C2EARTH, INC.
GEOLOGIC & GEOTECHNICAL ENGINEERING SERVICES

26 June 2020
Document Id. 02891U-02L4
Serial No. 19363

Mr. Sanjeet Dutta
250 Bonita Road
Portola Valley, CA 94028

SUBJECT: SUPPLEMENTAL EVALUATION
PROPOSED SITE RETAINING WALLS AND
LANDSCAPING IMPROVEMENTS
DUTTA PROPERTY
250 BONITA ROAD
SAN MATEO COUNTY, CALIFORNIA

Dear Mr. Dutta:

INTRODUCTION

As requested, we have performed supplemental evaluations of localized slope stability in the areas of the proposed improvements, and have re-reviewed the latest septic plans for the landscaping and retaining wall project to be constructed on your property at 250 Bonita Road in the Los Trancos Woods community of unincorporated San Mateo County, California.

Upp Geotechnology Inc. performed a geotechnical study for the development of the site for a prior owner of the property, and submitted the results of that study in a Geotechnical Investigation report dated 8 February 2001 (Serial No. 10370). Subsequently, you purchased the property and completed the site development. Upp Geotechnology Inc. provided updated recommendations, reviewed project plans, responded to county peer review comments, and observed and tested the geotechnical elements of the site development between 2005 and 2006. Effective 1 January 2012, Upp Geotechnology Inc. closed. C2Earth Inc. acquired the assets of Upp Geotechnology Inc. and continued to provide services for Upp Geotechnology Inc.'s clients under the trade name Upp Geotechnology.

The Upp Geotechnology Inc. 2001 report presented recommendations for structural piers, caissons, and concrete retaining walls, which were utilized in the current design for new walls and stairs to be built on the front and rear of the home. We developed additional recommendations for the project, including recommendations for Keystone block retaining walls which will be used to create a lawn area southeast of your home, and presented those recommendations in our Geotechnical Recommendations letter dated 7 November 2017 (Document Id. 02891U-02L1, published under our trade name, Upp Geotechnology).

We understand from our conversations with you and your septic consultant, that portions of the existing leachfield in the area of the proposed improvements will be removed, and new primary and expansion leachfield areas will be built uphill of the areas of the proposed improvements. The newly configured primary and expansion fields will use pressure-dosed dispersal methods. Because of the proximity of site retaining walls to some of the new drain fields, we developed supplemental recommendations for undrained poured concrete retaining walls, and presented those recommendations in our Supplemental Recommendations and Plan Review letter dated 12 March 2020 (Document Id. 02891U-02L3).

SUPPLEMENTAL SLOPE STABILITY EVALUATION

We understand that the County's Geologic and Geotechnical Peer Review consultant has identified a possible landslide deposit in the area of the proposed improvements from the review of Lidar imagery. Based on our review of stereo-paired aerial photographs and Lidar imagery, we concur that the area may be within a landslide deposit (see Figure 1, Landslide Interpretation Map).

Although geomorphology suggests a landslide in the area of the proposed improvements, prior subsurface observations during the study and construction observations phases for the residence revealed the site to be underlain at shallow depths by dense, indurated Santa Clara formation conglomerate comprised of hard, large boulders in a silty sand matrix. Photographs of exposures of the Santa Clara formation taken during the construction of the residence and driveway retaining walls are presented as Photos 1 through 10. In addition, logs of the prior test pits performed during the study for the residence are also attached. For reference, the locations of the test pits are provided on Figure 2, Updated Site Plan.

Consequently, it is our opinion that, if a landslide exists in the area of the proposed improvements, it is a sufficiently deep feature to have displaced a mass of intact conglomerate. To assess the influence the proposed project has on the overall slope stability, we performed a comparative, static, quantitative slope stability evaluation of the existing and proposed slope configurations as follows:

Overview

The following paragraphs describe the methodology and results of a comparative quantitative slope stability analyses that we performed to evaluate the influence of the proposed project on the slope stability at the subject property. We performed the analyses using the computer program Slide Version 2018 8.029 by Rocscience, Inc., utilizing the GLE/Morgenstern-Price methodology with non-circular Cuckoo slip surface search and surface altering optimization to calculate failure surfaces and the factor of safety against sliding. The analyses were performed in general accordance with the guidelines presented in the Special Publication 117A by the California Geological Survey (2008).

You should note that computer-aided slope stability analyses are mathematical models of the slopes and soil and they contain many assumptions. Slope stability analyses and the generated factors of safety only indicate general slope stability trends. In general, factors of safety below 1.00 indicate a potential failure. However, a slope with a factor of safety of less than 1.00 will not necessarily fail, but the probability of failure will be greater than that for a slope with a higher factor of safety. Conversely, a slope with a factor of safety greater than 1.00 may fail but the probability of stability is higher than that for a slope with a lower factor of safety.

Slope Geometry

We performed the slope stability analyses utilizing the existing and proposed surface profiles depicted on Figure 3, Updated Cross-Section A-A'. We generated this profile using topographic information and proposed retaining wall configurations presented on the project Structural Plan Sheet S1 by Schneider Engineering (Revision 1 dated 10 February 2020). Subsurface information was applied based upon our experience and existing available test pit and construction observations data.

C2EARTH

Soil Strength Parameters

We obtained soil strength parameters for the subsurface materials from the from the published values provided in the Seismic Hazard Zone Report for the Mindego Hill 7½-Minute Quadrangle, Santa Clara County, California (California Geologic Survey, 2002). For the Santa Clara formation (potentially displaced mass of Santa Clara conglomerate) (QTsc), we used the median cohesion along with the recommended phi angle. For the surficial materials (topsoil, colluvium, and fill), we utilized the median cohesion and recommended phi angle for Holocene (Qhc) deposits. In addition, we assigned wet and saturated unit weights based upon prior laboratory testing and our experience in the area. A table of the soil and rock parameters is presented below.

Unit	Phi Angle (degrees)	Cohesion (psf)	Wet Unit Weight (pcf)
Fill/Soil/Colluvium	25	610	120
Santa Clara formation	30	500	125

Soil and Rock Parameters

Slope Stability Analysis Results

Each analysis that we ran searched thousands of potential failure surfaces. The following is a summary of pertinent slope stability analysis results.

Slope Stability Analysis No. 1 and 2 evaluated the potential for global, deep-seated landsliding to occur under static conditions for the current and proposed site conditions, respectively. The lowest factors of safety for each analysis is presented in the following table and graphical illustrations of potential failure surfaces are shown on Figures 4 and 5, Slope Stability Analysis No. 1 and 2).

Analysis No.	Slope	Seismic	Factor of Safety
1	Cross-Section A-A' (Existing)	Static	2.19
2	Cross-Section A-A' (Proposed)	Static	2.25

Slope Stability Analyses and Results

SLOPE STABILITY FINDINGS

Our comparative evaluation revealed the proposed project has no negative influence on the overall stability of the site. Rather, the proposed grading configuration, removing material from on the slope and placing it lower on the slope retained by walls, will yield a slightly increased level of slope stability. Consequently we judge from geologic and geotechnical perspectives, that the proposed project may proceed as planned.

PROPOSED SEPTIC SYSTEM FINDINGS

The proposed on-site wastewater treatment system (OWTS) includes removing two expansion leachfield lines and one primary line in the areas of the proposed improvements, and constructing replacement lines elsewhere on the slope above the proposed improvements and residence. New leachfield lines will be comprised of trenches about 8 feet deep, filled with 6 feet of crushed drainrock, with 1½-inch diameter pressure dosed distribution pipes atop the drainrock. Existing primary leachlines to remain will have the conventional 3-inch drip distribution pipes replaced with 1½-inch diameter pressure dosed distribution pipes.

Based upon the thin layer of soil and colluvium mantling the Santa Clara formation materials on-site, we judge that proposed septic field lines will discharge effluent into the Santa Clara formation conglomerate (see Figure 3). The percolation test rating "A" with a rate of 7.35 inches per hour will result in good downward migration and percolation through the Santa Clara formation conglomerate.

Based on the results of the slope stability evaluation and the above percolation rates, it remains our opinion that the proposed upgraded OWTS will not have a significant impact on the stability of the slopes on the subject property, even though leachlines are within 50 feet of slopes greater than 50 percent. It also remains our opinion that the proposed upgraded OWTS should not degrade the quality of the local groundwater, and it is unlikely that effluent from the leachfield will surface. Furthermore, it is unlikely that effluent introduced into the subsurface soil will present a threat to the public health and safety or create a public nuisance.

The majority of the planned site retaining walls are greater than 10 feet from the nearest proposed primary or expansion leachfield lines, however, short returns at the ends of the walls encroach to within about 5 feet of the leachlines. Where close, the retaining wall heights are less than 1½ feet tall, whereas the start of the nearby leachfield drainrock begins at 2 feet below grade. The retaining walls within 25 feet of the proposed leachfield lines (upper 3 walls) will be poured concrete, pier-supported walls designed and constructed without backdrain systems.

