WHITESTONE
An Employee-Owned Company

1959 Highway 34
Building A, Suite 102
Wall, NJ 07719
732.592.2101
whitestoneassoc.com

January 8, 2024

via Parnagian Architects

TWO HILL PROPERTIES LLC
P.O. Box 1175
Medford, New Jersey 08055

Attention: Mr. Jeff Green
Owner

Regarding: LIMITED GEOTECHNICAL INVESTIGATION & SLOPE STABILITY ANALYSIS PROPOSED BUILDING IMPROVEMENTS TWO HILL ROAD BLOCK 22, LOT 9 ATLANTIC HIGHLANDS, MONMOUTH COUNTY, NEW JERSEY WHITESTONE PROJECT NO.: GS2321179.000

Dear Mr. Green:

Whitestone Associates, Inc. (Whitestone) is pleased to submit the attached summary report for the above-referenced project. The purpose of the investigation was to evaluate the existing subsurface conditions and conduct a slope stability analysis in support of the proposed building improvements referenced above. Whitestone's scope of services included conducting subsurface tests across the subject site, evaluating the conditions encountered, and developing geotechnical recommendations to evaluate the stability of the existing slope adjacent to the residential structure.

1.0 PROJECT DESCRIPTION

1.1 Site Location & Existing Conditions

The subject site located at Two Hill Road (Block 22, Lot 9) in Atlantic Highlands, Monmouth County, New Jersey houses a 2.5-story residential dwelling with a deck and associated pavements, landscaped areas, and utilities.

Based on the October 16, 2023 *Boundary & Topographic Survey* prepared by Insite Surveying, LLC, the residential property elevations range between 169 feet above North American Vertical Datum of 1988 (NAVD88) within the southern portion of the property and 132 feet above NAVD88 within the eastern portion of the property. There is an existing approximately 20-feet-tall slope located directly to the northeast and adjacent to the residential property with elevations ranging between 155 feet above NAVD88 and 135 feet above NAVD88. The existing slope extends downward in a northeasterly direction and has experienced slope instability and signs of stormwater washout/erosion. Apparent settlement of portions of the existing building and outdoor deck foundations adjacent to the existing slope has occurred.

1.2 Site Geology

The area encompassing the subject site is situated within the Atlantic Coastal Plain Physiographic Province of New Jersey. Specifically, the site is underlain by the Tertiary-age, Vincentown Formation. Specifically, the Vincentown Formation consists of dusky-yellow to pale-gray, medium grained, well to poorly sorted, quartz sand. This material generally weathers orange brown or red brown and typically is very glauconitic and clayey at the base. Overburden materials also include manmade fill.

2.0 FIELD & LABORATORY WORK

2.1 Field Exploration

Field exploration at the project site was conducted by means of one boring (identified as B-1) conducted with a truck-mounted drill rig using hollow stem augers and split-spoon sampling techniques and one hand-auger probe (identified as HA-1). The boring was conducted within accessible portions of the site at the top of the existing slope to a depth of approximately 50 feet below ground surface (fbgs). The hand-auger probe was conducted within accessible portions of the site at the bottom of the existing slope to a depth of approximately 10 fbgs. Test locations subsequently were backfilled to the surface with grout (where required) or excavated soils from the investigation. The locations of the tests are shown on the accompanying *Test Location Plan* included as Figure 1. *Records of Subsurface Exploration* are provided in Appendix A.

The subsurface tests were conducted in the presence of a Whitestone engineer who conducted field tests, recorded visual classifications, and collected samples of the various strata encountered. The tests were located in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate within a few feet.

The borings and Standard Penetration Tests (SPTs) were conducted in general accordance with ASTM International (ASTM) designation D 1586. The SPT resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthworks and foundations.

Groundwater level observations, although not encountered, were recorded during and immediately after the completion of field operations prior to backfilling the subsurface tests. Seasonal variations, temperature effects, man-made effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitor wells may not be representative of true groundwater levels.

2.2 Laboratory Program

Representative samples of the various strata encountered with the borings conducted were subjected to a laboratory program that included moisture content determinations (ASTM D-2216) and washed gradation analyses (ASTM D-422) in order to conduct supplementary engineering soil classifications in general accordance with ASTM D-2487. The soil strata tested were classified by the Unified Soil Classification System (USCS) and results of the laboratory testing are summarized in the following table. Quantitative test results are provided in Appendix B.

PHYSICAL/TEXTURAL ANALYSES SUMMARY							
Boring	**Sample**	**Depth (fbgs)**	**% Passing No. 200 Sieve**	**Moisture Content (%)**	**Liquid Limit (%)**	**Plastic Index (%)**	**USCS Classification**
B-1	S-5	8.0 - 10.0	23.1	12.8	Non-Plastic		SM
HA-1	S-1	1.0 - 10.0	25.8	16.1	Non-Plastic		SM

3.0 SUBSURFACE CONDITIONS

The subsurface soil conditions encountered within the subsurface tests consisted of the following generalized strata in order of increasing depth. *Records of Subsurface Exploration* are provided in Appendix A.

Surface Materials: The subsurface tests were conducted within either a brick-covered area or an existing wooded area of the subject site at the top and bottom of the existing slope, respectively, and encountered either 12 inches of topsoil or two inches of brick at the surface.

Existing Fill: Underlying the surface cover, boring B-1 encountered existing fill consisting of silty sand. The existing fill extended to a depth of approximately six inches below ground surface within the boring.

Coastal Plain Deposits: Underlying the surface cover and/or existing fill, the subsurface tests conducted encountered coastal plain deposits generally consisting of silty sand (USCS: SM) with variable amounts of gravel or poorly graded sand with silt (USCS: SP-SM). The subsurface tests were terminated within the coastal plain deposits at depths ranging from 10 fbgs to 50 fbgs. SPT N-values within this stratum ranged between six blows per foot (bpf) and refusal (refusal defined as greater than 50 blows per six-inch advancement of the split-spoon sampler), generally indicating loose to very dense relative densities and averaging approximately 29 bpf.

