

August 20, 2018

AG File No. 17546-1

2522082 Ontario Limited
581 Wellington Street West
Toronto, ON M5V 1G3

Attention: Mr. Andrew Iocobelli

**Ref: FINAL Slope Stability Investigation Report
The Reach Resort – 1315, 1329 and 1357 County Road 7
Prince Edward County**

Dear Sir:

Further to your request, we have completed our investigation and slope stability analysis for the above noted development and we are pleased to present our findings. The objectives of the assignment are:

- To investigate and determine the subsoil conditions of the existing embankment where it is proposed to construct new commercial structures as part of a resort development.
- To prepare a limited slope stability report detailing our findings and recommendations with respect to establishing a minimum setback from the embankment.

BACKGROUND AND SITE DESCRIPTION

A resort complex is being contemplated on lands in Prince Edward County at Civic Addresses 1315, 1329 and 1357 County Road No. 7. The site is located approximately 5 km east of Glenora on the south shore of Adolphus Reach. Based on a site plan provided to our office, structures will be constructed within the upper embankment slope on the north side of the site as well as along the top the embankment along the east side of the property. The embankment rises in height ranging between approximately 35 m and 43 m above Adolphus Reach below.

In general, the slope is densely vegetated with trees and bush. At the time of the site investigation, there was no evidence of slippage, erosion or soil cracking of the embankment surface and slope. A gravel driveway is present along the east side of the property and provides access along the upper north slope to an existing dwelling. An exposed bedrock face is present along the south side of the roadway and ranges in height between 5 meters and 30 meters. No evidence of rock instability was observed during our site visit.

A site location plan identifying the property location and the location of the test pits and overall topography is attached to this report as **Figure No. 1**. A portrayal of the proposed development is attached as **Figure No. 2**.

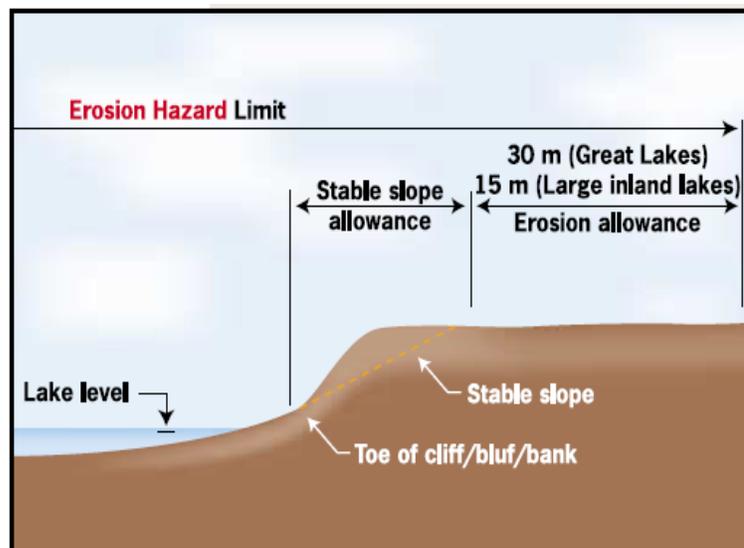
FIELDWORK/METHODOLOGY

The field program consisted of excavating a total of eight (8) test pits along the top of the existing embankment in the general area identified for construction of proposed resort style cabins. The test pits were excavated to depths ranging between 0.45 m and 0.75 m below existing grades using a rubber tire backhoe. The test pits were logged in the field under the supervision of qualified geotechnical personnel. All field work was completed on May 9, 2018.

To aid in the slope stability study, the publication ‘Great Lakes – St. Lawrence River System and Large Inland Lakes: Technical Guides for Flooding, Erosion and Dynamic Beaches in support of Natural hazards Policies’ prepared by MNR (2001) was used as a basis. The publication provides direction regarding erosion hazards on erosion prone shorelines. Two main components are considered during any slope stability or erosion hazard study, namely:

- Stable slope allowance: The stable slope allowance is the horizontal distance measured landward from the toe of the shoreline cliff, bluff or bank that is three times the height of the cliff, bank or bluff (for soil slopes) or one times the height for bedrock cliffs, banks or bluffs. This distance can also be determined using geotechnical engineering studies to determine the existing slope stability.
- Average annual recession: The recession rate average for the site where there is at least 35 years or reliable recession information.
- Erosion allowance: Where there is no reliable recession information, the province suggests a setback distance to allow for erosion along the shoreline.

