APPENDIX G
GEOTECHNICAL EVALUATIONS

APPENDIX G-1

WMSA GEOTECHNICAL EVALUATION

West Materials Storage Area Geotechnical Evaluation

Permanente Quarry

April 5, 2019

Prepared for:

Lehigh Southwest Cement Company,
Lehigh Hanson, Inc.

Prepared by:

Stantec Consulting Services Inc.
American Plaza II
57 W. 200 So., Suite 500
Salt Lake City, UT 84101

Revision	Description	Author		Quality Check		Independent Review	
3	Client comments	Paul Kos	4/5/19	Toni Jack	4/5/19	Greg Gold	4/5/19
2	Client Draft	Paul Kos	2/1/19	Toni Jack	2/1/19	Greg Gold	2/1/19
1	Client Draft	Paul Kos	12/21/18	Toni Jack	12/14/18	Greg Gold	12/14/18
0	Client Draft	Paul Kos	11/30/18	Toni Jack	11/30/18	Greg Gold	11/30/18
A	Initial Draft	Paul Kos	11/15/18	Toni Jack	11/15/18	Greg Gold	11/15/18

Sign-off Sheet

This West Materials Storage Area Geotechnical Evaluation was prepared by Stantec Consulting Services Inc. (Stantec) for the account of Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc. The material in it reflects Stantec's professional judgment in light of the scope, schedule, and other limitations stated in the document. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. Any use, which a third party makes of this document, is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party because of decisions made or actions taken based on this document.

Prepared by Paul J. Kos

(Signature)

Paul Kos

Reviewed by Nelson Kawamura

(Signature)

Nelson Kawamura

Approved by Gregory L. Gold

(Signature)

Greg Gold

Table of Contents

LIST OF TABLES

LIST OF PHOTOS

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

This West Materials Storage Area (WMSA) Geotechnical Evaluation has been prepared to assist Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc., with the upcoming Reclamation Plan amendment submission, under California's Surface Mining and Reclamation Act (SMARA). This report provides the proposed modifications to the reclaimed WMSA, documents previous and recent investigations of WMSA, and provides results of stability analyses.

Stantec's geotechnical evaluation of WMSA excludes the lower elevations (southern) of the western portions of WMSA, below the main haul road (the exclusion area). This area, which includes the Permanente Creek Restoration Area, was placed prior to the promulgation of SMARA, and the stability of the surficial materials were previously evaluated by Golder (Golder 2011). This amendment to the Reclamation Plan does not impact the geotechnical stability of these areas as no changes to the slopes have been made.

The geotechnical assessment provided in this report demonstrates that the proposed Reclamation Plan for WMSA meets or exceeds SMARA requirements for factors of safety under static and seismic conditions above the exclusion area.

During operations, areas of instability within the WMSA footprint have been observed from time to time. These areas will be managed operationally and will not impact the final surface of the amended Reclamation Plan.

Previous and recent investigations of WMSA included drilling programs and visual inspections. Stantec determined that the previous drilling provided adequate information for this study and no new boreholes were installed for this report. Stantec's investigation included aerial photograph review to identify features of interest (signs of potential instability, i.e. cracking) followed by a site visit to inspect these features and to review the overall conditions. Features of interest were all identified as game trails or drainage features, and no cracks or other signs of instability were identified. The site investigation also includes multiple measurements of slope gradients to confirm the greenstone overburden material strengths for geotechnical analyses.

The current Reclamation Plan would excavate most WMSA fill materials and relocate those materials to the North Quarry. Under the proposed amendment, Lehigh will reclaim the WMSA by leaving the majority of existing fills in place and making other modifications to improve slope stability and the visual appearance of the area. Lehigh would place additional greenstone overburden material at the western extent of the area to an elevation of approximately 2,060 above mean sea level (AMSL). A total volume of 2.2 million cubic yards (M yd^3) is required to complete the WMSA to its final design surface. The greenstone overburden material will be placed in 40-foot high lifts with 60-foot wide benches between the lifts to construct an overall 3H:1V slope. Once placement of the greenstone overburden material is completed, the slope will be graded to a 3H:1V slope with the crest of the slope remaining at an elevation of approximately 2,060 feet (ft) AMSL. The surface of the WMSA will be revegetated in accordance with the details and specifications of the included revegetation plan.

Geotechnical stability analyses were completed on two cross-sections through WMSA. These cross-sections represent the deepest fill depths, greatest fill slope heights, and/or the presence of a native slope below the fill area; all other cross-sections are a subset of these sections. The minimum acceptable factors of safety for the analyses are

1.3 for static conditions and 1.0 for pseudo-static conditions based on mining industry standards. All configurations modeled as part of this analysis meet or exceed the minimum acceptable factor of safety. Generally, geotechnical stability is governed by the fill slope gradient.

Abbreviations

%	percent
AMSL	Above mean sea level
bgs	Below ground surface
cm	centimeter
FoS	factor of safety
ft	feet
g	Gravitational force
Golder	Golder Associates Inc.
in	inches
ky	Yield acceleration
Lehigh	Lehigh Southwest Cement Company
m	meter
M	Million
M yd3	million cubic yards
pcf	Pounds per cubic foot
PGA	peak ground acceleration
psf	Pounds per square foot
RPA	Reclamation Plan Amendment
SMARA	[California's] Surface Mining and Reclamation Act
Stantec	Stantec Consulting Services, Inc.
USGS	United States Geological Survey
WMSA	West Materials Storage Area
yd3	Cubic yard

Glossary

Cohesion	The force which holds molecules or like particles together in a rock or soil.
Factor of safety	The ratio of resisting force to driving force in a slope stability problem. A factor of safety of one represents the minimum factor of safety under which the slope is stable.
Greenstone	Common term applied to metabasalts within the Franciscan Complex, due to unweathered, dark green color (Foruria 2004).
Greenstone overburden	Material unsuitable for use as aggregate material. Typically, it is weathered greenstone, but it may include other rock types such as low-grade limestone, graywacke, and chert.
North Highwall Reserve	Limestone and aggregate resources in the north highwall of the North Quarry.
Phi’ (ɸ’)	The frictional shear resistance of soil or rock.
Pseudo-static slope stability analysis	A limit equilibrium method of analysis, which represents the effects of earthquake shaking by accelerations that create inertial forces. This is the simplest way to analyze the dynamic effects of earthquake loading of a soil or slope. The output is a single factor of safety.
Rock Plant Reserve	Limestone and aggregate resources in an approximately 30.5-acre area at the southern extent of the Permanente Property.
Seismic deformation analysis	An empirical calculation which estimates the extent of lateral displacement during the design earthquake. The output is the median displacement.
Soil	Native, unconsolidated material present at the surface before mining operations began. Soil is assumed to be present beneath WMSA.
Static slope stability analysis	A limit equilibrium method of analysis that satisfies moment and force equilibrium to solve a slope stability problem. The output is a single factor of safety.

1.0 INTRODUCTION

1.1 PURPOSE

Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc., engaged Stantec Consulting Services Inc. (Stantec) to provide professional engineering services related to the development of the Reclamation Plan for the West Materials Storage Area (WMSA) at the Permanente Quarry. The Reclamation Plan for the WMSA involves placing additional greenstone overburden material in the storage area and regrading the area to promote vegetation growth and surface water management. To support the reclamation plan, static and pseudo-static slope stability analyses of the WMSA have been completed.

The WMSA Geotechnical Evaluation was prepared to assist Lehigh with the upcoming Reclamation Plan amendment submission under California's Surface Mining and Reclamation Act (SMARA). This report presents the Reclamation Plan, documents the results of stability analyses, and provides specifications to guide Lehigh in regrading the WMSA.

1.2 PROJECT BACKGROUND

The Permanente Quarry (Quarry) is a limestone and aggregate mining operation, active since the late 1930's, in the unincorporated foothills of western Santa Clara County, approximately two miles west of the city of Cupertino, California. The Quarry occupies a portion of a 3,510-acre property (Permanente Property) owned by Hanson Permanente Cement, Inc., and operated by Lehigh.

The Permanente Property is situated in the rugged foothills along the eastern side of the Santa Cruz Mountains segment of the California Coast Ranges. This area of the Coast Ranges is characterized by moderately to steeply sloping hillsides ranging from approximately 500 to 2,000 feet (ft) above mean sea level (AMSL). The eastern side of the range is incised with eastern flowing drainages, including the Permanente Creek Drainage Basin, which flows through the central part of the Permanente Property, and drains into the southern part of the San Francisco Bay, near Palo Alto and Mountain View, California. The regional location map is included as Figure 1.1.

Operational areas at the Quarry comprise surface mining excavations, overburden stockpiling, crushing and processing facilities, access roads, administrative offices, and equipment storage facilities. Other predominantly undisturbed areas are held in reserve for future mining or to buffer operational areas from adjacent land uses. The WMSA is where storage of low-quality limestone, greenstone, and overburden materials from the North Quarry has historically occurred. Figure 1.2 shows a plan view of the site.

Mining operations take place subject to SMARA, which mandates that surface mining operations have an approved reclamation plan that describes how mined lands will be prepared for alternative post-mining uses, and how residual hazards will be addressed. Golder Associates Inc. (Golder) completed geotechnical investigations and slope stability evaluations in 2011 to support an amended Reclamation Plan for the operational areas disturbed by mining activities. The current Reclamation Plan was approved in 2012. Changes to the current approved Reclamation Plan are being considered, which necessitate an update of the Reclamation Plan for the Permanente Quarry under SMARA.

This report provides specifications and guidelines to support the amended Reclamation Plan with respect to the WMSA and is accompanied by three other similar reports (Rock Plant Reserve Geotechnical Evaluation, North Highwall Reserve Geotechnical Evaluation, and North Quarry Backfill Geotechnical Evaluation), which provide specifications and guidelines related to the proposed amendments to the Reclamation Plan for other areas in the Quarry.

1.3 SCOPE OF WORK

Lehigh retained Stantec to prepare this report to support the amended Reclamation Plan in connection with the WMSA. Stantec's scope of work included:

- Review previous geologic and geotechnical studies.
- Evaluate historic and new data to determine strength parameters for stability analyses.
- Inspect the current conditions at WMSA
- Design WMSA filling to maximize capacity.
- Design reclaimed WMSA surface to comply with SMARA requirements.
- Evaluate geotechnical stability of proposed WMSA final topography under static and seismic conditions.
- Prepare a geotechnical report to document analysis and findings in support of the Reclamation Plan amendment.

1.4 LIMITATIONS

Stantec's scope of work in WMSA is limited in two aspects.

- The lower elevations (southern) of the western portions of WMSA, below the main haul road, were placed prior to the promulgation of SMARA, and the 2011 Reclamation Plan demonstrated that this area is stable. The placement of fill on top of pre-SMARA areas could affect the global stability of WMSA, and this was evaluated as part of this report.
- Recent movement in the eastern portion of WMSA suggests a potential instability. The stability of this area is currently being evaluated, and reclamation plans for this area will be assessed in a separate report.

2.0 WEST MATERIALS STORAGE AREA

2.1 HISTORY

The WMSA is located on the southern slope of the hillside to the west of the North Quarry. Stantec reviewed United States Geological Survey (USGS) topographic maps from 1953, as these maps were developed before any material was placed at WMSA. The native topography shows steeply dipping slopes with valleys oriented generally from west to east, as shown in Figure 2.1. The current topography surrounding the WMSA ranges in elevation from approximately 1,500 ft AMSL near the east toe to approximately 1,960 ft AMSL at the top of the area in the northwest. The WMSA measures approximately 157 acres in plan area. The maximum thickness of greenstone overburden at WMSA is approximately 350 ft. The existing topography is shown on Figure 2.2. WMSA is founded on native soils. WMSA primarily consists of greenstone overburden materials, but it may also contain greenstone and low-grade limestone. Greenstone overburden was placed by end dumping the material in lifts, which resulted in the pile slopes being placed at the material's angle of repose with benches between lifts. The lower, south-facing slopes were placed prior to SMARA. Following the passage of SMARA, overburden material continued to be placed on the upper portions of WMSA. Approximately 38 acres of the footprint, below 750 ft AMSL, was placed before the SMARA legislation was enacted. This area is located along the southern boundary of the WMSA. The pre-SMARA areas, existing conditions, end of mine conditions, and reclamation conditions are shown on Figures 2.2, 2.3, and 2.4, respectively.

2.2 PREVIOUS STUDIES

The WMSA area has previously been studied by others, and Stantec reviewed these reports to provide background information on the greenstone overburden pile, primarily foundation conditions, material strength properties, pile geometry, and groundwater levels. Stantec primarily relied upon the most recent stability assessment performed by Golder (Golder 2011), as this document includes a summary of the previous assessments performed by a variety of consulting firms. Previous geotechnical evaluations and groundwater monitoring have resulted in drilling 21 borings in the WMSA project area. Stantec evaluated available data for each of the borings including drill logs, lithologies, laboratory testing, and water levels. Information on these borings is summarized in Table 2.1. These data provide the basis for the foundation materials and groundwater levels used for the stability analyses. These data are included on the cross-sections included as Figure 2.5. Groundwater levels roughly follow the pre-mine topography, with water levels beneath the base of the rock pile in the foundation colluvial material or greenstone bedrock. Drill logs are included in Appendix C.

Table 2.1 WMSA Borehole Summary

Boring/Well Designation	Coordinates x	Coordinates y	Top of Casing Elevation (ft AMSL)	Boring TD (ft bgs)	Screen Interval (ft bgs)	PVC Casing (inch)	June 2018 Water Elevation (ft AMSL)
WMSA-DMW-1S	6087205	1945222	1,849.61	137	127-137	2	1,725.46
WMSA-DMW-1D	6087180	1945200	1,849.79	167	157-167	2	1,728.47
WMSA-DMW-2	6088646	1943650	1,762.79	312	292-312	2	1,479.5
WMSA-DMW-3S	6089302	1942661	1,372.09	30	10-30	2	1,351.9
WMSA-DMW-3D	6089292	1942653	1,372.21	65	55-65	2	1,351.98
WMSA-DMW-4	6090729	1944482	1,856.76	117	97-117	2	1,748.57
WMSA-DMW-5	6089312	1943712	1,821.13	327	307-327	2	1,522.01
WMSA-DMW-6	6087520	1944790	1,977.82	347	327-347	2	1,643.56
WMSA-DMW-7	6087467	1943381	1,614.98	95	72-92	2	1,561.8
WMSA-DMW-8S	6090029	1941671	1,287.93	30	10-30	2	1,277.2
WMSA-DMW-8D	6090031	1941657	1,287.92	65	55-65	2	1,275.95
WMSA-DMW-9	6087419	1944202	1,888.18	117	97-117	2	1,792.08
WMSA-DMW-10	6088222	1943519	1,645.02	145	100-120	2	1,536.3
WMSA-DMW-11	6090899	1942400	1,489.49	122	102-122	2	NA
WMSA-DMW-11A	~6090990	~1942260	~1,410	63	40-55	2	NA
WMSA-P6A	6087039	1944543	1,920.88	97	77-97	2	NA
WMSA-2	~6087930	~1945050	~1,960	158	NA	NA	NA
WMSA-3	~6088960	~1943210	~1,640	133	NA	NA	NA
WMSA-4	~6090480	~1942550	~1,590	78	NA	NA	NA
WMSA-5	~6090820	~1943290	~1,640	86	NA	NA	NA
WMSA-6	~6090800	~1943980	~1,610	68	NA	NA	NA

Notes: NA = Not available
No water was encountered in the WMSA-2 through -6 borings.
Borings WMSA-2 through -6 were abandoned after drilling.
Survey data not available for wells with approximate locations and elevations.

The material strength properties previously used for WMSA stability evaluations are based on laboratory testing, back analyses, and publications and are listed in Table 2.2 (Golder 2011). Stantec evaluated each of the parameters and agrees that these strengths are representative of the materials in the WMSA area. These same material strengths were used for the updated stability assessments discussed in this report. The greenstone strengths vary greatly depending on the amount of weathering or shearing that has occurred. To be conservative, strength values for weathered greenstone, which comprises the bulk of the waste material in the WMSA, are typically used for stability analyses, unless location-specific strength values are available. Also, the WMSA fill consists of “greenstone overburden”, which is primarily weathered greenstone, but is also comprised of other rock types, such as low-grade limestone, graywacke, chert, and other rock types unsuitable for use as aggregate.

Table 2.2 WMSA Strength Parameters

Material	Unit Weight (pcf)	Cohesion (psf)	Internal Friction (ϕ’)	Rationale
Greenstone Overburden	125	0	35°	WMSA slopes are 35° or steeper.
Soil	120	200	30°	Typical strength for clayey sand with some gravel. Laboratory testing.
Weathered Greenstone	165	1,800	27°	Typical strengths for weathered greenstone at Lehigh quarry.

2.3 2018 INVESTIGATION

Stantec investigated the WMSA area during a site visit in October 2018. A primary goal of the site visit was to visually assess the pile conditions and look for signs of instability. Prior to the site visit, Stantec engineers reviewed aerial photographs, and several linear features were identified on the aerial photographs. In addition, Stantec engineers reviewed previous reports to identify features requiring on-site inspection, and two areas with potential cracks were identified in the review (Golder 2011). The on-site inspection consisted of traversing each bench on the WMSA, measuring slope angles, and looking for signs of instability including slumping, bulging, over steepened slopes, cracks, seeps, ponding, erosion, etc. Each area with linear features was investigated during the site visit, and these features were determined to be game trails, drainage control structures, or erosion control structures. The game trails occur on the grassed areas west and north of the pile. One of these game trails can be seen in Photo 2.1.

Photo 2.1 Game Trail North of WMSA

Drainage control structures occur on the access road, and erosion control structures occur on the graded slopes on southern extent of WMSA. These drainage control structures can be seen in Photo 2.2. None of these features indicates an instability in the project area.

Photo 2.2 Drainage Control Structure on WMSA Road

During operations, areas of instability within the WMSA footprint have been observed from time to time, typically near the crests of angle of response slopes. These areas will be managed operationally and will not impact the final surface of the amended Reclamation Plan.

Two areas of potential cracking on the 1800 and 1900 benches of the WMSA were identified in the previous WMSA assessment performed by Golder (Golder 2011). Golder presented the crack locations on their maps, and the text states that “these cracks occurred along interim, angle-of-repose slopes for individual lifts” Golder 2011). A Stantec engineer and engineering geologist visited each area of the potential cracking during the October inspection and found erosional features in the locations were cracks had been identified. No evidence of instability in these areas was observed. The erosional features observed are shown in Photo 2.3.

Photo 2.3 Area Previously Identified with Cracks: Only Sediment and Erosion Identified

Stantec reviewed available geologic maps and aerial photographs to identify faults and shear zone. Fault mapping and site inspections do not indicate the presence of shear zones that have contributed to previous slope instabilities at the Permanente Property. Small shear zones are likely present in the bedrock material; however, these are not expected to have a significant impact on WMSA stability.

Stantec evaluated the existing slope angles during the site visit. The greenstone overburden material was placed by end-dump methods, and the resulting angle of repose slopes provide information on the material strength properties. Several slope angle measurements were performed using a handheld inclinometer, and all the slopes were measured at angles between 35° and 39°. Measured slope heights ranged from less than 10 ft to over 100 ft, with most of the measured slopes being between benches with 30-foot to 70-foot high slopes. All slopes with gradients less than 35° were either benches, roads, or had been graded and reclaimed. Several road cuts were also observed to be nearly vertical at the top of slope. These observations confirm, albeit conservatively, that the material strengths exceed the previously used strength parameters of a cohesionless material with an internal friction angle of 35°. In summary, Stantec engineers traversed each road and bench in the WMSA to identify site features and look for signs of instability. Stantec noted areas with some erosion and areas with evidence of ponding water, but no signs of instability were observed in the project area.

2.4 SURFICIAL DEPOSITS

Soil and/or colluvium/alluvium were identified in each of the borings suggesting the foundation of the WMSA was not prepared prior to the placement of material. Therefore, it has been assumed that soil and colluvium are present in all areas of the WMSA footprint. Golder sampled drill cuttings and identified the material as a clayey sand with gravel to a gravelly clay (Golder 2011). The stability analyses include this layer of surficial material.