Groundwater: Static groundwater was not encountered within the subsurface tests conducted to a maximum explored depth of 50 fbgs. Groundwater levels should be expected to fluctuate seasonally and following periods of precipitation.

4.0 GLOBAL STABILITY EVALUATION

4.1 General

Based on the aforementioned *Boundary & Topographic Survey*, there is an existing approximately 20-feet-tall slope located directly to the northeast and adjacent to the existing residential building that has experienced instability and signs of stormwater washout/erosion. As such, a slope stability analysis was conducted to assess the conditions of the existing slope and evaluate global stability for areas of concern based on current conditions.

4.2 Method of Analysis

Whitestone evaluated the global stability for the existing slope conditions using classical limit equilibrium methods that assume full development of shear strength along the rupture surface at failure. The limit equilibrium method requires information about the soil strength characteristics to compute a factor of safety along a potential sliding mass. Information regarding stress strain behavior is not used and no information regarding slope movements produced. Movements are usually analyzed by the finite element analysis, which is outside the scope of this study. The factor of safety is the ratio between the soil shear strength and the shear stress required to stabilize the slope. The computer program Geostase was used to conduct the slope stability analysis. The method of analysis selected for this evaluation included a random search of potential failure surfaces using the Modified Bishop Method.

4.3 Existing Soil Parameters

EXISTING SOIL PARAMETERS			
Soil Type	**Moist Unit Weight (pcf)**	**Saturated Unit Weight (pcf)**	**Internal Friction Angle (degrees)**
SM (Loose)	125.0	130.0	29
SM (Medium Dense)	128.0	135.0	30
SM (Dense)	130.0	140.0	31
SP-SM (Medium Dense)	128.0	135.0	30

4.4 Conclusions & Recommendations

Whitestone conducted a slope stability analysis across the subject site to determine the most critical failure paths along the existing slope. The existing factor of safety for the subject site was estimated to be approximately 1.005. To evaluate potential improvements to the global slope stability, a soil nail system was assessed to achieve the maximum factor of safety possible along the proposed slope. Based on Whitestone's analysis, two rows of 12 soil nails each, spaced five feet apart, installed along the existing slope and at 35 degrees from horizontal to the underlying dense soils with soil nail length of up to 20 feet with a bond strength of two kips per linear foot will achieve a factor of safety of 1.778 (a factor of safety of 1.5 is the industry standard for required stability). A cross section of the slope stability analysis utilizing soil nails is provided herein as Figure 3. A cross section of the slope stability analyses for the existing conditions is included herein as Figure 2.

Based on the project information and Whitestone's evaluation, a stable factor of safety of at least 1.5 was only achieved in Whitestone's global stability analyses assuming installation of 20-feet soil nails along the existing slope. Although a theoretical factor of safety of 1.5 may be achieved using computer modeling techniques, implementation of any slope stability methods may not be feasible from a constructability standpoint due to equipment accessibility and the avoidance of vegetation disturbance along the face of the slope. Moreover, past studies have indicated that slope failures may be triggered by random occurrences including excessive rain fall, groundwater seepage, and seismic activity that cannot be fully modeled by current methods.

The area encompassing the subject site is known to exhibit signs of slope failure. Signs of slope failure have been categorized and mapped as individual slump blocks. The subject site is not located within any of the currently known and mapped slump blocks. Furthermore, significant signs of slope failure, such as identification of a scarp, were not observed.

As such, it is Whitestone's preliminary opinion that the existing site will contain an ongoing risk of slope instability. At a minimum, precautionary activities, such as reinforcement of the slope if/where practical, the installation and monitoring of slope inclinometers to evaluate earth movements over time, routine review of slope conditions for seepage and similar indications of deteriorating conditions, and the re-directing of any site drainage away from the slope, should be conducted to reduce, but not eliminate, the risk of slope failures at the site.

Surface Drainage & Erosion Maintenance: While sufficient shear strength is available to prevent a global slope failure, surficial sloughing can still result from improper water control and concentrated runoff over the face of the slope. As such, Whitestone recommends installing a diversion ditch to direct water runoff away from the slope face, potentially to an existing stormwater system. The specific system, grading, and drainage details should be designed by the civil engineer.

Due to the steepness of the existing slope, some surficial sloughing was noted and routine bi-annual maintenance is expected to be required for the slope to mitigate surficial erosion and effects of freeze-thaw. Slumped material should not be allowed to accumulate and any zones of depletion from the crest of the slope should be filled to avoid concentration of runoff. Slumped material may be replaced with structural fill, placed in accordance with the recommendations in this report. Where structural fill is used, final grading may require the use of turf reinforcement matting to maintain surficial stability until vegetation is reestablished.

4.4.1 Lateral Earth Pressures

General: While no new retaining structures currently are proposed, Whitestone would be pleased to assist with the calculation of lateral earth pressures based on the soil parameters presented herein, if requested.

Lateral Earth Pressures: The following soil parameters apply to the encountered subsurface strata and may be used for design of the proposed temporary and permanent retaining structures:

LATERAL EARTH PRESSURE PARAMETERS		
Parameter	**On-Site Soils**	**Imported Granular Backfill**
Moist Density (γ_{moist})	135 pcf	140 pcf
Internal Friction Angle (φ)	28°	30°
Active Earth Pressure Coefficient (K_a)	0.36	0.33
Passive Earth Pressure Coefficient (K_p)	2.77	3.00
At-Rest Earth Pressure Coefficient (K_o)	0.53	0.50

Retaining structures free to rotate generally can be designed to resist active ant at-rest earth pressures. Retaining structures situated below static groundwater levels should also be designed to resist hydrostatic pressure.

