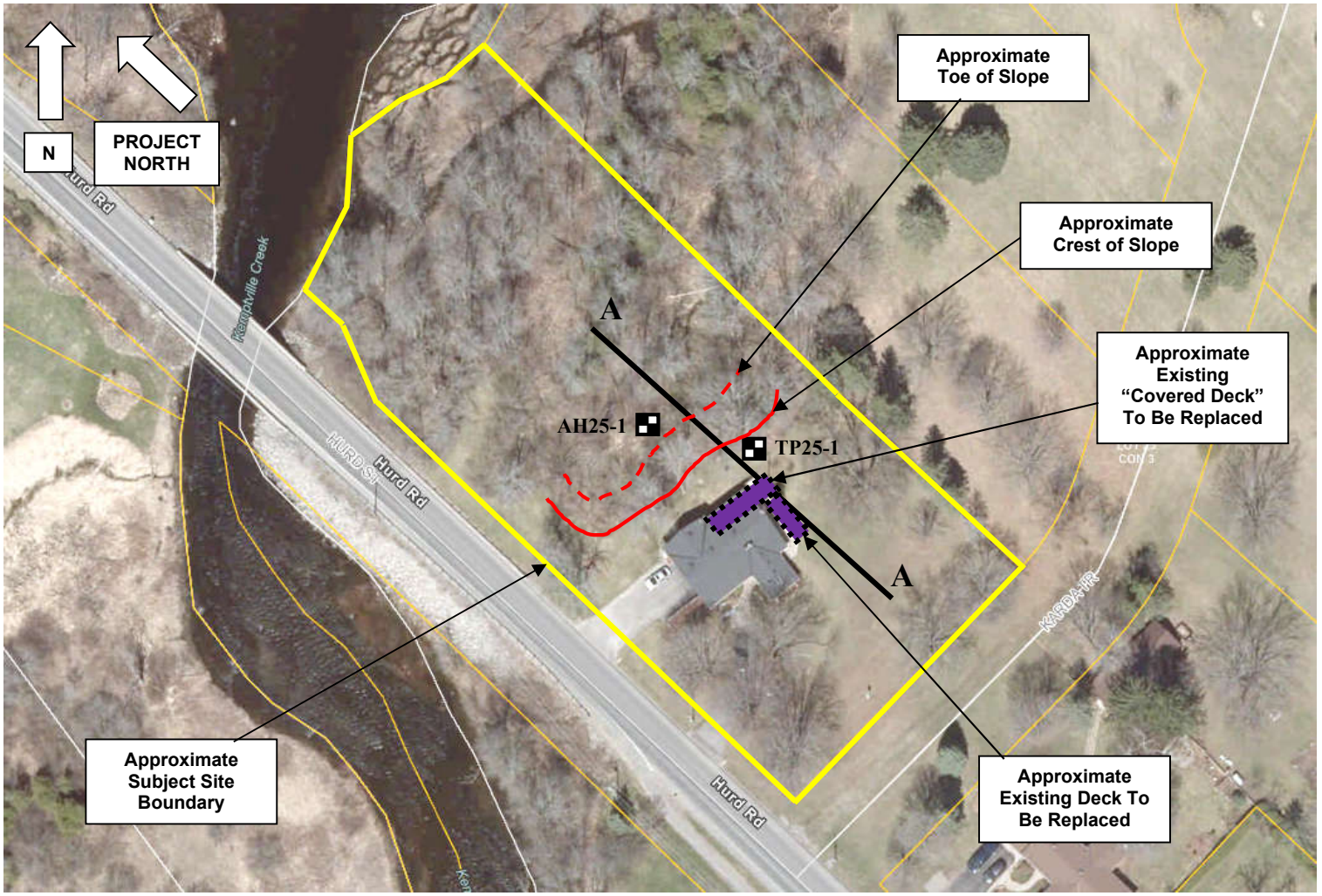
CONSULTING ENGINEERS

Project No. 025025

Date March 2025

AERIAL SKETCH PLAN

FIGURE 2



Reference: Leeds Grenville Public Map Viewer GIS website

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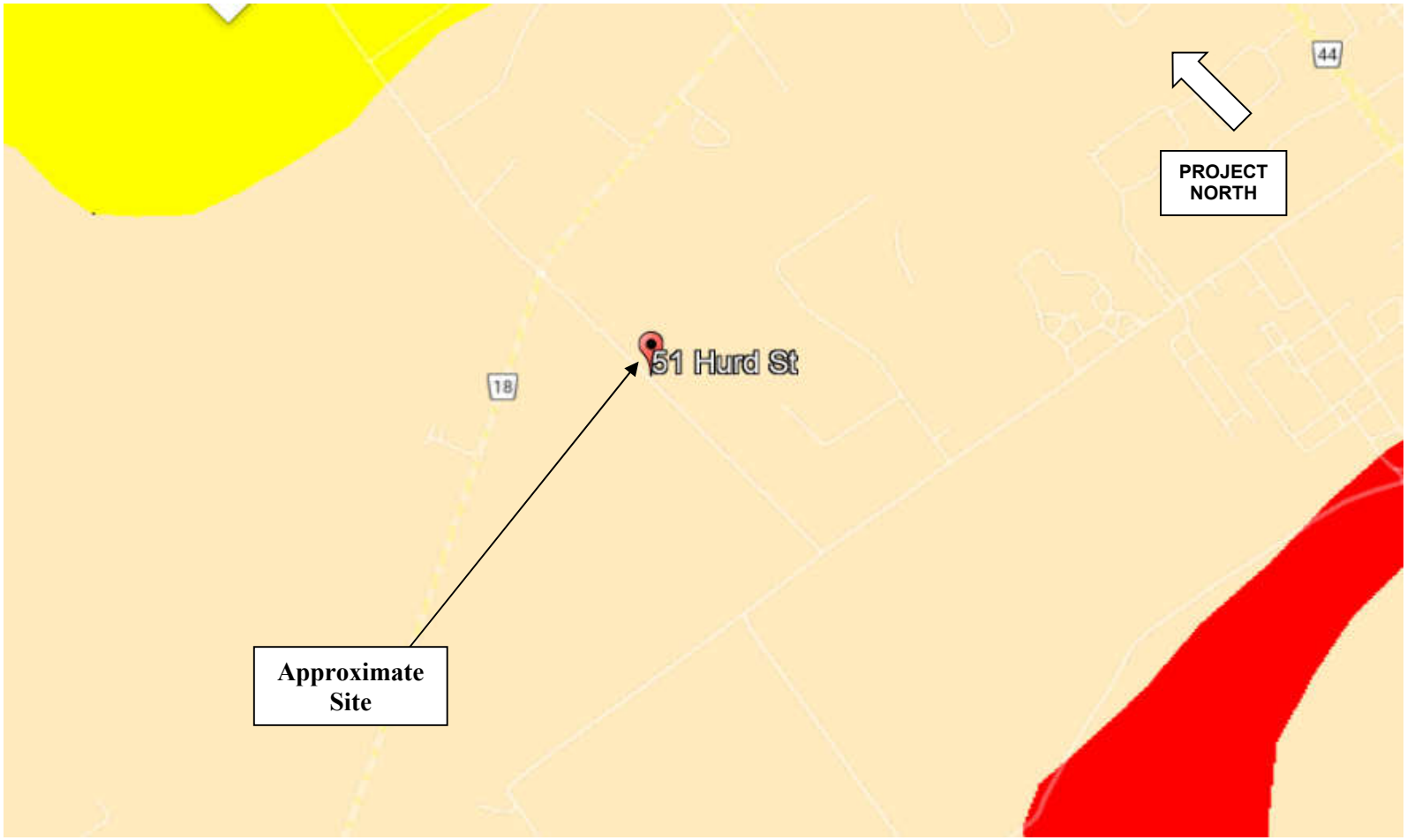
Project No. 025025