2.5 BEDROCK MATERIALS

The drill logs indicate the presence of some limestone beneath WMSA; however, all foundations were assumed greenstone for the stability evaluations to be conservative with the analysis.

2.6 OPERATIONAL PLAN

The crest of WMSA is relatively flat, and additional material is planned for storage at the uppermost portions of the rock pile. The western portion of WMSA can store an additional 2.2 million cubic yards (M yd^3), as shown on Figure 2.3. This material will be placed in a similar manner as previous material, end dumped in 40-foot high lifts, to an elevation of approximately 2,060 ft.

2.7 RECLAMATION PLAN

Stantec completed static and pseudo-static slope stability analyses to evaluate the stability of the existing slopes as well as the slopes of the regraded (post reclamation) WMSA. Once the pile is at maximum capacity, Lehigh will reclaim the WMSA by regrading the slopes to 3h:1v slopes or less to improve geotechnical stability and surface water management. Topsoil and other amendments will be placed on the slopes, and vegetation planted in a manner consistent with the revegetation plan component of the proposed Reclamation Plan amendment. The pre-SMARA slopes will be reclaimed in accordance with the currently approved Reclamation Plan. The amendment to the Reclamation Plan only addresses surfaces where modifications to the Reclamation Plan were made. As such, this amendment has no impact on the pre-SMARA slopes. The reclamation topography is shown on Figure 2.4.

3.0 GEOTECHNICAL EVALUATION

Two cross-sections of the WMSA were modeled to ensure that an appropriate factor of safety against slope failure is achieved. These sections include the greatest fill depths and the native ridge beneath WMSA. These cross-sections represent the worst-case scenarios for WMSA, and all other cross-sections are a subset of these sections. The steep portions of the sections present the pre-SMARA areas of WMSA. Figures 2.1 through 2.4 show the locations of the two cross-sections which were analyzed, and the cross-sections are included as Figure 2.5.

The slope stability analyses were modeled using the software Slope-W® 2018 R2 version 9.1 by GeoStudio, released in 2018. The software used limit equilibrium on slices of potential failure surface to calculate factor of safety (FoS). The models are evaluated under static and pseudo-static conditions, with horizontal ground acceleration, for the closure configurations of the stockpiles using the Spencer method. The two types of analysis have been summarized in Table 3.1. The minimum acceptable factors of safety for the analyses are 1.3 for static conditions, and 1.0 for pseudo-static conditions based on mining industry standards. For the pseudo-static model conditions, a horizontal seismic coefficient of 0.15g was applied to the static condition models to be consistent with previous studies (Golder 2011) and to follow recommendations for earthquakes with magnitudes up to 8-1/4 (Seed 1982). To evaluate the slope stabilities, cross-sections were analyzed for the reclamation surfaces.

Table 3.1 Stability Analyses

Analysis Type	Description	Minimum Acceptable Factor of Safety
Static Analysis	A limit equilibrium method of analysis that satisfies moment and force equilibrium to solve a slope stability problem. The output is a single FoS for the potential failure surface with the lowest FoS.	1.3
Pseudo-static Analysis	A limit equilibrium method of analysis that represents the effects of earthquake shaking by accelerations that create inertial forces. This is the simplest way to analyze the dynamic effects of earthquake loading of a soil or slope. The output is a single FoS for the potential failure surface with the lowest FoS.	1.0

Site-specific geotechnical information, on the backfill materials, is available for the greenstone overburden, bedrock, and native soils. Strength parameters for the material have been established in previous geotechnical analyses of the Lehigh property and are based on laboratory testing, back-calculation, and published values for material properties (Golder 2011). These strength parameters are listed in Table 3.2.

Table 3.2 Geotechnical Strength Parameters

Material	Unit Weight (pcf)	Cohesion (psf)	Phi' (Degrees)
Soil	120	200	30
Greenstone Overburden	125	0	35
Weathered Greenstone	165	1,800	27
Greenstone Bedrock	165	12,500	30

All configurations modeled as part of this analysis meet or exceed the minimum acceptable factor of safety, as defined in Table 3.1. Results from the stability analyses are shown in Table 3.3. Appendix A contains printouts of the slope stability sections analyzed for both cross-sections.

Table 3.3 Geotechnical Stability Analyses Results

Section	Analysis Type	Factor of Safety
Section A-A' South	Static	2.41
	Pseudo-static	1.52
Section A-A' North	Static	2.27
	Pseudo-static	1.46
Section B-B' South	Static	1.81
	Pseudo-static	1.23
Section B-B' North	Static	1.67
	Pseudo-static	1.16

Seismic displacements were calculated using an empirical equation developed by Bray and Travasarou (Bray 2007). This method estimates the displacement of a rigid block on a slope and is consistent with previous displacement analyses. The peak ground acceleration (PGA) value of 0.6 times the force of gravity (g) was used for the calculations, which is also consistent with previous analyses. This PGA corresponds to an earthquake with a mean return time of 475 years (Petersen 2008). The yield acceleration (ky) was calculated using the Slope/W model by adjusting the seismic coefficient until the model provided a FoS = 1.0, and these values were used for the displacement calculation. The ky values and displacement results are listed in Table 3.4. The displacement calculations are included in Appendix B. Cross-sections with pseudo-static FoS greater than 1.15 will have minimal displacement during a seismic event (Seed 1982), and displacements for these cross-sections are assumed less than two inches. The actual displacements were not calculated for these sections. Literature on seismic slope displacements suggest that median displacements of less than 6-in (15 centimeter [cm]) are "minor" and displacements of greater than 3 ft (1 meter [m]) are "major" (Bray 2007). All displacements for WMSA are "minor" and unlikely to influence the reclaimed slope.

Table 3.4 Seismic Displacement Analyses Results

Section	Yield Acceleration ky (g)	Seismic Displacement (in)		
		Median	16% Exceedance	84% Exceedance
Section A-A' South	na	<2	<2	<2
Section A-A' North	na	<2	<2	<2
Section B-B' South	na	<2	<2	<2
Section B-B' North	na	<2	<2	<2

4.0 CONCLUSION

This report provides the analysis and supporting information needed to demonstrate that Lehigh Southwest Cement Company's plan for reclamation operations at the West Materials Storage Area meets SMARA and associated design and performance requirements. The geotechnical assessment provided in this report demonstrates that the proposed Reclamation Plan meets or exceeds SMARA requirements for factors of safety under static and seismic conditions.

This report has been prepared for Lehigh Southwest Cement Company to provide them with a geotechnical evaluation in support of placing greenstone overburden material and reclaiming the West Materials Storage Area. As mutual protection to Lehigh, the public, and Stantec, this report and its figures are submitted for exclusive use by Lehigh Cement Company. Our report and recommendations should not be reproduced in whole or in part without our express written permission, other than as required in relation to agency review and submittals. The drawings included with the report are for regulatory review and are not intended as detailed construction drawings. The authors who have signed below have prepared all information and design results contained herein and Nelson Kawamura, California PE, has certified attached drawings. Personnel from Lehigh Southwest Cement Company reviewed a draft of this report.

Stantec Consulting Ltd.

Paul J. Kos

Paul Kos P.E., P.Eng. Senior Geological Engineer, Denver
Phone: 720-889-6122
paul.kos@stantec.com

Nelson Kawamura

Nelson Kawamura G.E.
Principal, Civil Engineer, Waterpower & Dams
Phone: 503-220-5424
nelson.kawamura@stantec.com

REGISTERED PROFESSIONAL ENGINEER
NELSON KAWAMURA
GE 2868
EXP. 9/30/2019
GEOTECHNICAL
STATE OF CALIFORNIA

April 5, 2019

5.0 REFERENCES

Bray, J. D., and Travasarou, T., 2007. "Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements", Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

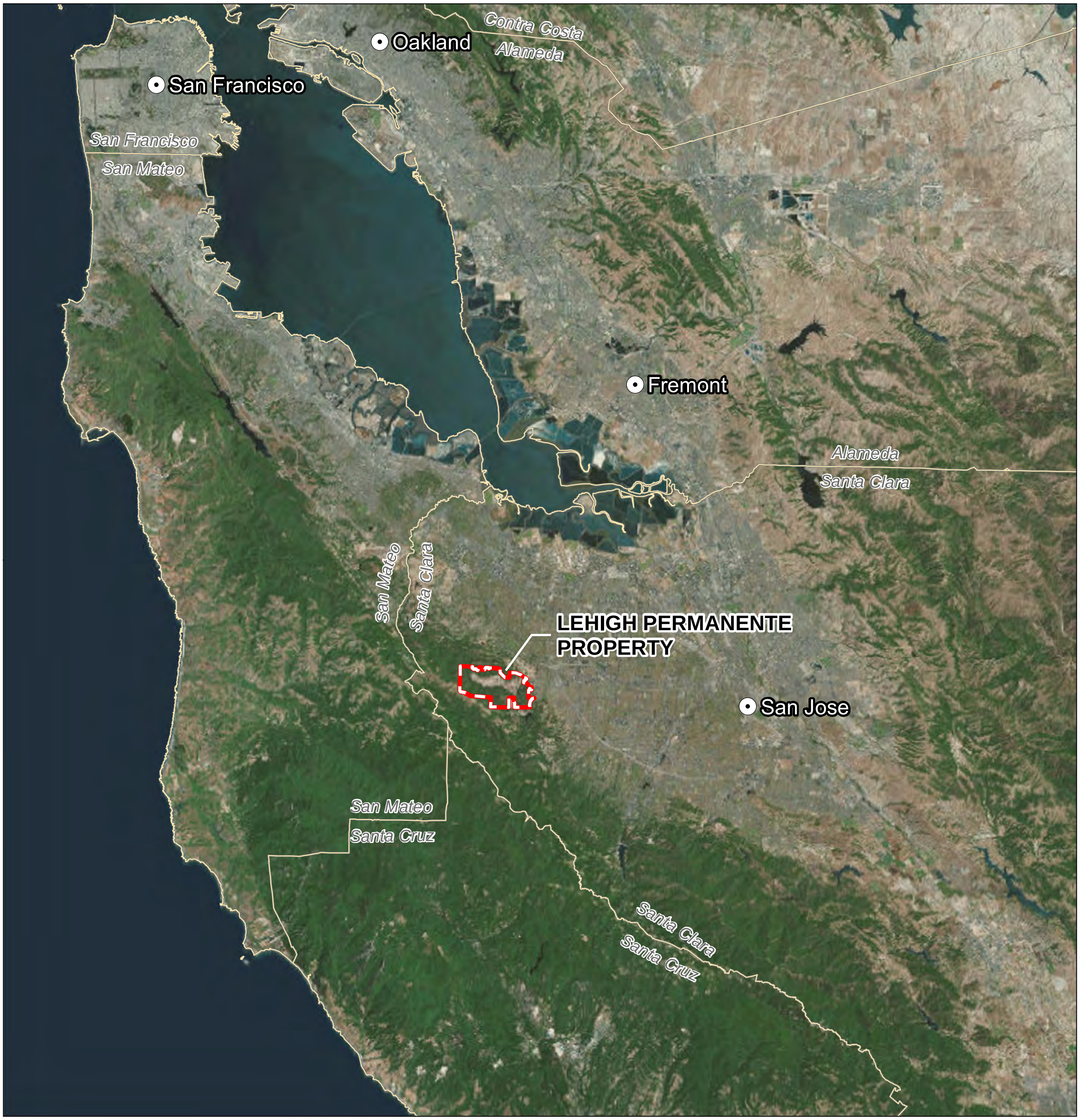
Foruria, J. September 2004. Geology of the Permanente Limestone & Aggregate Quarry, Santa Clara County, California. 2004.

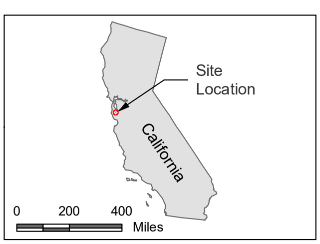
Golder Associates, November 2011. Geotechnical Evaluations and Design Recommendations (Revised). Permanente Quarry Reclamation Plan Update, Santa Clara County, California. 2011.

Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth S., 2008. Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008–1128, 61 p.

Seed, H. B., 1979. "Considerations in the Earthquake-Resistant Design of Earth and Rockfill Dams," Geotechnique, vol. 29, No. 3, pp. 215-263.

FIGURES





City

Lehigh Permanente Property

County

0 4 8 Miles

(At original document size of 8.5x11)
1:500,000

N

Stantec

Project Location
T07N, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-12-20
Technical Review by PK on 2018-12-20
Finalized on 2019-04-05

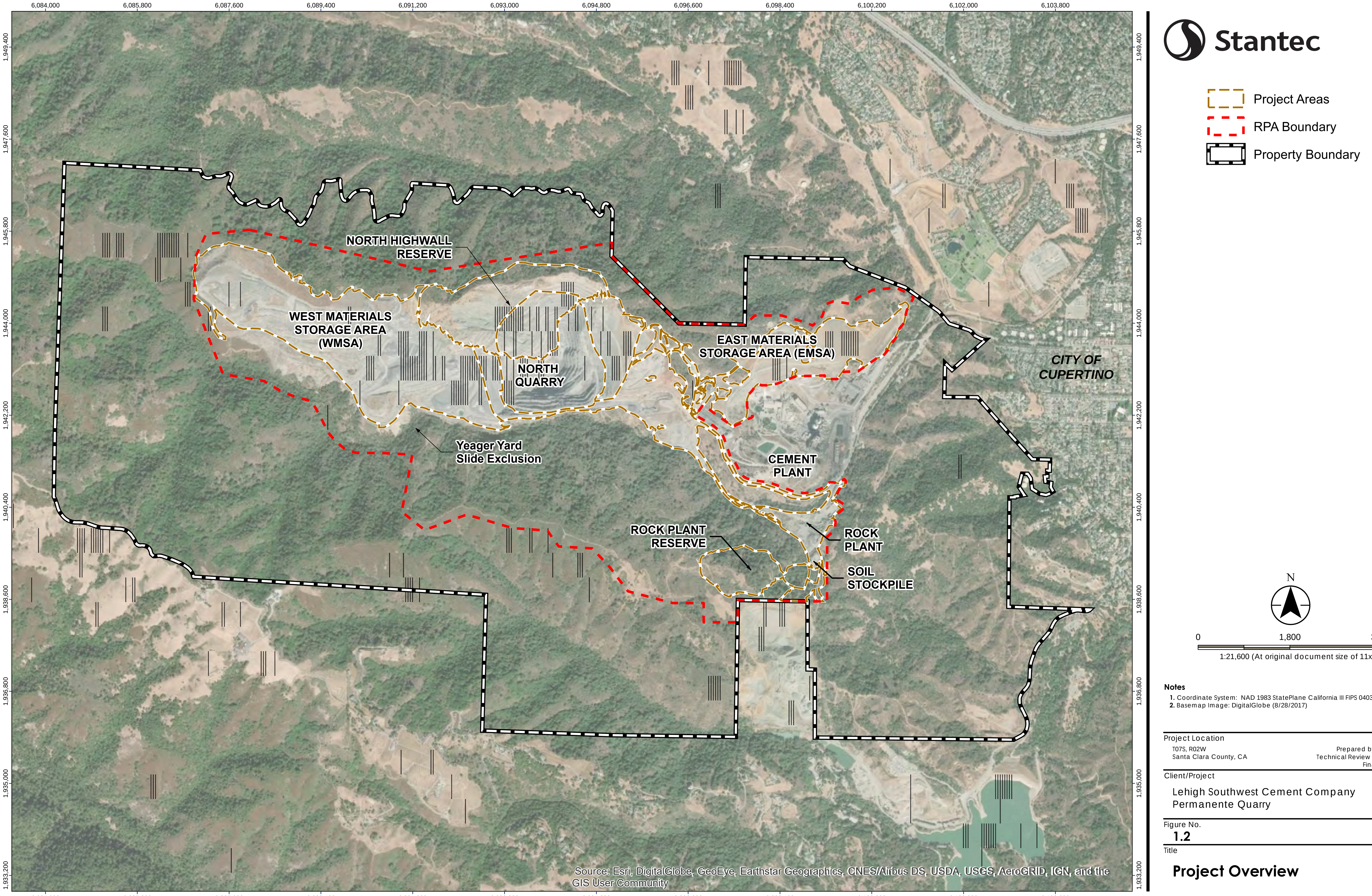
Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
1.1

Title
Regional Location Map

Notes
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

U:\233001289\gis_MXDs\Lehigh_Permanente_Regional_Location_11x17_Landsc_20181220.mxd Revised: 2018-12-20 By: cbolen



Stantec

1:21,600 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Basemap Image: DigitalGlobe (8/28/2017)

Project Location	Review
T07S, R02W Santa Clara County, CA	Prepared by CBB on 2018-12-18 Technical Review by PK on 2018-12-19 Finalized on 2019-04-05

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

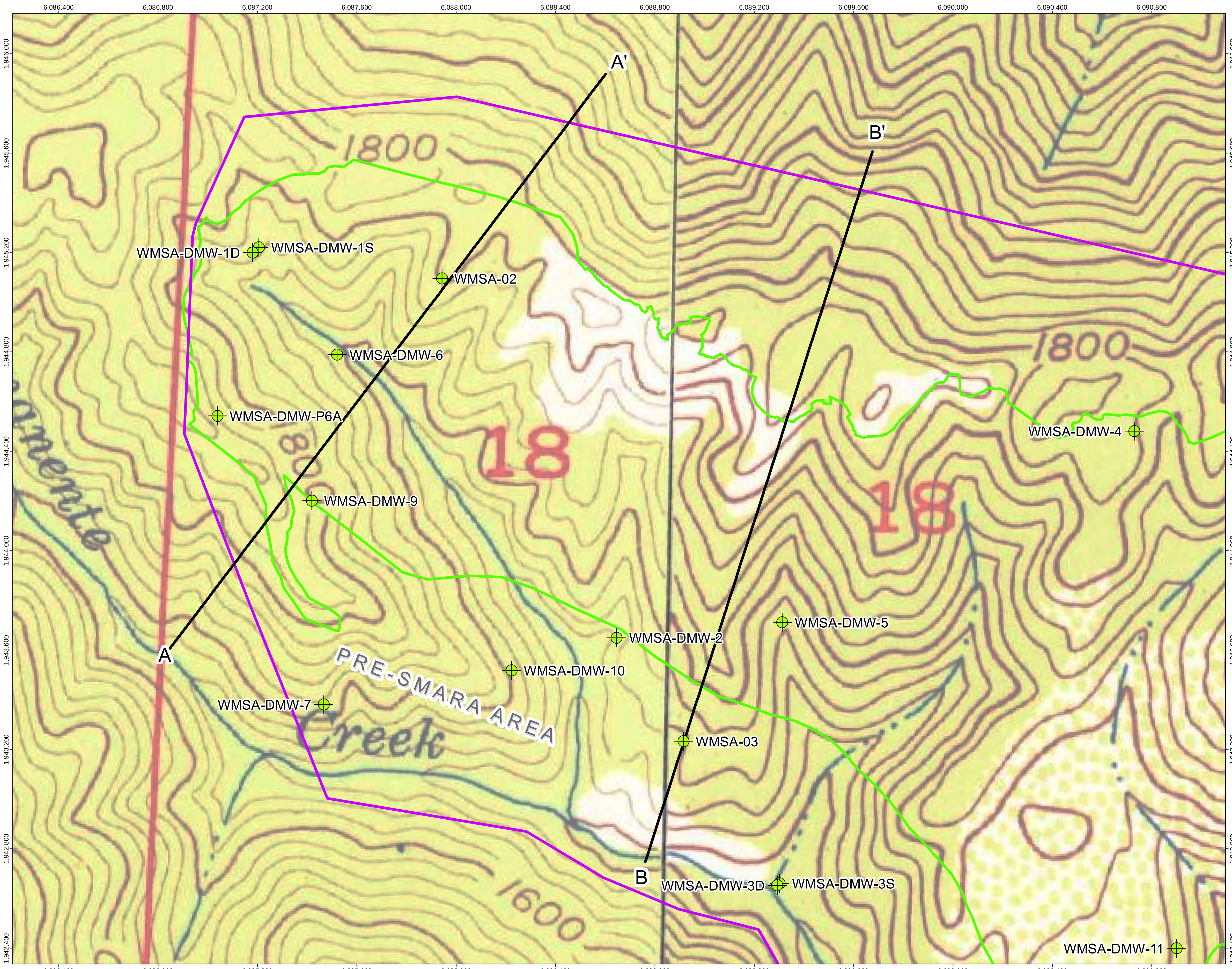
Figure No.

