PATERSON GROUP

memorandum

re: **Retaining Wall Global Stability Analysis**
Proposed Retaining Walls
1009 Trim Road – Ottawa, Ontario

to: **Mr. John Smit** - john.smit@rogers.com

to: Starwood – **Mr. Martin Chénier** - chenierm@live.ca

date: May 30, 2025

file: PG5336-MEMO.07

Further to your request and authorization, Paterson Group (Paterson) prepared the current memorandum to provide the results of the global stability analysis for the proposed retaining wall structures to be located at the aforementioned site. This memorandum should be read in conjunction with Paterson Group Report PG5336-1 Revision 4, dated May 30, 2025.

The following drawing was reviewed as part of the global stability analysis:

- Drawing C200 – Site Grading Plan, Revision 2, dated March 25, 2024, prepared by EXP.

The following sections provide a summary of the global stability analysis and our associated conclusions.

1.0 Proposed Development

Based on the review of the drawings provided by the client, the proposed complex will consist of four high rise residential buildings. It is understood that each tower will be constructed over a common podium consisting of an underground parking structure founded over a pile foundation bearing on bedrock. Retaining walls with heights greater than 1 m are proposed to retain the surrounding landscaped areas to the north and east of the subject site.

It is understood that the retaining wall will be located outside the limits of the underground parking structure.

2.0 Field Observations

Surface Conditions

The subject site expected to be raised significantly along the northern portion of the site.

Based on the grading plan provided by the client, it is understood that Armor stone retaining walls will be used to raise the grade along this area.

The ground surface within the subject site slopes down gradually towards the northern portion of the site. The northern portion of the site is wet land from the Ottawa River. The site is bordered to the north by the Ottawa River, to the east by vacant treed land, to the west by Tweddle Road, and to the south by Trim Road.

Subsurface Conditions

Generally, the subsurface profile at the test hole locations consists of topsoil underlain by a fill consisting of silty sand mixed with clay and/or gravel. Fill consisting of boulders and blast rock were also noted on site. A very stiff brown silty clay deposit was encountered under the fill layer. The brown silty clay was underlain by a stiff grey silty clay layer. Practical refusal to DCPT was encountered in BH3 and BH4 between 34.0 and 41.8 m below existing grade.

Bedrock

Based on available geological mapping, the subject site is located in an area where the bedrock consists of interbedded limestone and dolomite of the Gull River formation. The overburden drift thickness is estimated to be between 20 to 35 m.

Groundwater

Based on our review of the recovered soil samples from the geotechnical filed investigation completed between June 29 to July 2, 2020, the long-term groundwater level is expected to be at a depth ranging between 4 to 5 m below existing ground surface.

It is further understood that the proposed flood line elevation along the north side of the site facing Ottawa River is 45.00 m.

3.0 Global Stability Analysis

Three (3) cross-sections, considered as the “worst case” scenario, has been analyzed for global stability, where the proposed slope and/or retaining walls have more than 2m height. The location of the cross-section is shown on the attached drawing.

The analysis of global stability was carried out using SLIDE, a computer program that permits a two-dimensional global stability analysis using several methods, including the Bishop’s method, which is a widely used and accepted analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to those favouring failure.

Theoretically, a factor of safety (FS) of 1.0 represents a condition where the structure is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsoil and groundwater conditions, a factor of safety greater than one is usually required to ascertain that the risks of failure are acceptable. A minimum factor of safety of 1.5 is generally recommended for static analysis conditions, and a minimum FS of 1.1 is generally recommended for seismic analysis conditions, where the failure of the retaining wall would endanger permanent structures.

Static Loading Analysis

The effective strength soil parameters used for static analysis were chosen based on our experience in the area and general values provided in the City of Ottawa's "Slope Stability Guidelines for Development Applications". The effective strength soil parameters used for static analysis are presented in Table 1 on next page.

Table 1 – Effective Strength Soil and Material Parameters (Static Analysis)

Soil Layer	Unit Weight (kN/m^3)	Friction Angle (degrees)	Cohesion (kPa)
Engineered Fill	22	38	0
Brown Silty Clay Fill	16	1	33
Brown Silty Clay Native	16	10	33
Grey Silty Clay Native	16	7	27
Existing Fill	18	2	28
Lightweight Fill	0.15	18	5

The results of the static loading analysis at Section A-A, Section B-B and Section C-C are shown below. The factor of safety was found to exceed 1.5 under static conditions. Accordingly, the proposed slopes and retaining walls are considered to be stable under static loading.

Seismic Loading Analysis

The total strength soil parameters used for seismic analysis were chosen based on our experience in the area and general values provided in the City of Ottawa's "Slope Stability Guidelines for Development Applications". A horizontal acceleration of 0.20g was applied for the retaining walls under seismic conditions, in accordance with OBC 2024.

The strength soil parameters used for seismic analysis are presented in Table 2 below.

Table 2 – Total Strength Soil and Material Parameters (Seismic Analysis)

Soil Layer	Unit Weight (kN/m^3)	Friction Angle (degrees)	Undrained Shear Strength (kPa)
Engineered Fill	22	38	0
Brown Silty clay	16	-	50
Brown Silty Clay Native	16	-	150
Grey Silty Clay Native	16	-	100
Existing Fill	18	2	28
Lightweight Fill	0.15	18	5

The results of the seismic loading analysis at Section A-A, Section B-B and Section C-C are shown below. The factor of safety was found to exceed 1.1 under seismic conditions. Accordingly, the proposed retaining wall is considered to be stable under seismic loading, from a global stability perspective.