Based upon the above, from geologic and geotechnical engineering perspectives, the proposed upgrades to the OWTS may proceed as planned.

It has been our pleasure to continue to assist you with this project.

Sincerely,
C2Earth, Inc.

6-26-2020

Christopher R. Hundemer, Principal
Certified Engineering Geologist 2314
Certified Hydrogeologist 882
Registered Civil Engineer 87149

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER R. HUNDEMER
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STATE OF CALIFORNIA

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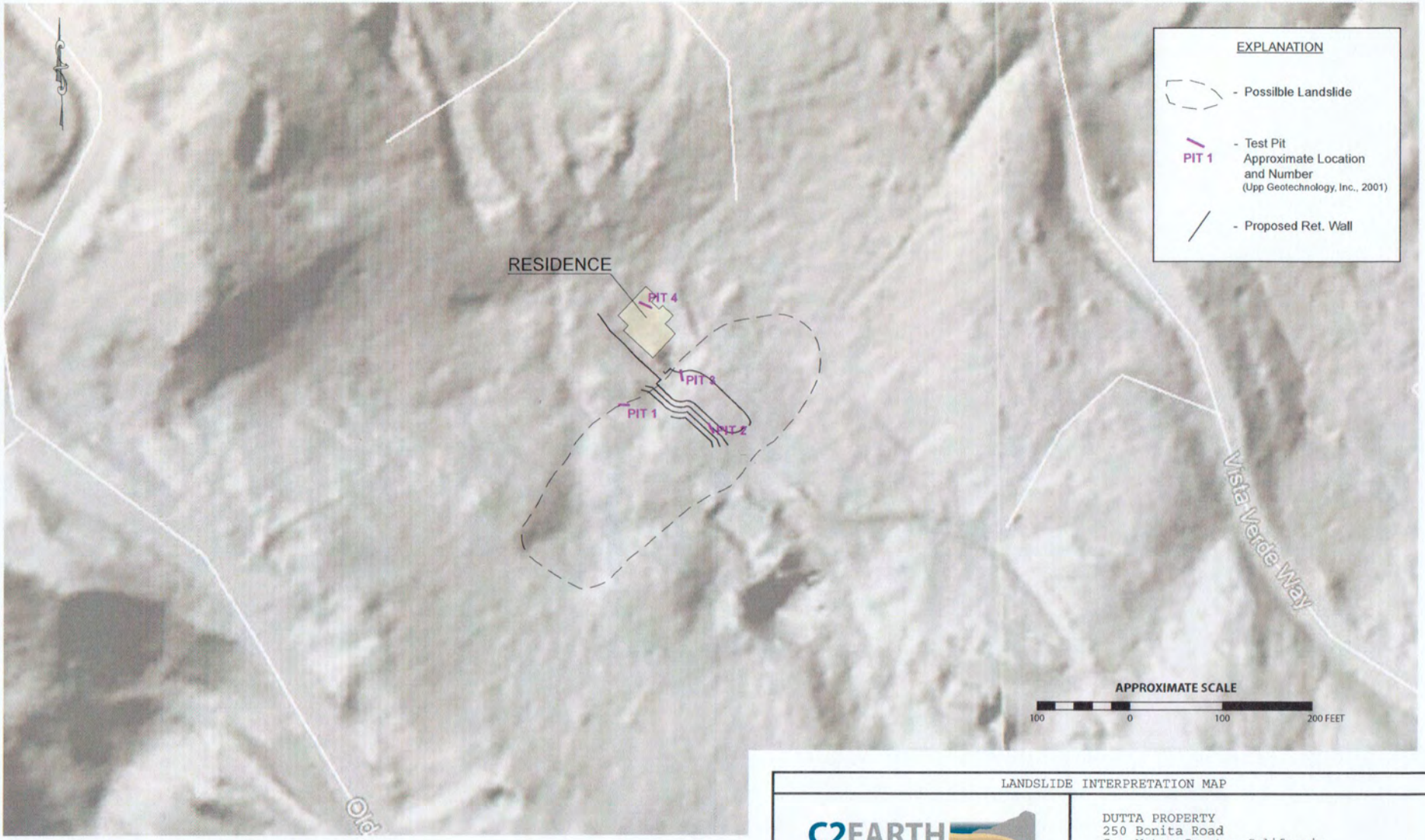
Mr. Christopher Day (via e-mail to christopherdayr@aol.com)

Inclusions: Figure 1: Landslide Interpretation Map
Figure 2: Updated Site Plan
Figure 3: Updated Cross-Section A-A'
Figures 4-5: Slope Stability Results 1 and 2
Photos 1 through 10
Logs of Prior Test Pits 1 through 4 (Upp Geotechnology, Inc., 2001)



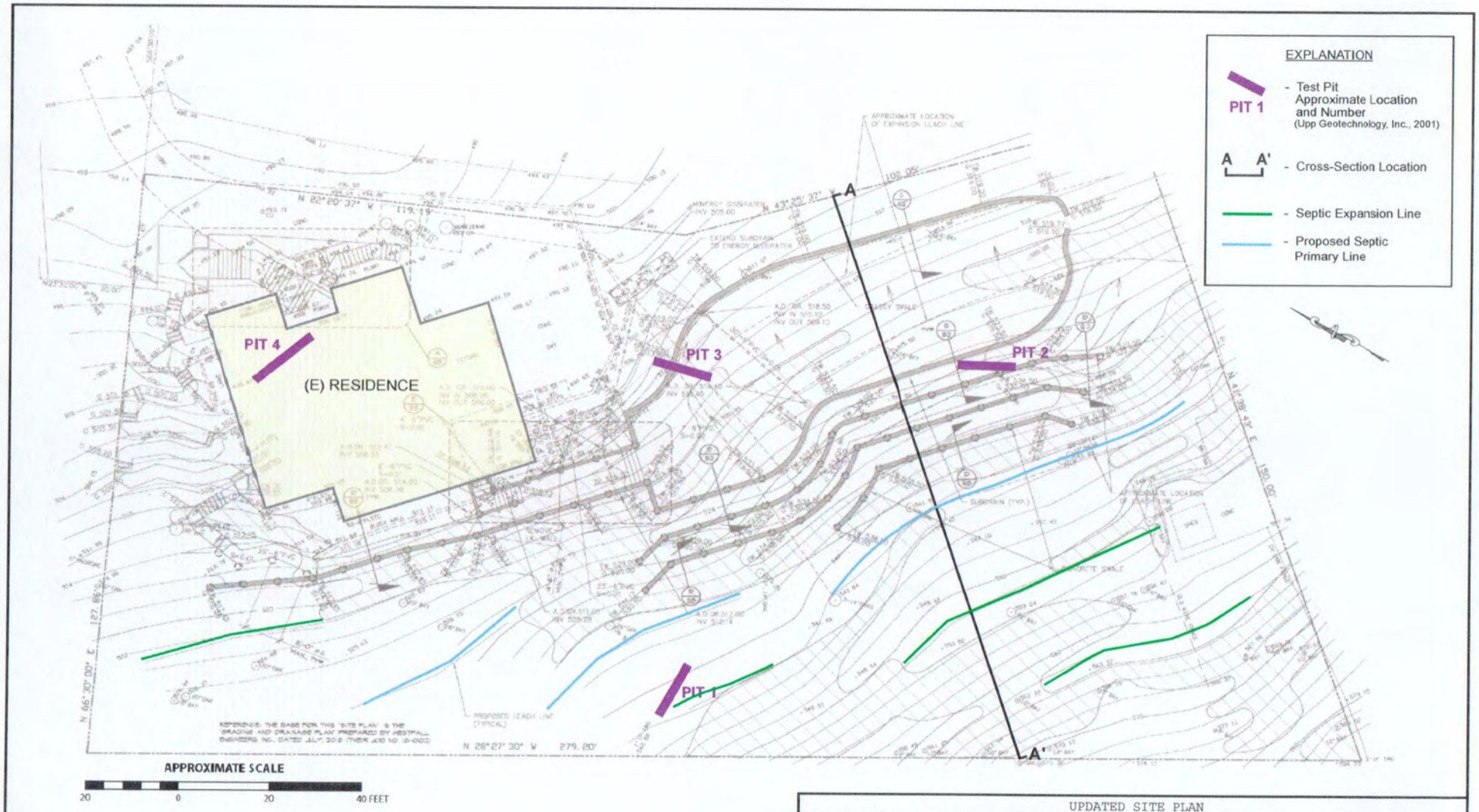
BASE: LiDAR imagery acquired from Earthscope Northern California LiDAR Project; Accessed via Google Earth 22 June 2020

LANDSLIDE INTERPRETATION MAP

C2EARTH

DUTTA PROPERTY
250 Bonita Road
San Mateo County, California

DRAFTED/REVIEWED	SCALE	DOCUMENT ID.	DATE	
KK/CH	As Shown	02891U-02L4	June 2020	Figure 1



NOTE: This plan is a conceptual illustation of observed geotechnical features and should not be used for any other purpose.