1.2

Title

Project Overview

\\us0349-ppfss01\Shared_projects\233001289\gis_MXDs\233001289\Lehigh_Permanente_Project_Overview_11x17_Landsc_20190405.mxd Revised: 2019-04-09 By: pkos



Stantec

- Borehole
- WMSA Boundary
- Cross-Section
- 2012 RPA Boundary

N

0 400 800 Feet

1:4,800 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Historical Topo Basemaps: Mindego Hill (1:24000; 1955); Cupertino (1:24000; 1953)

Project Location	Review
T07S, R02W Santa Clara County, CA	Prepared by CBB on 2018-12-18 Technical Review by PK on 2018-12-19 Finalized on 2019-04-05

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

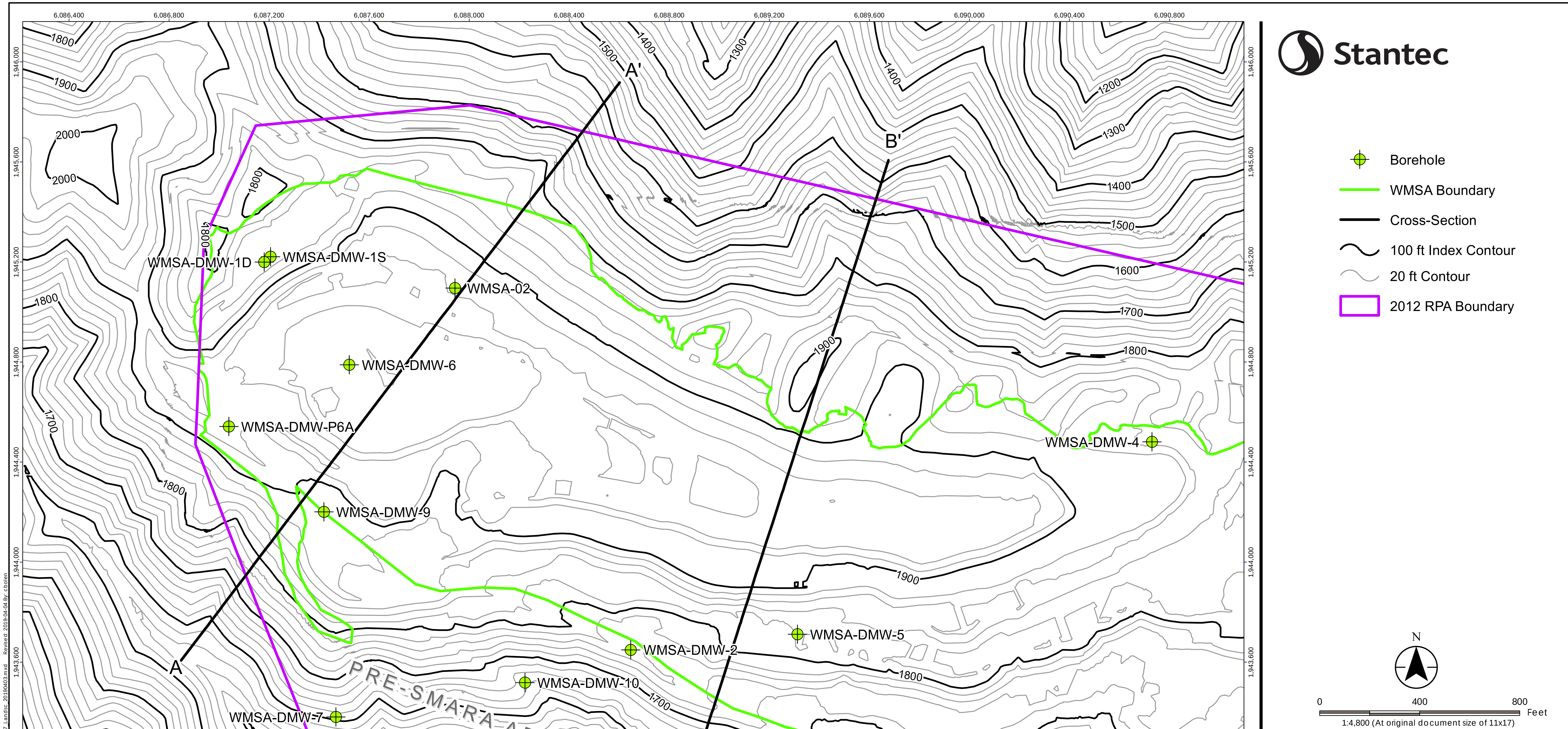
Figure No.

2.1

Title

West Material Storage Area
Pre-Mine Topography

U:\233001289\gis_MXDs\233001329\WMSA\Lehigh_Permanente_Project_WMSA_Pre_Mine_Topo_11x17_Landsc_20190403.mxd Revised: 2019-04-04 By: cbolen



Note

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

Project Location	Review
T07S, R02W Santa Clara County, CA	Prepared by CBB on 2018-12-18 Technical Review by PK on 2018-12-19 Finalized on 2019-04-05

Client/Project

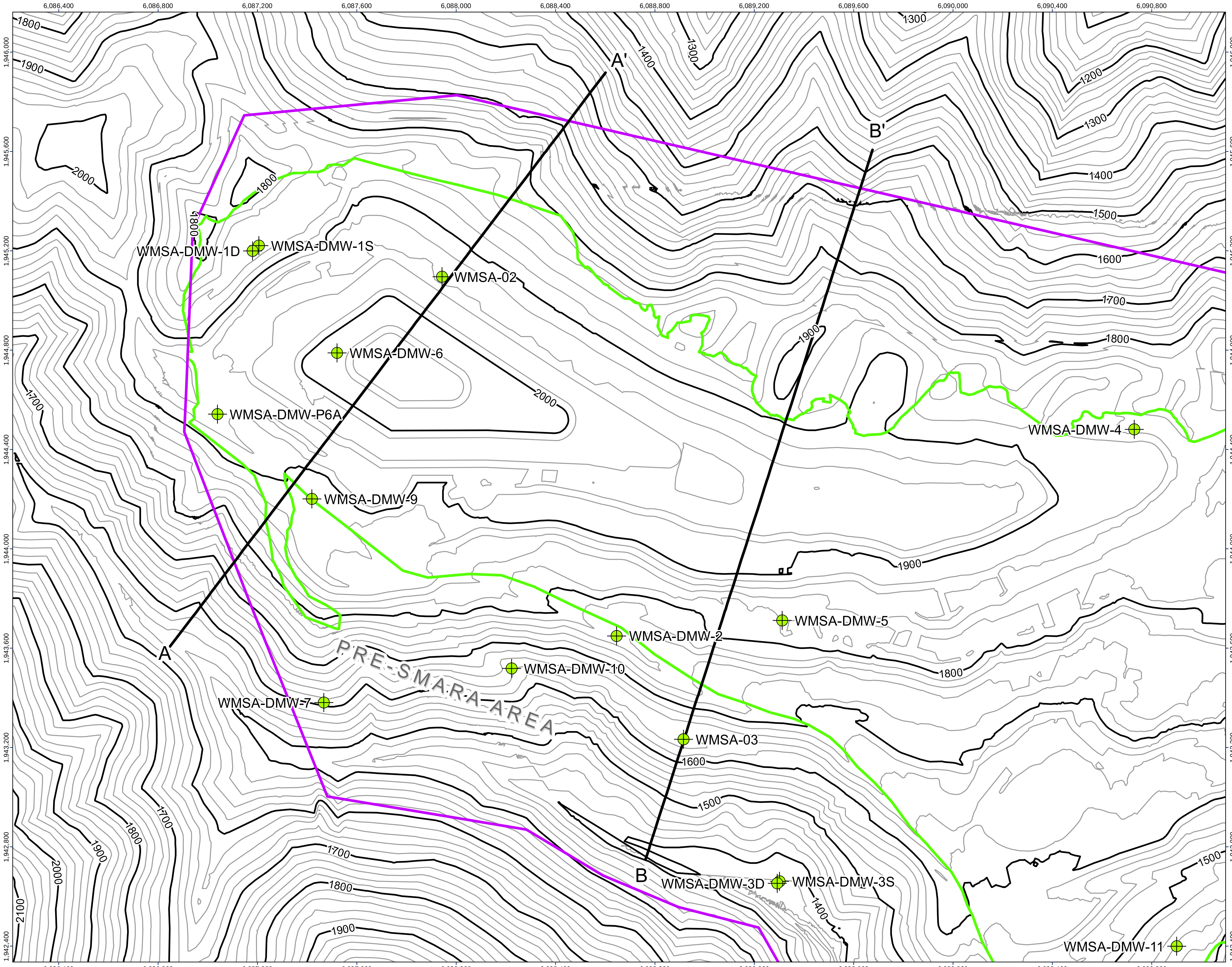
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.

2.2

Title

West Material Storage Area
Current Topography



Stantec

Borehole
WMSA Boundary
Cross-Section
100 ft Index Contour
20 ft Contour
2012 RPA Boundary

N

0 400 800 Feet
1:4,800 (At original document size of 11x17)

Note
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

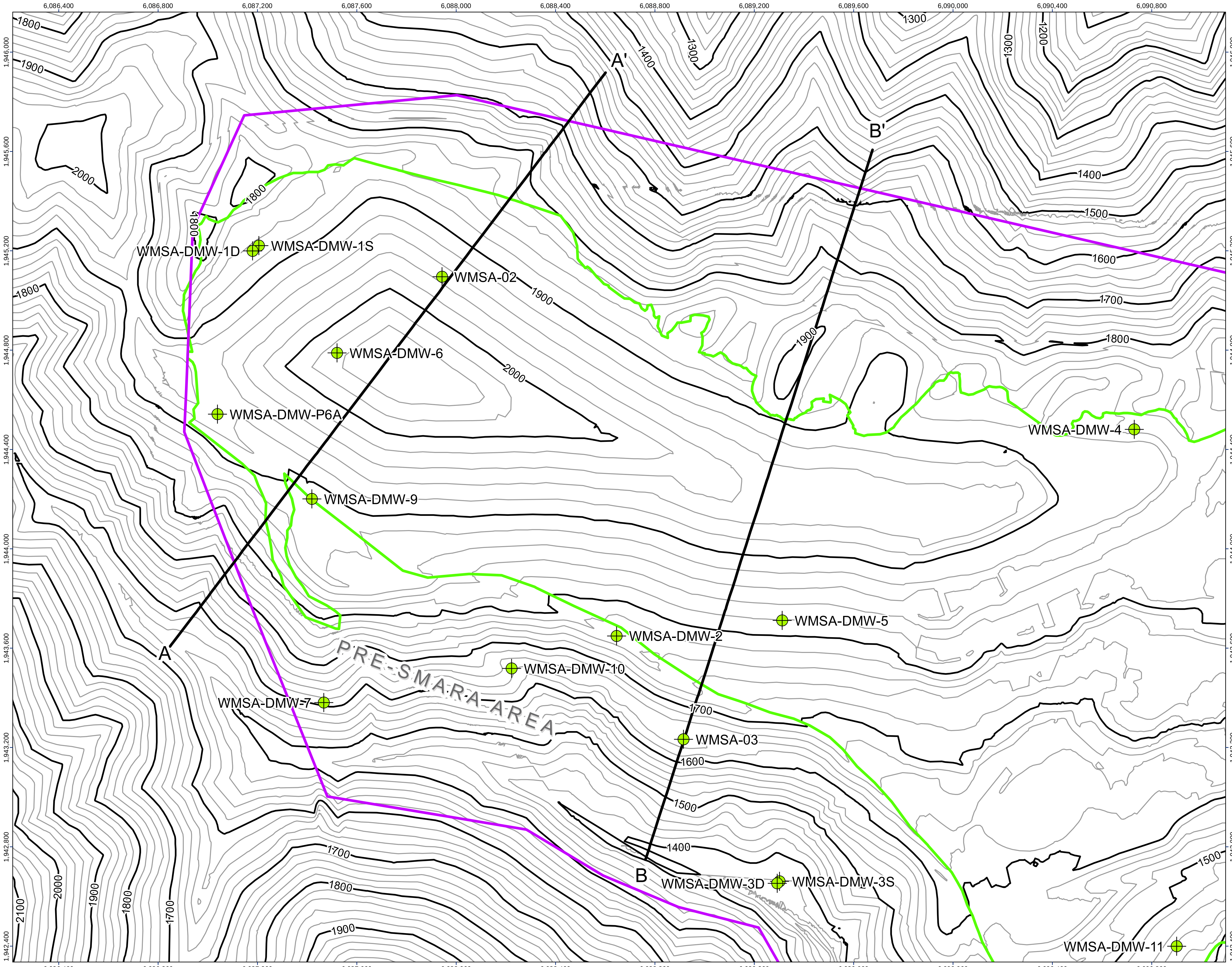
Project Location
T07S, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-12-18
Technical Review by PK on 2018-12-19
Finalized on 2019-04-05

Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
2.3

Title
West Material Storage Area
Build-Out Topography



Stantec

- Borehole
- WMSA Boundary
- Cross-Section
- 100 ft Index Contour
- 20 ft Contour
- 2012 RPA Boundary

N

0 400 800 Feet

1:4,800 (At original document size of 11x17)

Note

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

Project Location

T07S, R02W
Santa Clara County, CA

Review

Prepared by CBB on 2018-12-18
Technical Review by PK on 2018-12-19
Finalized on 2019-04-05

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

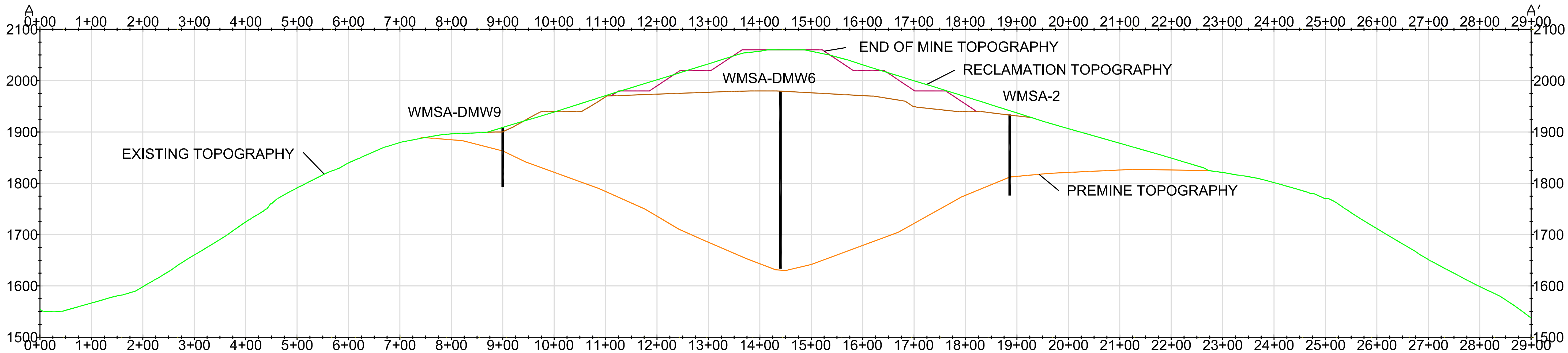
Figure No.

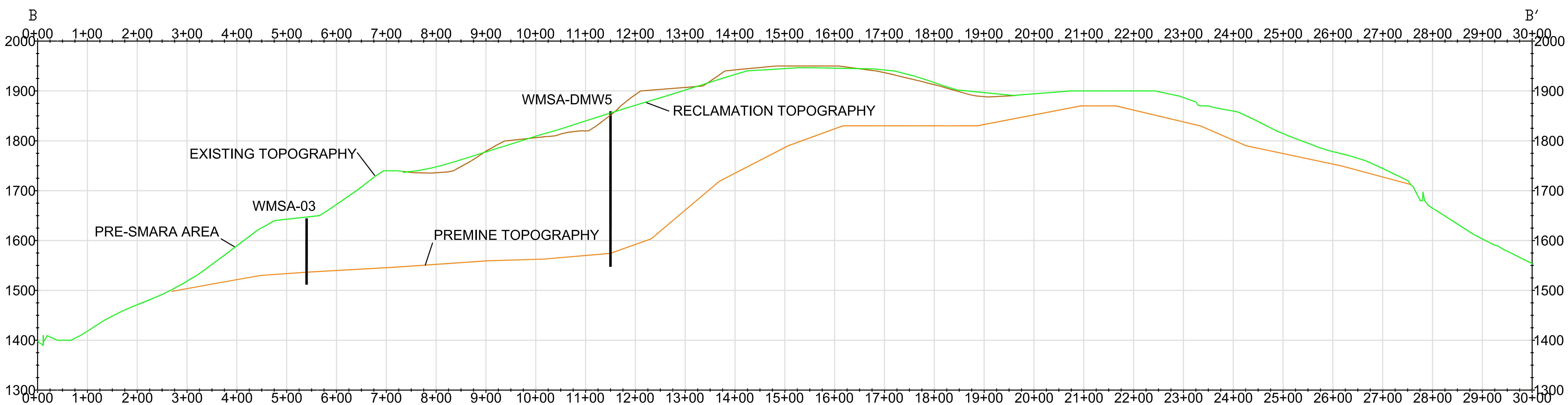
2.4

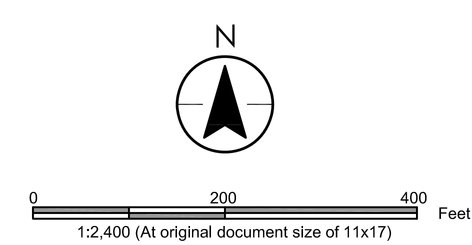
Title

West Material Storage Area
Reclamation Topography

DWG: V:\2274\active\233001289\Lehigh_S_437\437-3, 223001328_PermanentSeesaw\Disc\CAD\WMSA Section_04feb2019.dwg
Plotted: Apr 05, 2019 - 11:34am By: pkos







Stantec

Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
2.5

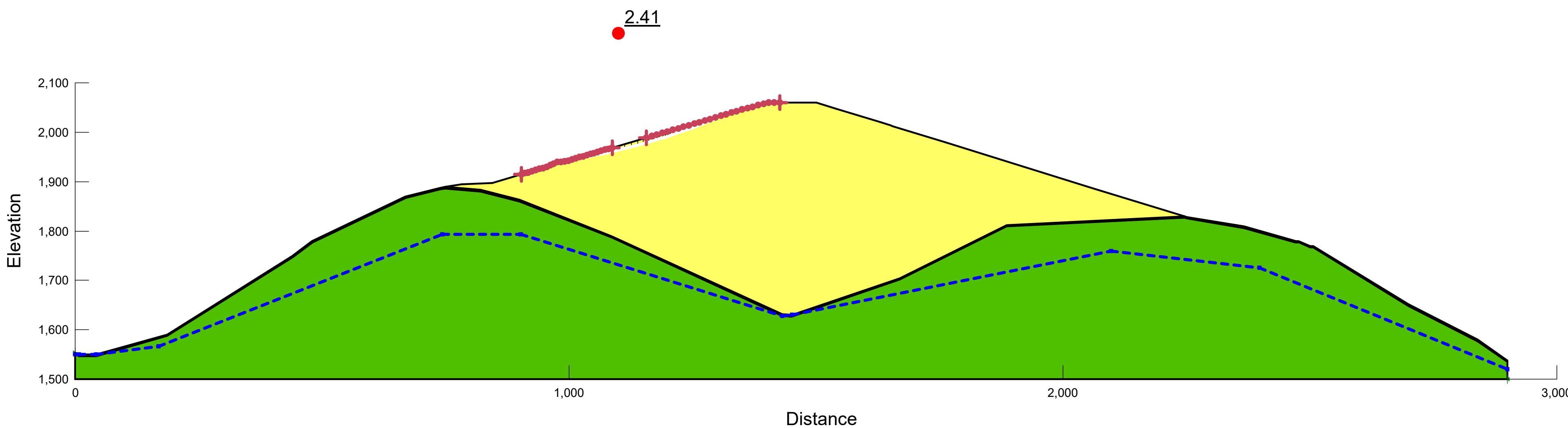
Title
West Material Storage Area
Cross-Sections