Date March 2025

SURFICIAL GEOLOGY MAP

FIGURE 3



Reference: Physiography of South Ontario, OGS, Chapman and Putnam, 2007

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6 Till Plains (Drumlinized)

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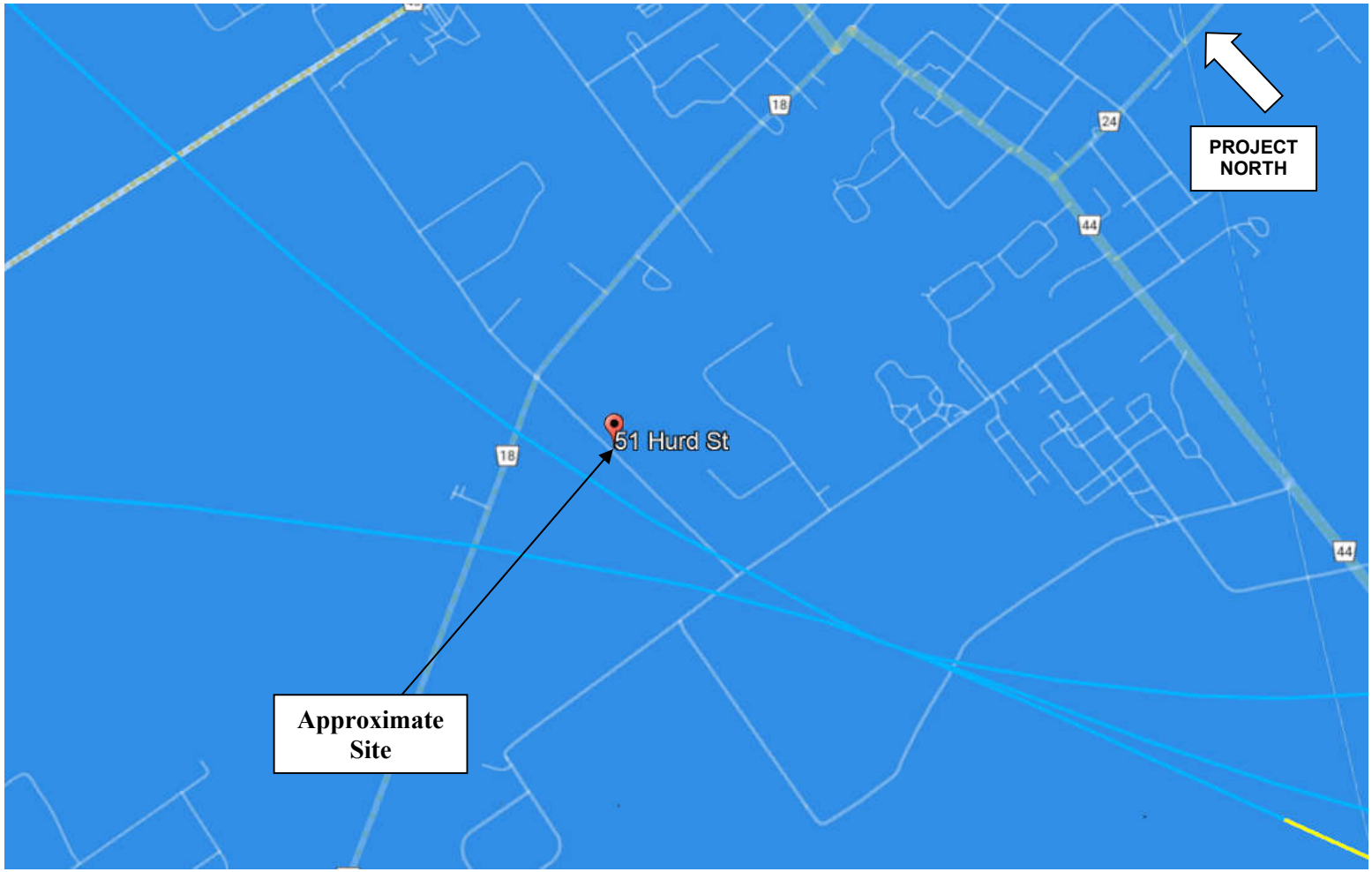
Date March 2025