4.0 Conclusions

As a result of global stability analysis performed using SLIDE, the proposed retaining walls associated with the development building at the subject site greater than 1 m in height, were analyzed and had factors of safety exceeding 1.5 under static conditions and 1.1 under seismic conditions, respectively.

As such, the proposed retaining walls are considered stable from a global stability perspective.

It is highly recommended that proper drainage system, such as perforated pipe, be provided at the rear of the retaining walls to prevent the hydrostatic pressure build-up behind the retaining walls.

We trust that the current submission meets your immediate requirements.

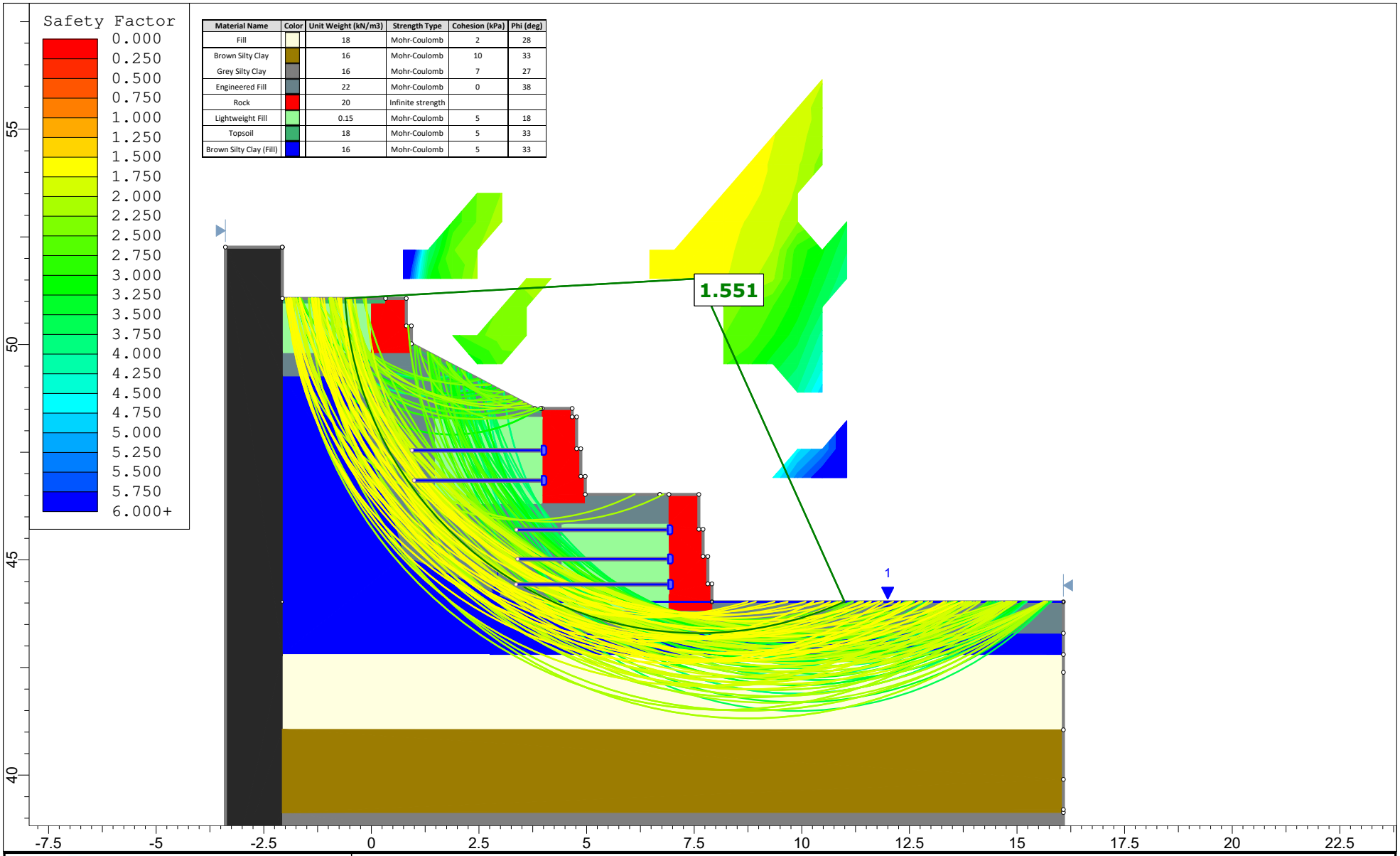
Best Regards,

Paterson Group Inc.

Pratheep Thirumoolan, M.Eng. Joey R. Villeneuve, M.A.Sc., P.Eng., ing.

Attachments:

- ❒ Figures 1 to 6 – Global Stability Analysis Under Static & Seismic Condition
- ❒ Markup Site Plan



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Fill		18	Mohr-Coulomb	2	28
Brown Silty Clay		16	Mohr-Coulomb	10	33
Grey Silty Clay		16	Mohr-Coulomb	7	27
Engineered Fill		22	Mohr-Coulomb	0	38
Rock		20	Infinite strength		
Lightweight Fill		0.15	Mohr-Coulomb	5	18
Topsoil		18	Mohr-Coulomb	5	33
Brown Silty Clay (Fill)		16	Mohr-Coulomb	5	33