Lateral earth pressure will depend on the backfill slope angle and the wall batter angle. A sloped backfill will add surcharge load and affect the angle of the resultant force. The effect of other surcharges will also need to be included in earth pressure calculations, including the loads imposed by adjacent structures and traffic. The effects of proposed sloped backfill surface grades, and proposed slopes beyond the toe of the retaining structure, if applicable, must be considered when calculating resultant forces to be resisted by the retaining structure. A coefficient of friction of 0.35 against sliding can be used for concrete on the existing site soils. Retaining structure footings should be designed so that the combined effect of vertical and horizontal resultants and overturning moment does not exceed the maximum soil bearing capacity provided below in Section 4.4.2.

Adequate drainage of water which may collect on the backfill side of the retaining structure should be incorporated into the design and/or hydrostatic pressures should be added to the pressure calculations. Depending on the type, drainage along the backside and in front of the structure may be provided by a free draining, clean stone layer separated from surrounding soils by a filtration fabric. Numerous commercially fabricated drainage systems also are available. A system of perforated drain pipes and/or weep holes may be used at the base of the backfill side of the retaining structure in order to collect and remove the water and relieve hydrostatic pressure.

Backfill Criteria: Whitestone recommends that granular soils be used to backfill behind the proposed retaining structures. The granular backfill materials should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and five percent to 15 percent of material finer than a #200 sieve. The material should be free of clay lumps, organics, and deleterious material. Portions of the site soils consisted of poorly graded sand with silt (USCS: SP-SM) which are anticipated to be suitable as retaining/below-grade wall reuse. The site soils with an appreciable amount of fines (USCS: SM) are not anticipated to be suitable for retaining/below-grade wall backfill unless approved by the wall designer. Accordingly, imported granular soils may be required. Maximum densities in the table above should not be exceeded to avoid creating excessive lateral pressure on the structure(s) during compaction operations.

Whitestone recommends that backfill directly behind the structure be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within a zone measured at a 45-degree angle from the base of the structure during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

4.4.2 Shallow Foundation Design Criteria

If required for new construction and following slope stabilization as outlined in Section 4.4, Whitestone recommends that the proposed new structures be supported on conventional shallow spread and continuous wall footings designed to bear within the underlying medium dense to dense natural site soils and/or properly placed structural fill provided these materials are properly evaluated, placed and compacted in accordance with this report. Foundations bearing within the natural site soils may be designed using a maximum allowable net bearing pressure of 3,000 pounds per square foot (psf).

All footing bottoms should be improved by in-trench compaction in the presence of the geotechnical engineer. Regardless of loading conditions, proposed foundations should be sized no less than minimum dimensions of 24 inches for continuous wall footings and 36 inches for isolated spread footings.

Foundation Inspection: Whitestone recommends that the suitability of the bearing soils along and below the footing bottoms be verified by a geotechnical engineer prior to placing concrete for the footings. Where areas of unsuitable materials are encountered in footing excavations, overexcavation and recompaction or replacement may be necessary to provide a suitable footing subgrade. Any overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation. Lateral overexcavation can be reduced if the grade is restored with lean concrete or approved flowable fill. The bottom of overexcavation should be compacted with vibrating plates or plate tampers (“jumping jacks”) to compact locally disturbed materials.

Settlement: Whitestone estimates post construction settlements of proposed foundations to be approximately less than one inch if the recommendations outlined in this report are properly implemented. Differential settlement of foundations should be less than one-half inch.

Frost Coverage: Footings subject to frost action should be placed at least 36 inches below adjacent exterior grades or the depth required by local building codes to provide protection from frost penetration.

5.0 CLOSING

Whitestone appreciates the opportunity to be of service to Two Hill Properties LLC. Please note that Whitestone has the capability to conduct the additional geotechnical engineering services recommended herein.

Please contact us with any questions or comments regarding this report.

Sincerely,

WHITESTONE

Mudar Khantamr, P.E.
Senior Associate

Laurence W. Keller, P.E.
Vice President

RL/ri L:\Job Folders\2023\2321179GS\Reports and Submittals\21179 LGI.docx
Enclosures
Copy: Brian Parnagian, AIA, Parnagian Architects
Travis Pummer, Parnagian Architects