BEDROCK GEOLOGY MAP

FIGURE 4



Reference: Ontario Geological Survey, 2011

NOT TO SCALE

5

Oxford Formation: dolostone, minor shale and sandstone

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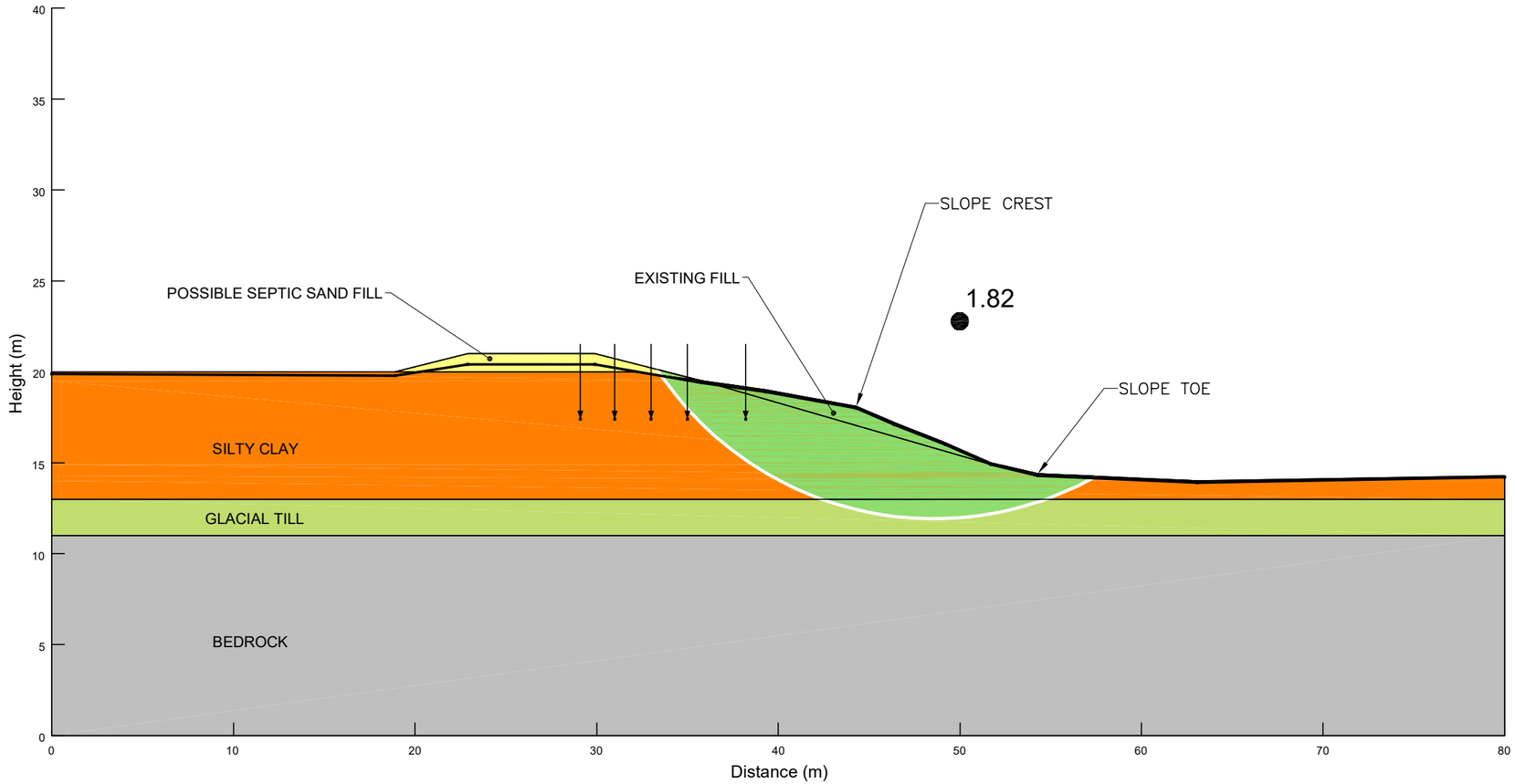
Project No. 025025