APPENDIX A

Slope Stability Analyses

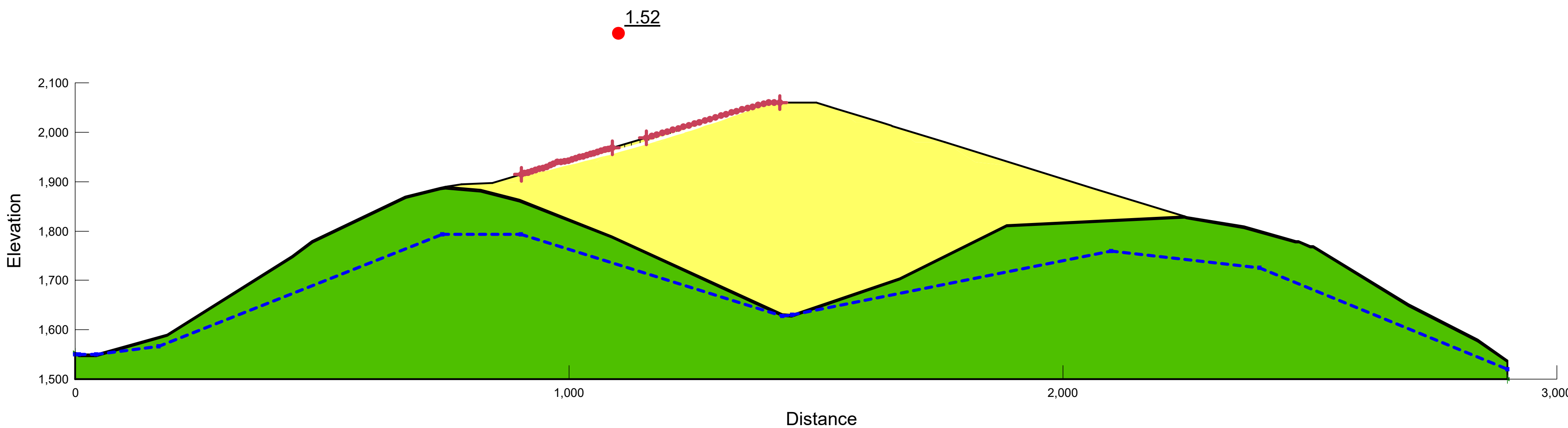
Title: WMSA - Section A
Parent: 01. South Slope - Static
Name: 01b. Reclamation Surface
Method: Spencer
Factor of Safety: 2.41
Horz Seismic Coef.:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone Bedrock	165	12,500	30
	Greenstone Overburden	125	0	35
	Surface Soil	120	200	30



Title: WMSA - Section A
Parent: 02. South Slope - Pseudostatic
Name: 02b. Reclamation Surface
Method: Spencer
Factor of Safety: 1.52
Horz Seismic Coef.: 0.15

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone Bedrock	165	12,500	30
	Greenstone Overburden	125	0	35
	Surface Soil	120	200	30

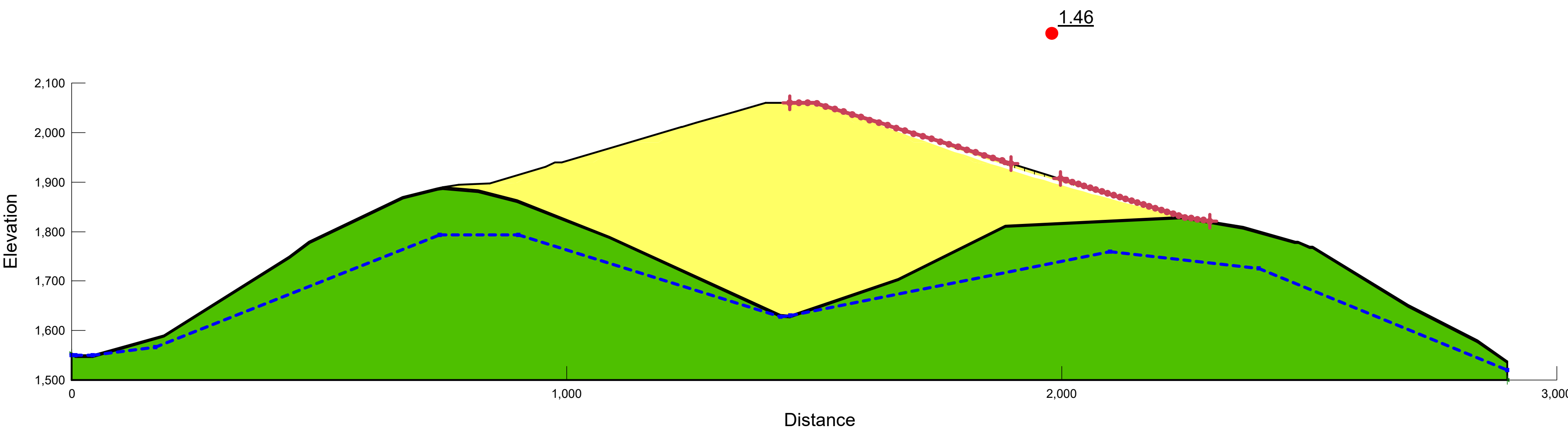


Title: WMSA - Section A
Parent: 03. North Slope - Static
Name: 03b. Reclamation Surface
Method: Spencer
Factor of Safety: 2.27
Horz Seismic Coef.:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone Bedrock	165	12,500	30
	Greenstone Overburden	125	0	35
	Surface Soil	120	200	30

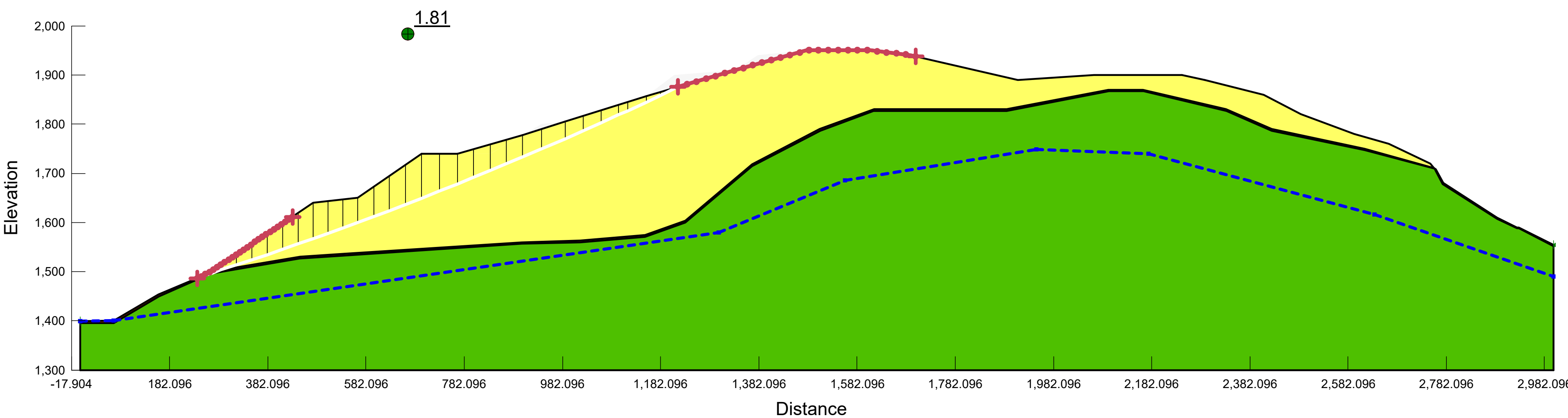
Title: WMSA - Section A
Parent: 04. North Slope - Pseudostatic
Name: 04b. Reclamation Surface
Method: Spencer
Factor of Safety: 1.46
Horz Seismic Coef.: 0.15

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone Bedrock	165	12,500	30
	Greenstone Overburden	125	0	35
	Surface Soil	120	200	30



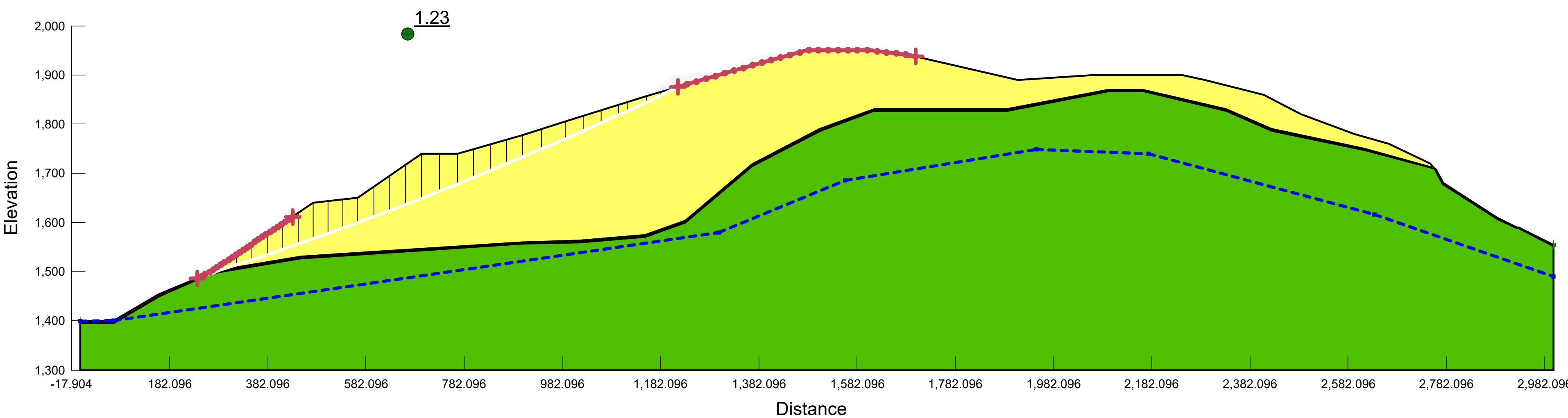
Title: WMSA - Section B
Parent: 01. South Slope - Static
Name: 01f. Reclaimed Surface (Global)
Method: Spencer
Factor of Safety: 1.81
Horz Seismic Coef.:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone Bedrock	165	12,500	30
	Greenstone Overburden	125	0	35
	Surface Soil	120	200	30



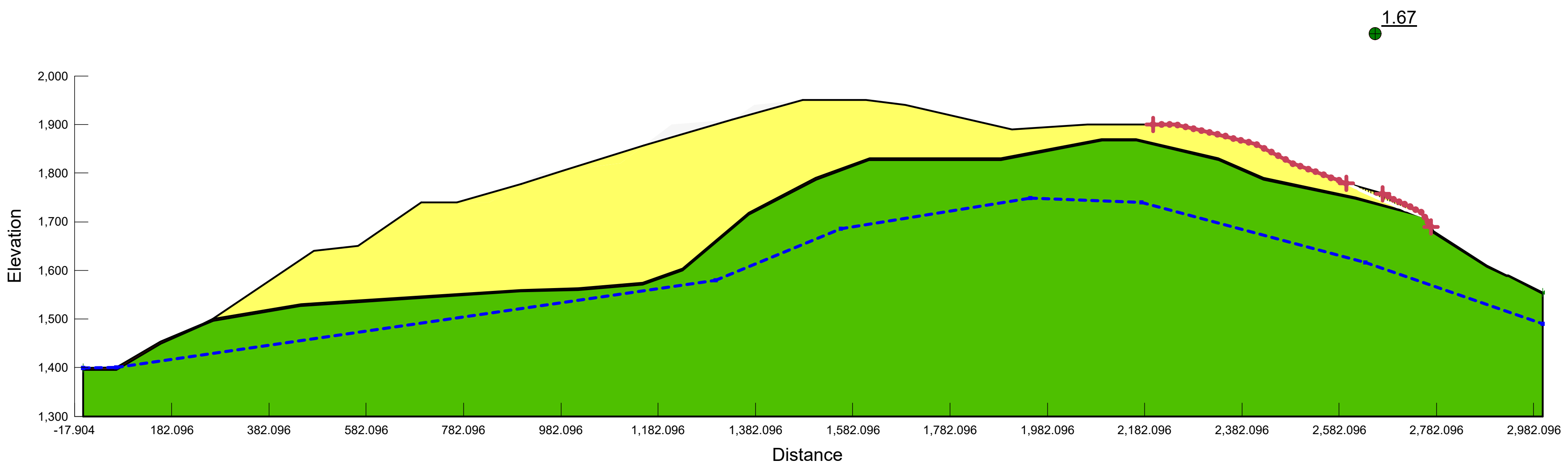
Title: WMSA - Section B
Parent: 02. South Slope - Pseudostatic
Name: 02f. Reclaimed Surface (Global)
Method: Spencer
Factor of Safety: 1.23
Horz Seismic Coef.: 0.15

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone Bedrock	165	12,500	30
	Greenstone Overburden	125	0	35
	Surface Soil	120	200	30



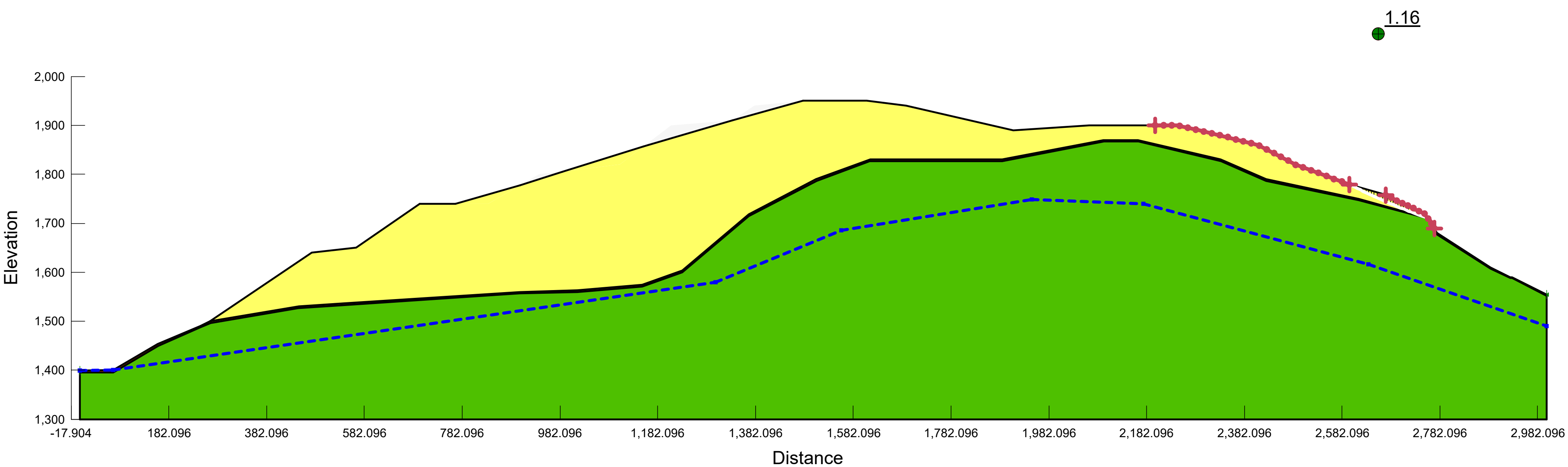
Title: WMSA - Section B
Parent: 03. North Slope - Static
Name: 03b. Reclaimed Surface
Method: Spencer
Factor of Safety: 1.67
Horz Seismic Coef.:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone Bedrock	165	12,500	30
	Greenstone Overburden	125	0	35
	Surface Soil	120	200	30



Title: WMSA - Section B
Parent: 04. North Slope - Pseudostatic
Name: 04b. Reclaimed Surface
Method: Spencer
Factor of Safety: 1.16
Horz Seismic Coef.: 0.15

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone Bedrock	165	12,500	30
	Greenstone Overburden	125	0	35
	Surface Soil	120	200	30



APPENDIX B

Seismic Displacement Analysis

WMSA Seismic Displacement Analysis

Section	Yield Acceleration ky (g)	Average Failure Surface Height (ft)	Seismic Displacement (in) (Bray and		
			Median	16% exceedence	84% exceedence
Section A	na	na	na	na	na
Section B	na	na	na	na	na

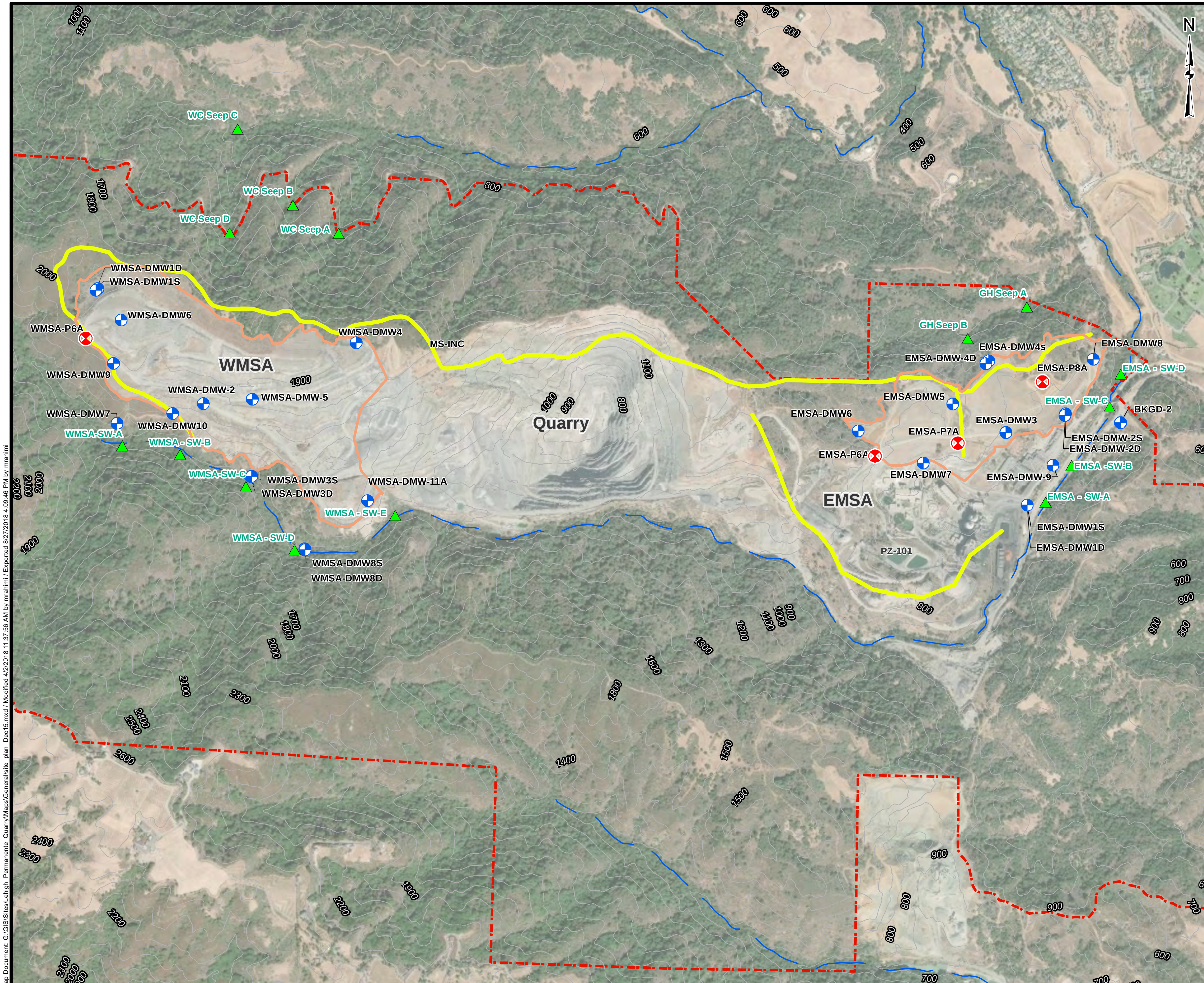
Note: Seismic displacement analyses were done for all models that have a FOS < 1.15 for Pseudo-static stability

Based on: Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, ASCE, V. 133(4), pp. 381-392, April 2007

MODEL INPUTS:	**Value**	**Reference**
Moment Magnitude Mw	7.1	Golder
PGA	0.6g	Golder
Non-ZeroStandard Deviation	0.66	Bray & Travasarou paper
Ts Coefficient	1.5	Bray & Travasarou paper

APPENDIX C

WMSA Drilling Logs



Map Document: G:\GIS\Sites\Lehigh_Permanente_Quarry\Maps\General\site_plan_Dec15.mxd / Modified 4/2/2018 11:37:56 AM by mrahimi / Exported 8/27/2018 4:09:46 PM by mrahimi

LEGEND

Well Type

- Monitoring Well
- Piezometer
- Seep and Surface Water Sample Location
- 100 ft surface elevation contour
- Former Ridgecrest
- Property Boundary
- EMSA/WMSA Boundary (Approximate)

REFERENCES

1) USGS 1/9th Arc NED DEM based off of 2006 LIDAR Survey
2) Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3) Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
4) Former Ridgecrest created from 1952 Cupertino and 1955 Mindego Hills Quadrangle USGS Topographic Maps.