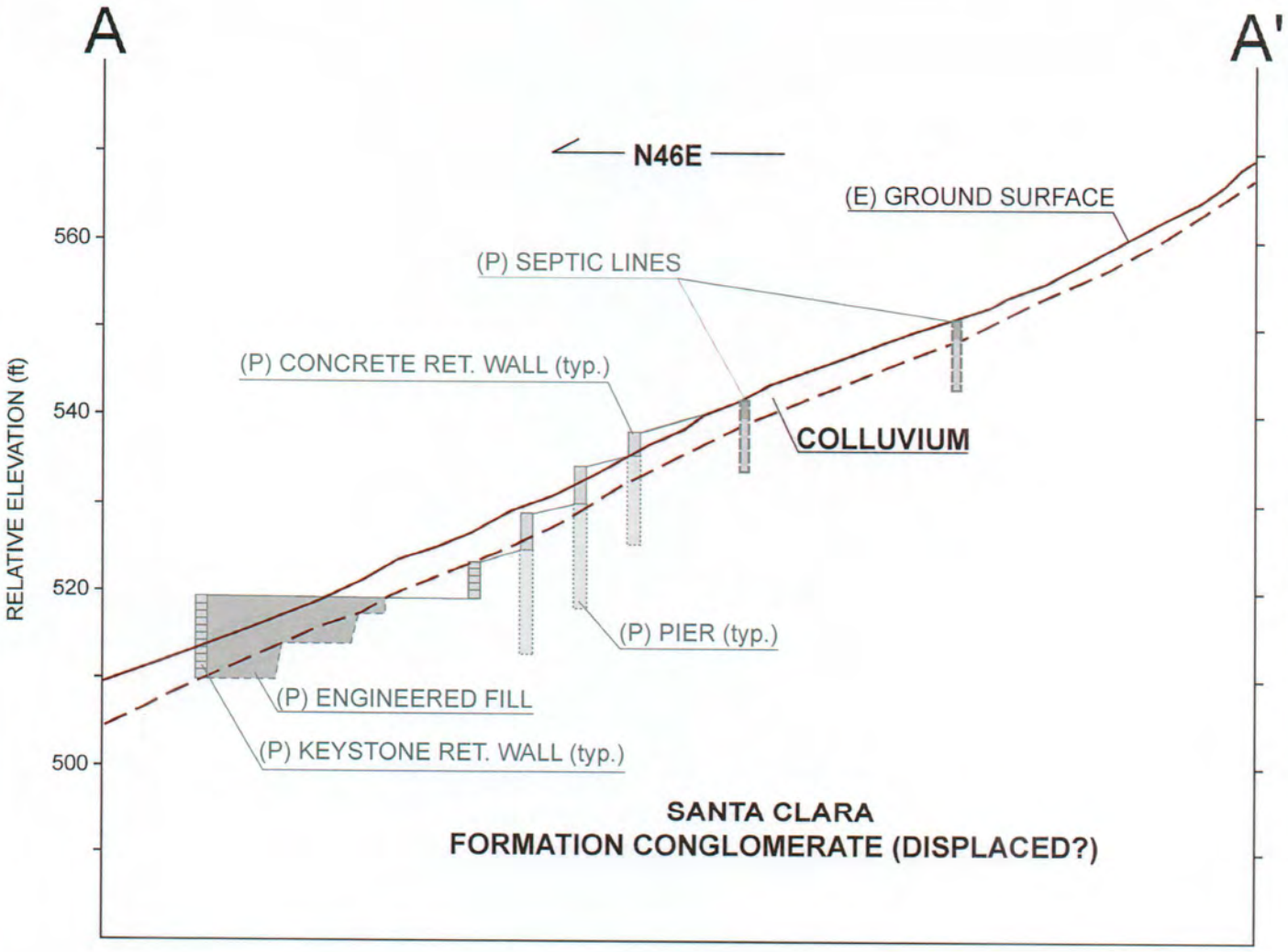
BASE: Site Plan; Sheet S1; SCHNEIDER ENGINEERING; Revision 1 dated 10 February 2020

UPDATED SITE PLAN

C2EARTH

DUTTA PROPERTY
250 Bonita Road
San Mateo County, California

DRAFTED/REVIEWED	SCALE	DOCUMENT ID.	DATE	
KK/CH	As Shown	02891U-02L4	June 2020	Figure 2



NOTE: This cross-section is a conceptual illustration of general subsurface relationships and should not be used for any other purpose.

BASE: Site Plan; Sheet S1; SCHNEIDER ENGINEERING; Revision 1 dated 10 February 2020

UPDATED CROSS SECTION A-A'