The following sketch depicts the various components under consideration:



SITE AND SUBSURFACE CONDITIONS

Full details of the subsurface conditions encountered at the test pit locations are presented on the individual test pit logs attached as **Enclosure No. 1**. It is emphasized however, that the soil types, their sequence, thickness and physical properties may vary between test locations and samples both vertically and horizontally.

Representative samples of the subsoil materials encountered within the test pits were collected and returned to our office for further visual review.

In general, the typical subsoil encountered in the test pit locations consisted of a surficial layer of topsoil overlying compact silty sand with gravel and cobbles (range 0.18 m to 0.4 m thickness) overlying limestone bedrock. The limestone bedrock was encountered at depths ranging between 0.25 m and 0.5 m below existing grade. The limestone bedrock was weathered (and excavated with the backhoe) for an average depth of 0.25 m.

Groundwater infiltration was not observed during the test pit investigation.

SLOPE STABILITY ASSESSMENT

Topographic survey data utilized for the assessment was provided by the Client (Blumetric Environmental CAD file). Three sections were analyzed to determine the factor of safety in terms of slope stability. The sections locations (A, B and C) are shown on **Figure No. 2**. Slope sections for each of Sections A, B and C are shown on **Figure No. 3**. The analysis was completed using a two-dimensional slope stability modelling program employing the Simplified Bishop Method. Based on our site observations and test pit program, the analysis was completed assuming the entire embankment is composed of limestone bedrock due to the very shallow overburden soils. The following bedrock parameters were used in the slope analysis:

Density:	26 kN/m ³
Cohesion:	1000 kPa
Friction Angle:	33 degrees

SECTION A-A

This section represents an area where buildings will be constructed on the embankment slope immediately beneath the top of the embankment. Entrance to the cabins will be from the upper level of the embankment and the structures will be founded on piles advanced into the bedrock slope.

The lowest Factor of Safety for this section was determined to be 31.3. For the purposes of this study, a Factor of Safety over 1.5 is considered to represent a slope with acceptable, long term stability.

Stable Slope Allowance

Based on a projected 1H:1V stable slope (applicable for bedrock embankment) from the toe of slope at the water level to the first landward break of the embankment where the proposed structure is located, the stable slope allowance is determined as 27 m measured from the toe of slope at the lake level (or 4 m from the first landward break).

Erosion Allowance

Based on a bedrock embankment, a minimum erosion allowance setback of 0 m is considered suitable. However, an erosion access allowance of 6 m is recommended measured from the edge of the stable slope allowance location (27 m from the toe of slope at the lake level) to the face of any structure (buildings). This setback will allow equipment access should any remedial repairs to the slope be necessary.

Setback Distance

The recommended setback distance is determined to be 33 m measured from the toe of slope at the lake level (or 10 m from the edge of the first landward break) as depicted on **Figure No. 2**.

SECTION B-B

This section represents an area where buildings will be constructed on the embankment slope above and south of the existing gravel driveway. Entrance to the cabins will be from the most upper level of the embankment and the structures will be founded on piles advanced into the bedrock slope.

The lowest Factor of Safety for this section was determined to be 39.0. For the purposes of this study, a Factor of Safety over 1.5 is considered to represent a slope with acceptable, long term stability.

Stable Slope Allowance

Based on a projected 1H:1V stable slope (applicable for bedrock embankment) from the toe of slope at the water level to the first landward break, the stable slope allowance is determined to be equal to the horizontal distance from the water level to a location within the first landward break of the embankment. Throughout this location, the distance varies due to the nature of the shoreline at the lake level. For ease of measurement, the north edge of the existing gravel driveway should be taken as the stable slope allowance distance from the toe of slope at the lake level.

Erosion Allowance

Based on a bedrock embankment, a minimum erosion allowance setback of 0 m is considered suitable. However, an erosion access allowance of 6 m is recommended measured from the north edge of the existing gravel driveway to the face of any structure (buildings). This setback will allow equipment access should any remedial repairs to the slope be necessary.

Setback Distance

The recommended setback distance is determined to be 6.0 m measured from the north edge of the existing driveway as depicted on **Figure No. 2**.