1,200 0 1,200 Feet

1 in = 1,300 feet

PROJECT

PERMANENTE QUARRY
SANTA CLARA COUNTY, CA

TITLE

SITE PLAN

GOLDER

PROJECT No.		063-7109-914	FILE No. site_plan_Dec15.mxd
DESIGN	MM	4/2/2013	SCALE: 1:15,600 REV. 0
GIS	MR	4/2/2018	
CHECK	GW	4/2/2018	**FIGURE 3**
REVIEW	GW	4/2/2018	

Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

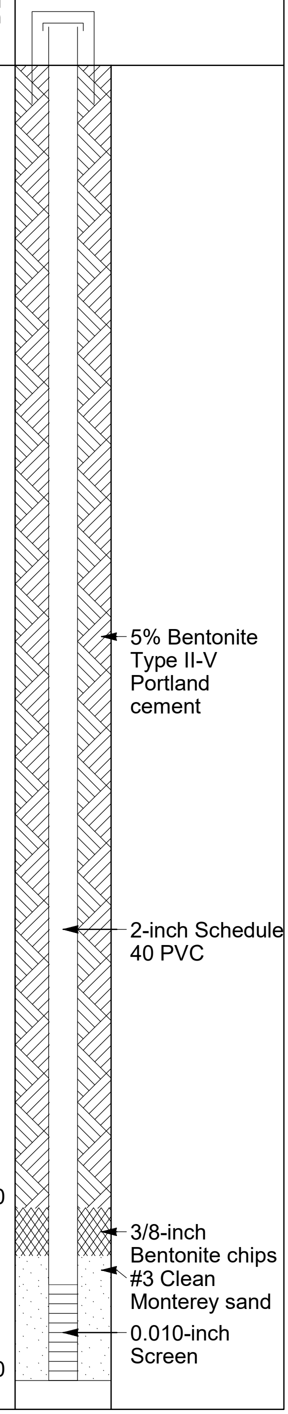
WELL NUMBER WMSA-DMW-1S

PROJECT NUMBER 063-7109-919
PROJECT NAME Lehigh Hydrogeologic Investigation
LOCATION Cupertino, CA
DRILLING METHOD Sonic
SAMPLING METHOD Corebarrel
GROUND ELEVATION ~1865-ft MSL
TOP OF CASING ~1868-ft MSL
LOGGED BY Jeff Linder
REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

DATE STARTED 6/23/15
DATE COMPLETED 6/24/15
CASING TYPE/DIAMETER PVC / 2-inch
SCREEN TYPE/SLOT Slotted / 0.010-inch
GRAVEL PACK TYPE #3 Monterey Sand
GROUT TYPE/QUANTITY 5% Bentonite Cement
GPS COORDINATES

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0			[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.	
0	10				
0	20				
0	30				
0	40				
0	50				
0	60				
0	70				
0	80				
0	90			@87'bgs: Perched moisture, insufficient for sampling.	95.0
0	100			[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, increased rock competency with depth.	
0	110				119.0
0	120			[FRANCISCAN FORMATION] Greenstone. Moderately weathered, hard, with abundant calcite veining. Increased rock competency with depth, very slow groundwater infiltration rate.	
0	130	▽			137.0
				Bottom of borehole at 137.0 feet.	

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

WELL NUMBER WMSA-DMW-1D

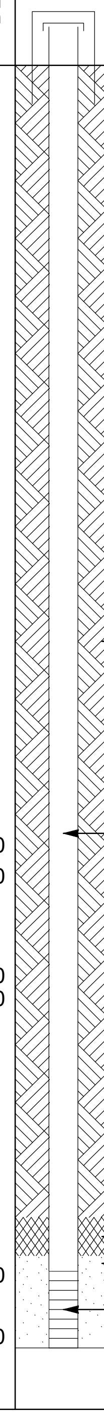
PROJECT NUMBER	063-7109-919	**DATE STARTED**	6/24/15
PROJECT NAME	Lehigh Hydrogeologic Investigation	**DATE COMPLETED**	6/26/15
LOCATION	Cupertino, CA	**CASING TYPE/DIAMETER**	PVC / 2-inch
DRILLING METHOD	Sonic	**SCREEN TYPE/SLOT**	Slotted / 0.010-inch
SAMPLING METHOD	Corebarrel	**GRAVEL PACK TYPE**	#3 Monterey Sand
GROUND ELEVATION	~1865-ft MSL	**GROUT TYPE/QUANTITY**	5% Bentonite Cement
TOP OF CASING	~1868-ft MSL	**GPS COORDINATES**	
LOGGED BY	Jeff Linder		

REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0			[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.	
0	10				
0	20				
0	30				
0	40				
0	50				
0	60				
0	70				
0	80			[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, increased rock competency with depth.	82.0
0	90				
0	100			@103-107'bgs: Low grade limestone, slightly weathered; white; abundant calcite veining, dry.	103.0 107.0
0	110				
0	120			@120-123'bgs: Low grade limestone, slightly weathered; white; abundant calcite veining, dry.	120.0 123.0
0	130				
0	140				
0	150	∇		@155'bgs: First encountered groundwater, very slow infiltration rate.	
0	160			[FRANCISCAN FORMATION] Greenstone. Moderately weathered, hard, with abundant calcite veining. Increased rock competency with depth.	159.0 167.0

Bottom of borehole at 167.0 feet.

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

WELL NUMBER WMSA-DMW-2

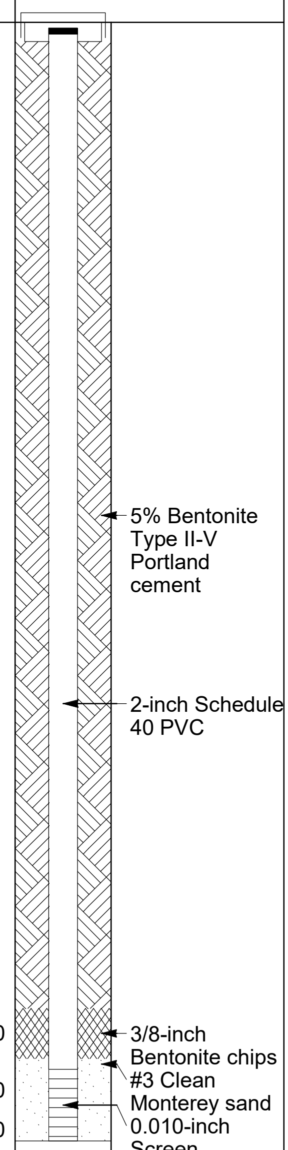
PROJECT NUMBER	063-7109-919	**DATE STARTED**	7/28/15
PROJECT NAME	Lehigh Hydrogeologic Investigation	**DATE COMPLETED**	8/1/15
LOCATION	Cupertino, CA	**CASING TYPE/DIAMETER**	PVC / 2-inch
DRILLING METHOD	Sonic	**SCREEN TYPE/SLOT**	Slotted / 0.010-inch
SAMPLING METHOD	Corebarrel	**GRAVEL PACK TYPE**	#3 Monterey Sand
GROUND ELEVATION	~1650-ft MSL	**GROUT TYPE/QUANTITY**	5% Bentonite Cement
TOP OF CASING	~1653-ft MSL	**GPS COORDINATES**	
LOGGED BY	Jeff Linder		

REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0			[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.	
0	10			
0	20			
0	30			
0	40			
0	50			
0	60			
0	70			
0	80			
0	90			
0	100			
0	110			
0	120			
0	130			
0	140			
0	150			
0	160			
0	170			
0	180			
0	190			
0	200			
0	210			
0	220			
0	230			
0	240			
0	250			
0	260			
0	270			
0	280			285.0
0	290		[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry. Consolidation and rock strength increase with depth, dry, no odor.	
0	300		[FRANCISCAN FORMATION] Greenstone. Moderately to highly weathered, argillic alteration, with abundant calcite veining. Increased rock competency with depth, very slow groundwater infiltration rate.	301.0
0	310	∇		312.0

Bottom of borehole at 312.0 feet.

WELL DIAGRAM



LEHIGH MONITORING WELLS GINT_LOGS.GPJ LOG A EWNN01.GDT 2/25/16

Golder Associates

425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

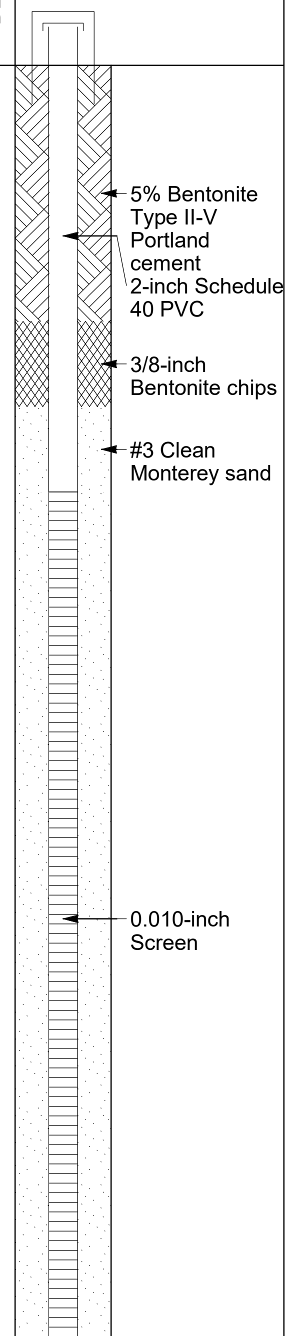
WELL NUMBER WMSA-DMW-3S

PROJECT NUMBER	063-7109-919	**DATE STARTED**	7/15/15
PROJECT NAME	Lehigh Hydrogeologic Investigation	**DATE COMPLETED**	7/16/15
LOCATION	Cupertino, CA	**CASING TYPE/DIAMETER**	PVC / 2-inch
DRILLING METHOD	Mini Sonic	**SCREEN TYPE/SLOT**	Slotted / 0.010-inch
SAMPLING METHOD	Corebarrel	**GRAVEL PACK TYPE**	#3 Monterey Sand
GROUND ELEVATION	~1410-ft MSL	**GROUT TYPE/QUANTITY**	5% Bentonite Cement
TOP OF CASING	~1413-ft MSL	**GPS COORDINATES**	
LOGGED BY	Jeff Linder		

REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0			[ROAD BASE] Silty GRAVEL, fine to coarse, subangular to angular (GW); reddish brown topsoil mixed with gravel-cobble sized fill; dry, loose, no odor.	7.5
0	10	▽ (~12)		[ALLUVIUM] SILTY CLAY with some ~1-inch gravel and sand lenses, fine to medium sand and fine gravel, subrounded, moderate to high iron oxidation (CL); Yellowish to orange-brown; moist, unconsolidated. @12.5'bgs: Well graded sand lens ~1-inch thick. Saturated. @14'bgs: Well graded sand lens ~1-inch thick. Saturated.	18.5
0 0	20			[FRANCISCAN FORMATION] Greenstone. Fresh to moderately weathered, with abundant calcite veining. Increased rock competency with depth, very hard drilling.	30.0
	30			Bottom of borehole at 30.0 feet.	

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

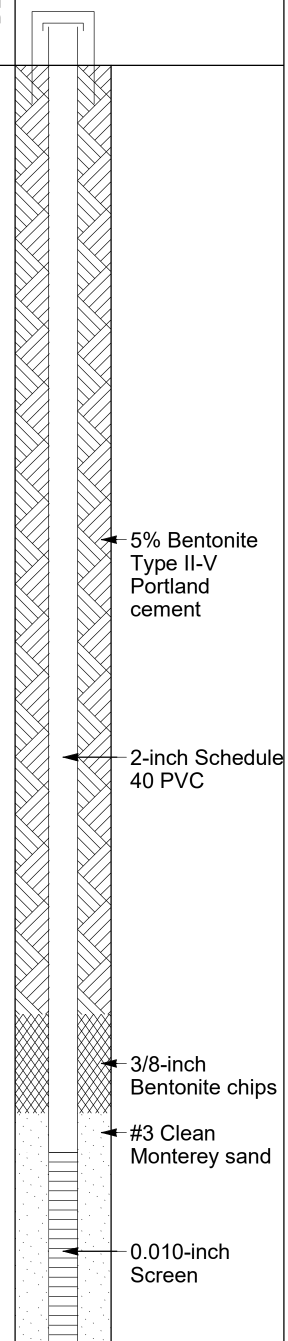
WELL NUMBER WMSA-DMW-3D

PROJECT NUMBER	063-7109-919	**DATE STARTED**	7/14/15
PROJECT NAME	Lehigh Hydrogeologic Investigation	**DATE COMPLETED**	7/16/15
LOCATION	Cupertino, CA	**CASING TYPE/DIAMETER**	PVC / 2-inch
DRILLING METHOD	Mini Sonic	**SCREEN TYPE/SLOT**	Slotted / 0.010-inch
SAMPLING METHOD	Corebarrel	**GRAVEL PACK TYPE**	#3 Monterey Sand
GROUND ELEVATION	~1410-ft MSL	**GROUT TYPE/QUANTITY**	5% Bentonite Cement
TOP OF CASING	~1413-ft MSL	**GPS COORDINATES**	
LOGGED BY	Jeff Linder		

REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0		[ROAD BASE] Silty GRAVEL, fine to coarse, subangular to angular (GW); reddish brown topsoil mixed with rocky road fill; dry, loose, no odor.	7.0
0	10	▽	[ALLUVIUM] SILTY CLAY with some ~1-inch gravel and sand lenses, fine to medium sand and fine gravel, subrounded, moderate to high iron oxidation (CL); Yellowish to orange-brown; moist, unconsolidated, no odor. @12.5'bgs: Well graded sand lens ~1-inch thick. Saturated. @14'bgs: Well graded sand lens ~1-inch thick. Saturated.	20.0
0	20		[FRANCISCAN FORMATION] Greenstone. Fresh to moderately weathered, with abundant calcite veining. Increased competency with depth, very hard drilling.	
0	30			
0	40			
0	50			
0	60			65.0
			Bottom of borehole at 65.0 feet.	

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

WELL NUMBER WMSA-DMW-4

PROJECT NUMBER	063-7109-919	**DATE STARTED**	6/27/15
PROJECT NAME	Lehigh Hydrogeologic Investigation	**DATE COMPLETED**	6/29/15
LOCATION	Cupertino, CA	**CASING TYPE/DIAMETER**	PVC / 2-inch
DRILLING METHOD	Sonic	**SCREEN TYPE/SLOT**	Slotted / 0.010-inch
SAMPLING METHOD	Corebarrel	**GRAVEL PACK TYPE**	#3 Monterey Sand
GROUND ELEVATION	~1885-ft MSL	**GROUT TYPE/QUANTITY**	5% Bentonite Cement
TOP OF CASING	~1888-ft MSL	**GPS COORDINATES**	
LOGGED BY	Jeff Linder		

REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH	WELL DIAGRAM
0	0			[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.		
0	10					
0	20			@17'bgs: Perched moisture, insufficient for sampling.	21.0	
0				[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, increased rock competency with depth, dry, no odor.		
0	30					
0	40					5% Bentonite Type II-V Portland cement
0	50					
0	60					2-inch Schedule 40 PVC
0	70					
0	80				81.0	
				[FRANCISCAN FORMATION] Greenstone. Moderately to highly weathered, argillic alteration, with abundant calcite veining. Increased rock competency with depth, dry, no odor.		
0	90					3/8-inch Bentonite chips; #3 Clean Monterey sand
0	100					0.010-inch Screen
0	110	▽		@109'bgs: First encountered groundwater, very slow infiltration rate.	117.0	
				Bottom of borehole at 117.0 feet.		

Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

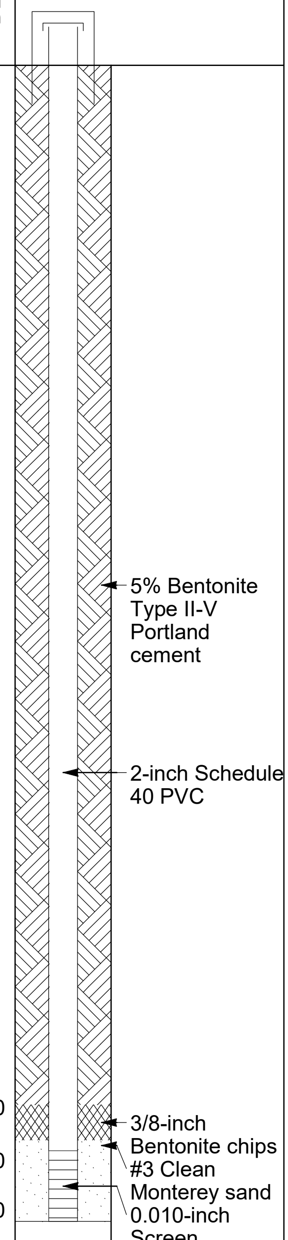
WELL NUMBER WMSA-DMW-5

PROJECT NUMBER 063-7109-919
PROJECT NAME Lehigh Hydrogeologic Investigation
LOCATION Cupertino, CA
DRILLING METHOD Sonic
SAMPLING METHOD Corebarrel
GROUND ELEVATION ~1830-ft MSL
TOP OF CASING ~1833-ft MSL
LOGGED BY Jeff Linder
DATE STARTED 7/14/15
DATE COMPLETED 7/28/15
CASING TYPE/DIAMETER PVC / 2-inch
SCREEN TYPE/SLOT Slotted / 0.010-inch
GRAVEL PACK TYPE #3 Monterey Sand
GROUT TYPE/QUANTITY 5% Bentonite Cement
GPS COORDINATES
REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0				[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.	
0	10				
0	20				
0	30				
0	40				
0	50				
0	60				
0	70				
0	80			@77-81'bgs: Fines.	
0	90			@84-107'bgs: Fines.	
0	100				
0	110				
0	120				
0	130			@125-131'bgs: Fines, no odor.	
0	140				
0	150				
0	160				
0	170				
0	180				
0	190				
0	200				
0	210				
0	220				
0	230				
0	240				
0	250				
0	260				
0	270				
0	280				
0	290			@281'bgs: Some perched moisture, insufficient for sampling.	
0	300			@290-298'bgs: Very large boulders, hard drilling, dry.	298.0
0	310			[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, no odor.	313.0
0	320	▽		[FRANCISCAN FORMATION] Greenstone. Moderately to highly weathered, argillic alteration, with abundant calcite veining. Increased rock competency with depth, very slow groundwater infiltration rate.	327.0

Bottom of borehole at 327.0 feet.