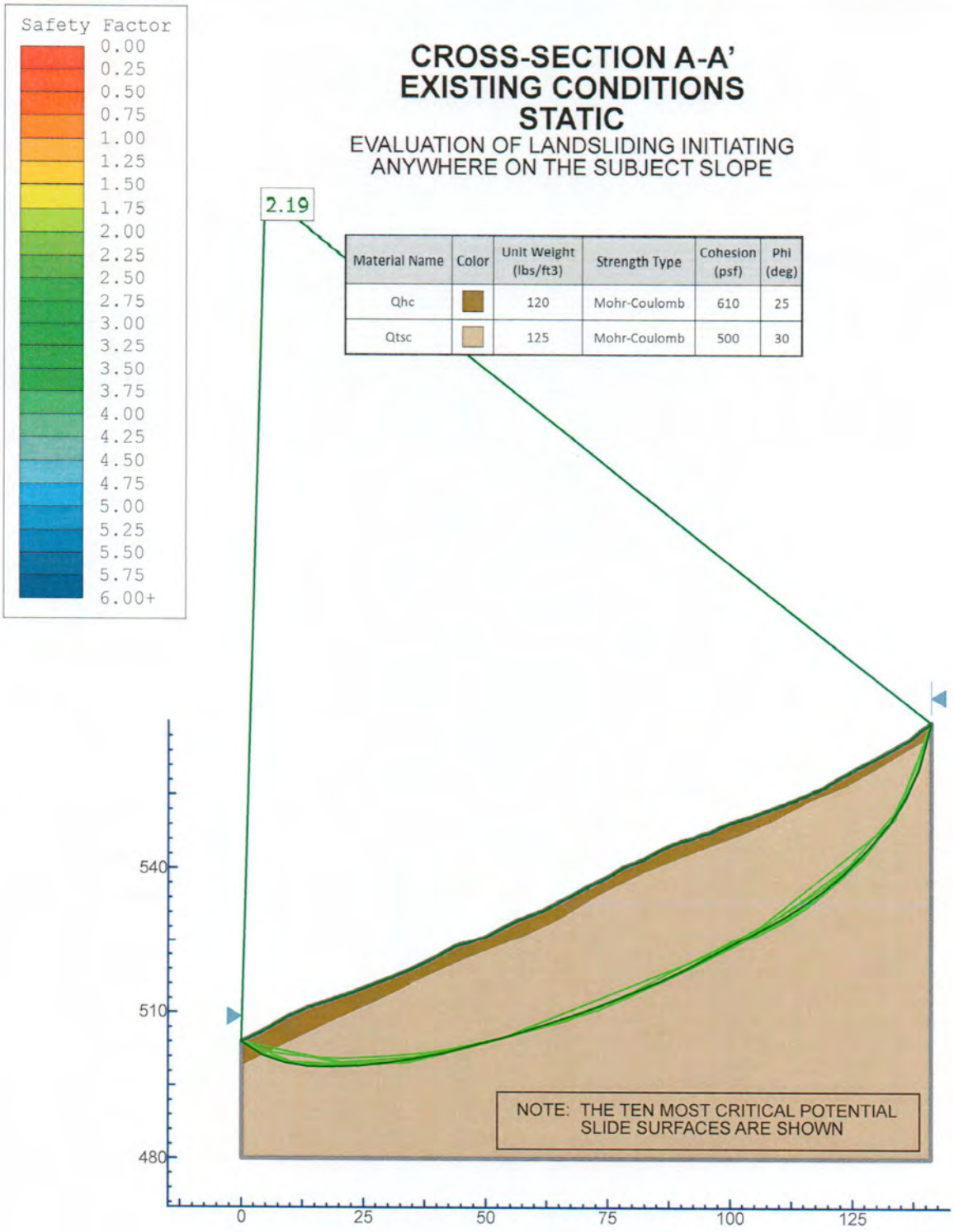
C2EARTH

DUTTA PROPERTY
250 Bonita Road
San Mateo County, California

DRAFTED/REVIEWED	SCALE	DOCUMENT ID.	DATE	
KK/CH	1" = 20'	02891U-02L4	June 2020	Figure 3

CROSS-SECTION A-A'
EXISTING CONDITIONS
STATIC

EVALUATION OF LANDSLIDING INITIATING
ANYWHERE ON THE SUBJECT SLOPE



BASE: Slide 2018; ROCSCIENCE, INC.; Version 8.029

SLOPE STABILITY ANALYSIS NO. 1

C2EARTH

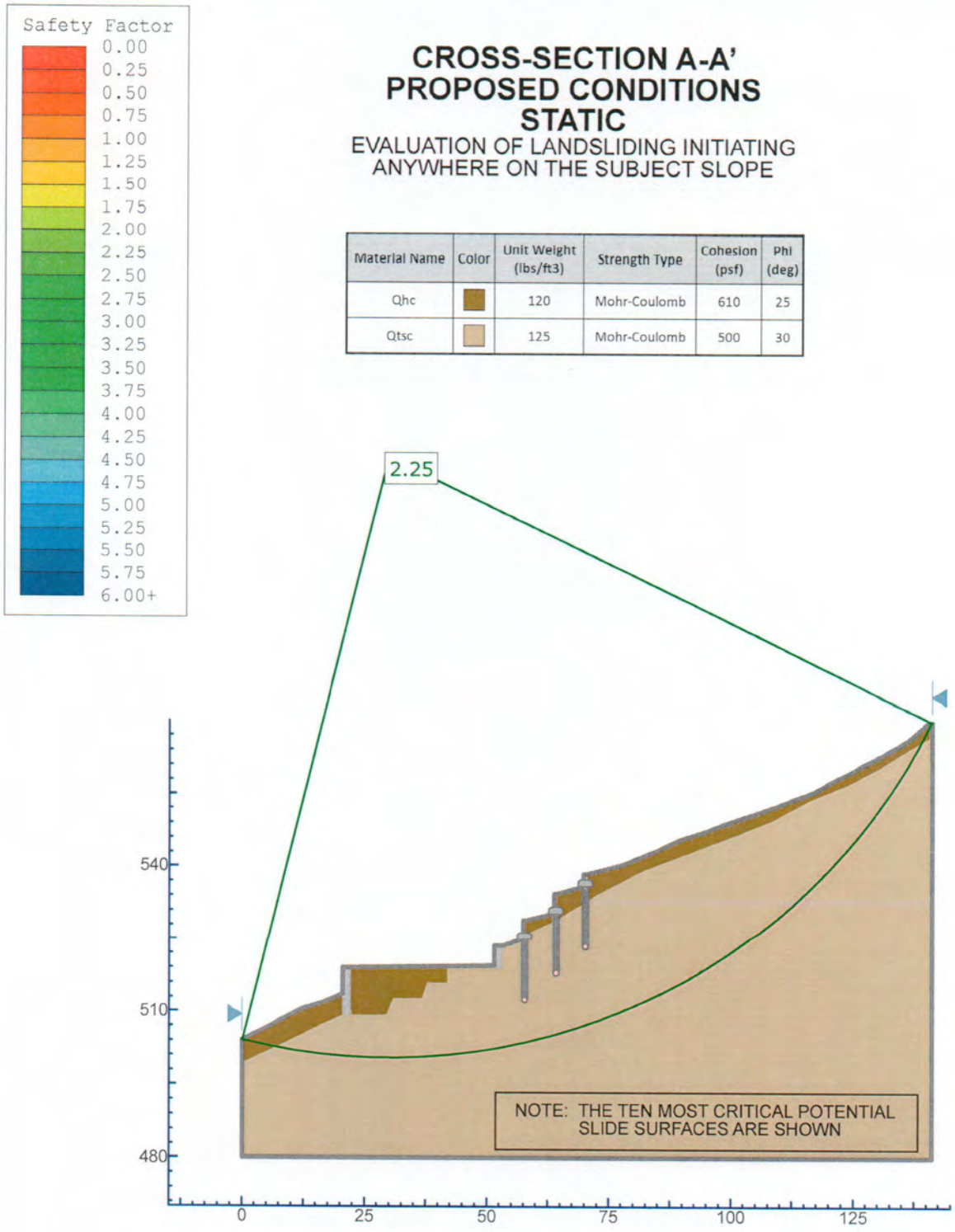
DUTTA PROPERTY
250 Bonita Road
San Mateo County, California

DRAFTED/REVIEWED	SCALE	DOCUMENT ID.	DATE	
KK/CH	As Shown	02891U-02L4	June 2020	Figure 4

CROSS-SECTION A-A'
PROPOSED CONDITIONS
STATIC

EVALUATION OF LANDSLIDING INITIATING
ANYWHERE ON THE SUBJECT SLOPE

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qhc		120	Mohr-Coulomb	610	25
Qtsc		125	Mohr-Coulomb	500	30



BASE: Slide 2018; ROCSCIENCE, INC.; Version 8.029

SLOPE STABILITY ANALYSIS NO. 2

C2EARTH

DUTTA PROPERTY
250 Bonita Road
San Mateo County, California

DRAFTED/REVIEWED	SCALE	DOCUMENT ID.	DATE	
KK/CH	As Shown	02891U-02L4	June 2020	Figure 5

PHOTO 1

PHOTO 2

PHOTO 3

PHOTO 4

PHOTO 5

PHOTO 6

PHOTO 7

PHOTO 8

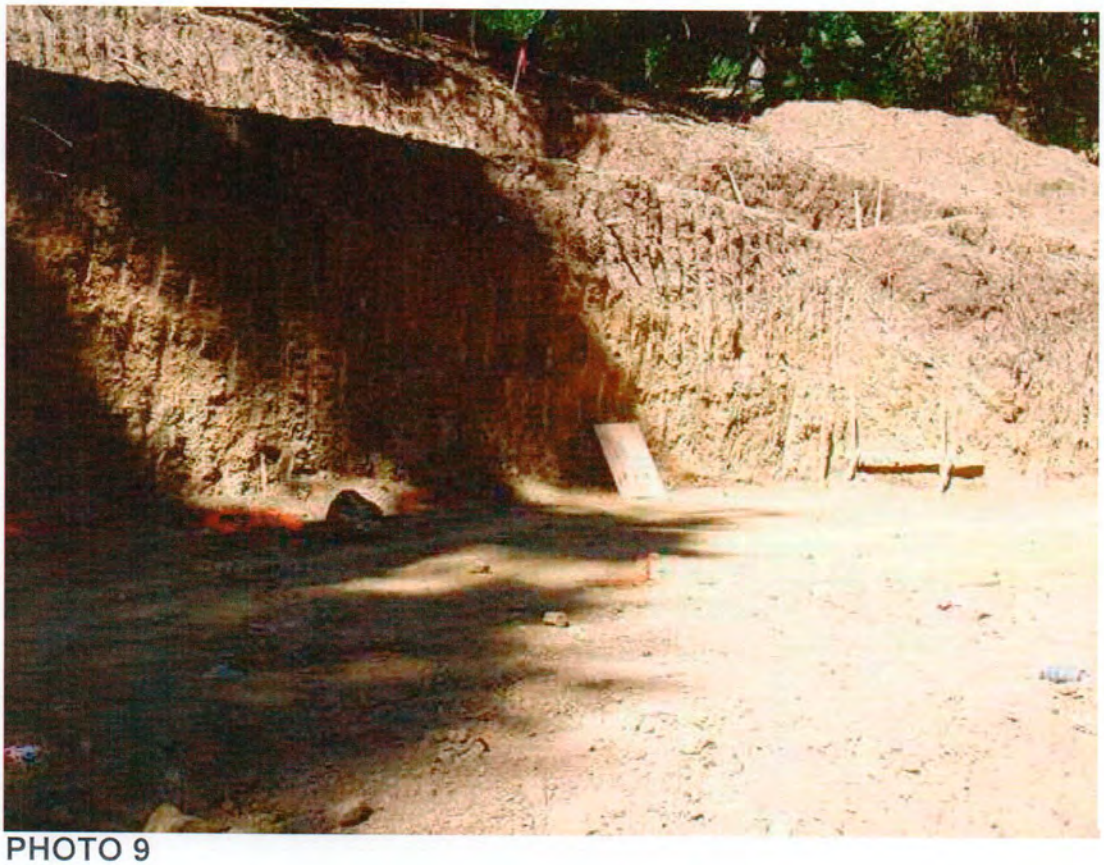
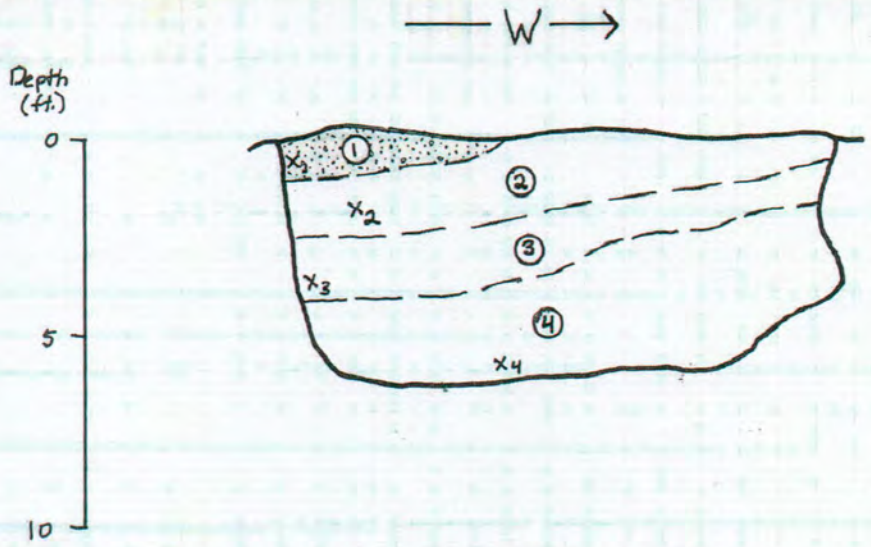