Date March 2025



ANALYSIS NAME

STATIC CONDITIONS - SLOPE SECTION A-A
FIGURE 5

LOCATION

51 HURD STREET
MUNICIPALITY OF NORTH GRENVILLE
ONTARIO

PROJECT

SLOPE STABILITY ASSESSMENT

CLIENT

LOCKWOOD BROTHERS CONSTRUCTION

DATE	DRAWN BY	APPROX.SCALE	FILE NO.
March 2025	DGM	As Shown	025025

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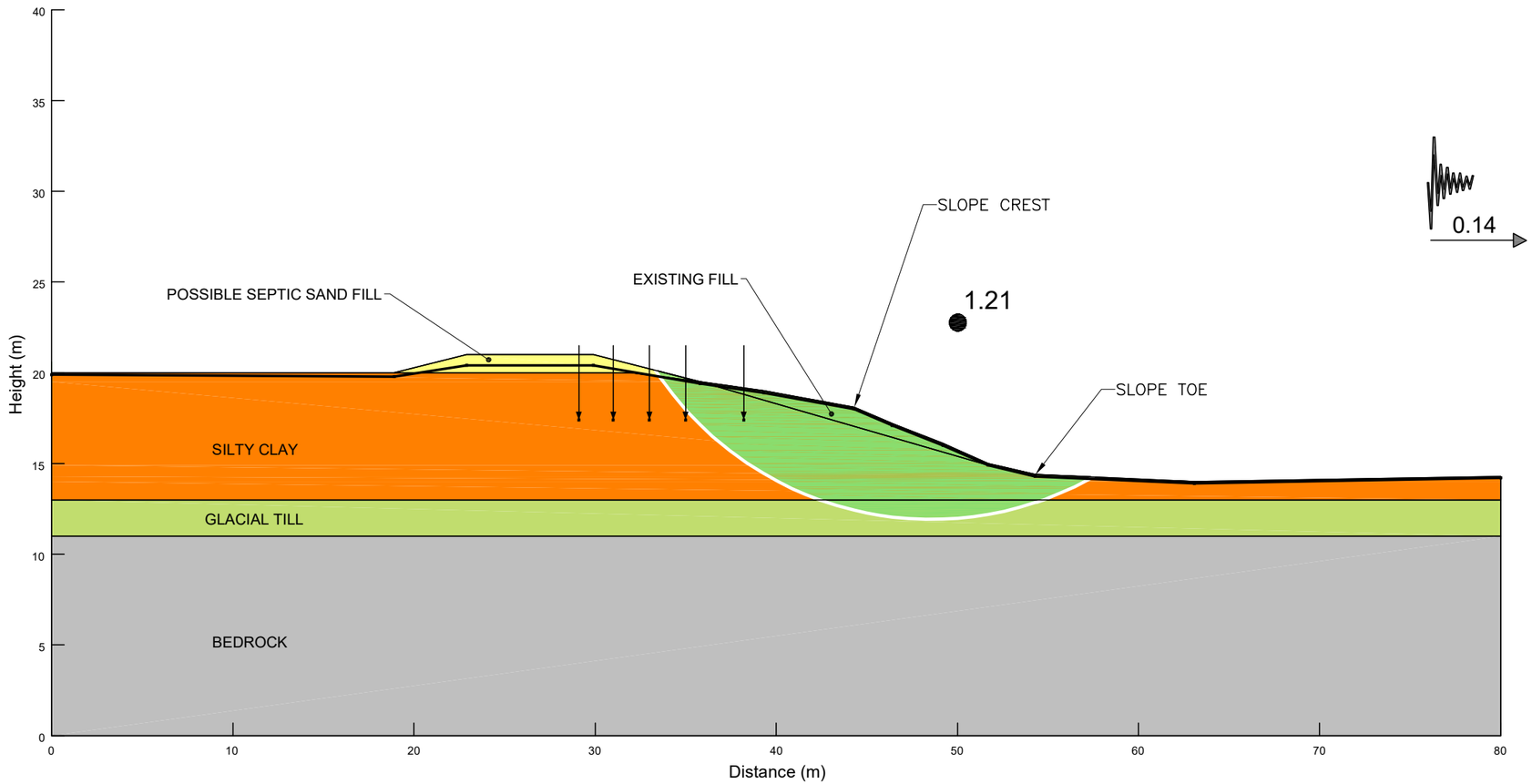