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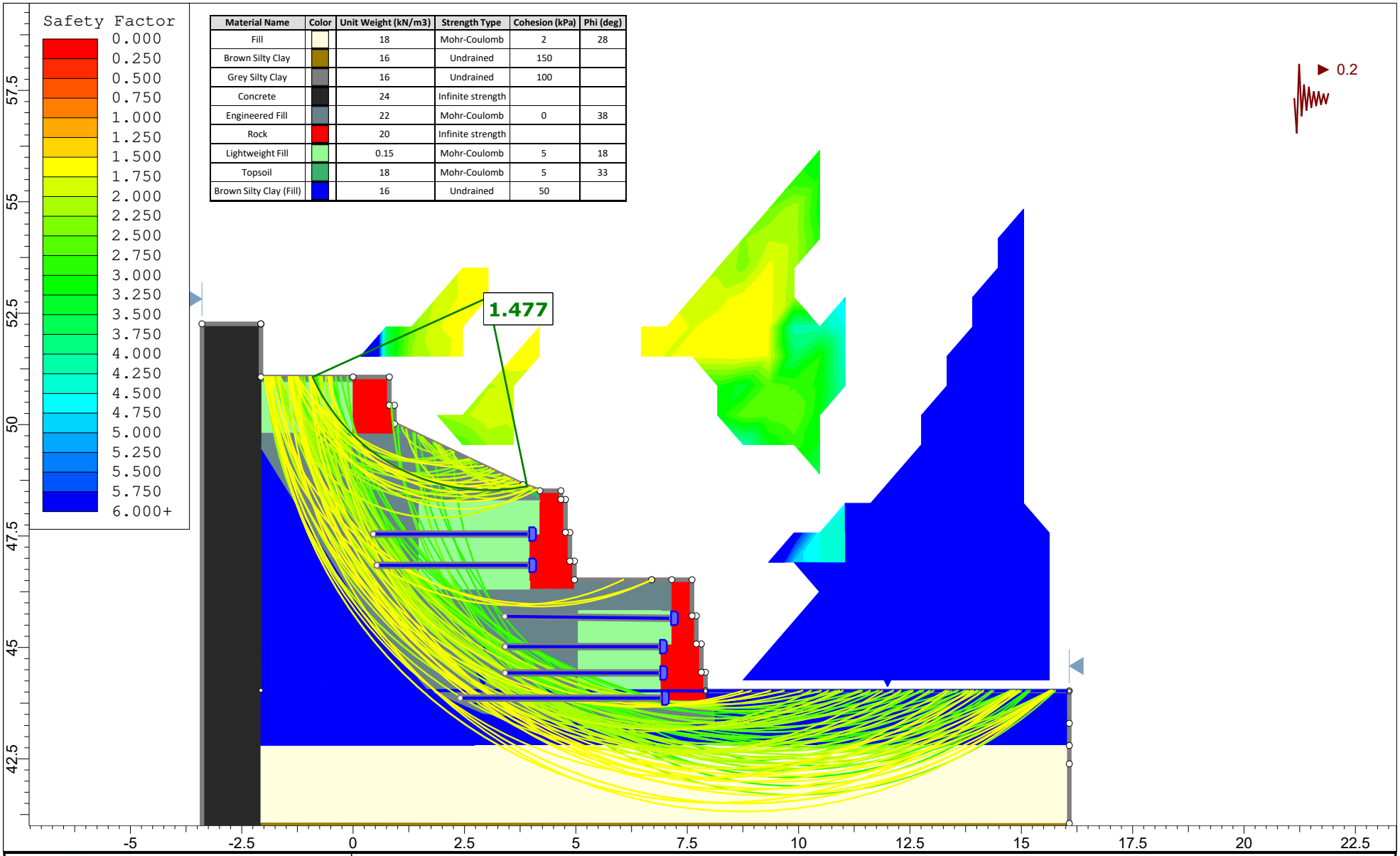
Project	**Starwood Group Inc.**		
Figure No.	**Retaining Wall Section A-A - Static Conditions**		
Drawn By	Pratheep Thirumoolan	***Comany***	Paterson Group
Date	30/05/2025	***File Name***	1009 Trim Road - Retaining Wall Global Stability



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Fill		18	Mohr-Coulomb	2	28
Brown Silty Clay		16	Undrained	150	
Grey Silty Clay		16	Undrained	100	
Concrete		24	Infinite strength		
Engineered Fill		22	Mohr-Coulomb	0	38
Rock		20	Infinite strength		
Lightweight Fill		0.15	Mohr-Coulomb	5	18
Topsoil		18	Mohr-Coulomb	5	33
Brown Silty Clay (Fill)		16	Undrained	50	