SECTION C-C

This section represents an area where buildings will be constructed along the west side of the existing gravel driveway on top of the existing embankment.

The lowest Factor of Safety for this section was determined to be 43.6. For the purposes of this study, a Factor of Safety over 1.5 is considered to represent a slope with acceptable, long term stability.

Stable Slope Allowance

Based on a projected 1H:1V stable slope (applicable for bedrock embankment) from the toe of slope at the water level to the first landward break, the stable slope allowance is determined to be equal to the horizontal distance from the water level to a location within the first landward break of the embankment. Throughout this location, the distance varies due to the nature of the shoreline at the lake level. For ease of measurement, the east edge of the existing gravel driveway should be taken as the stable slope allowance distance from the toe of slope at the lake level.

Erosion Allowance

Based on a bedrock embankment, a minimum erosion allowance setback of 0 m is considered suitable. However, an erosion access allowance of 6 m is recommended measured from the edge of the existing embankment to the face of any structure (buildings). This setback will allow equipment access should any remedial repairs to the slope be necessary.

Setback Distance

The recommended setback distance is determined to be 6.0 m measured from the east edge of the existing driveway as depicted on **Figure No. 2**.

Site Drainage Control

It is recommended that drainage of the developed site be designed such that sheet flow over the embankment be minimized by directing water flow away from the embankment. The existing vegetation on the embankment should remain in place as much as possible and not be disturbed during development of the site.

CLOSURE

The Limitations of Report attached, form an integral part of this report. It is recommended that Ainley Group be retained to provide a general overview of the final design elements of the development to verify the correct interpretation and findings of this report.

We trust the above information meets your needs at this time and should you have any questions or concerns, please do not hesitate to contact our office.

Yours very truly,

AINLEY GRAHAM & ASSOCIATES LIMITED



Bill McLatchie, P.Eng.
Senior Geotechnical Engineer

cc. Mike Keene, Fotenn

Limitations of Report

The conclusions and recommendations given in this report are based on information determined at the test pit locations. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the boreholes.

The comments made in this report are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all factors that may affect construction methods and costs. The contractors bidding on this project or undertaking the construction should therefore make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

This report has been prepared for design purposes, for the sole use of the named Client. Any uses, which a Third Party makes of this report, or any reliance or decisions to be made based on it, are the responsibilities of said Third Parties. Ainley Group accepts no responsibility for damages if any, suffered by any Third Party as a result of decisions made or actions based on this report.



KEY MAP
N.T.S.