ANALYSIS NAME

PSEUDO-STATIC CONDITIONS - SLOPE SECTION A-A
FIGURE 6

LOCATION

51 HURD STREET
MUNICIPALITY OF NORTH GRENVILLE
ONTARIO

PROJECT

SLOPE STABILITY ASSESSMENT

CLIENT

LOCKWOOD BROTHERS CONSTRUCTION

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TABLE I
RECORD OF TEST PIT AND AUGERHOLE

51 HURD STREET, KEMPTVILLE
MUNICIPALITY OF NORTH GRENVILLE
ONTARIO

TEST PIT/AUGERHOLE NO. [APPROX. ELEV.]	DEPTH (METRES)	DESCRIPTION
TP25-1 [±93.5m]	0.00 – 1.20	Topsoil, sand, silt, clay, occasional boulder, occasional piece of wood (FILL)
	1.20 – 3.05	Grey brown SILTY CLAY, trace sand, trace gravel
	3.05	End of test pit

No groundwater seepage observed into test pit at time of field work, February 27, 2025.

AH25-1 [±89.2m]	0.00 – 0.20	Branches, cobbles
	0.20 – 0.80	Grey brown SILTY CLAY
	0.80	Refusal to advance auger/soil probe on possible boulder

Soil moist in augerhole at time of field work, March 14, 2025.

APPENDIX A

MECP WELL RECORDS

Ontario — Ministry of the Environment, Conservation and Parks

Tag#: A318397 (r Print Below) A318397

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☒ Metric ☐ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	12518791 Canada Inc		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
10278 Hyndman Road	Mountain	ON	K0E 1S0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
53 Hurd Street	Oxford on the Rideau	25	3

County/District/Municipality	City/Town/Village	Province	Postal Code
North Grenville	Kemptville	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	448575	4984031	TW # 1/3	

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Clay, Hard Pan &	Gravel		0	18
Grey & Black	Limestone			18	132
Grey & Black	Limestone			132	138

Test Well # 1 of 3

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/cm)
28	18	Neat cement	9.36
18	0	Bentonite slurry	12.6

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2	28
6"	Open Hole		28	138

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water: Fresh / Untested / Other, specify
132	☐	☒ Fresh ☐ Untested
	☐	☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	28	9 3/4"
28	138	6"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 120

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 17.9"

If flowing give rate (l/min/GPM): X

Recommended pump depth (m/ft): 100'

Recommended pump rate (l/min/GPM): 20

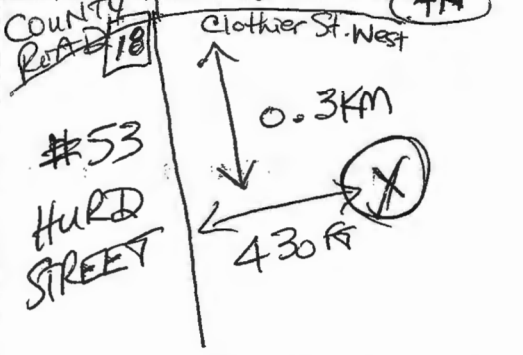
Well production (l/min/GPM): 20

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	17'5"		17.9"
1	17.8	1	17.5
2	17.8	2	17.5
3	17.9	3	17.5
4	17.9	4	17.5
5	17.9	5	17.5
10	17.9	10	17.5
15	17.9	15	17.5
20	17.9	20	17.5
25	17.9	25	17.5
30	17.9	30	17.5
40	17.9	40	17.5
50	17.9	50	17.5
60	17.9"	60	17.5"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 1/2 HP - 10 GPM Set @ 100 FT

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd	C7681

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
6659 Franktown Road	Richmond	ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted Y Y Y Y M M D D
6138382170	Hanna, Jeremy	T3632		2021 05 31

Well owner's information package delivered	Date Package Delivered Y Y Y Y M M D D	Date Work Completed Y Y Y Y M M D D
☒ Yes ☐ No	2021 05 19	2021 05 14

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Ministry's Copy

Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☒ Imperial

We Tag#:A318396 int Below)

A318396

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	12518791 Canada Inc		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
10278 Hyndman Road	Mountain	ON	K0E 1S0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
53 Hurd Street	Oxford on the Rideau	25	3

County/District/Municipality	City/Town/Village	Province	Postal Code
North Grenville	Kemptville	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	448513	4984118	TW# 2/3	

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Clay	& Hard Pan		0'	14'
Grey & Black	Limestone			14'	130'
Grey & Black	Limestone			130'	136'

Test well #2 of 3

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/cft)
24'	14'	Neat cement	9.36
14'	0'	Bentonite slurry	12.6

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify ____

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify ____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2'	24'
6"	Open Hole		24'	136'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	☐ Gas	Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify
130		
		Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
		Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	24'	9 3/4"
24'	136'	6"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 120

Pumping rate (l/min/GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 9.8'

If flowing give rate (l/min/GPM): X

Recommended pump depth (m/ft): 100'