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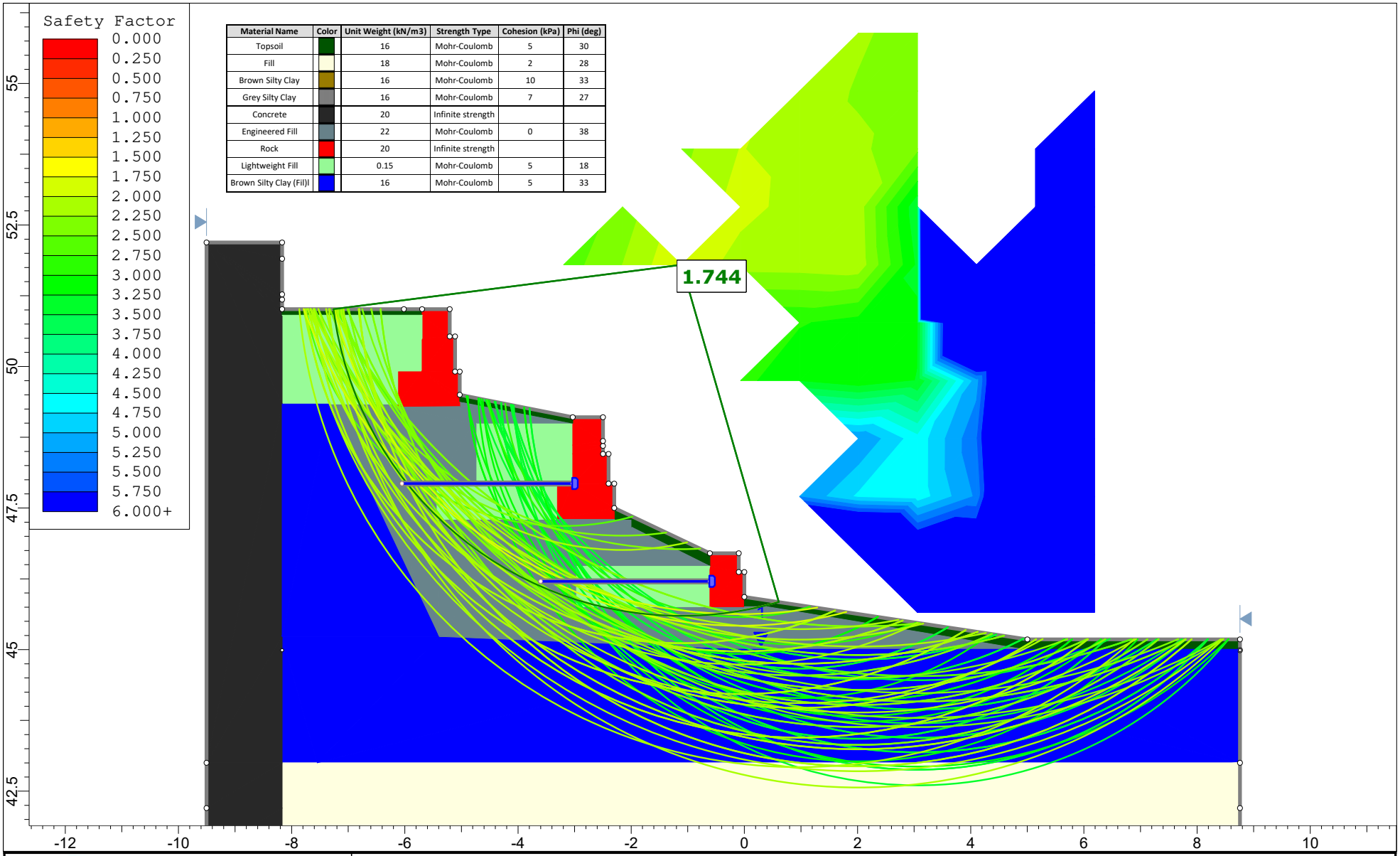
Project	**Starwood Group Inc.**		
Figure No.	**Retaining Wall Section A-A - Seismic Conditions**		
Drawn By	Pratheep Thirumoolan	***Comany***	Paterson Group
Date	30/05/2025	***File Name***	1009 Trim Road - Retaining Wall Global Stability



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Topsoil		16	Mohr-Coulomb	5	30
Fill		18	Mohr-Coulomb	2	28
Brown Silty Clay		16	Mohr-Coulomb	10	33
Grey Silty Clay		16	Mohr-Coulomb	7	27
Concrete		20	Infinite strength		
Engineered Fill		22	Mohr-Coulomb	0	38
Rock		20	Infinite strength		
Lightweight Fill		0.15	Mohr-Coulomb	5	18
Brown Silty Clay (Fil)l		16	Mohr-Coulomb	5	33

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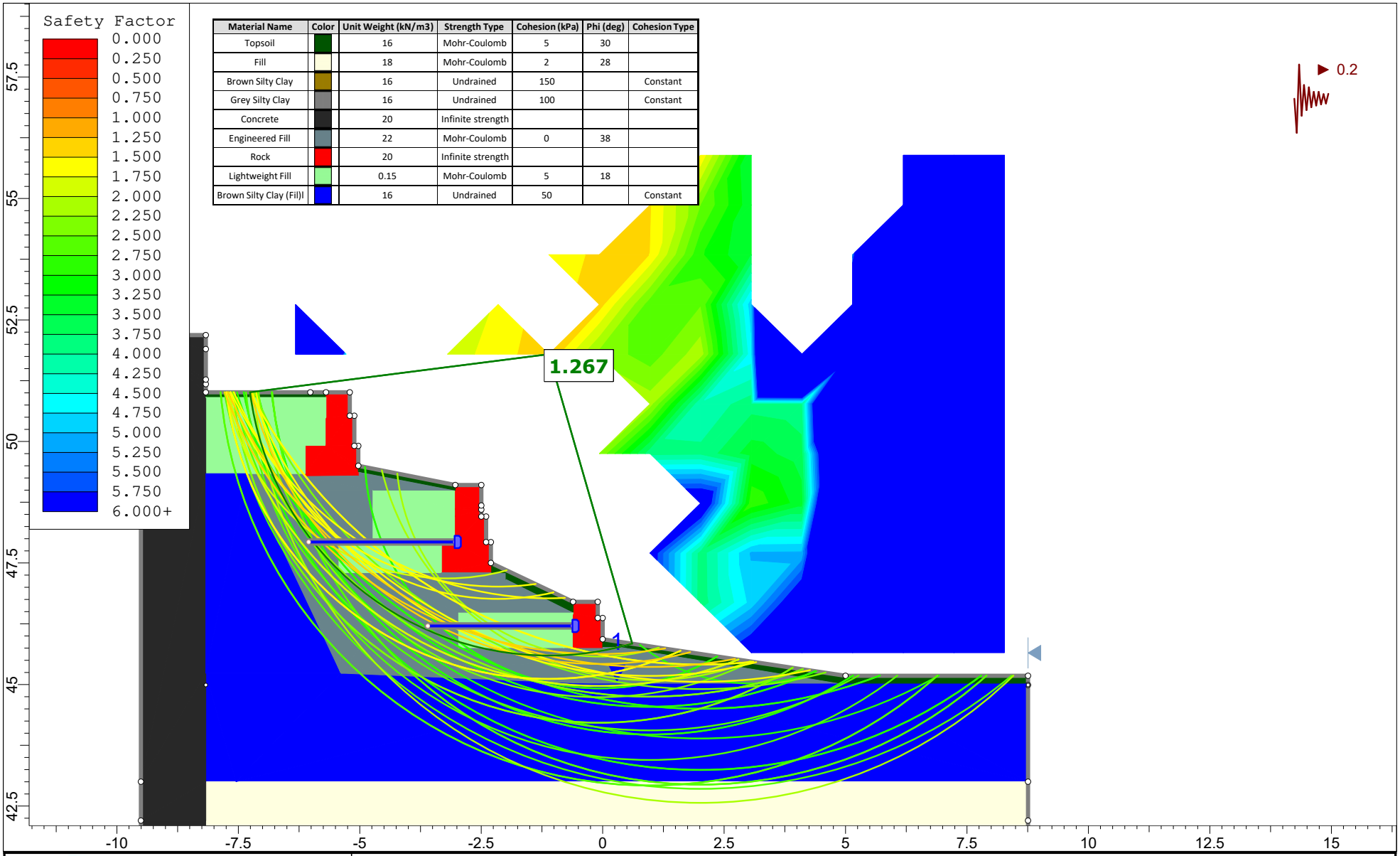
Project	**Starwood Group Inc.**		
Figure No.	**Retaining Wall Section B-B - Static Conditions**		
Drawn By	Pratheep Thirumoolan	***Comany***	Paterson Group
Date	30/05/2025	***File Name***	1009 Trim Road - Retaining Wall Global Stability