PHOTO 9

PHOTO 10



1. **SILTY SAND to SANDY SILT (ML)**; dark brown; heterogeneous with 10-20% rounded to angular rock fragments to 1½-inch diameter; fine- to coarse-grained; slightly plastic; moist; abundant rootlets (Fill)

2. **SANDY SILT (ML)**; very dark brown; homogeneous; <5% small rock fragments; fine- to medium-grained; subrounded; plastic; moist; abundant organics (Buried Topsoil)

3. **SANDY SILT (ML)**; very dark grayish brown; heterogeneous with 10-20% small, subrounded to angular rock fragments to 1-inch diameter; fine- to medium-grained; moist; trace roots and organics (Colluvium)

4. **CONGLOMERATE**; variegated color; rounded to subrounded rock fragments in a dark yellowish brown silty sand matrix; heterogeneous; very fine- to medium grained; rocks to 4-inch diameter; moist; trace organics (Santa Clara Formation)

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	DEPTH (ft)	MOISTURE CONTENT (%)
1	1	17
2	2	16
3	4	13
4	6	7

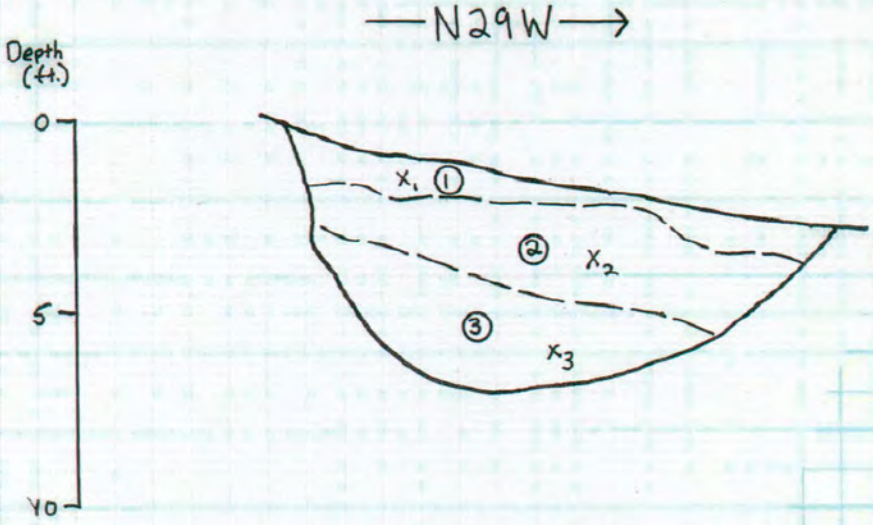
LOGGED BY: C. Hundemer; UPP GEOTECHNOLOGY, INC.; 1-5-01

LOG OF EXPLORATION PIT 1

UPP GEOTECHNOLOGY, INC.
Engineering Geology • Geotechnical Engineering

LANDS OF LATIMER
247 Bonita Road
San Mateo County, California

APPROVED BY	SCALE	PROJECT NO.	DATE	
PH.	1" = 5'	2054.2R1	February 2001	Figure 8



1. **SANDY SILT (ML)**; very dark grayish brown; heterogeneous with 10-20% rounded to subrounded rock fragments to 1-inch diameter; slightly plastic; fine- to medium-grained; subrounded; moist; abundant organics (Topsoil)

2. **SANDY SILT (ML)**; very dark brown; heterogeneous with 10-20% small, angular to subrounded rock fragments; moist; moderately plastic; trace organics (Colluvium)

3. **CONGLOMERATE**; variegated color; rounded to subrounded rock fragments in a dark yellowish brown to dark brown silty sand matrix; heterogeneous; very fine- to medium grained; rocks to 4-inch diameter; moist; trace organics (Santa Clara Formation)

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	DEPTH (ft)	MOISTURE CONTENT (%)
1	1	16
2	2	16
3	4½	9

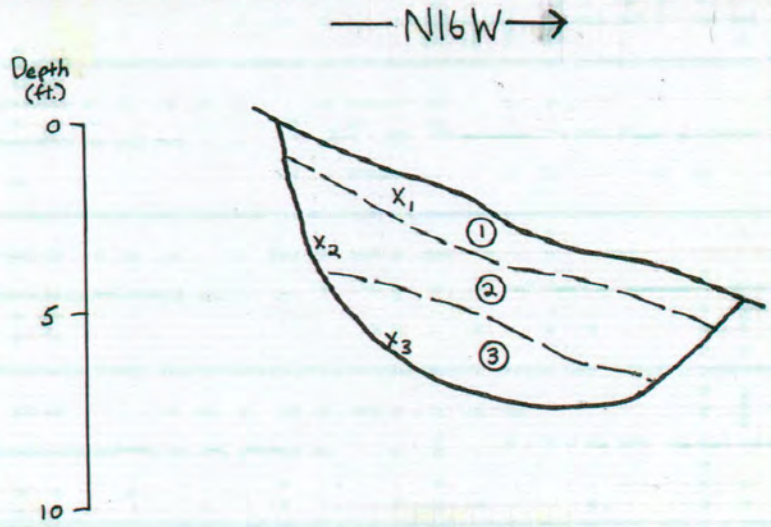
LOGGED BY: C. Hundemer; UPP GEOTECHNOLOGY, INC.; 1-5-01

LOG OF EXPLORATION PIT 2

UPP GEOTECHNOLOGY, INC.
Engineering Geology • Geotechnical Engineering

LANDS OF LATIMER
247 Bonita Road
San Mateo County, California

APPROVED BY	SCALE	PROJECT NO.	DATE	
CH	1" = 5'	2054.2R1	February 2001	Figure 9



1. **SANDY SILT (ML)**; very dark grayish brown to black; heterogeneous with 10-15% subrounded to subangular rock fragments to 1-inch diameter; slightly plastic; fine- to medium-grained; subrounded; moist; abundant organics (Topsoil)

2. **SANDY SILT to SILTY SAND (ML/SM)**; dark grayish brown; heterogeneous with 10-20% small, angular to subrounded rock fragments; moist; moderately plastic; trace organics (Colluvium)

3. **CONGLOMERATE**; variegated color; rounded to angular rock fragments to 3-inch diameter in a brown to yellowish brown silty sand matrix; indurated; very fine- to fine-grained; subrounded to subangular; dry to slightly moist (Santa Clara Formation)

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	DEPTH (ft)	MOISTURE CONTENT (%)
1	1	17
2	3	10
3	5	8

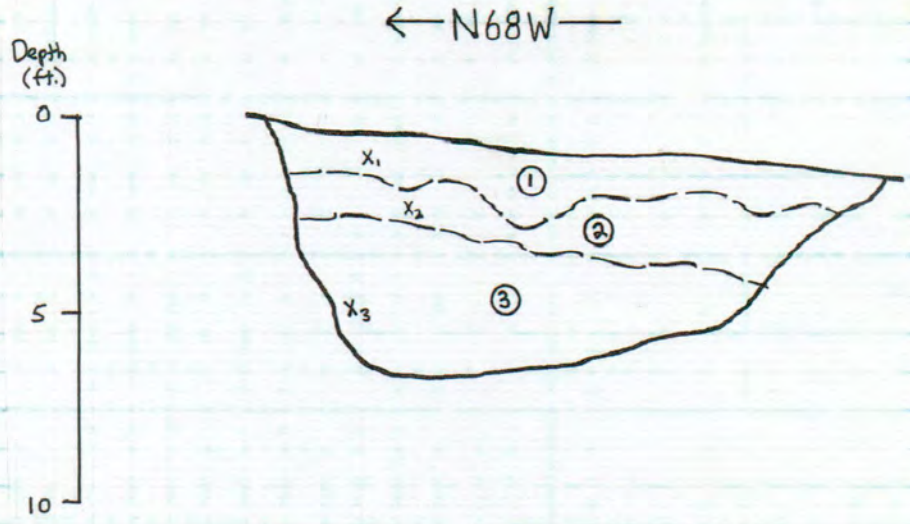
LOGGED BY: C. Hundemer; UPP GEOTECHNOLOGY, INC.; 1-5-01