Recommended pump rate (l/min/GPM): 20

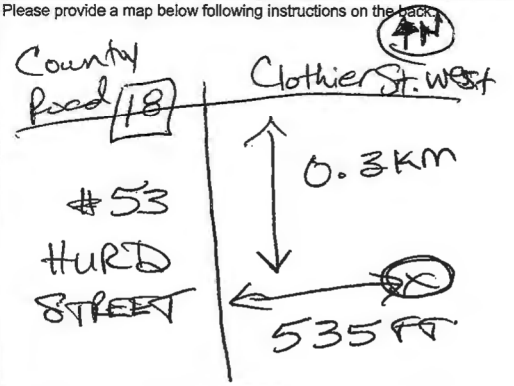
Well production (l/min/GPM): 20

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	7'9"		9.8"
1	9.6	1	8.1
2	9.6	2	7.9
3	9.6	3	7.9
4	9.7	4	7.9
5	9.7	5	7.9
10	9.7	10	7.9
15	9.8	15	7.9
20	9.8	20	7.9
25	9.8	25	7.9
30	9.8	30	7.9
40	9.8	40	7.9
50	9.8	50	7.9
60	9.8"	60	7.9"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 1/2HP-10 GPM Set @ 100 FT

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	7681

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
6659 Franktown Road	Richmond	ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted (Y Y Y Y M M D D)
6138382170	Hanna, Jeremy	T3632		2021 05 31

Well owner's information package delivered	Date Package Delivered (Y Y Y Y M M D D)	Well Work Completed (Y Y Y Y M M D D)
☒ Yes ☐ No	2021 05 19	2021 05 14

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Tag#: A318395 (Print Below)

A318395

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	12518791 Canada Inc		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
10278 Hyndman Road	Mountain	ON	K0E 1S0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
53 Hurd Street	Oxford on the Rideau	25	3

County/District/Municipality	City/Town/Village	Province	Postal Code
North Grenville	Kemptville	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	448497	4984028	TW# 3/3	

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Clay + Hard Pan + Gravel			0'	18'
Grey & Black	Limestone			18'	135'
Grey & Black	Limestone			135'	141'

Test Well #3 of 3

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
28'	18'	Neat cement	9.36
18'	0'	Bentonite slurry	12.6

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify ____

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify ____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2'	28'
6"	Open Hole		28'	141'

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water: Fresh / Untested / Other, specify
135'	☐	☒ Untested
	☐	☐ Fresh ☐ Untested
	☐	☐ Fresh ☐ Untested

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	28'	9 3/4"
28'	141'	6"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 130

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 13.2"

If flowing give rate (l/min/GPM): X

Recommended pump depth (m/ft): 100'

Recommended pump rate (l/min/GPM): 20

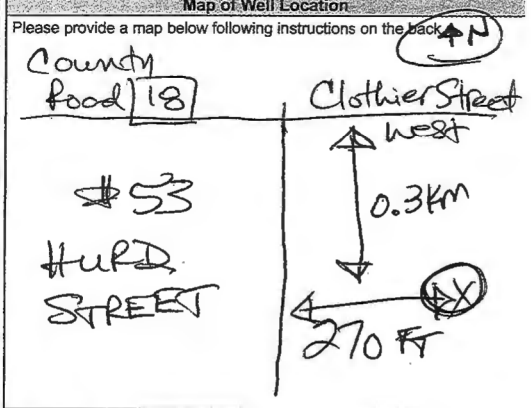
Well production (l/min/GPM): 20

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	10'1"		13.2"
1	12.7	1	11.7
2	12.7	2	10.1
3	12.8	3	10.1
4	12.9	4	10.1
5	12.9	5	10.1
10	13.2	10	10.1
15	13.2	15	10.1
20	13.2	20	10.1
25	13.2	25	10.1
30	13.2	30	10.1
40	13.2	40	10.1
50	13.2	50	10.1
60	13.2"	60	10.1"

Map of Well Location

Please provide a map below following instructions on the back.



Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	7681

Business Address (Street Number/Name)	Municipality
6859 Franktown Road	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138882170	Hanna, Jeremy

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted (Y Y Y Y M M D D)
T3632		2021 05 31

Comments: 1/2HR-10GPM Set @ 100 FT

Well owner's information package delivered	Date Package Delivered (Y Y Y Y M M D D)	Date Work Completed (Y Y Y Y M M D D)
☒ Yes ☐ No	2021 05 19	2021 05 14