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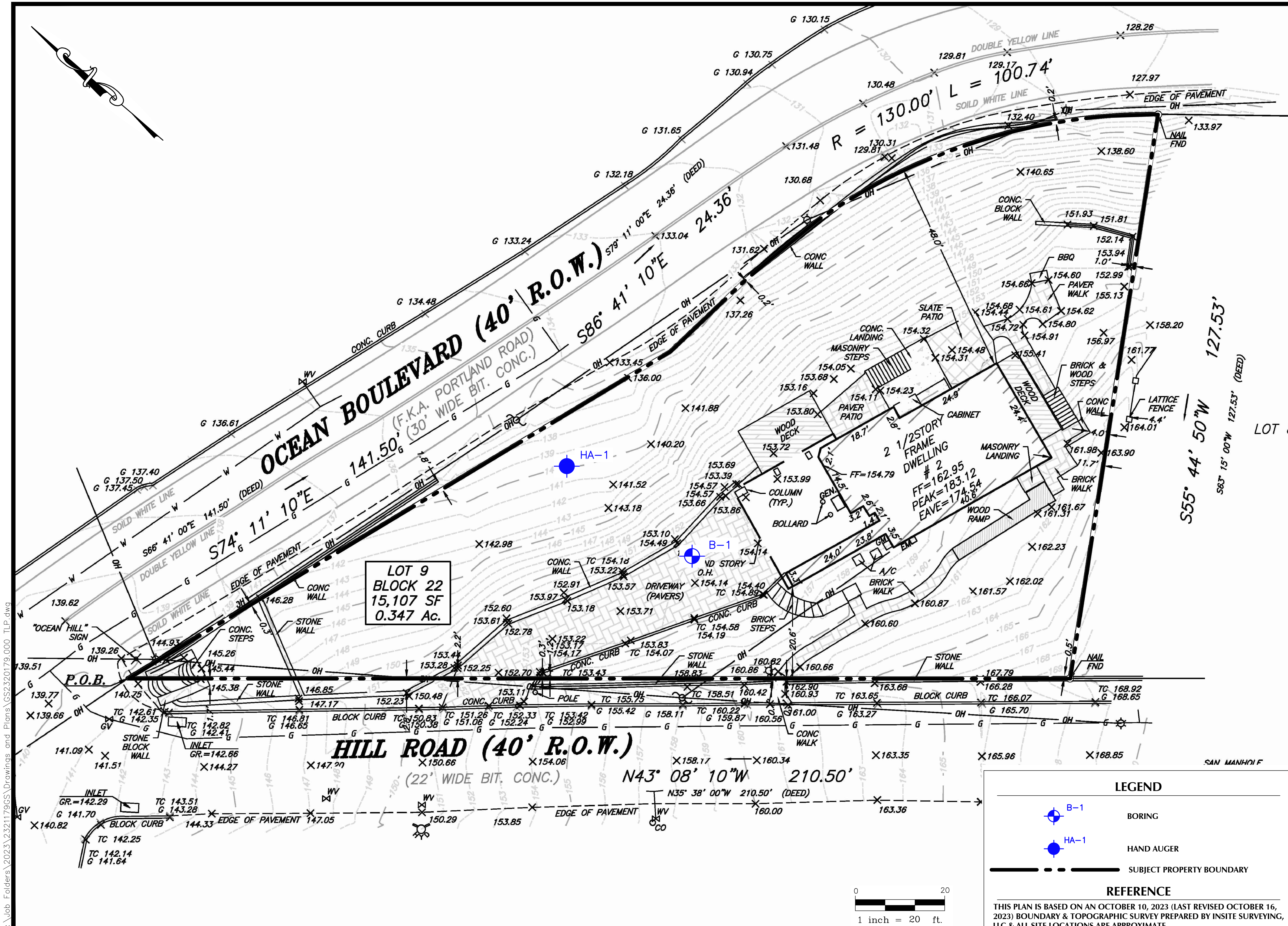
FIGURE 1
Test Location Plan



LEGEND

- B-1 BORING
- HA-1 HAND AUGER
- SUBJECT PROPERTY BOUNDARY

REFERENCE

THIS PLAN IS BASED ON AN OCTOBER 10, 2023 (LAST REVISED OCTOBER 16, 2023) BOUNDARY & TOPOGRAPHIC SURVEY PREPARED BY INSITE SURVEYING, LLC & ALL SITE LOCATIONS ARE APPROXIMATE.

WHITESTONE
An Employee-Owned Company
1959 HIGHWAY 34 BUILDING A, UNIT 102 WALL, NJ 07719
732-592-2101 WHITESTONEASSOC.COM

DRAWING TITLE: **TEST LOCATION PLAN**

CLIENT: **TWO HILL PROPERTIES LLC**

PROJECT: PROPOSED BUILDING IMPROVEMENTS, TWO HILL ROAD, ATLANTIC HIGHLANDS, MONMOUTH COUNTY, NJ

PROJECT #: GS2321179.000	
DESIGNED BY: GR	PROJ. MGR.: MK
DATE: 1/8/24	FIGURE: 1
SCALE: 1" = 20'	

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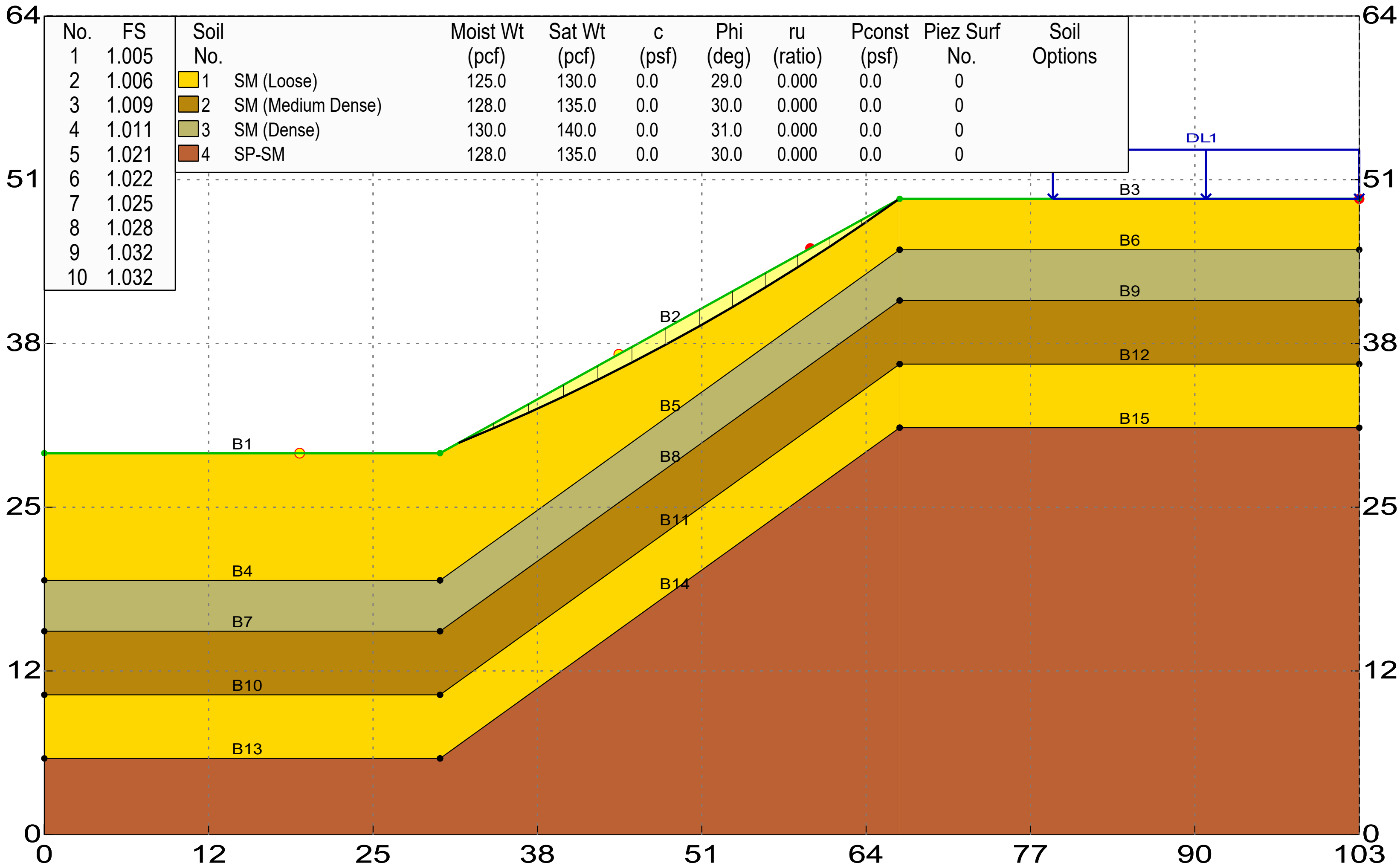
FIGURE 2
Existing Slope Stability Analysis