LOG OF EXPLORATION PIT 3

UPP GEOTECHNOLOGY, INC.
Engineering Geology • Geotechnical Engineering

LANDS OF LATIMER
247 Bonita Road
San Mateo County, California

APPROVED BY	SCALE	PROJECT NO.	DATE	
CJH.	1" = 5'	2054.2R1	February 2001	Figure 10



1. **SILT (ML)**; black; heterogeneous with 5-10% angular to subrounded sand and rock frgments; moist; abundant roots and decaying organics (Topsoil)

2. **CLAYEY SAND to SILTY SAND (SC/SM)**; dark yellowish brown; heterogeneous with 10-20% small, angular to subrounded rock fragments; moist; moderately plastic; trace organics (Colluvium)

3. **CONGLOMERATE**; variegated color; rounded to angular rock fragments to 8-inch diameter in a yellowish brown silty sand matrix; indurated; very fine- to fine-grained; subrounded to subangular; dry to slightly moist (Santa Clara Formation)

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	DEPTH (ft)	MOISTURE CONTENT (%)
1	½	32
2	2	12
3	4½	7

LOGGED BY: C. Hundemer; UPP GEOTECHNOLOGY, INC.; 1-5-01

LOG OF EXPLORATION PIT 4

UPP GEOTECHNOLOGY, INC.
Engineering Geology • Geotechnical Engineering

LANDS OF LATIMER
247 Bonita Road
San Mateo County, California

APPROVED BY	SCALE	PROJECT NO.	DATE	
CH	1" = 5'	2054.2R1	February 2001	Figure 11

12 March 2020
Document Id. 02891U-02L3
Serial No. 19275

Mr. Sanjeet Dutta
250 Bonita Road
Portola Valley, CA 94028

SUBJECT: SUPPLEMENTAL RECOMMENDATIONS AND PLAN REVIEW
PROPOSED SITE RETAINING WALLS AND
LANDSCAPING IMPROVEMENTS
DUTTA PROPERTY
250 BONITA ROAD
SAN MATEO COUNTY, CALIFORNIA

Dear Mr. Dutta:

INTRODUCTION

As requested, we have developed supplemental recommendations and have reviewed project septic and structural plans and calculations for the proposed site retaining walls and landscaping improvements to be constructed on your property at 250 Bonita Road in the Los Trancos Woods community of unincorporated San Mateo County, California. Upp Geotechnology Inc. performed the geotechnical study for the development of the site for a prior owner of the property, and submitted the results of that study in a Geotechnical Investigation report dated 8 February 2001 (Serial No. 10370). Subsequently, you purchased the property and completed the site development. Upp Geotechnology Inc. provided updated recommendations, reviewed project plans, responded to county peer review comments, and observed and tested the geotechnical elements of the site development between 2005 and 2006.

The Upp Geotechnology Inc. 2001 report presented recommendations for structural piers, caissons, and concrete retaining walls, which were utilized in the current design for new walls and stairs to be built on the front and rear of the home. Effective 1 January 2012, Upp Geotechnology Inc. closed. C2Earth Inc. acquired the assets of Upp Geotechnology Inc. and continued to provide services for Upp Geotechnology Inc.'s clients under the trade name Upp Geotechnology. At your request, we also developed supplemental recommendations for the project, including recommendations for Keystone block retaining walls which will be used to create a lawn area southeast of your home, and presented those recommendations in our Geotechnical Recommendations letter dated 7 November 2017 (Document Id. 02891U-02L1, published under our trade name, Upp Geotechnology). We understand from our conversations with you and with your septic consultant, that portions of the existing leachfield in the area of the proposed improvements will be removed, and new primary and expansion leachfield areas will be built uphill of the areas of the proposed improvements. The newly configured primary and expansion fields will use pressure-dosed dispersal methods.

SUPPLEMENTAL RECOMMENDATIONS

The location of the leachfield requires that site retaining walls immediately downslope of the leachfield area be designed as undrained, poured concrete walls. Additionally, we understand that you are planning to support new front entry stairs on drilled piers. Consequently, we have developed the following supplemental recommendations for pier-supported undrained poured concrete retaining walls and entry stair piers:

- Drill piers with a minimum diameter of 16 inches and embed them a minimum of 8 feet into the underlying Santa Clara formation materials.
- Design and construct drilled piers no closer than 3 pier diameters apart (measured center of pier to center of pier).

- Design the portion of the piers in the supportive bedrock using a skin friction value of 450 psf for dead plus live loads, with a 1/3 increase for transient loads, including wind and seismic.
- Neglect any portion of the piers in fill and/or non-supportive colluvium and any point-bearing resistance for support.
- Design for resistance to lateral loads using a passive pressure equal to an equivalent fluid weight of 400 pcf to a maximum of 3,000 psf taken over **1½ times** the pier diameter for the length of the piers in the Santa Clara formation.
- Design undrained, (active condition) site retaining walls to resist an equivalent fluid pressure of 90 pcf. Add an additional equivalent fluid pressure increment to the active and at-rest condition for backfill steeper than 4:1 (horizontal to vertical), in accordance with the following:

  + 8 pcf for slopes between 3:1 and 4:1
  + 12 pcf for slopes between 2:1 and 3:1
  + Contact us for slopes steeper than 2:1

- Site walls less than 6 feet tall are not subject to additional earthquake loading requirements.

PLAN REVIEW

We have reviewed the following structural plans and calculations for the proposed improvements to your property, along with the following new septic plans for the property:

- Plan Sheets S1 through S4 (Revision 1 dated 10 February 2020) by Schneider Engineering;
- Structural Calculations (dated 10 February 2020) by Schneider Engineering.
- Septic Plan Sheets OWTS 1 and OWTS 2 (dated 7 March 2020) by Christopher Day, R.E.H.S.

Our plan review was made from a soil and foundation engineering viewpoint; no review was made of other aspects of the project design, such as project structural engineering. Based on our review, it is our opinion, the above referenced plans and calculations appear to be in general conformance with the recommendations of our reports. However, we make no representation as to the accuracy of dimensions, measurements, calculations or any portion of the design, other than that covered by our recommendations.

Sincerely,
C2Earth, Inc.

5-13-2020

Christopher R. Hundemer, Principal
Certified Engineering Geologist 2314
Certified Hydrogeologist 882
Registered Civil Engineer 87149

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER R. HUNDEMER
87149
CIVIL
STATE OF CALIFORNIA

Distribution: Addressee (3 via mail and via e-mail to sanjeetdutta@yahoo.com)
Mr. Fred Schneider (via e-mail to fasengineer@sbcglobal.net)
Mr. Christopher Day (via e-mail to christopherdayr@aol.com)

UPP GEOTECHNOLOGY
Engineering Geology • Geotechnical Engineering
a division of C2EARTH, INC.

11 January 2019
Document Id. 02891U-02L2
Serial No. 18771

Mr. Sanjeet Dutta
250 Bonita Road
Portola Valley, CA 94028

SUBJECT: PLAN REVIEW
PROPOSED SITE RETAINING WALLS AND
LANDSCAPING IMPROVEMENTS
DUTTA PROPERTY
250 BONITA ROAD
SAN MATEO COUNTY, CALIFORNIA

Dear Mr. Dutta:

As you requested, we have reviewed the following plans and calculations for the proposed site retaining walls and landscaping improvements to be constructed on your property at 250 Bonita Road in the Los Trancos Woods community of unincorporated San Mateo County, California:

- Structural Plan Sheets S1 through S4 by Schneider Engineering dated December 2018
- Structural Calculations by Schneider Engineering dated 10 December 2018

We previously performed the geotechnical study for the development of the site for a prior owner of the property, and submitted the results of that study in a Geotechnical Investigation report dated 8 February 2001 (Serial No. 10370). Subsequently, you purchased the property and completed the site development. We provided updated recommendations, reviewed project plans, responded to county peer review comments, and observed and tested the geotechnical elements of the site development between 2005 and 2006.

Our 2001 report presented recommendations for structural piers, caissons, and concrete retaining walls, which were utilized in the current design for new walls and stairs to be built on the front and rear of the home. At your request, we also developed supplemental recommendations for the project, including recommendations for Keystone block retaining walls which will be used to create a lawn area southeast of your home, and presented those recommendations in our Geotechnical Recommendations letter dated 7 November 2017 (Document Id. 02891U-02L1).

Our plan review was made from a geotechnical engineering viewpoint; no review was made of other aspects of the project design, such as project structural engineering. Based on our review, we find the plans and calculations to be in general conformance with the recommendations of our 2001 report and 2017 letter. However, we make no representation as to the accuracy of dimensions, measurements, calculations or any portion of the design, other than that covered by our recommendations.

We appreciate the opportunity to continue to assist you with your project.

Sincerely yours,
Upp Geotechnology
a division of C2Earth, Inc.