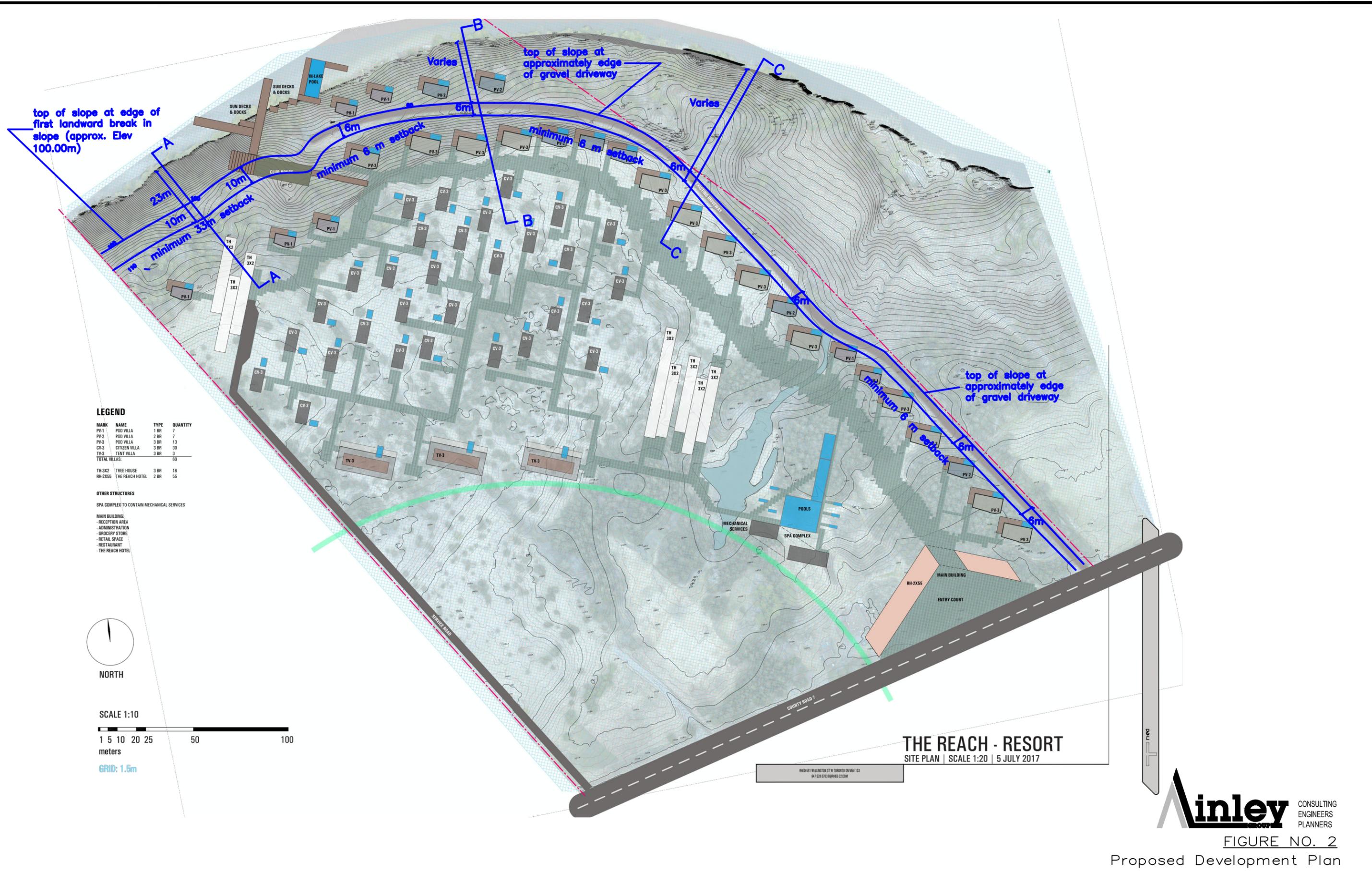
TEST PIT DATA				
ID	TOP OF GRADE ELEVATION (masl)	WEATHERED BEDROCK ELEVATION (masl)	SOUND BEDROCK ELEVATION (masl)	ENCOUNTERED GROUNDWATER ELEVATION (masl)
TP1	116.44	116.04	115.74	NE
TP2	115.95	115.60	115.30	NE
TP3	115.23	114.98	114.73	NE
TP4	114.32	114.07	113.82	NE
TP5	112.55	112.25	112.10	NE
TP6	110.73	110.23	109.98	NE
TP7	108.51	108.16	107.96	NE
TP8	108.45	108.10	107.70	NE

LEGEND

- ⊕ = TEST PIT LOCATION
- NE = FEATURE NOT ENCOUNTERED



FIGURE NO. 1
SITE AND TEST PIT LOCATION PLAN



LEGEND

MARK	NAME	TYPE	QUANTITY
PV-1	POD VILLA	1 BR	7
PV-2	POD VILLA	2 BR	7
PV-3	POD VILLA	3 BR	13
CV-3	CITIZEN VILLA	3 BR	30
TV-3	TENT VILLA	3 BR	3
TOTAL VILLAS:			60
TH-3X2	TREE HOUSE	3 BR	16
RH-2X55	THE REACH HOTEL	2 BR	55

- OTHER STRUCTURES**
- SPA COMPLEX TO CONTAIN MECHANICAL SERVICES
 - MAIN BUILDING:
 - RECEPTION AREA
 - ADMINISTRATION
 - GROCERY STORE
 - RETAIL SPACE
 - RESTAURANT
 - THE REACH HOTEL