Two Hill Road, Atlantic Higlands, New Jersey
Proposed Building Improvements

GREGORY GEOTECHNICAL - GHG

2\Slope Stability Existing.gsd



No.	FS
1	1.005
2	1.006
3	1.009
4	1.011
5	1.021
6	1.022
7	1.025
8	1.028
9	1.032
10	1.032

Soil No.		Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.	Soil Options
1	SM (Loose)	125.0	130.0	0.0	29.0	0.000	0.0	0	
2	SM (Medium Dense)	128.0	135.0	0.0	30.0	0.000	0.0	0	
3	SM (Dense)	130.0	140.0	0.0	31.0	0.000	0.0	0	
4	SP-SM	128.0	135.0	0.0	30.0	0.000	0.0	0	

GEOSTASE FS = 1.005

Simplified Bishop Method

GEOSTASE Slope Stability Analysis

GEOSTASE® by GREGORY GEOTECHNICAL SOFTWARE

PLATE C.1

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FIGURE 3
Slope Stability Analysis with Soil Nails

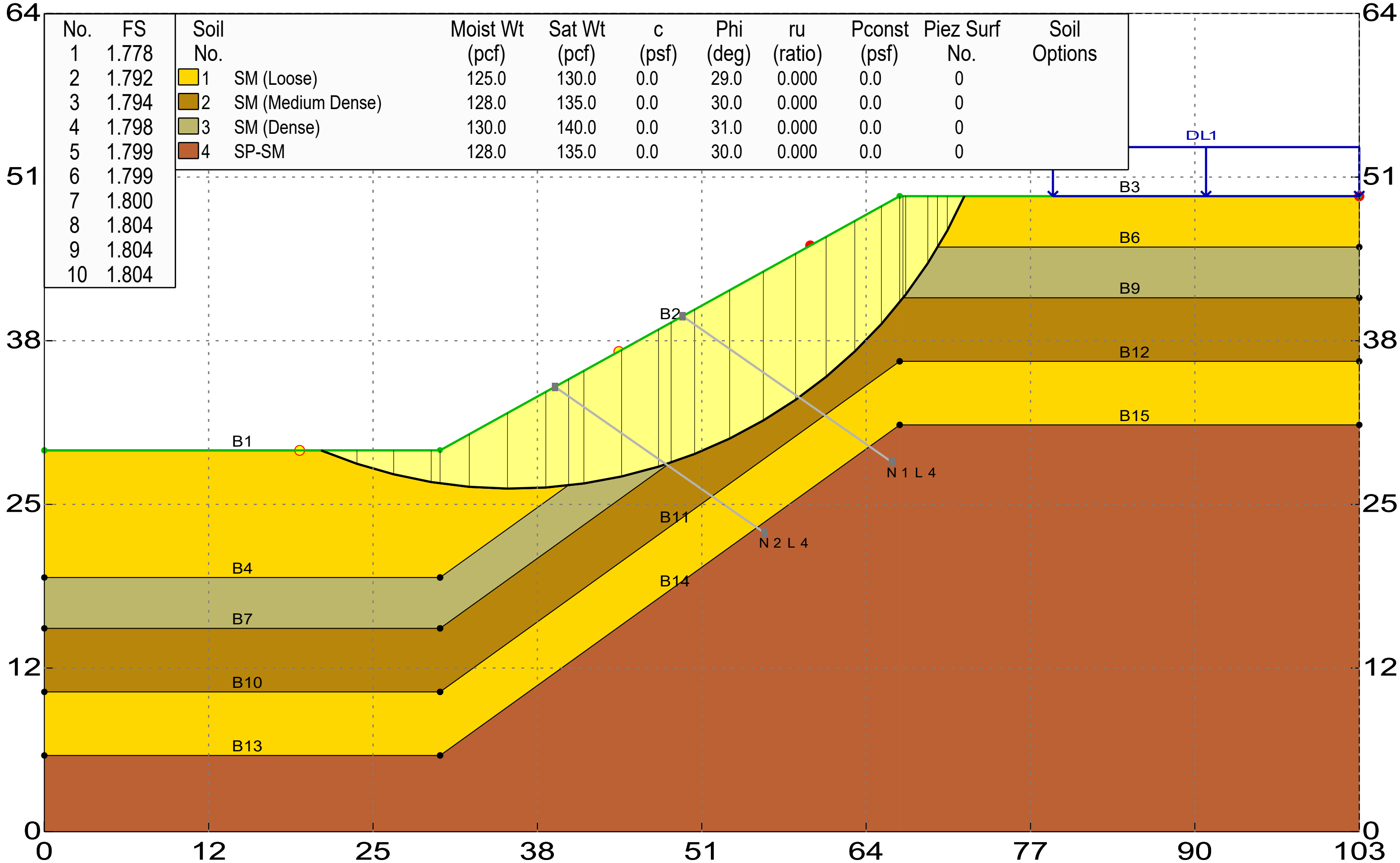
Two Hill Road, Atlantic Higlands, New Jersey
Proposed Building Improvements