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type
Topsoil		16	Mohr-Coulomb	5	30	
Fill		18	Mohr-Coulomb	2	28	
Brown Silty Clay		16	Undrained	150		Constant
Grey Silty Clay		16	Undrained	100		Constant
Concrete		20	Infinite strength			
Engineered Fill		22	Mohr-Coulomb	0	38	
Rock		20	Infinite strength			
Lightweight Fill		0.15	Mohr-Coulomb	5	18	
Brown Silty Clay (Fil)l		16	Undrained	50		Constant

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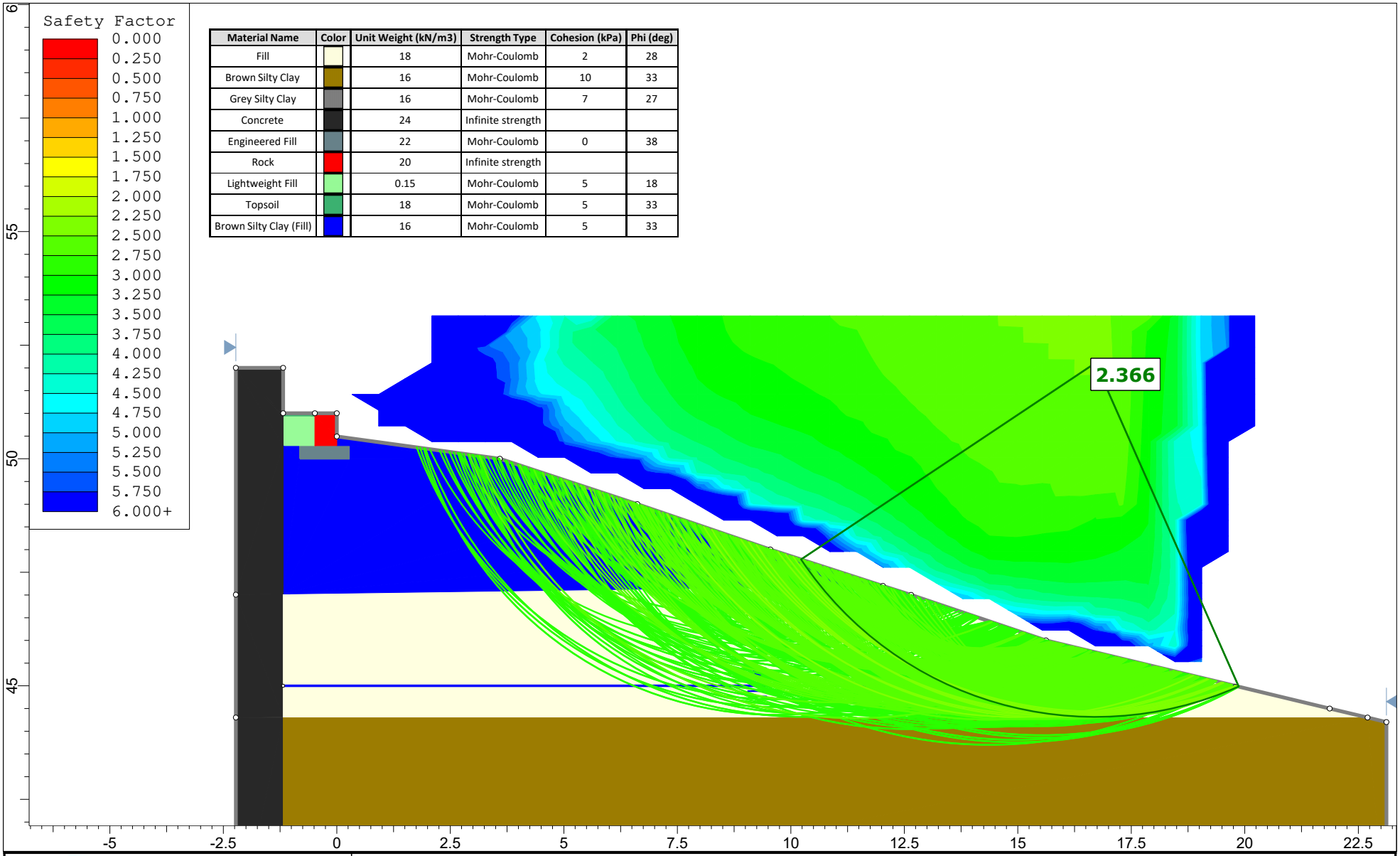
Project	**Starwood Group Inc.**		
Figure No.	**Retaining Wall Section B-B - Seismic Conditions**		
Drawn By	Pratheep Thirumoolan	***Comany***	Paterson Group
Date	30/05/2025	***File Name***	1009 Trim Road - Retaining Wall Global Stability