1-11-19

Christopher R. Hundemer, Principal
Certified Engineering Geologist 2314
Certified Hydrogeologist 882
Registered Civil Engineer 87149

Distribution: Addressee (3 via mail and via e-mail to sanjeetdutta@yahoo.com)
Mr. Fred Schneider (via e-mail to fasengineer@sbcglobal.net)

UPP GEOTECHNOLOGY
Engineering Geology • Geotechnical Engineering
a division of C2EARTH, INC.

7 November 2017
Document Id. 02891U-02L1
Serial No. 18250

Mr. Sanjeet Dutta
250 Bonita Road
Portola Valley, CA 94028

SUBJECT: GEOTECHNICAL RECOMMENDATIONS
PROPOSED SITE RETAINING WALLS AND
LANDSCAPING IMPROVEMENTS
DUTTA PROPERTY
250 BONITA ROAD
SAN MATEO COUNTY, CALIFORNIA

Dear Mr. Dutta:

INTRODUCTION

As requested, we are pleased to have developed updated geotechnical recommendations for the proposed landscaping improvements to your property at 250 Bonita Road in the Los Trancos Woods community of unincorporated San Mateo County, California.

The current project involves constructing a generally flat lawn area on the hillside southeast of your home. Segmented block retaining walls (SRWs) will be constructed on both the uphill and downhill sides of the lawn area to support cuts and fills to create the flat pad. We also anticipate that a paver-covered path will be constructed leading from the backdoor of your residence to the lawn area. An unpaved landscaping path is also planned to lead from the driveway to the area behind the home on the slope on the northwest side of the home, and new wooden stairs are planned to lead from the driveway to the home's front entry. The approximate locations of the proposed improvements are provided on Figure 1, Partial Site Plan.

We previously performed the geotechnical study for the development of the site for a prior owner of the property, and submitted the results of that study in a report dated 8 February 2001. Subsequently, you purchased the property and completed the site development. We provided updated recommendations, reviewed project plans, responded to county peer review comments, and observed and tested the geotechnical elements of the site development between 2005 and 2006.

The purpose of this supplemental evaluation was to develop updated geotechnical engineering recommendations for the currently proposed improvements. Although information from our prior study and construction observations was used to develop these updated recommendations, this letter serves as a stand-alone document for the currently proposed project.

SCOPE OF SERVICES

We conducted this study in accordance with the scope and conditions presented in our proposal dated 29 September 2017 (Document Id. 02891U-02P1). We make no other warranty, either expressed or implied. Our scope of services for this study included:

- reviewing of selected geologic literature and our previous report and construction observations data of the subject property to evaluate the prevailing geologic and geotechnical engineering conditions;
- updating a partial site plan and preparing a slope profiles (based upon a proposed improvements plan that was provided to us);
- consulting with your project designer;
- analyzing geotechnical engineering properties from collected data; and
- preparing this letter.

We have prepared this letter as a product of our service for your exclusive use for the proposed landscaping improvements to the subject property. Other parties may not use this report, nor may the report be used for other purposes without prior written authorization from Upp Geotechnology, a division of C2Earth, Inc (C2).

SITE CONDITIONS

Our principal engineer/geologist visited the site on 21 September 2017 to meet with you to discuss the project and observe the site conditions in the area of the proposed lawn. The proposed lawn and associated retaining walls are planned for the gentle to moderately steep slope southeast of the residence. The proposed lawn is planned to be at a relative elevation of about 518 to 519, which will require constructing a wall up to about 5 feet tall on the downslope side of the yard area, and a series of terraced walls 2 ½ to 4 feet tall on the uphill side. The ground surface between the terraced walls will have a gradient of about 2:1 (horizontal to vertical). Based on our prior subsurface exploration and observations of drilled piers and excavations for the residence, driveway, and existing retaining walls, we anticipate up to about 3 feet of non-supportive soil and colluvium mantling the supportive Santa Clara formation materials in the area of the proposed improvements. Our interpretation of the subsurface conditions in the area of the improvements is presented on Figure 2, Cross-Section A-A'.

RECOMMENDATIONS

Because the project is still in a relatively early phase of development, it is conceivable that changes and additions will be made to the proposed development concept following submission of this letter. We recommend that as various changes and additions are made, we be consulted to evaluate the geotechnical aspects of these modifications.

The following recommendations must be incorporated into all aspects of the proposed landscaping improvements.

Seismic Design Criteria

We recommend that the project design engineer provide appropriate seismic design criteria for proposed foundations and associated improvements. The following information is intended to aid the project structural design engineer to this end and is based on criteria set forth in the 2016 California Building Code (CBC). The mapped spectral accelerations and site coefficients were computed using the Beta version of the USGS Seismic Design Maps application with the 2015 NEHRP Recommended Seismic Provision, which are being incorporated into the 2016 ASCE 7 Standard.

Design Parameters

Latitude = 37.3443°
Longitude = -122.1995°
Site Class = C
$S_s = 2.453$
$S_1 = 1.028$
$F_a = 1.2$
$F_v = 1.4$

Experience has shown that earthquake-related distress to structures can be substantially mitigated by quality construction. We recommend that a qualified and reputable contractor and skilled craftsmen build the associated improvements. We also recommend that the project structural design engineer and project architect monitor the construction to make sure that their designs and recommendations are properly interpreted and constructed.

Earthwork

At the time of this study, the full extent of any proposed earthwork had not been finalized. We anticipate that a moderate amount of grading will be required to construct the proposed landscaping improvements. Any proposed earthwork should be performed in accordance with the recommendations provided below.

Clearing and Site Preparation

- Clear all obstructions, including brush, trees not designated to remain, and debris on any areas to be graded.
- Clear and backfill any holes or depressions resulting from the removal of underground obstructions below proposed finished subgrade levels with suitable material compacted to the requirements for engineered fill given below.
- After clearing, strip the site to a sufficient depth to remove all surface vegetation and organic-laden topsoil. We estimate that a stripping depth of approximately 3 inches would be required on natural slope areas. This material must not be used as engineered fill; however, it may be used for landscaping purposes.

Fill Material

- Based on our prior study and prior construction observations, it is our opinion that on-site colluvial and Santa Clara formation materials should be suitable for use as fill. On-site or imported materials must meet the requirements specified below to be used as engineered fill.
- Materials used for engineered fill must meet the following requirements:
  - have an organic content less than 3% by volume,
  - no rocks or lumps greater than 6 inches in maximum dimension, and
  - no more than 15% of the fill may be greater than 2½ inches in maximum dimension.
- If on-site materials do not meet the requirements given above, they may be off-hauled or used for landscaping purposes only.
- In addition to the requirements above, any import fill must have a plasticity index (PI) of 15% or less.
- **Contact C2 with samples of proposed fill materials at least four days prior to fill placement for laboratory testing and evaluation.**

Keyways and Benches

- Fill placed on slopes in excess of 5:1 must be benched into the underlying Santa Clara formation to provide a firm, stable surface for support of the fill.
- Where not supported by retaining walls, the toe of proposed fill must be supported by a keyway excavated a minimum of 3 feet into the supportive Santa Clara formation, as measured on the downhill side of the keyway. We anticipate that the top of the supportive material / bedrock will be about 3 to 4 feet below existing grade.
- Benches generally must be a minimum of 5 feet wide and must be excavated entirely into the supportive material.
- Temporary back slopes may be vertically excavated provided they are constructed in the dry season and meet Cal OSHA requirements.
- Both the keyway and any required benches must be excavated near level in the direction parallel to the natural slope and must be provided with an approximately 2% gradient sloping into the hillside to provide resistance to lateral movement.
- **Contact C2 to evaluate the actual location, size, and depth of the required keyway and benches at the time of construction.**

Compaction Procedures

- Prior to fill placement, scarify the surface to receive the fill to a depth of 6 inches.
- Moisture condition the imported fill to the materials' approximate optimum moisture content.
- Spread and compact the fill in lifts not exceeding 8 inches in loose thickness.
- Compact the fill to at least 90% relative compaction by the Modified Proctor Test method, in general accordance with the ASTM Test Designation D1557 (latest revision).
- **Contact C2 to observe the placement and test the compaction of engineered fill.** Provide at least two working days notice prior to placing fill.

Permanent Slopes

- Construct the gradients of cut or fill slopes to no steeper than 2:1.
- Re-vegetate all graded surfaces or areas of disturbed ground prior to the onset of the rainy season following construction to control soil erosion.
- Install other erosion control provisions if vegetation is not established by the rainy season.
- Maintain ground cover vegetation once it is established to provide long-term erosion control.