GREGORY GEOTECHNICAL - GHG

2\Slope Stability Existing.gsd

No.	FS
1	1.778
2	1.792
3	1.794
4	1.798
5	1.799
6	1.799
7	1.800
8	1.804
9	1.804
10	1.804

Soil No.		Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.	Soil Options
1	SM (Loose)	125.0	130.0	0.0	29.0	0.000	0.0	0	
2	SM (Medium Dense)	128.0	135.0	0.0	30.0	0.000	0.0	0	
3	SM (Dense)	130.0	140.0	0.0	31.0	0.000	0.0	0	
4	SP-SM	128.0	135.0	0.0	30.0	0.000	0.0	0	



GEOSTASE FS = 1.778

Simplified Bishop Method

GEOSTASE Slope Stability Analysis

GEOSTASE® by GREGORY GEOTECHNICAL SOFTWARE

PLATE C.1

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APPENDIX A
Records of Subsurface Exploration

RECORD OF SUBSURFACE EXPLORATION

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Project:	Proposed Building Improvements	**WAI Project No.:**	GS2321179.000
Location:	Two Hill Road; Atlantic Highlands, Monmouth County, NJ	**Client:**	Two Hill Properties LLC

Surface Elevation:	± 154.0 feet	**Date Started:**	12/6/2023	**Water Depth | Elevation (feet bgs) | (feet)**		**Cave-In Depth | Elevation (feet bgs) | (feet)**	
Termination Depth:	50.0 feet bgs	**Date Completed:**	12/6/2023				
Proposed Location:	Top of Slope	**Logged By:**	AM	**During:**	NE | ---		
Drill / Test Method:	HSA / SPT	**Contractor:**	AC	**At Completion:**	NE | ---	**At Completion:**	38.0 | ---
		Equipment:	CME-45	**24 Hours:**	--- | ---	**24 Hours:**	--- | ---

Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	DEPTH (feet)	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
						0.0 – 0.5	PAVEMENT	2" Brick	
						0.5 – 1.0	FILL	Brown Silty Sand, Moist (FILL)	
0 - 2	S-1	X	5 - 7 - 5 - 4	10	12	1.0	COASTAL PLAIN DEPOSITS	Orangish-Brown Silty Sand, Trace Gravel, Moist, Medium Dense (SM)	
2 - 4	S-2	X	3 - 3 - 3 - 3	8	6			As Above, Loose (SM)	
4 - 5.3	S-3	X	3 - 12 - 50/3"	8	62/3"	5.0		As Above, with Gravel, Very Dense (SM)	Heavy Auger Grinding from 5.0 fbgs to 7.0 fbgs
6 - 8	S-4	X	55 - 35 - 33 - 40	6	68			As Above, Dark Orangish-Brown, Dense (SM)	
8 - 10	S-5	X	13 - 10 - 10 - 13	14	20	10.0		As Above, Medium Dense (SM)	
13 - 15	S-6	X	2 - 3 - 3 - 3	14	6	15.0		As Above, Trace Gravel, Loose (SM)	
18 - 20	S-7	X	9 - 8 - 5 - 6	16	13	18.0 – 20.0		Orangish-Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
23 - 25	S-8	X	9 - 10 - 14 - 12	12	24	25.0		As Above (SP-SM)	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

WHITESTONE

Boring No.: B-1

Project:	Proposed Building Improvements	**WAI Project No.:**	GS2321179.000
Location:	Two Hill Road; Atlantic Highlands, Monmouth County, NJ	**Client:**	Two Hill Properties LLC

Surface Elevation:	± 154.0 feet	**Date Started:**	12/6/2023	**Water Depth (feet bgs) | Elevation (feet)**		**Cave-In Depth (feet bgs) | Elevation (feet)**	
Termination Depth:	50.0 feet bgs	**Date Completed:**	12/6/2023				
Proposed Location:	Top of Slope	**Logged By:**	AM	**During:**	NE | ---		
Drill / Test Method:	HSA / SPT	**Contractor:**	AC	**At Completion:**	NE | ---	**At Completion:**	38.0 | ---
		Equipment:	CME-45	**24 Hours:**	--- | ---	**24 Hours:**	--- | ---

Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	DEPTH (feet)	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
						25.0	COASTAL PLAIN DEPOSITS	Orangish-Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
28 - 30	S-9		54 - 26 - 23 - 30	14	49	28.0		Orangish-Brown Silty Sand, Moist, Dense (SM)	
						30.0			
33 - 35	S-10		15 - 14 - 15 - 15	14	29	33.0		Orangish-Brown Poorly Graded Sand with Silt, Moist, Medium Dense (SP-SM)	
						35.0			
38 - 40	S-11		12 - 18 - 26 - 22	12	44			As Above, Dense (SP-SM)	
						40.0			
43 - 45	S-12		37 - 22 - 28 - 27	16	50			As Above, Very Dense (SP-SM)	
						45.0			
48 - 50	S-13		8 - 12 - 12 - 16	12	24	48.0		Orangish-Brown Silty Sand, Moist, Medium Dense (SM)	
						50.0		Boring Log B-1 Terminated at a Depth of 50.0 Feet Below Ground Surface	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

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Boring No.: HA-1

Page 1 of 1

Project:	Proposed Building Improvements	**WAI Project No.:**	GS2321179.000
Location:	Two Hill Road; Atlantic Highlands, Monmouth County, NJ	**Client:**	Two Hill Properties LLC