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Fill		18	Mohr-Coulomb	2	28
Brown Silty Clay		16	Mohr-Coulomb	10	33
Grey Silty Clay		16	Mohr-Coulomb	7	27
Concrete		24	Infinite strength		
Engineered Fill		22	Mohr-Coulomb	0	38
Rock		20	Infinite strength		
Lightweight Fill		0.15	Mohr-Coulomb	5	18
Topsoil		18	Mohr-Coulomb	5	33
Brown Silty Clay (Fill)		16	Mohr-Coulomb	5	33

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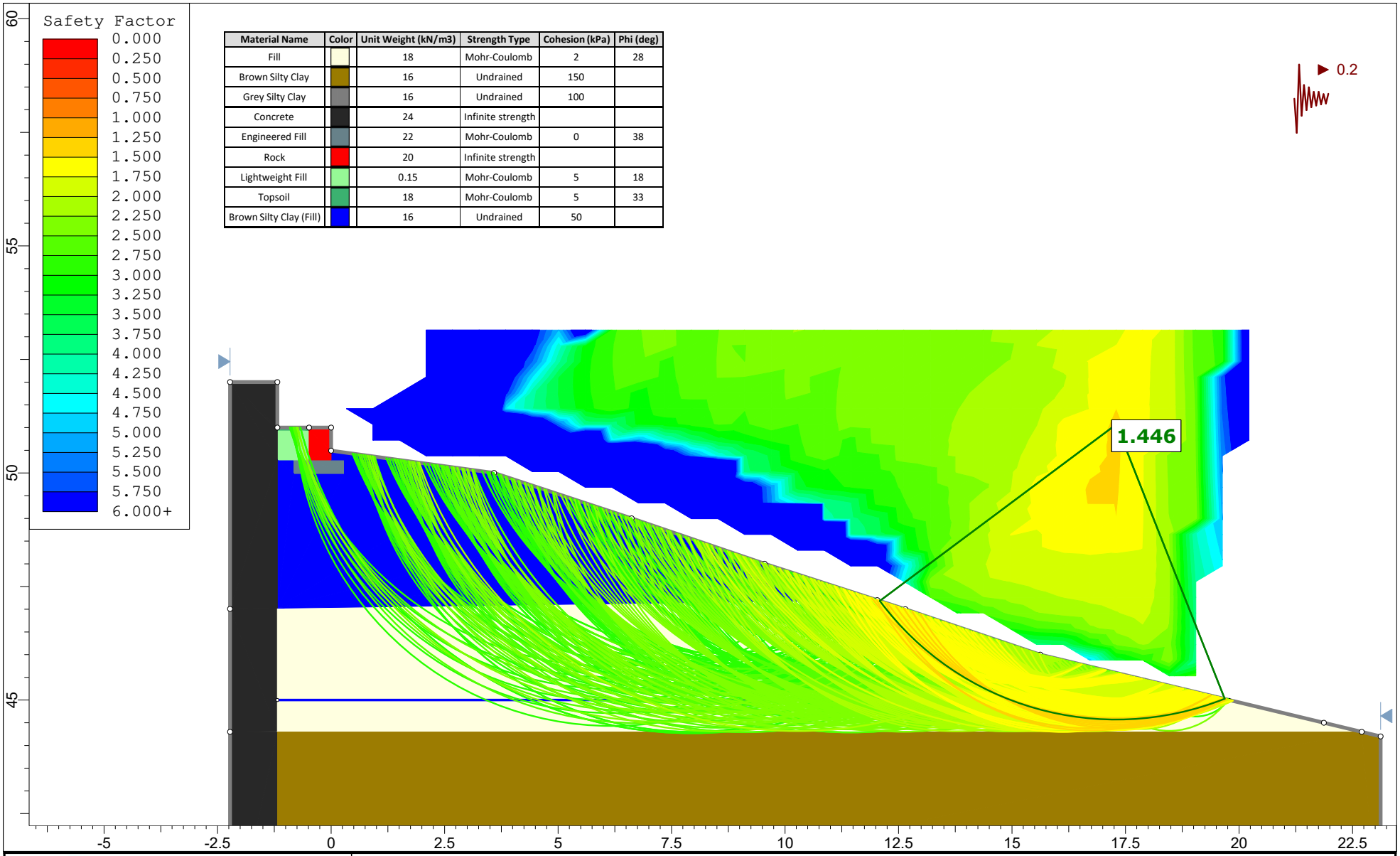
Project	**Starwood Group Inc.**		
Figure No.	**Retaining Wall Section C-C - Static Conditions**		
Drawn By	Pratheep Thirumoolan	***Comany***	Paterson Group
Date	30/05/2025	***File Name***	1009 Trim Road - Retaining Wall Global Stability