SCALE 1:10



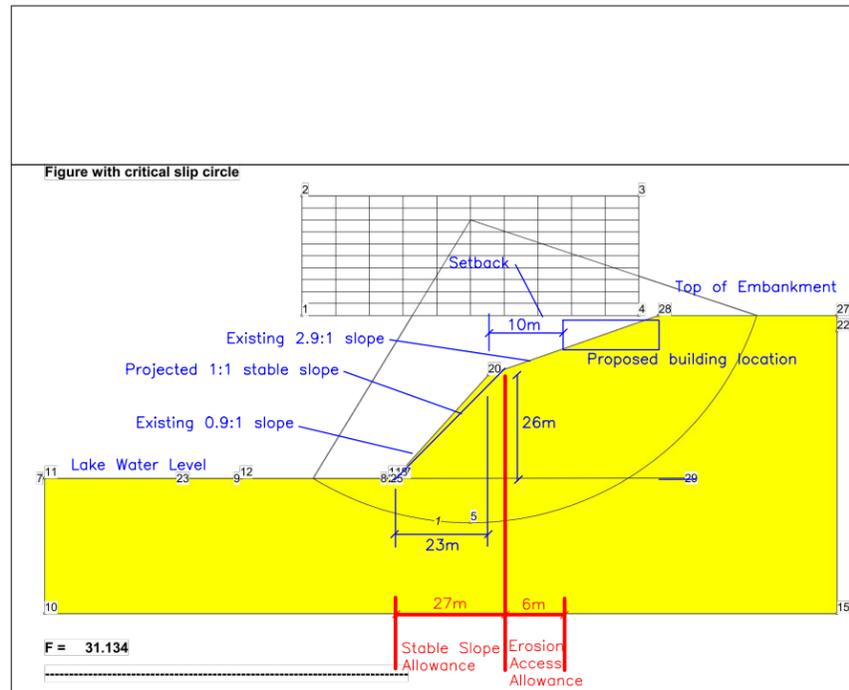
GRID: 1.5m

THE REACH - RESORT
 SITE PLAN | SCALE 1:20 | 5 JULY 2017

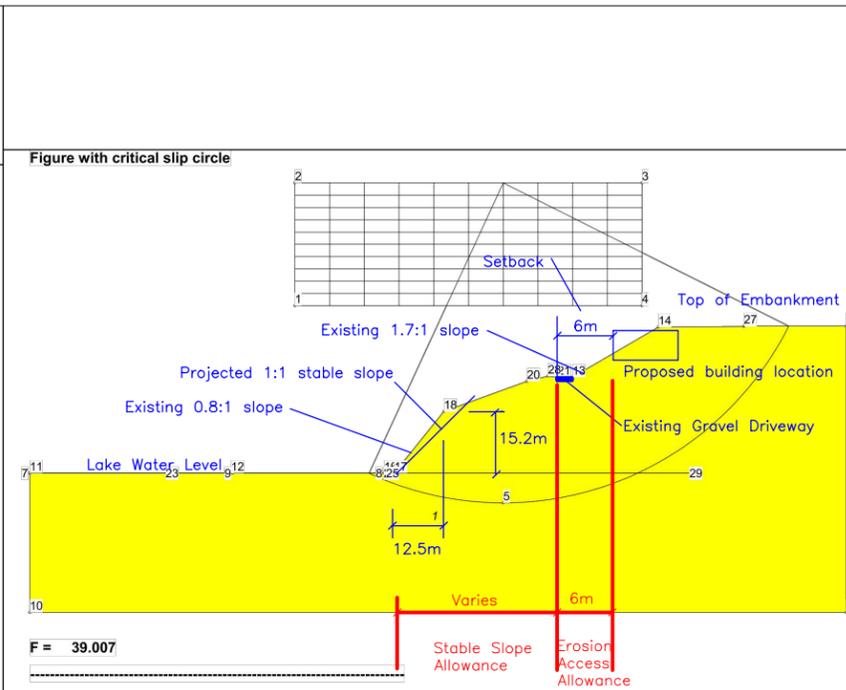
1000 WEST WILKINSON ST W TORONTO ON M6P 1G3
 416 593 8783 DR@INLEY-CP.COM



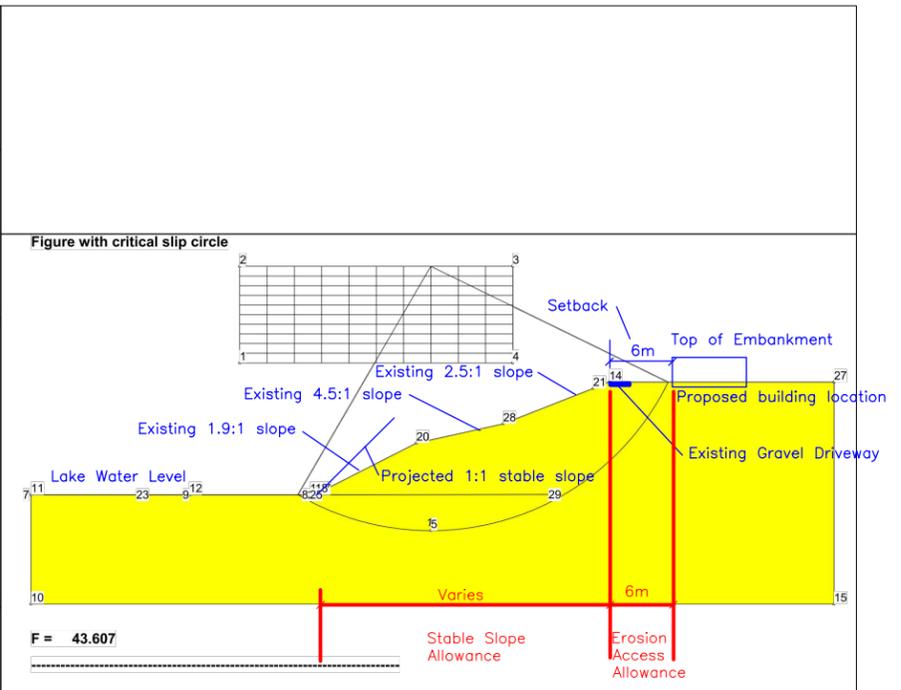
FIGURE NO. 2
 Proposed Development Plan



Section A-A
NTS



Section B-B
NTS



Section C-C
NTS



Ainley Group
 1-50 Grant Timmins Drive
 Kingston, Ontario
 K7M 8N2

Log of Test Pit: TP4

Project No.: 17546-1

Project: The Reach Resort

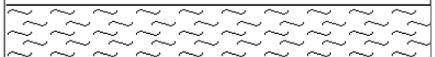
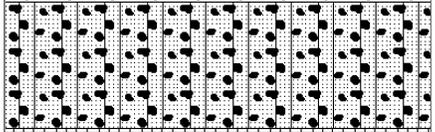
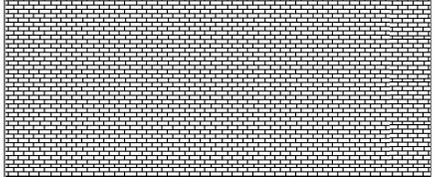
Client: 2522082 Ontario Limited

Location: 1357 County Road 7, Prince Edward County, Ontario

Ground Elevation (masl): 114.32

Water Elevation (masl): NA

Depth to Water (m): NA

SUBSURFACE PROFILE			SAMPLE		Groundwater	Symbol Log
Depth	Elevation	Description	Number	Type		
0	0.00	Ground Surface				
	0.07	Topsoil Silty sand with gravel and rootlets, brown.				
	0.25	Silty Sand Silty sand with gravel and cobbles, compact, brown.				
	0.50	Weathered Limestone Bedrock				