Surface Elevation:	± 140.0 feet	**Date Started:**	12/15/2023		**Water Depth (feet bgs)**	**Elevation (feet)**	**Cave-In Depth (feet bgs) | Elevation (feet)**
Termination Depth:	10.0 feet bgs	**Date Completed:**	12/15/2023				
Proposed Location:	Bottom of Slope	**Logged By:**	RL	**During:**	NE	---	
Excavating Method:	Hand Auger	**Contractor:**	Whitestone	**At Completion:**	NE	---	**At Completion:** DNC | ---
Test Method:	Visual Observation	**Equipment:**	Hand Auger	**24 Hours:**	---	---	

SAMPLE INFORMATION Depth (ft.)	Number	Type	DEPTH (feet)	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
			0.0			
				TOPSOIL	12" Topsoil	
			1.0	COASTAL PLAIN DEPOSITS	Light Brown Silty Sand, Moist (SM)	
			5.0		As Above (SM)	
			10.0		Hand Auger HA-1 Terminated at a Depth of 10.0 Feet Below Ground Surface	
			15.0			

NOTES: bgs = below ground surface, DNC = Did Not Cave, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

DYNAMIC CONE PENETROMETER TEST RESULTS TWO HILL ROAD ATLANTIC HIGHLANDS, MONMOUTH COUNTY, NEW JERSEY WHITESTONE PROJECT NO.: GS2321179.000			
Field Engineer:	R. Lombreglia		
Date:	12/6/23		
Hand Auger Location*	Depth Below Footing Subgrade (feet)	DCP-Blows per 1.75 inches	DCP-Average Blows per 5.25 inches
HA-1	0.0	1-3-4	2.67
HA-1	2.0	2-4-5	3.67
HA-1	4.0	3-5-5	4.33
HA-1	6.0	3-5-7	5.0
HA-1	8.0	4-6-7	5.67

* Please refer to *Test Location Plan* prepared by Whitestone Associates, Inc. dated January 8, 2024.

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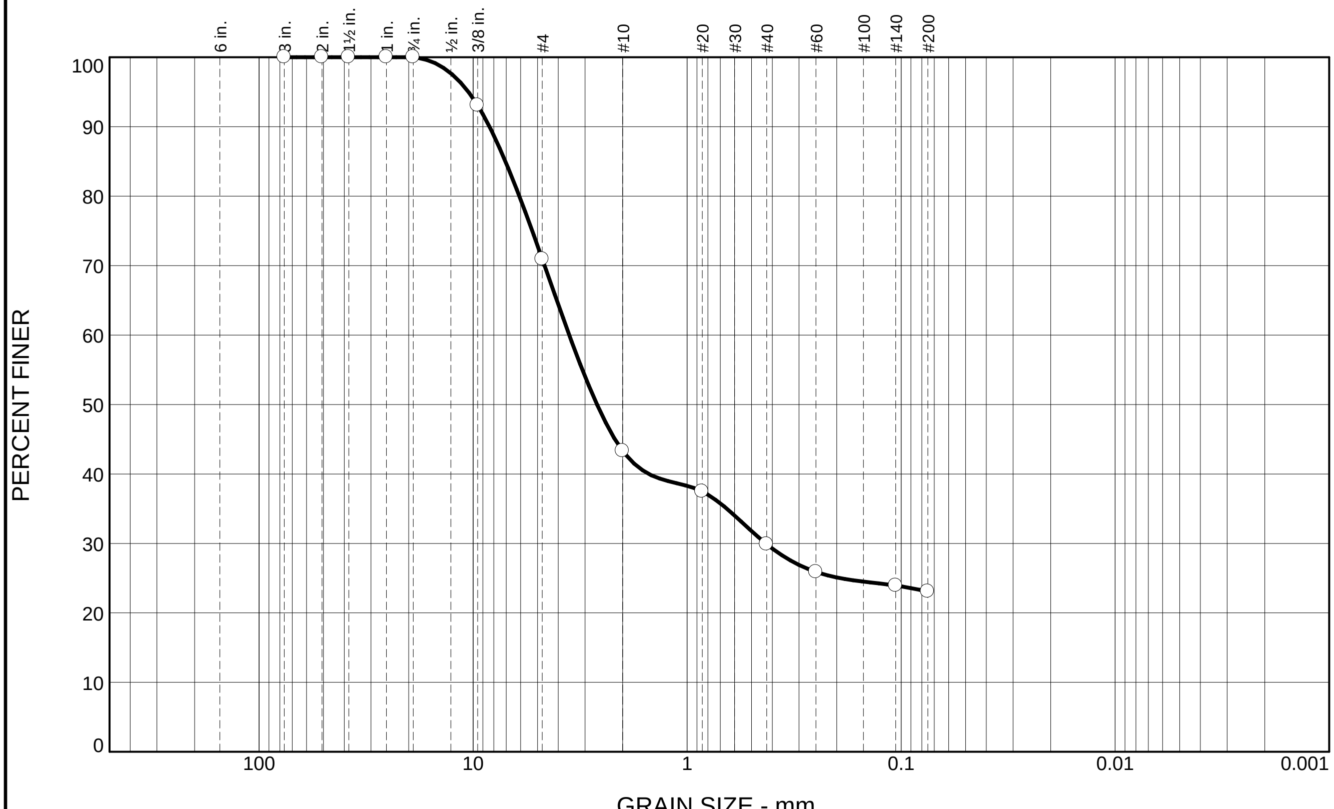
APPENDIX B
Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	29.1	27.6	13.4	6.8	23.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	93.1		
#4	70.9		
#10	43.3		
#20	37.5		
#40	29.9		
#60	25.9		
#140	23.9		
#200	23.1		

* (no specification provided)

Material Description

Silty Sand with Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 8.3845 D_{85}= 7.0644 D_{60}= 3.5533
D_{50}= 2.6372 D_{30}= 0.4294 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Wn = 12.8 %