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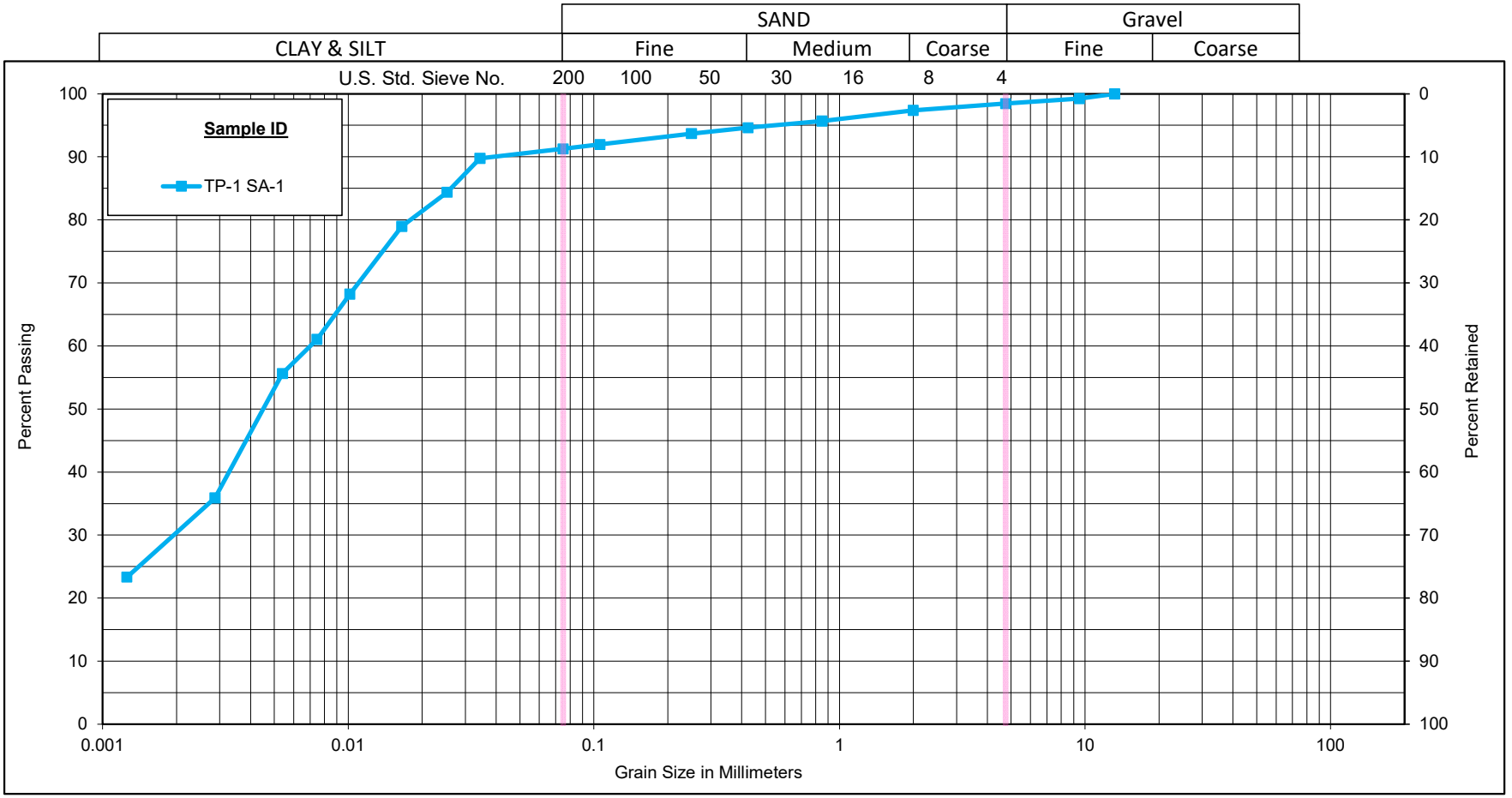
APPENDIX B

LABORATORY GRAIN SIZE DISTRIBUTION TESTING RESULTS

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
TP-1 SA-1	10'	1.6	7.1	62.3	29.0

Stantec

GRAIN SIZE DISTRIBUTION

Morey Associates, File #025025

Materials Testing

Figure No.

Project No. 121625580

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	**Morey Associates, File #025025**	Project No.:	**121625580**
Project:	**Materials Testing**	Test Method:	**LS702**
Material Type:	**Soil**	Sampled By:	**Morey Associates**
Source:	**TP-1**	Date Sampled:	**January 30, 2025**
Sample No.:	**SA-1**	Tested By:	**Brian Prevost**
Sample Depth	**10'**	Date Tested:	**March 4, 2025**

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	53.07
Sample Weight after Hydrometer and Wash (g)	3.35
Percent Passing No. 200 Sieve (%)	**93.7**
Percent Passing Corrected (%)	**91.22**

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	**262.10**
Sample Weight After Sieve (g)	**260.40**
Percent Loss in Sieve (%)	**0.65**

SOIL INFORMATION		
Liquid Limit (LL)		
Plasticity Index (PI)		
Soil Classification		
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	40	g

CALCULATION OF DRY SOIL MASS	
Oven Dried Mass (W_o), (g)	144.79
Air Dried Mass (W_a), (g)	145.10
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9979
Air Dried Mass in Analysis (M_a), (g)	53.18
Oven Dried Mass in Analysis (M_o), (g)	53.07
Percent Passing 2.0 mm Sieve (P_{10}), (%)	97.37
Sample Represented (W), (g)	54.50

SIEVE ANALYSIS		
Sieve Size mm	**Cum. Wt. Retained**	**Percent Passing**
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2	0.0	100.0
9.5	2.0	99.2
4.75	4.1	98.4
2.00	6.9	97.4
Total (C + F)[1]	260.40	
0.850	0.92	95.68
0.425	1.50	94.62
0.250	2.00	93.70
0.106	2.95	91.95
0.075	3.32	91.28
PAN	3.33	

Note 1: (C + F) = Coarse + Fine

HYDROMETER DETAILS	
Volume of Bulb (V_B), (cm^3)	63.3
Length of Bulb (L_2), (cm)	14.2
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.3
Scale Dimension (h_s), (cm/Div)	0.17
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