2		End of test pit at 0.50 m below existing site grades on Limestone Bedrock. Note: Groundwater infiltration was not encountered during the test pit investigation.				
4						

Excavated By: Drew Harrison Haulage

Excavation Method: Rubber Tire Backhoe

Excavation Date: May 9, 2018

Project Engineer: Lois-Ann Hayes, P.Eng

Project Technician: Joshua Charlton

Sheet: 1 of 1



Ainley Group
 1-50 Grant Timmins Drive
 Kingston, Ontario
 K7M 8N2

Log of Test Pit: TP5

Project No.: 17546-1

Project: The Reach Resort

Client: 2522082 Ontario Limited

Location: 1357 County Road 7, Prince Edward County, Ontario

Ground Elevation (masl): 112.55

Water Elevation (masl): NA

Depth to Water (m): NA

SUBSURFACE PROFILE			SAMPLE		Groundwater	Symbol Log
Depth	Elevation	Description	Number	Type		
0	0.00	Ground Surface				
	0.07	Topsoil Silty sand with gravel and rootlets, brown.				
	0.30	Silty Sand Silty sand with gravel and cobbles, compact, brown.				
	0.45	Weathered Limestone Bedrock				
2		End of test pit at 0.45 m below existing site grades on Limestone Bedrock. Note: Groundwater infiltration was not encountered during the test pit investigation.				
4						

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