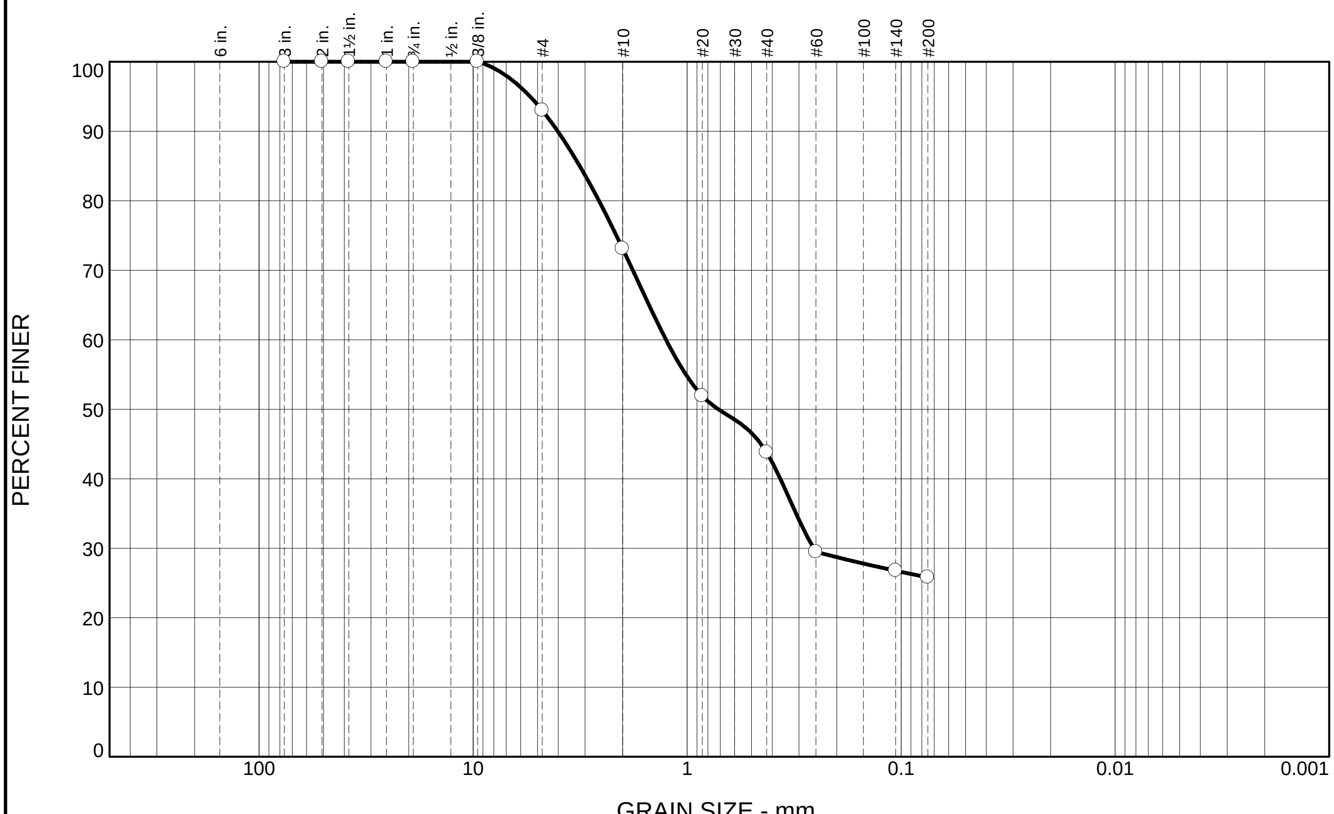
Source of Sample: B-1 **Depth:** 8.0' - 10.0'
Sample Number: S-5

Date: 12/18/2023

WHITESTONE ASSOCIATES, INC.
Warren, New Jersey

Client: Two Hill Properties LLC
Project: Proposed Building Improvements
Two Hill Road, Atlantic Highlands, Monmouth County, NJ
Project No: GS2321179.000 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.0	19.9	29.3	18.0	25.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	93.0		
#10	73.1		
#20	51.9		
#40	43.8		
#60	29.5		
#140	26.8		
#200	25.8		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 4.0206 D_{85}= 3.1741 D_{60}= 1.2551
D_{50}= 0.7154 D_{30}= 0.2564 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Wn = 16.1 %

Source of Sample: HA-1 **Depth:** 1.0' - 10.0'
Sample Number: S-1

Date: 12/18/2023

WHITESTONE ASSOCIATES, INC.
Warren, New Jersey

Client: Two Hill Properties LLC
Project: Proposed Building Improvements
Two Hill Road, Atlantic Highlands, Monmouth County, NJ
Project No: GS2321179.000 **Figure**

WHITESTONE

APPENDIX C
Supplemental Information
(USCS, Terms & Symbols)

WHITESTONE
An Employee-Owned Company

1959 HIGHWAY 34
BUILDING A, SUITE 102
WALL, NJ 07719
732.592.2101
whitestoneassoc.com

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMITS LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMITS GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

GRADATION*

	% FINER BY WEIGHT
TRACE	1% TO 10%
LITTLE	10% TO 20%
SOME	20% TO 35%
AND	35% TO 50%

COMPACTNESS*
Sand and/or Gravel

	RELATIVE DENSITY
LOOSE	0% TO 40%
MEDIUM DENSE	40% TO 70%
DENSE	70% TO 90%
VERY DENSE	90% TO 100%

CONSISTENCY*
Clay and/or Silt

	RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT
VERY SOFT	LESS THAN 250
SOFT	250 TO 500
MEDIUM	500 TO 1000
STIFF	1000 TO 2000
VERY STIFF	2000 TO 4000
HARD	GREATER THAN 4000

** VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE.
WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.*

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1959 HIGHWAY 34
BUILDING A, SUITE 102
WALL, NJ 07719
732.592.2101
whitestoneassoc.com

WHITESTONE
An Employee-Owned Company

GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %.
LL: Liquid limit, %.
PI: Plasticity index, %.
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered).
SS: Split-Spoon - 1 ⅜" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
OB: Diamond Bit.
CB: Carbide Bit
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

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