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Fill		18	Mohr-Coulomb	2	28
Brown Silty Clay		16	Undrained	150	
Grey Silty Clay		16	Undrained	100	
Concrete		24	Infinite strength		
Engineered Fill		22	Mohr-Coulomb	0	38
Rock		20	Infinite strength		
Lightweight Fill		0.15	Mohr-Coulomb	5	18
Topsoil		18	Mohr-Coulomb	5	33
Brown Silty Clay (Fill)		16	Undrained	50	

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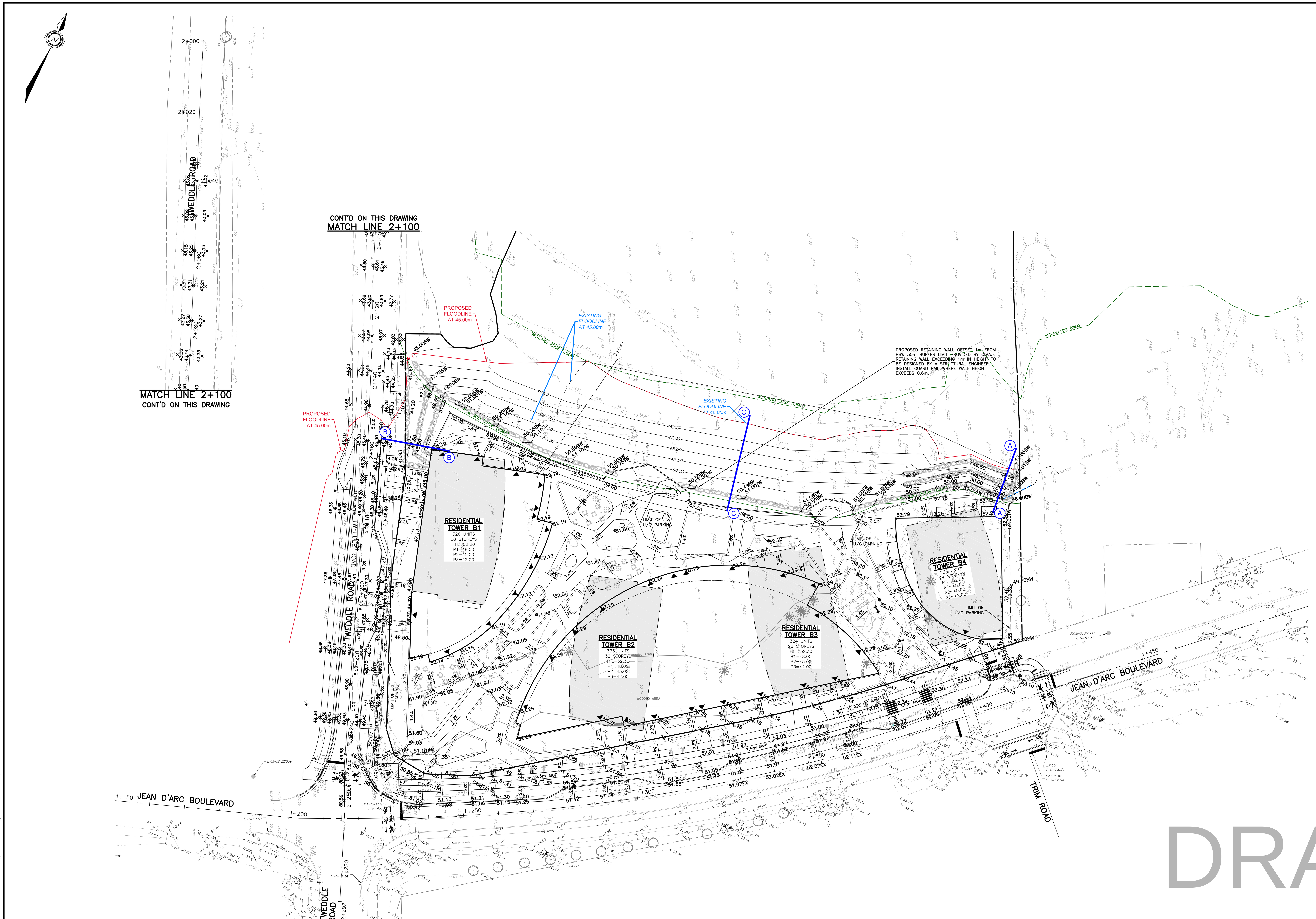
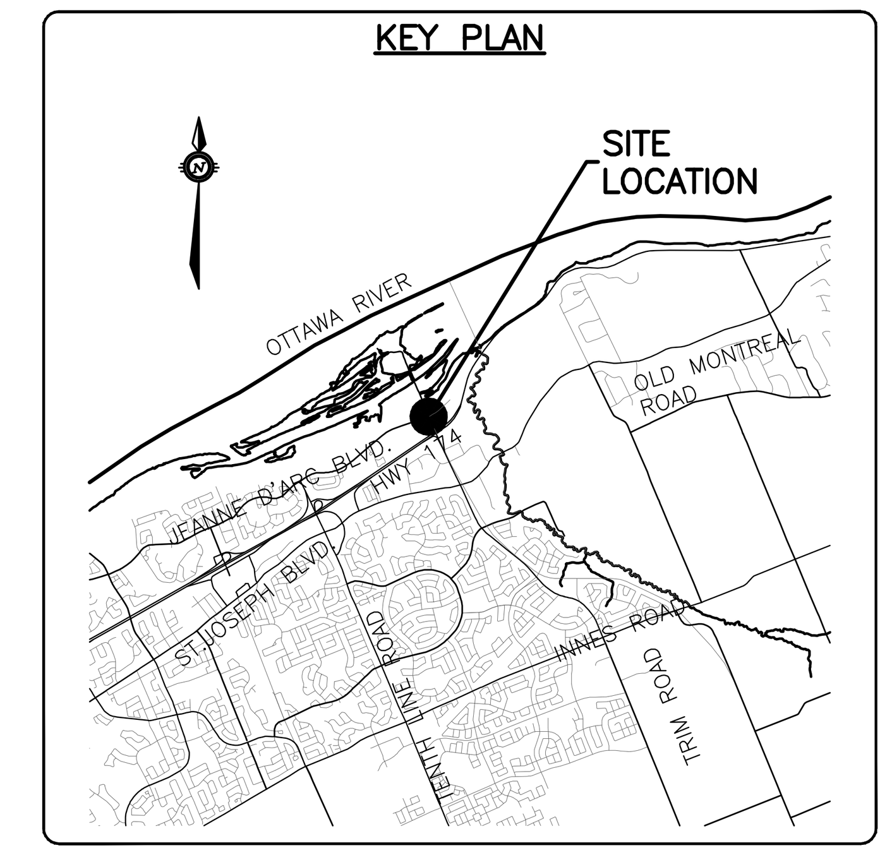
Project	**Starwood Group Inc.**		
Figure No.	**Retaining Wall Section C-C - Seismic Conditions**		
Drawn By	Pratheep Thirumoolan	*Comany*	Paterson Group
Date	30/05/2025	*File Name*	1009 Trim Road - Retaining Wall Global Stability