START TIME 9:41 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
04-Mar-25	9:42 AM	1	55.0	5.0	20.0	50.0	89.76	6.71798	10.09098	0.013286	0.03444
04-Mar-25	9:43 AM	2	52.0	5.0	20.0	47.0	84.37	7.22798	10.09098	0.013286	0.02526
04-Mar-25	9:46 AM	5	49.0	5.0	20.0	44.0	78.99	7.73798	10.09098	0.013286	0.01653
04-Mar-25	9:56 AM	15	43.0	5.0	20.0	38.0	68.22	8.75798	10.09098	0.013286	0.01015
04-Mar-25	10:11 AM	30	39.0	5.0	20.0	34.0	61.03	9.43798	10.09098	0.013286	0.00745
04-Mar-25	10:41 AM	60	36.0	5.0	20.0	31.0	55.65	9.94798	10.09098	0.013286	0.00541
04-Mar-25	1:51 PM	250	25.0	5.0	20.5	20.0	35.90	11.81798	9.96839	0.013205	0.00287
05-Mar-25	9:41 AM	1440	18.0	5.0	20.5	13.0	23.34	13.00798	9.96839	0.013205	0.00126

Remarks:

Reviewed By: Daniel Boateng

Date: March 5, 2025

APPENDIX C

COMPLETED TABLE 4.2 SLOPE STABILITY RATING CHART (EXCERPT FROM SECTION 4.3.2 OF THE MNR "TECHNICAL GUIDE - RIVER & STREAM SYSTEMS: EROSION HAZARD LIMIT")

TABLE 4.2 - SLOPE STABILITY RATING CHART

Site Location: *51 Hurd Street, Kemptville, ON* File No. *025025*

~~Property Owner:~~ Client *Lockwood Brothers Construction* ~~Inspection~~ Site Visits Date: *January to March, 2025*

~~Inspected~~ Site Visit By: *Morey Associates Ltd. technical staff* Weather: *Varied*

1.	**SLOPE INCLINATION**		
	degrees	**horiz. : vert.**	
	a) 18 or less	3 : 1 or flatter	0
	b) 18 - 26	2 : 1 to more than 3 : 1	6
	c) more than 26	steeper than 2 : 1	16
2.	**SOIL STRATIGRAPHY**		
	a) Shale, Limestone, Granite (Bedrock)		0
	b) Sand, Gravel		6
	c) Glacial Till		9
	d) Clay, Silt		12
	e) Fill		16
	f) Leda Clay		24
3.	**SEEPAGE FROM SLOPE FACE**		
	a) None or Near bottom only		0
	b) Near mid-slope only		6
	c) Near crest only or, From several levels		12
4.	**SLOPE HEIGHT**		
	a) 2 m or less		0
	b) 2.1 to 5 m		2
	c) 5.1 to 10 m		4
	d) more than 10 m		8
5.	**VEGETATION COVER ON SLOPE FACE**		
	a) Well vegetated; heavy shrubs or forested with mature trees		0
	b) Light vegetation; Mostly grass, weeds, occasional trees, shrubs		4
	c) No vegetation, bare		8
6.	**TABLE LAND DRAINAGE**		
	a) Table land flat, no apparent drainage over slope		0
	b) Minor drainage over slope, no active erosion		2
	c) Drainage over slope, active erosion, gullies		4
7.	**PROXIMITY OF WATERCOURSE TO SLOPE TOE**		
	a) 15 metres or more from slope toe		0
	b) Less than 15 metres from slope toe		6
8.	**PREVIOUS LANDSLIDE ACTIVITY**		
	a) No - no evidence of previous slope failures at proposed site development area		0
	b) Yes		6

SLOPE INSTABILITY RATING VALUES INVESTIGATION RATING SUMMARY **TOTAL** *26*

APPENDIX D

SITE PHOTOGRAPHS

Photograph 1: Subject slope with existing dwelling/covered deck in background, floodplain in foreground.
[Looking in project south direction]

Photograph 2: Crest of subject slope in foreground, floodplain in background with Kemptville Creek beyond.
[Looking in project north direction]

Photograph 3 [Google Street View Webiste – Nov.2024]: Existing dwelling/covered deck and subject slope [Looking in project east direction]

APPENDIX E

2015 NATIONAL BUILDING CODE SEISMIC HAZARD CALCULATION

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 45.010N 75.650W

2025-03-15 15:32 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.438	0.237	0.138	0.039
Sa (0.1)	0.511	0.288	0.175	0.055
Sa (0.2)	0.427	0.245	0.152	0.050
Sa (0.3)	0.323	0.187	0.118	0.041
Sa (0.5)	0.228	0.133	0.084	0.029
Sa (1.0)	0.113	0.067	0.043	0.015
Sa (2.0)	0.054	0.032	0.020	0.006
Sa (5.0)	0.014	0.008	0.005	0.001
Sa (10.0)	0.005	0.003	0.002	0.001
PGA (g)	0.273	0.156	0.096	0.029
PGV (m/s)	0.189	0.106	0.065	0.020

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information