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

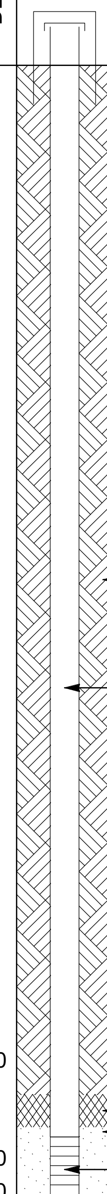
WELL NUMBER WMSA-DMW-6

PROJECT NUMBER 063-7109-919
PROJECT NAME Lehigh Hydrogeologic Investigation
LOCATION Cupertino, CA
DRILLING METHOD Sonic
SAMPLING METHOD Corebarrel
GROUND ELEVATION ~1935-ft MSL
TOP OF CASING ~1938-ft MSL
LOGGED BY Jeff Linder
DATE STARTED 6/29/15
DATE COMPLETED 7/11/15
CASING TYPE/DIAMETER PVC / 2-inch
SCREEN TYPE/SLOT Slotted / 0.010-inch
GRAVEL PACK TYPE #3 Monterey Sand
GROUT TYPE/QUANTITY 5% Bentonite Cement
GPS COORDINATES
REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0				[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.	
0	10				
0	20				
0	30				
0	40				
0	50				
0	60				
0	70				
0	80				
0	90				
0	100				
0	110				
0	120				
0	130				
0	140				
0	150				
0	160				
0	170				
0	180				
0	190				
0	200				
0	210				
0	220				
0	230				
0	240				
0	250				
0	260				
0	270				
0	280				
0	290				
0	300			@295-307'bgs: Hard drilling through very large boulders.	307.0
0	310			[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, no odor. @315'bgs: Decrease in oxidation and weathering, increased hardness and rock competency with depth.	
0	320				
0	330				337.0
0	340	▽		[FRANCISCAN FORMATION] Greenstone. Moderately to highly weathered, argillic alteration, with abundant calcite veining. Increased rock competency with depth. @345'bgs: First encountered groundwater, very slow infiltration rates.	347.0

Bottom of borehole at 347.0 feet.

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

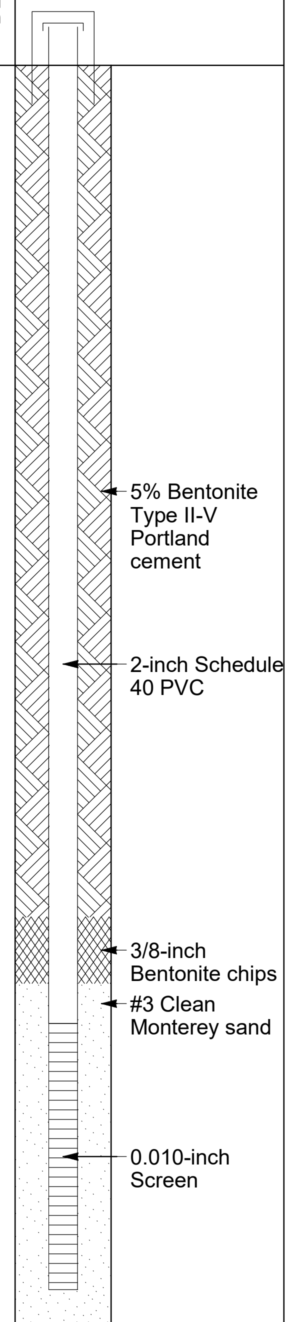
WELL NUMBER WMSA-DMW-7

PROJECT NUMBER 063-7109-919
PROJECT NAME Lehigh Hydrogeologic Investigation
LOCATION Cupertino, CA
DRILLING METHOD Mini Sonic
SAMPLING METHOD Corebarrel
GROUND ELEVATION ~1620-ft MSL
TOP OF CASING ~1623-ft MSL
LOGGED BY Jeff Linder
REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

DATE STARTED 7/7/15
DATE COMPLETED 7/9/15
CASING TYPE/DIAMETER PVC / 2-inch
SCREEN TYPE/SLOT Slotted / 0.010-inch
GRAVEL PACK TYPE #3 Monterey Sand
GROUT TYPE/QUANTITY 5% Bentonite Cement
GPS COORDINATES

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0			[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation. Top 5-ft resemble topsoil with roots and other organics. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, no odor.	
0	10				
0	20				
0	30			@27'bgs: Decrease in iron oxidation and weathering, increased rock competency and freshness with depth. Color change to olive brown.	
0	40				
0	50			[FRANCISCAN FORMATION] Greenstone. Moderately to highly weathered, argillic alteration, with abundant calcite veining. Increased rock competency with depth, dry, no odor.	45.0
0	60				
0	70				
0	80	∇		@85'bgs: Very slow groundwater infiltration.	
0	90				95.0
				Bottom of borehole at 95.0 feet.	

WELL DIAGRAM



Golder Associates

425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

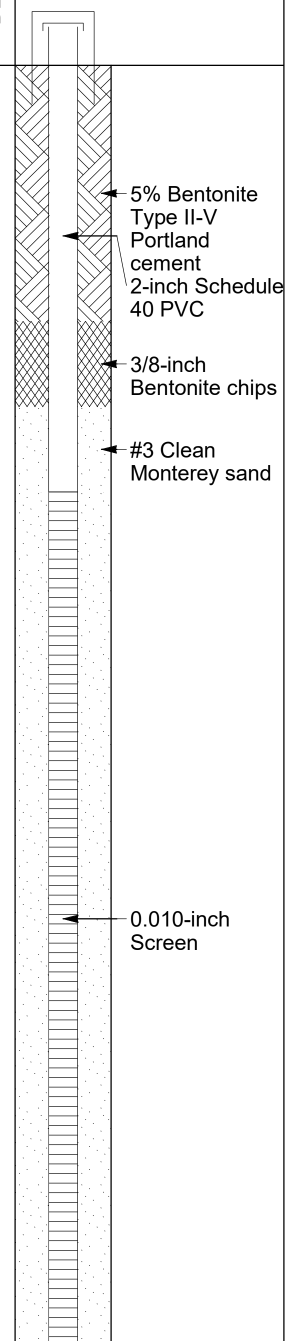
WELL NUMBER WMSA-DMW-8S

PROJECT NUMBER	063-7109-919	**DATE STARTED**	7/13/15
PROJECT NAME	Lehigh Hydrogeologic Investigation	**DATE COMPLETED**	7/14/15
LOCATION	Cupertino, CA	**CASING TYPE/DIAMETER**	PVC / 2-inch
DRILLING METHOD	Mini Sonic	**SCREEN TYPE/SLOT**	Slotted / 0.010-inch
SAMPLING METHOD	Corebarrel	**GRAVEL PACK TYPE**	#3 Monterey Sand
GROUND ELEVATION	~1380-ft MSL	**GROUT TYPE/QUANTITY**	5% Bentonite Cement
TOP OF CASING	~1383-ft MSL	**GPS COORDINATES**	
LOGGED BY	Jeff Linder		

REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0			[ROAD BASE] Silty GRAVEL, fine to coarse, subangular to angular (GW); reddish brown topsoil mixed with gravel-cobble sized fill; dry, loose, no odor.	3.0
0	10			[ALLUVIUM] SILTY CLAY with some ~1-inch gravel and sand lenses, fine to medium sand and fine gravel, subrounded, moderate iron oxidation (CL); pale-brown; moist, unconsolidated, no odor.	20.0
0	20	▽ (19.5)		@19.5'bgs: First encountered water in a saturated sandy clay, unconsolidated zone.	
0				[FRANCISCAN FORMATION] Greenstone. Fresh to moderately weathered, with abundant calcite veining. Increased competency with depth, very hard drilling.	30.0
	30			Bottom of borehole at 30.0 feet.	

WELL DIAGRAM



Golder Associates

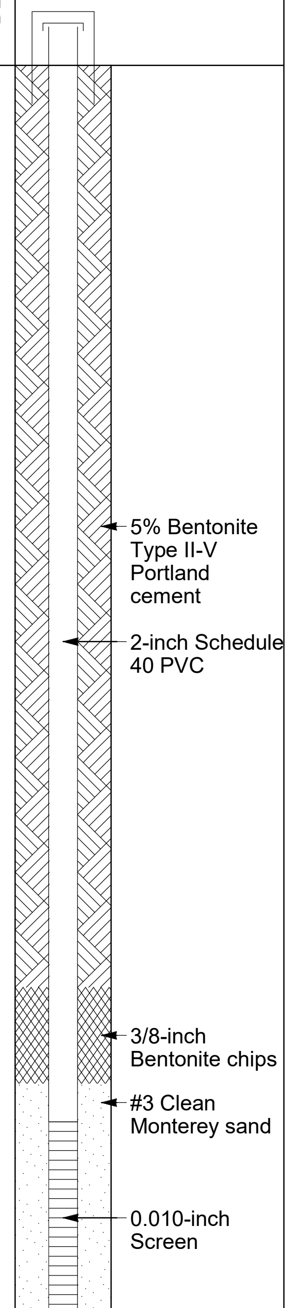
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

WELL NUMBER WMSA-DMW-8D

PROJECT NUMBER 063-7109-919
PROJECT NAME Lehigh Hydrogeologic Investigation
LOCATION Cupertino, CA
DRILLING METHOD Mini Sonic
SAMPLING METHOD Corebarrel
GROUND ELEVATION ~1380-ft MSL
TOP OF CASING ~1383-ft MSL
LOGGED BY Jeff Linder
DATE STARTED 7/12/15
DATE COMPLETED 7/13/15
CASING TYPE/DIAMETER PVC / 2-inch
SCREEN TYPE/SLOT Slotted / 0.010-inch
GRAVEL PACK TYPE #3 Monterey Sand
GROUT TYPE/QUANTITY 5% Bentonite Cement
GPS COORDINATES
REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0		[ROAD BASE] Silty GRAVEL, fine to coarse, subangular to angular (GW); reddish brown topsoil mixed with rocky road fill; dry, loose, no odor.	3.0
			[ALLUVIUM] SILTY CLAY with some ~1-inch gravel and sand lenses, fine to medium sand and fine gravel, subrounded, moderate iron oxidation (CL); pale-brown; moist, unconsolidated, no odor.	
0	10			
0	20	▽	@19.5'bgs: First encountered water in a saturated sandy clay, unconsolidated zone.	20.0
			[FRANCISCAN FORMATION] Greenstone. Fresh to moderately weathered, with abundant calcite veining. Increased competency with depth, very hard drilling.	
0	30			
0	40			
0	50			
0	60			65.0
			Bottom of borehole at 65.0 feet.	

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

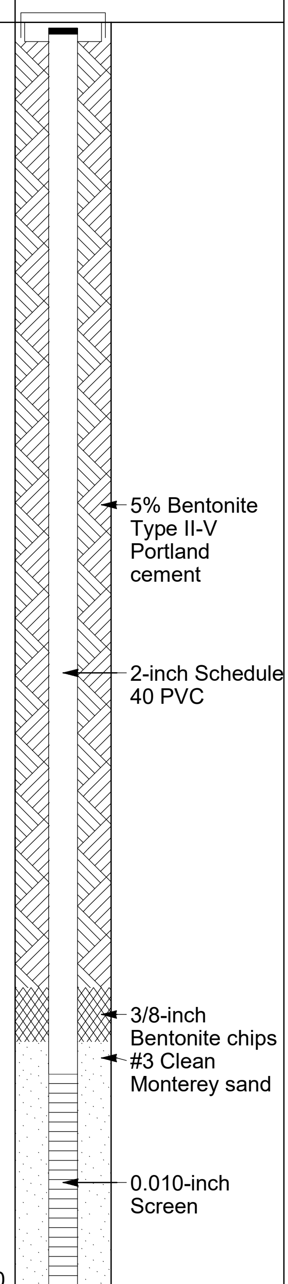
WELL NUMBER WMSA-DMW-9

PROJECT NUMBER 063-7109-919
PROJECT NAME Lehigh Hydrogeologic Investigation
LOCATION Cupertino, CA
DRILLING METHOD Sonic
SAMPLING METHOD Corebarrel
GROUND ELEVATION ~1770-ft MSL
TOP OF CASING ~1773-ft MSL
LOGGED BY Jeff Linder
REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

DATE STARTED 7/13/15
DATE COMPLETED 7/14/15
CASING TYPE/DIAMETER PVC / 2-inch
SCREEN TYPE/SLOT Slotted / 0.010-inch
GRAVEL PACK TYPE #3 Monterey Sand
GROUT TYPE/QUANTITY 5% Bentonite Cement
GPS COORDINATES

PID	DEPTH (FT. BGS)	Water Level	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0		[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.	
0	10			
0	20			
0	30			
0	40			47.0
0	50		[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, no odor.	
0	60			
0	70			
0	80		@84'bgs: Increased rock competency, freshness and decreased weathering. Color change to olive brown.	
0	90			98.0
0	100	▽	[FRANCISCAN FORMATION] Greenstone. Moderately to highly weathered, argillic alteration, with abundant calcite veining. Increased rock competency with depth, dry no odor. Very slow groundwater infiltration rate.	
0	110			117.0
			Bottom of borehole at 117.0 feet.	

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

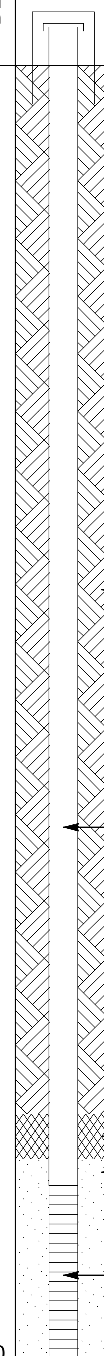
WELL NUMBER WMSA-DMW-10

PROJECT NUMBER	063-7109-919	**DATE STARTED**	7/10/15
PROJECT NAME	Lehigh Hydrogeologic Investigation	**DATE COMPLETED**	7/14/15
LOCATION	Cupertino, CA	**CASING TYPE/DIAMETER**	PVC / 2-inch
DRILLING METHOD	Mini Sonic	**SCREEN TYPE/SLOT**	Slotted / 0.010-inch
SAMPLING METHOD	Corebarrel	**GRAVEL PACK TYPE**	#3 Monterey Sand
GROUND ELEVATION	~1650-ft MSL	**GROUT TYPE/QUANTITY**	5% Bentonite Cement
TOP OF CASING	~1653-ft MSL	**GPS COORDINATES**	
LOGGED BY	Jeff Linder		

REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0			[ROAD BASE] Silty GRAVEL, fine to coarse, subangular to angular (GW); dark grey; dry, loose, no odor.	6.0
0	10			[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, no odor.	
0	20				
0	30				
0	40				
0	50			@45'bgs: Decrease in iron oxidation and weathering, increased rock competency and freshness with depth. Color change to olive brown, dry, no odor.	
0	60				
0	70				
0	80				84.0
0	90			[FRANCISCAN FORMATION] Greenstone. Moderately to highly weathered, argillic alteration, with abundant calcite veining. Increased rock competency with depth, dry, no odor.	
0	100				
0	110				
0	120				
0	130				
0	140	▽		@137'bgs: Very slow groundwater infiltration.	145.0
				Bottom of borehole at 145.0 feet.	

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

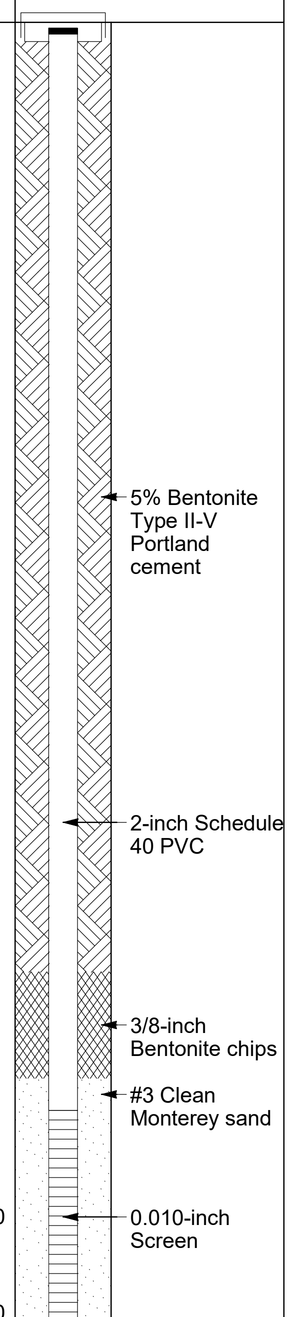
WELL NUMBER WMSA-DMW-11

PROJECT NUMBER 063-7109-919
PROJECT NAME Lehigh Hydrogeologic Investigation
LOCATION Cupertino, CA
DRILLING METHOD Sonic
SAMPLING METHOD Corebarrel
GROUND ELEVATION ~1470-ft MSL
TOP OF CASING ~1473-ft MSL
LOGGED BY Jeff Linder
DATE STARTED 8/1/15
DATE COMPLETED 8/3/15
CASING TYPE/DIAMETER PVC / 2-inch
SCREEN TYPE/SLOT Slotted / 0.010-inch
GRAVEL PACK TYPE #3 Monterey Sand
GROUT TYPE/QUANTITY 5% Bentonite Cement
GPS COORDINATES
REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0				[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.	
0	10				
0	20				
0	30				
0	40				
0	50				
0	60				
0	70			@68-69'bgs: fines.	
0	80				88.5
0	90			[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry. Consolidation and rock strength increase with depth, no odor.	
0	100	∇		@97.5'bgs: First encountered groundwater.	
0	110				113.0
0	120			[FRANCISCAN FORMATION] Black shale with abundant calcite veining. Highly weathered, argillaceous alteration with moderate to high fissility. Limited blocks of relatively competent, moderately weathered R2 rock.	122.0

Bottom of borehole at 122.0 feet.

WELL DIAGRAM



Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: 408-220-9223
Fax: 408-220-9224

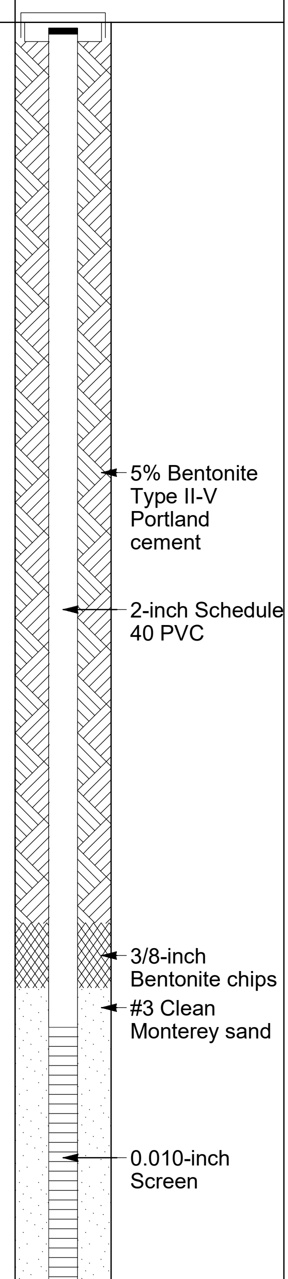
WELL NUMBER WMSA-P6A

PROJECT NUMBER	063-7109-919	**DATE STARTED**	7/11/15
PROJECT NAME	Lehigh Hydrogeologic Investigation	**DATE COMPLETED**	7/13/15
LOCATION	Cupertino, CA	**CASING TYPE/DIAMETER**	PVC / 2-inch
DRILLING METHOD	Sonic	**SCREEN TYPE/SLOT**	Slotted / 0.010-inch
SAMPLING METHOD	Corebarrel	**GRAVEL PACK TYPE**	#3 Monterey Sand
GROUND ELEVATION	~1820-ft MSL	**GROUT TYPE/QUANTITY**	5% Bentonite Cement
TOP OF CASING	~1823-ft MSL	**GPS COORDINATES**	
LOGGED BY	Jeff Linder		

REMARKS Sonic drilling with 4-inch sample corebarrel. Well casing installed inside 6 5/8-inch sonic casing.