EXISTING LEGEND

- SURVEY MONUMENT PLANTED
- SURVEY MONUMENT FOUND
- OHW — OVERHEAD WIRES
- UP — UTILITY POLE
- LS — LIGHT STANDARD
- CB — CATCH BASIN
- T/G — TOP OF GRATE
- GM — GAS METER
- TB-T — TRAFFIC CONTROL BOX
- MH-T — TRAFFIC MANHOLE
- MH-ST — STORM SEWER MANHOLE
- MH-S — SANITARY SEWER MANHOLE
- V&VB — WATER VALVE AND VALVE BOX
- FH — FIRE HYDRANT
- EXISTING TREES/SHRUBS
- B — BOLLARD
- BF — BOARD FENCE
- +65.00 — LOCATION OF ELEVATIONS
- +65.00 — TOP OF CURB ELEVATION
- WRW — WOODEN RETAINING WALL
- C/L — CENTRELINE

PROPOSED LEGEND

- PROPERTY LINE
- SANMH 200 — PROPOSED SANITARY MANHOLE
- STMMH 100 — PROPOSED STORM MANHOLE
- OGS — PROPOSED OIL GRIT SEPARATOR
- CB1 — PROPOSED CATCHBASIN
- RD — PROPOSED ROOF DRAIN
- V&VB — PROPOSED WATER VALVE & VALVE BOX
- PROPOSED WATER METER
- RM — PROPOSED REMOTE WATER METER
- SC — PROPOSED SIAMESE CONNECTION
- FF / USF — FINISHED FLOOR ELEVATION / UNDERSIDE OF FOOTING ELEVATION
- P1 — PARKING LEVEL 1
- 2.0% — PROPOSED SLOPE & DIRECTION OF FLOW
- x 51.00 — PROPOSED GRADE
- x 50.85(S) — PROPOSED SWALE GRADE
- PROPOSED SWALE
- T/W= — PROPOSED TOP OF WALL GRADE
- T/G= — TOP OF GRATE
- ICD — INLET CONTROL DEVICE
- ONSITE OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- PROPOSED BUILDING ENTRY/EXIT
- DC — DEPRESSED CURB/SIDEWALK
- BH2-20 — BOREHOLE LOCATION AND NUMBER

CAUTION
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

JOB BENCH MARK JBM
CITY OF OTTAWA CONTROL MONUMENT 20160007 WITH AN OF ELEVATION=52.51
NORTHING=5040095.91 EASTING=384293.97

TOPOGRAPHIC INFORMATION
PART OF LOT 30, CONCESSION 1 (OLD SURVEY),
GEOGRAPHIC TOWNSHIP OF CUMBERLAND, CITY OF OTTAWA.
TOPOGRAPHIC INFORMATION PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. O.L.S (TP388Z) SURVEY DATED SEPTEMBER 23, 2024.
SITE GRID SYSTEM MTM NAD 83, ZONE 9,

REV	REVISION DESCRIPTION	DATE	BY	APPD
2	ISSUED FOR REVIEW	18/03/25	AAS	BT
1	ISSUED FOR REVIEW	16/10/24	SAB	JLF

SCALE: 0 5m 10m 20m HORIZONTAL 1:500
NORTH
DESIGNED BY
REVIEWED BY

CLIENT
TRIM 1 GP INC.
115 CHAMPAGNE AVE SOUTH
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BASEPLAN	SAB
DESIGN	JLF
CHECKED	JLF
CAD	SAB
PROJECT MANAGER	BMT
APPROVED	BMT

PROJECT
1015 TWEDDLE ROAD DEVELOPMENT
1015 TWEDDLE ROAD
OTTAWA, ONTARIO.

TITLE
SITE GRADING PLAN

PROJECT No.	OTT-00259629-A0
SURVEY	AOV
DATE	OCT 2024
DRAWING No.	C200

D07-??-??-????

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