Trench Backfill

- Backfill any utility trench with compacted engineered fill.
- Place suitable on-site soil into the trenches in lifts not exceeding 8 inches in uncompacted thickness, and compact it to at least 90% relative compaction by mechanical means only.
- If imported sand is used, compact it to at least 90% relative compaction. Do not use water jetting to obtain the minimum degree of compaction in imported sand backfill. If the trench is greater than 50 feet long, located on sloping ground greater than 5:1 (horizontal to vertical), and is backfilled with sand, check dams should be installed to reduce the potential of the sand washing out.
- **Contact C2 to observe and test compaction of the fill.**

Segmented Block Retaining Walls

- We anticipate that the proposed retaining walls uphill and downhill of the proposed lawn area will be constructed as flexible segmented block retaining walls (SRW). Based on proposed wall heights, we anticipate that the uphill walls will be designed and constructed as gravity walls, while the taller lower wall will be designed and constructed using geogrid reinforcement.

- We recommend that the SRWs be designed and constructed in general accordance with the manufacturer's recommendations, including being provided with geogrid reinforcement, if necessary.
- The following material parameters may be used for the SRW design. For the Santa Clara formation (foundation materials), use a unit weight of 125 pcf, an internal angle of friction of 30 degrees, and negligible cohesion with an allowable bearing capacity of 2,000 psf. For engineered fill or on-site soil or colluvial materials (backfill materials), use a unit weight of 120 pcf, an internal angle of friction of 25 degrees, and negligible cohesion.
- Site walls are not subject to additional earthquake loading requirements.
- Construct the SRWs so that a minimum of one layer of blocks is keyed into the underlying Santa Clara formation materials below any soil or colluvium.
- Calculate the wall height from the bottom of the lowest block to the top of the upper block.
- Apply appropriate surcharge loading for sloping ground at the top of the retaining wall in accordance with the manufacturer's recommendations.
- Provide drainage provisions to prevent the build up of hydrostatic pressure in accordance with the manufacturer's recommendations and the recommendations presented in the preceding section for basement retaining walls.
- **Contact C2 to observe the excavation prior to placement of the SRW blocks** to evaluate if the blocks are founded in material of sufficient supporting capacity.
- **Contact C2 to observe the placement of geogrid and test the compaction of backfill.**

Flatwork

We anticipate that flatwork leading from the house to the lawn will be comprised of flexible pavers. Because of the potential for differential fill or soil thickness beneath the pavers, we judge that there is a risk of minor ongoing cosmetic damage to the flatwork. It should be anticipated that periodic maintenance to level or repair pavers may be necessary. To mitigate (but not eliminate) the risk from differential movement to the pavers, we recommend that, where practical, you remove and recompact fill and soil to be a uniform thickness of engineered fill beneath the walkway.

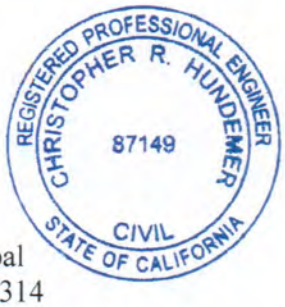
Other Elements

Other elements that are planned, such as the decomposed gravel pathway, low landscaping walls less than 2 feet tall, and the new wooden entry steps do not require geotechnical input, and are outside of our scope of evaluation. If you would like us to provide specific geotechnical recommendations for these elements, please contact us.

PLAN REVIEW AND CONSTRUCTION OBSERVATION

We must be retained to review the final grading, retaining wall, and drainage control plans, in order to verify that our recommendations have been properly incorporated into the proposed project. In addition, we must also observe and document the geotechnical construction aspects of the project.

Sincerely yours,
Upp Geotechnology
a division of C2Earth, Inc.



Christopher R. Hundemer, Principal
Certified Engineering Geologist 2314
Certified Hydrogeologist 882
Registered Civil Engineer 87149

THIS DOCUMENT HAS BEEN DIGITALLY SIGNED

Distribution: Addressee (2 via mail and via e-mail to sanjeetdutta@yahoo.com)
Ms. Adriana Carias (via e-mail to acarias@lsls.net)

Inclusions: Figure 1, Partial Site Plan
Figure 2, Cross-Section A-A'

NOTE: This plan is a conceptual illustration of observed geotechnical features and should not be used for any other purpose.

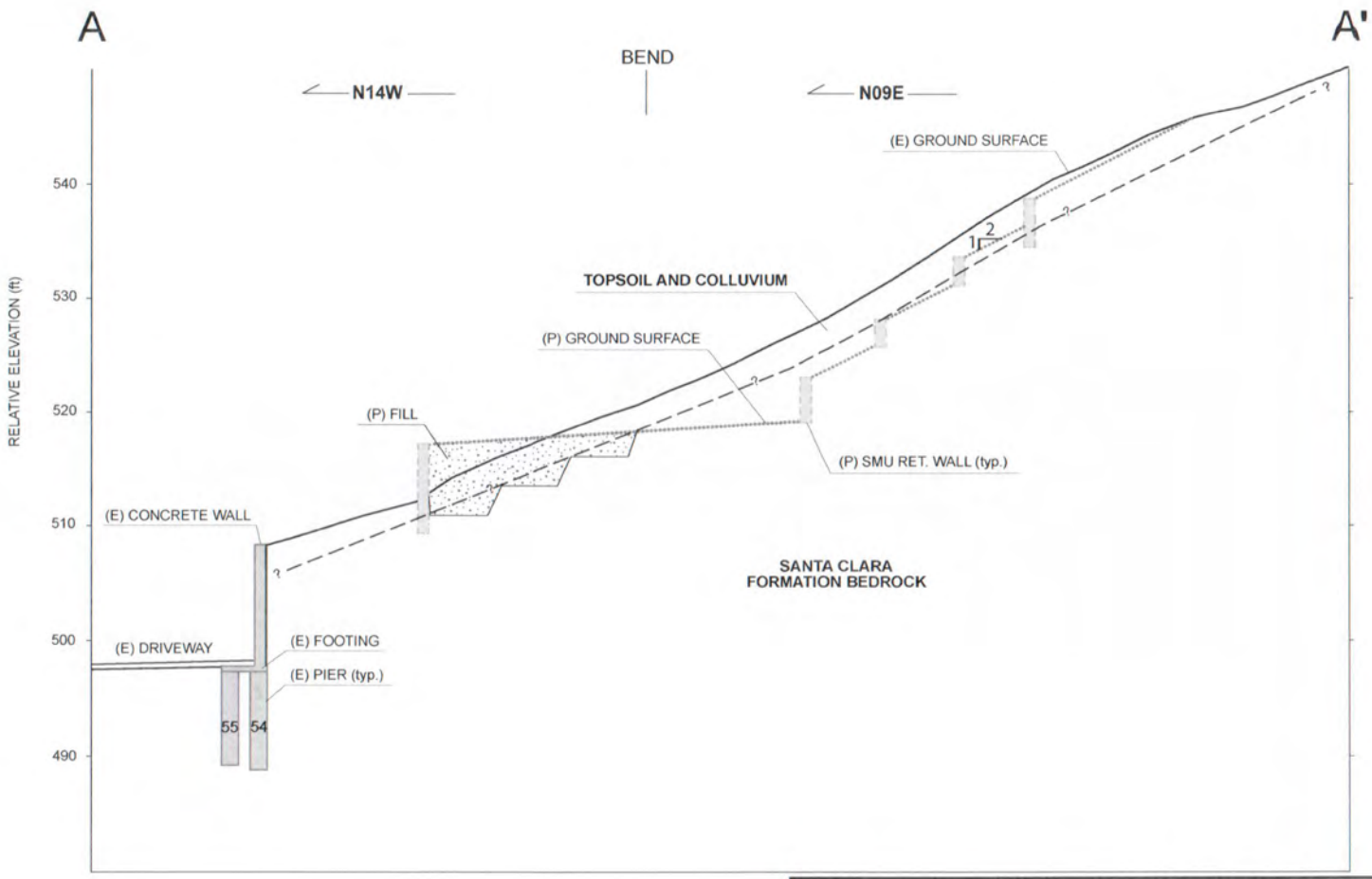
BASE: Conceptual Plan; Sheets LC.1, LC.2, and LC.3; LANDSYSTEMS LANDSCAPE ARCHITECTS AND CONTRACTORS; 27 October 2017

PARTIAL SITE PLAN

UPP GEOTECHNOLOGY
a division of C2EARTH, INC.

DUTTA PROPERTY
250 Bonita Road
San Mateo County, California

DRAFTED/REVIEWED	SCALE	DOCUMENT ID.	DATE	
RW/CH	As Shown	02891U-02L1	November 2017	Figure 1



NOTE: This cross-section is a conceptual illustration of general subsurface relationships and should not be used for any other purpose.

BASE: Conceptual Plan; Sheets LC.1, LC.2, and LC.3; LANDSYSTEMS LANDSCAPE ARCHITECTS AND CONTRACTORS; 27 October 2017

CROSS-SECTION A-A'

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DUTTA PROPERTY
250 Bonita Road
San Mateo County, California

DRAFTED/REVIEWED	SCALE	DOCUMENT ID.	DATE	
KK/CH	1"= 10'	02891U-02L1	November 2017	Figure 2