PID	DEPTH (FT. BGS)	Water Level	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	0			[FILL] GRAVEL, fine to coarse, subangular to angular (GW); dry, loose, no odor.	
0	10				
0	20			[FRANCISCAN FORMATION] Franciscan metabasalt. Highly weathered, abundant iron oxidation, roots and other organics near the contact. Most of the rock material has weathered into a soil. Very poorly consolidated, dry, no odor.	21.0
0	30				
0	40				
0	50			@48'bgs: Decrease in iron oxidation and weathering, increased rock competency and freshness with depth. Color change to olive brown.	
0	60				
0	70	∇			
0	80				
0	90			[FRANCISCAN FORMATION] Greenstone. Moderately to highly weathered, argillic alteration, with abundant calcite veining. Increased rock competency with depth, dry, no odor. Very slow groundwater infiltration rate.	92.0
				Bottom of borehole at 97.0 feet.	97.0

WELL DIAGRAM



APPENDIX G-2

NORTH HIGHWALL RESERVE
GEOTECHNICAL EVALUATION

North Highwall Reserve Geotechnical Evaluation

Permanente Quarry

April 5, 2019

Prepared for:

Lehigh Southwest Cement
24011 Stevens Creek Blvd.
Cupertino, CA 95014-5659

Prepared by:

Stantec Consulting Services Inc.
2890 E. Cottonwood Parkway, Suite 300
Salt Lake City, UT 84121

Revision	Description	Author		Quality Check		Independent Review	
3	Client Comments	Paul Kos	4/5/19	Toni Jack	4/5/19	Greg Gold	4/5/19
2	Client Review	Paul Kos	2/1/19	Toni Jack	2/1/19	Greg Gold	2/1/19
1	Client Review	Paul Kos	12/21/18	Toni Jack	12/14/18	Greg Gold	12/21/18
0	For Approval	Paul Kos	11/30/18	Toni Jack	11/30/18	Greg Gold	11/30/18
A	Initial Draft	Paul Kos	11/28/18	Toni Jack	11/28/18	Greg Gold	11/28/18

Sign-off Sheet

This document entitled North Highwall Reserve Geotechnical Evaluation was prepared by Stantec Consulting Services Inc. (Stantec) for the account of Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party because of decisions made or actions taken based on this document.

Prepared by ______________________________

(signature)

Paul Kos

Reviewed by ______________________________

(signature)

Nelson Kawamura

Approved by ______________________________

(signature)

Greg Gold

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

The North Highwall Reserve Geotechnical Evaluation has been prepared to assist Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc., with the upcoming Reclamation Plan amendment submission, under California's Surface Mining and Reclamation Act (SMARA). This report presents the proposed mining and reclamation plan, documents previous and recent investigations of the North Quarry area and provides results of stability analyses to support Lehigh in mining and reclaiming the North Quarry and in mitigating the historic landslide (Main Slide) in the North Quarry.

The North Quarry is where mineral extraction currently occurs and has historically taken place. The North Quarry features a large mining area, with elevations that currently range from approximately 550 feet (ft) to 1,750 feet above mean sea level (AMSL). The North Quarry has a history of localized instability of the highwalls, and an integral part of this project involves revising the mining and reclamation plans to mitigate the Main Slide.

Previous and recent investigations of the North Quarry include drilling programs, geologic mapping, laboratory testing, and visual inspections. The site has been studied for geology several times, and these investigations were used to develop the 2018 investigation. This recent geologic investigation included aerial photograph interpretation and field mapping of faults, bedding, and structure for potential impacts to highwall stability. A key finding is that bedding dip slope and direction appear to have a negative impact on slope stability, and highwalls sloped in the dip direction (generally south east) need to be sloped at less than the dip angle. The investigation also included drilling, geotechnical sampling, and geophysical logging of the boreholes to identify areas of weathered versus competent greenstone in the proposed highwall. These data were used to design a permanently stable highwall.

Lehigh will regrade the North Quarry to stabilize the Main Slide and recover economic limestone resources in the north wall. The mining will begin at the 1,900-foot AMSL elevation, and the slope will be mined from top to bottom to the 600-foot AMSL elevation. The current practice of 50-foot high slopes between benches will be continued. The inter-bench slope gradients range from 26° to 38° depending on rock types, wall orientation, structure, and wall height. The Reclamation Plan for the North Quarry proposes modifications to the 1972 Scenic Easement by lowering the crest by up to 100 feet to elevations that vary between 1,390 feet and 1,425 feet AMSL. The new configuration will allow the area to be revegetated and improve the overall aesthetic appearance of the ridgeline.

The Main Slide will be mitigated by removing it in its entirety. Previous investigations suggest that the Main Slide occurred along a fault at the base of the limestone. Recent drilling data indicate competent greenstone beneath the fault and associated weathered greenstone. This plan intends to excavate the landslide and fault, thus leaving a permanently stable highwall in competent greenstone.

Geotechnical stability analyses were completed on five cross-sections through the North Quarry. These cross-sections represent a variety of slope angles and combinations of lithology and include sections through the Main Slide. The minimum acceptable factors of safety for the analyses are 1.3 for static conditions and 1.0 for pseudo-static conditions, based on mining industry standards. All configurations modeled as part of these analyses meet or exceed the minimum acceptable factor of safety. Generally, geotechnical stability is governed by the near surface geology, which will have reduced strengths due to mining activities. The geotechnical analyses require that groundwater be lowered along some of the highwalls so that it does not coincide with this surficial "mining impacted zone"

Abbreviations

°	degree (s)
%	percent
AMSL	Above mean sea level
BFA	bench face angle
cm	centimeter(s)
ft	feet
FoS	factor of safety
g	Gravitational force
Golder	Golder Associates Inc.
GSI	geological strength index
in	inches
IRA	Inter-ramp angle
ksi	Kips per square inch
ky	yield acceleration
Lehigh	Lehigh Southwest Cement Company, a subsidiary of Heidelberg Cement
m	meter
pcf	Pounds per cubic foot
PGA	Peak ground acceleration
psf	Pounds per square foot
psi	Pounds per square inch
RMR	rock mass rating
RPA	Reclamation Plan Amendment
RQD	Rock quality designation
SMARA	[California's] Surface Mining and Reclamation Act
Stantec	Stantec Consulting Services, Inc.
UCS	Uniaxial Compressive Strength
WMSA	West Material Storage Area

Glossary

Cohesion	The force which holds molecules or like particles together in a rock or soil.
Factor of safety	The ratio of resisting force to driving force in a slope stability problem. A factor of safety of one represents the minimum factor of safety for which the slope is stable.
Greenstone	Common term applied to metabasalts within the Franciscan Complex, due to unweathered, dark green color (Foruria 2004).
Greenstone overburden	Material unsuitable for use as aggregate material. Typically, it is weathered greenstone, but it may include other rock types such as low-grade limestone, graywacke, and chert.
North Highwall Reserve	Limestone and aggregate resources in the north highwall of the North Quarry.
Phi', ɸ'	The frictional shear resistance of soil or rock.
Pseudo-static slope stability analysis	A limit equilibrium method of analysis which represents the effects of earthquake shaking by accelerations that create inertial forces. This is the simplest way to analyze the dynamic effects of earthquake loading of a soil or slope. The output is a single factor of safety.
Rock Plant Reserve	Limestone and aggregate resources in an approximately 30.5-acre area at the southern extent of the Permanente Property.
Seismic deformation analysis	An empirical calculation which estimates the extent of lateral displacement during the design earthquake. The output is the median displacement.
Scenic Easements	The Ridgeline Protection Easement Deed executed in 1972 which applies to a portion of the northern ridgeline.
Soil	Native, unconsolidated material present at the surface before mining operations began.
Static slope stability analysis	A limit equilibrium method of analysis which satisfies moment and force equilibrium to solve a slope stability problem. The output is a single factor of safety.

1.0 INTRODUCTION

1.1 PURPOSE

Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc., engaged Stantec Consulting Services Inc. (Stantec) to provide professional engineering services related to development of the Reclamation Plan for the North Quarry at the Permanente Property. The Reclamation Plan for the North Quarry involves mining limestone and aggregate resources from the existing quarry, mitigating the existing landslide, and backfilling the quarry to the minimum elevation of the surrounding natural topography. The mining, landslide mitigation, and reclamation plans are described herein to provide guidance to Lehigh for completing and reclaiming the quarry. In addition, static and pseudo-static slope stability analyses of the reclamation surface have been completed to support these plans.

This North Highwall Reserve Geotechnical Evaluation has been prepared to assist Lehigh with upcoming Reclamation Plan amendment submissions under California's Surface Mining and Reclamation Act (SMARA). This report presents the Reclamation Plan, documents the results of stability analyses, and provides specifications to guide Lehigh in reclaiming the North Quarry.

1.2 PROJECT BACKGROUND

The Permanente Quarry (Quarry) is a limestone and aggregate mining operation, active since the late 1930's, in the unincorporated foothills of western Santa Clara County, approximately two miles west of the city of Cupertino, California. The Quarry occupies a portion of a 3,510-acre property (Permanente Property) owned by Hanson Permanente Cement, Inc. and operated by Lehigh.

The Permanente Property is situated in the rugged foothills along the eastern side of the Santa Cruz Mountains segment of the California Coast Ranges. This area of the Coast Ranges is characterized by moderately to steeply sloping hillsides ranging from approximately 500 to 2,000 feet (ft) above mean sea level (AMSL). The eastern side of the range is incised with eastern flowing drainages, including the Permanente Creek Drainage Basin, which flows through the central part of the Permanente Property, and drains into the southern part of the San Francisco Bay, near Palo Alto and Mountain View, California. The regional location map is included as Figure 1.1.

Operational areas at the Quarry comprise surface mining excavations, overburden stockpiling, crushing and processing facilities, access roads, administrative offices, and equipment storage facilities. Other predominantly undisturbed areas are held in reserve for future mining or to buffer operational areas from adjacent land uses. The North Quarry is where mineral extraction currently occurs and has historically taken place. The North Quarry features a large mining area, with elevations that currently range from approximately 550 to 1,750 feet AMSL. Limestone and greenstone mined from the North Quarry are crushed and can be either processed into aggregate products at Lehigh's on-site rock (aggregate) plant or are used for cement manufacture at Lehigh's adjacent cement plant. Figure 1.2 shows a plan view of the site.

The North Quarry is located on the hillside to the west of the cement plant. The topography surrounding the North Quarry ranges in elevation from approximately 1,000 feet AMSL near the east end of the south highwall to approximately 1,750 feet AMSL, at the top of the scarp in the northwest corner of the highwall. Mining operations in the North Quarry are ongoing, with plans to mine the southern portion of the quarry to an elevation of 440 feet AMSL and the northern portion of the quarry to an elevation of 600 feet AMSL. Currently, the quarry has been developed to a maximum elevation of approximately 525 feet AMSL.

Mining operations take place subject to SMARA, which mandates that surface mining operations have an approved reclamation plan that describes how mined lands will be prepared for alternative post-mining uses, and how residual hazards will be addressed. Golder Associates Inc, (Golder) completed geotechnical investigations and slope stability evaluations in 2011 to support an amended Reclamation Plan for the operational areas disturbed by mining activities. The current Reclamation Plan was approved in 2012. Changes to the current approved Reclamation Plan are being considered, which necessitate an update of the Reclamation Plan for the Permanente Quarry under SMARA.

This report provides geologic information and specifications and guidelines to support the amended Reclamation Plan with respect to mining and reclaiming the North Quarry and mitigating the landslide, and is accompanied by three other similar reports (Rock Plant Reserve Geotechnical Evaluation, West Materials Storage Area Geotechnical Evaluation, and North Quarry Backfill Geotechnical Evaluation), which provide specifications and guidelines related to the proposed amendments to the Reclamation Plan for other areas in the Quarry.

1.3 SCOPE OF WORK

Lehigh retained Stantec to prepare this report to support the amended Reclamation Plan in connection with the North Highwall Reserve. Stantec's scope of work included:

- Review previous geologic and geotechnical studies.
- Analyze current and historical aerial photographs.
- Map geological structures and lithology.
- Plan and oversee drilling operations.
- Log core and cuttings for geotechnical and geological properties.
- Plan and oversee geophysical evaluation of boreholes.
- Procure core and drill cutting samples for geotechnical laboratory analysis.
- Evaluate historic and new data to determine rock strength parameters for stability analyses.
- Revise geologic model with new drilling data and prepare cross-sections.
- Redesign a stable north highwall.
- Design a stable slope below existing landslide.
- Evaluate geotechnical stability of highwall and landslide area under static and seismic conditions.

2.0 SITE INVESTIGATIONS

Lehigh is seeking a Reclamation Plan amendment for the Permanente Property in order to improve overall site reclamation, expand its resource base in the area and support its nearby cement operations. The property has been studied extensively for several decades in support of the mining operation; this section briefly discusses the previous site investigations and results. A detailed discussion of the previous geologic and geotechnical investigations is available in the current Reclamation Plan geotechnical documents prepared by Golder (Golder 2011). This section also provides a summary of the recent site investigations, which included a drilling program and field mapping to characterize resources, rock strength, and geologic structures in the Quarry area.

2.1 PREVIOUS GEOLOGIC INVESTIGATIONS

The geology in the project area is complex due to the faulting and deformation associated with the Franciscan Complex. This geologic unit consists of faulted limestone and metabasalts (greenstone) and also contains basalt, diorite, shale, sandstone, chert, greywacke, and schist. Structure in the area includes numerous low- and high-angle faults. Low-angle faults separate limestone units from greenstone units and tend to follow the limestone bedding planes and typically dip to the southeast at 10° to 40°. High-angle faults, including the regional Berrocal Fault, are typically oriented in the northwest-southeast direction and dip at greater than 60°. The geology has been mapped several times by different geologists, and numerous drilling programs have been conducted. The results of these previous studies on the geologic units, structure, and interpretation were included in previous submittals (Golder 2011 and Foruria 2004). Figure 2.1 shows the regional geology that has been mapped for the greater project area. Figure 2.2 shows the geology in the vicinity of the North Quarry and includes the results of the recent geologic investigations discussed below.

The geology of the North Quarry consists of the Franciscan Complex, as discussed above. The highwalls are mostly limestone mixed with a minority of greenstone. Several faults, including the Berrocal Fault, intersect the existing highwall. Golder identified key aspects that impact North Quarry slope stability:

- Bedding is well-developed in the limestone, and although it roughly parallels the thrust faults, bedding orientations can change abruptly due to small-scale folding, or across the contacts between adjacent limestone blocks. Bedding is overturned near the Northwest Berrocal Fault strand. Bedding is involved in the control of bench face angles along the west and north walls; and in the development of slides two to three benches high in the north wall, west of the Main Slide (1987), below elevation approximately 1,500 feet (Golder 2011).
- Surface weathering affects rock mass strength of all lithologies to some extent, but particularly greenstones, which are pervasively oxidized and reduced to a clay-rich residual soil within 50 to 100 feet of the original ground surface.
- Thrust contacts along the north wall dip to the south, toward the North Quarry. A greenstone/limestone contact is implicated in development of the Main Slide (Golder 2011).

2.2 PREVIOUS GEOTECHNICAL EVALUATIONS

The North Quarry and related landslide areas have been evaluated several times by several companies. Each investigation included drilling, laboratory testing, assessment of strength parameters for the various rock types encountered, and slope stability calculations. The rock strength parameters were based on laboratory data, rock mass rating (RMR) calculations, and back-analysis of landslide areas. The strength parameters for soil, greenstone overburden, and limestone have been consistent through multiple geotechnical analyses performed by multiple consultants, and these values are listed in Table 2.1. The strength parameters for greenstone vary significantly depending on the condition of the bedrock and particularly the amount of weathering and shearing, and lower-bound values have historically been used for design purposes to be conservative. These lower-bound values are based on back-analysis of the Main Slide in the North Quarry. Laboratory data suggest the in-place greenstone may have significantly higher strength. Site observations also suggest that greenstone strengths are often under-reported as several areas of the highwall are constructed in weathered greenstone, and these areas have maintained their integrity with 50-foot high benches with face angles of 60° to 70° (Golder 2011).

Table 2.1 Historic Rock Strength Summary

Material	Unit Weight (pcf)	Cohesion (psf)	Φ’ (°)
Limestone	165	12,500	30
Greenstone	155-165	1,400-1,880	19-23
Weathered Greenstone	125	1,400	19
Fault	155	0	20
Slide Debris	135	0-700	20-23
Greenstone Overburden	125	0	35
Soil	120	200	30

2.3 2018 DRILLING

Six boreholes were drilled during 2018 to characterize the geologic and geotechnical conditions in the North Highwall Reserve and beneath the Main Slide in the North Quarry. Four sonic borings were advanced, at the crest of the landslide, to identify the thickness of the weathered greenstone and the base of the landslide material. Two core holes were advanced into bedrock beneath the landslide to characterize the extent of limestone versus greenstone and to obtain site-specific geotechnical information. Stantec recorded percent recovery, fracture information, and lithology from the core before calculating rock quality designation (RQD). Core samples were procured and submitted to a geotechnical laboratory for strength testing. The complete data set was then used to calculate RMR and strength parameters for each rock type. Figure 2.2 shows the Permanente Property geology with 2018 borehole locations. Table 2.2 summarizes details for these boreholes. The drilling logs are included in Appendix A.

Table 2.2 Borehole Details

Borehole	Method	Elevation (ft)	Dip (°)	Azimuth (°)	Total Depth (ft)
GT-1-2018-1	Core	~1,310	-70	45	500
GT-1-2018-2	Core	~950	-70	271	171
S-1-2018-1	Sonic	~1,790	-90	-	70
S-1-2018-2	Sonic	~1,730	-90	-	200
S-1-2018-3	Sonic	~1,670	-90	-	150
S-1-2018-4	Sonic	~1,620	-90	-	150

2.4 2018 FAULT AND STRUCTURE MAPPING

The current understanding of major fault structures in the area is based on surface mapping, drill hole intercepts, aerial photography, mapping, and published reports. As noted from the previous reports for the site and available regional geological information, the Quarry area is less than two miles from the San Andreas Fault and the Berrocal Fault. The Berrocal Fault has been mapped with multiple trace locations and has been mapped as running through the Permanente Property. The North Quarry area has numerous shear zones and faults running through it, which include both high and low angle faults (Foruria 2004). Given the potentially controlling nature of these faults on overall highwall stability, the development of a fault structure model was a critical step in evaluating the quarry. In consideration of potential structural impacts on quarry stability, conservative values for rock strength and quarry wall slopes were used for the design.

Fault and discontinuity mapping were performed by Stantec personnel in October 2018. Stantec concentrated on mapping exposed larger scale discontinuities and shear zones and collecting data on dominant discontinuities and fracture and bedding sets in the North Quarry and across the Permanente Property. Stantec acquired structural orientations along many of the discontinuities and shear zones exposed within the quarry, with an emphasis on the larger structures that could be traced across the Quarry as these features are more likely to have an impact on the Quarry stability. In total, 145 discontinuity data points on joints, shears, shear-zones, and bedding were obtained while mapping the Permanente Property. Fault mapping by Stantec indicated numerous moderate to high angle, north-south and northwest-southeast trending structures present throughout the North Quarry, and the results of the mapping are presented on Figure 2.2. The northwest oriented sets appear to be in agreement with the northwest trending faults mapped by Foruria (2004). It may be likely that the two distinct orientation groups represent a change in the overall faulting regime for the region; however, the timing of which of the orientations are more recent was not evident in the exposures.

Stantec's review of historical stereo-photographs from as early as 1960 indicated a large northwest trending fault, or wide fault zone across the Permanente Property. This fault is clearly visible in the stereo-paired historical photos, but it is difficult to identify on the ground due to vegetation and modifications to the terrain that have occurred since the photo was obtained. The fault zone trends to the northwest and appears to dip steeply to the northeast. The fault may be made up of multiple strands (en echelon), with the main strand trending northwest along the slope break of the ridge south of Permanente Creek, southeastward across the top of the ridge, and down a southeast trending drainage toward the Stevens Creek Quarry's northern and western highwall (Figure 2.2). While it is likely that this fault traverses the North Quarry, it is difficult to identify how the numerous faults that traverse the quarry are connected, as the bottom of the quarry is obscured, and there appears to be two dominant trends as identified above. The interpretation is that the major fault visible on the historic aerial photos is possibly the western trace of the Berrocal Fault, with many other strands of faulting contained within the North Quarry walls. Stantec recognizes that multiple faults intercept the quarry walls, and the design considers the potential impacts of the structures.

Discontinuity orientations were obtained in multiple locations within the North Quarry. Additional discontinuity data was also acquired from down hole geophysical logging. Dips software by Rocscience (ref, Version 7.006) was used for creating a stereonet of the surficial data collected in order to conduct a discontinuity analysis. The main discontinuity orientations delineated are shown on Figure 2.3.

Discontinuity data collected across the site suggests roughly three prominent orientations of discontinuities. Bedding is encountered within several of the limestone units exposed along the surveyed area, and generally dips moderately out of the slope with an average dip of 33° and dip direction of 147° to the southeast (set 5m, Figure 2.3). Areas along the 1,200 to 1,300-foot levels within the western portion of the North Quarry exhibit more steeply dipping beds.

The collected discontinuity data indicated a prominent high angle, north-south trending series of faults exposed along the north, east, and south wall of the North Quarry (sets 1m and 2m, Figure 2.3). These discontinuities primarily dip westward with an average dip of 76° and dip direction of 270°, though some eastward dipping discontinuities are also present with an average dip of 75° and dip direction of 87°. Faults among this group typically exhibit moderately wide to wide zones of deformation, including gouge, drag folds, and mapped minor to moderate lithologic offset. These faults tend to persist over a range from tens to hundreds of feet, with the largest faults potentially traversing across the North Quarry and beyond. Other kinematic indications, such as slickensides, are sparse, but do appear on several surfaces. These largely indicate a combination of right lateral and reverse motion, but it is important to mention that the determination of recency of movement along these faults was beyond the scope of this mapping, and the presence of faults within the quarry does not imply that they are active. These discontinuities likely exist due to the extensively deformed nature of the Franciscan Formation Melange unit of the Permanente Block.

Collected data also indicated a second dominant orientation that is a high angle, northwest-southeast trending group of faults, exposed along the western, northern, and southern quarry highwalls (sets 3m and 4m, Figure 2.3). Discontinuities and faults along this trend are high angle and dip primarily to the southwest. Faults along this orientation persist on the order of hundreds of feet at minimum, and many likely traverse the Quarry and persist for thousands of feet to the northwest and southeast. Larger faults along this orientation exhibit very large, wide shear zones, on the order of feet to tens of feet across, with clay gouge and brecciation along the shear zone. Few kinematic indicators were encountered along these discontinuities, shears, and deformation zones to indicate direction of offset. However, these are likely also present due to the deformation in the Permanente Block of the Franciscan Formation.

3.0 MINING AND RECLAMATION PLAN

3.1 MINING PLAN

Stantec has developed a mine shell configuration for the North Quarry, based on Lehigh's geological resource models and recent drilling results, in order delineate the ultimate highwall heights and configuration. The existing topography for the North Quarry is shown on Figure 3.1. This design aims to stabilize the Main Slide, recover economic limestone resources in the north wall, and achieve long-term slope stability in the North Quarry. The design vertical extents ranged from 1,900 to 600 feet AMSL in elevation. Quarry wall heights range from 800 feet in the north wall to 1,300 feet in the west wall. Benches will be mined in 25-foot intervals, with a catch bench every other bench or 50 vertical feet apart. Inter-ramp or inter-bench slope angles are 26.5 degrees, or 2H:1V for the west and northwest walls from the top cut down to the 1,250-foot elevation, with a 1H:1V face angle. This guidance is summarized in Table 3.1. The bench height of 50 feet is based on current operating practice and equipment sizing and assumes a multiple number of mining cuts make up the 50-foot bench height. These guidelines follow the general configuration for the existing highwalls within the Quarry. Shallower slopes were designed where the cut from current topography would be less than 50 feet. Below the 1,250-foot elevation, the entire north wall has significantly more limestone; therefore, a steeper angle of 38 degrees or 1.28H:1V was recommended and utilized with a 0.75H:1V face angle. At the 1,000-foot elevation, extra width was added to the catch bench across the entire wall from west to north for post mining access. The 600-foot elevation bench at the bottom of the quarry has approximate dimensions of 450 by 600 feet.

This ultimate design for the North Quarry does propose the modification of the Scenic Easement. The new design crest of the Scenic Easement varies between approximately 1,390 feet and 1,425 feet AMSL. This corresponds to a decrease in the elevation of the crest line of up to 100 feet lower than currently stated in the agreement. This is done to allow for revegetation, improve the aesthetic quality of the ridgeline, and permanently stabilize this area which historically has been subject to small landslides and a degrading highwall and resolve inconsistencies between the Scenic Easement and the existing conditions. The ultimate design for the North Quarry is shown in Figure 3.2.

Table 3.1 Preliminary Highwall Guidance

Component	Specification
Bench Height (competent rock)	50 ft
Bench Width	25 to 50 ft
Bench Face Angle (BFA)	45 to 53°
Inter-ramp Angle (IRA)	Max. 45°
Cut slope in overburden (RMR<25)	2H:1V (27°)

3.2 LANDSLIDE MITIGATION

The Main Slide of the North Quarry will be removed in its entirety. The landslide cause was previously identified as a fault at the limestone-greenstone interface, and the sliding occurred along weathered greenstone in the vicinity of the fault (Golder 2011). Stantec's investigation of the Main Slide and other landslides in the area suggest that a combination of faulting and dipping limestone caused the slope failure. The recent drilling confirmed the presence of the intact greenstone beneath the landslide material both at the crest and toe of the landslide. Therefore, removing the landslide and underlying fault in their entirety will leave a stable greenstone highwall slope. To be conservative, and to minimize excess rock volumes, the highwall in the Main Slide area will be sloped at an overall 2H:1V gradient. The lowest section of the remaining highwall contains both limestone and greenstone, and this section of the quarry is an interim surface as it will be backfilled during site closure. Thus, the slope gradient below the 1,200-foot elevation is 38°. Above 1,200-foot elevation, the highwall is sloped at 2H:1V where there is intact greenstone.

3.3 RECLAMATION PLAN

North Quarry highwalls will be mined to reclamation grade and limits. Topsoil and other amendments will be placed on the benches and vegetation planted in a manner consistent with the revegetation plan component of the proposed Reclamation Plan amendment. Stormwater will be managed according to the included plans and the North Quarry will be left in a condition that all water naturally drains and does not form a lake or standing water. The reclamation topography is shown on Figure 3.3, and cross-sections through the North Quarry are shown on Figure 3.4.

4.0 GEOTECHNICAL EVALUATION

The following presents a geotechnical evaluation of the North Quarry's northern wall, including the Main Slide. Note that, at lower elevations, the North Quarry will be backfilled, with a mixture of greenstone rock (generated on site) and clean fill (imported from off-site) to a minimum elevation of approximately 990 feet AMSL. Details on the backfilling process and materials and geotechnical evaluation of the backfilled quarry are included in the North Quarry Backfill Geotechnical Evaluation.

4.1 ROCK MASS CHARACTERIZATION

The rock mass has been characterized using the 1989 version of the Rock Mass Rating system (RMR_{89}). The RMR_{89} system provides an empirical methodology for estimating rock mass shear strengths for different rock units using guidelines set forth by Hoek et al. (2000) and Bieniawski (1989). Each rock unit is classified from “Very Poor Rock” to “Very Good Rock” based on a rating system with a maximum value of 100. RMR_{89} ratings are then correlated to the Geological Strength Index (GSI). Ratings are assigned based on the following categories:

- Uniaxial Compressive Strength (UCS) of intact rock.
- Rock Quality Designation (RQD).
- Spacing of discontinuities.
- Condition of discontinuities (persistence, aperture, roughness, infill and weathering).
- Groundwater conditions (typically set to dry or damp for boreholes where the data will be used in stability analyses that will account for groundwater conditions).

4.2 UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK

Design UCS values for each rock type consider field estimates using a geological hammer, point load testing, and/or laboratory UCS test results. Typical values will be considered for rock types with limited information. Laboratory testing was carried out to quantitatively assess the compressive strength of core samples. Table 4.1 summarizes the laboratory results for UCS.

Table 4.1 UCS Data Summary

Drill Hole	Depth	Rock Type	UCS (psi)
GT-1-2018-1	1.0- 54.3	Greenstone/Metabasalt	1,286
GT-1-2018-1	92.0 - 144.0	Greenstone/Metabasalt, breccia	275.5
GT-1-2018-1	144.0 - 410.0	Greenstone/Metabasalt	4,060
GT-1-2018-1	410 - 500	Greenstone/Metabasalt	684
GT-1-2018-2	0 - 11.7	Greenstone/Metabasalt Breccia	1,286
GT-1-2018-2	65.0 - 120.1	Bleached and Ca veined Limestone	9,955
GT-1-2018-2	120.1 - 171.0	Lightly bleached Limestone	7,105
GT-2-2018-14	70.5 - 78.0	Limestone, Ca Veined	15,310
GT-2-2018-14	119.0 - 145.0	Breccia/Clay	189
GT-2-2018-14	145.0 - 239.0	Metabasalt/Greenstone	3,764

4.3 ROCK QUALITY DESIGNATION

All recovered rock cores were evaluated for an RQD. RQD is defined as the summation of recovered core pieces of minimum length of 100 mm over the total length of the core run and is a good measure of the degree of jointing and discontinuity within a rock mass. A higher RQD generally indicates a higher quality, less fractured rock mass.

RQD values appear to fall into two different groupings. The breccia with clay zones and clay zones (fault gouge) have low RQD values (0 to 30) while the intact rock (limestone and metabasalt/greenstone) and breccia typically have higher RQD values based on the weighted averages (47 to 68). RQD values in excess of 80 occur in lengths of competent rock within the core so the weighted values for the more competent lithologies may be affected by disturbance due to movement along the faults that have been noted in the area of the quarry.

Table 4.2 summarizes the weighted RQD values for each major rock type.

Table 4.2 RQD Summary

Major Rock Type	Weighted RQD (%)	RQD Range (%)
Limestone	47	0 to 87
Metabasalt/Greenstone	68	0 to 100

4.4 RMR SUMMARY AND CLASSIFICATION

Major rock types encountered are generally described as Fair Rock, based on weighted average RMR_{89} values. However, similar to RQD, the weighted RMR_{89} values reflect a range including lower values likely resulting from fault related deterioration. RMR_{89} values for each rock type are shown in Table 4.3. These values correspond well with information from the earlier studies (Golder 2011).

Table 4.3 RMR_{89} Summary

Drill Hole	Depth (ft)	Rock Type	RMR	Description	GSI
GT-2-2018-14	27.0 - 31.0	Breccia/Clay	26	Poor Rock	26
GT-2-2018-14	31 - 49.5	Breccia/Clay	18	Poor Rock	18
GT-2-2018-14	49.5 - 70.5	Metabasalt/Greenstone	35	Poor Rock	35
GT-2-2018-14	70.5 - 78.0	Limestone, Ca Veined	55	Fair Rock	55
GT-2-2018-14	78.0 - 104.0	Metabasalt/Greenstone	47	Fair Rock	47
GT-2-2018-14	104.0 - 119.0	Limestone	41	Fair Rock	41
GT-2-2018-14	119.0 - 145.0	Breccia/Clay	43	Fair Rock	43
GT-2-2018-14	145.0 - 239.0	Metabasalt/Greenstone	52	Fair Rock	52
GT-2-2018-14	239.0 - 262.0	Alternating Greenstone and Limestone	47	Fair Rock	47
GT-1-2018-1	1.0- 54.3	Greenstone/Metabasalt	30	Poor Rock	30
GT-1-2018-1	54.3 - 92.0	Limestone	43	Fair Rock	43
GT-1-2018-1	92.0 - 144.0	Greenstone/Metabasalt, breccia	56	Fair Rock	56
GT-1-2018-1	144.0 - 410.0	Greenstone/Metabasalt	57	Fair Rock	57
GT-1-2018-1	410 - 500	Greenstone/Metabasalt	50	Fair Rock	50
GT-1-2018-2	0 - 11.7	Greenstone/Metabasalt Breccia	19	Poor Rock	19
GT-1-2018-2	11.7 - 65.0	Bleached Limestone, interbedded Chert	59	Fair Rock	59
GT-1-2018-2	65.0 - 120.1	Bleached and Ca veined Limestone	51	Fair Rock	51
GT-1-2018-2	120.1 - 171.0	Lightly bleached Limestone	53	Fair Rock	53

4.5 GEOTECHNICAL STABILITY

The slope stability analyses were modeled using the software Slope-W® 2018 R2 version 9.1 by GeoStudio, released in 2018. The software used limit equilibrium calculations on slices of potential failure surfaces to calculate factors of safety (FoS). The models were evaluated under static and pseudo-static conditions, with horizontal ground acceleration for operation and closure configurations of the highwalls using the Spencer method. The minimum FoS for each model evaluation is included in this report. The two types of analysis have been summarized in Table 4.4. The minimum acceptable factor of safety for the analyses are 1.3 for static conditions and 1.0 for pseudo-static conditions based on mining industry standards. For the pseudo-static model conditions, a horizontal seismic coefficient of 0.15 time the force of gravity (g) was applied to the static condition models to be consistent with previous studies (Golder 2011) and to follow recommendations for earthquakes with magnitudes up to 8-1/4 (Seed 1982). To evaluate the slope stabilities, cross-sections were analyzed for the reclamation surface. The cross-section locations are shown on Figures 3.1 to 3.3, and sections are shown on Figure 3.4.

Table 4.4 Stability Analyses

Analysis Type	Description	Minimum Acceptable Factor of Safety
Static Analysis	A limit equilibrium method of analysis which satisfies moment and force equilibrium to solve a slope stability problem. The output is a single FoS for the potential failure surface with the lowest FoS.	1.3
Pseudo-static Analysis	A limit equilibrium method of analysis which represents the effects of earthquake shaking by accelerations that create inertial forces. This is the simplest way to analyze the dynamic effects of earthquake loading of a soil or slope. The output is a single FoS for the potential failure surface with the lowest FoS.	1.0

Site specific geotechnical information is available for each rock type on the property, and strength parameters for the material have been established in previous geotechnical analyses (Golder 2011). These strength parameters are based on laboratory testing, back-calculation, and published values for soil properties. These strength parameters are listed in Table 4.5.

Table 4.5 Geotechnical Strength Parameters

Material	Unit Weight (pcf)	Cohesion (psf)	Phi' (Degrees)
Greenstone Overburden	125	0	35
Greenstone (Mining Influenced Zone/Weathered)	165	1,800	27
Greenstone	165	12,500	30
Limestone	165	12,500	30

As previously discussed, the greenstone strengths can vary significantly depending on the degree of weathering, and Stantec focused on evaluating the greenstone strengths as part of the 2018 geotechnical investigation. The greenstone strengths were re-evaluated based on RMR classifications. The historic greenstone strength (ϕ'=27° and cohesion=1,800 pounds per square foot [psf]) is suitable for areas that have been influenced or will be influenced by mineral extraction; designated as the "Mining Influenced Zone". A stronger strength for greenstone is expected for the area "beyond" the mining operation. A 75-foot horizontal distance from the highwall was used to define the mining influenced zone. This distance is one and one-half times the bench height following industry design guidelines (Hustrulid 2000).

The greenstone parameters, from RMR classification, were provided to estimate Mohr-Coulomb strength parameters. RocLab (1.0) free software from Roc Science were used to do the calculation. The calculations were based "General" application for failure envelope range. The disturbance factor D = 0 is used for the greenstone beyond the "Mining Influenced Zone". The calculated friction angle and cohesion are listed in Table 4.6.

Table 4.6 Greenstone Strength Parameters

DH ID	RM Unit	Depth (ft)	Friction Angle (degrees)	Cohesion (ksi)	Cohesion (psf)
GT-2-2018-14	RM-3	49.5 - 70.5	26.1	0.077	11,088
GT-2-2018-14	RM-5	78.0 - 104.0	31.9	0.269	38,736
GT-2-2018-14	RM-8	145.0 - 239.0	32.7	0.197	28,368
GT-1-2018-1	RM-1	1.0- 54.3	21.8	0.022	3,168
GT-1-2018-1	RM-4	144.0 - 410.0	34.9	0.313	45,072
GT-1-2018-1	RM-5	410 - 500	30.5	0.108	15,552
		Average	30	0.164	23,664

The average value of calculated friction angle (30 degrees) is selected for the greenstone. The average cohesion is 23,664 psf from the calculations; however, the cohesion is capped at 12,500 psf based on the strength parameters used for limestone.

Stability analyses are focused on the highwall. The configurations modeled as part of this analysis meet or exceed the minimum acceptable factor of safety, as defined in Table 4.4.The stability of the backfilled soil slopes is analyzed in a separate report, North Quarry Backfill Geotechnical Evaluation. The final surface stability analysis does consider the presence of the backfilled material providing a buttress for the lower highwall slopes. Generally, geotechnical stability is governed by the mining influenced zone and the presence of limestone remaining in the highwall. Results from the stability analyses are shown in Table 4.7. Appendix B contains printouts of the slope stability sections.

Table 4.7 Geotechnical Stability Analyses Results

Section	Analysis Type	Upper Slope	Middle Slope
A	Static	1.50	2.15
	Pseudo-static	1.17	1.67
B	Static	1.75	1.30
	Pseudo-static	1.31	1.04
C	Static	1.92	1.32
	Pseudo-static	1.41	1.04
D	Static	1.80	1.36
	Pseudo-static	1.35	1.09
E	Static	1.95	
	Pseudo-static	1.40	

Seismic displacements were calculated using an empirical equation developed by Bray and Travasarou (Bray 2007). This method estimates the displacement of a rigid block on a slope. This method is consistent with previous displacement analyses. The peak ground acceleration (PGA) value of 0.6g was used for the calculations, which is also consistent with previous analyses. This PGA corresponds to an earthquake with a mean return time of 475 years (Petersen 2008). The yield acceleration (ky) was calculated using the Slope/W model by adjusting the seismic coefficient until the model provided a FoS = 1.0, and these values were used for the displacement calculation. The ky values and displacement results are listed in Table 4.8. The displacement calculations are included in Appendix C. Cross-sections with pseudo-static FoS greater than 1.15 will have minimal displacement during a seismic event (Seed 1982), and displacements for these cross-sections are assumed to be less than two inches (in). Literature on seismic slope displacements suggest that median displacements of less than 6 in (15 centimeters [cm]) are "minor" and displacements of greater than 3 feet (1 meter [m]) are "major" (Bray 2007). All displacements for the North Quarry are "minor" and unlikely to impact the reclaimed slope.

Table 4.8 Seismic Displacement Analyses Results

Section	Yield Acceleration ky (g)	Seismic Displacement (in)		
		Median	16% Exceedance	84% Exceedance
Section A - Upper Slope	na	<2	<2	<2
Section A - Middle Slope	na	<2	<2	<2
Section B - Upper Slope	na	<2	<2	<2
Section B - Middle Slope	0.18	2	5	1
Section C - Upper Slope	na	<2	<2	<2
Section C - Middle Slope	0.185	2	4	1
Section D - Upper Slope	na	<2	<2	<2
Section D - Middle Slope	0.205	2	3	1
Section E	na	<2	<2	<2

The geotechnical analysis assumes that groundwater does not impact the highwall slope stability, and these conditions must be confirmed, or drains must be installed wherever groundwater is present to lower the groundwater elevations beneath the mining influenced zone. The geotechnical analysis also assumes that discontinuities that may create slide planes or wedge failures are not present beyond those identified by the fault and structure mapping. The design considers the presence of these faults and adverse dipping structure; however, additional geotechnical investigations should confirm the subsurface conditions where no faults were identified.

5.0 RECOMMENDATIONS

The geotechnical assessment provided in this report demonstrates that the proposed Reclamation Plan for North Quarry mine plan meets or exceeds SMARA requirements for factors of safety under static and seismic conditions. Recommendations for on-going geotechnical monitoring during development of the mine include:

- Additional delineation and mapping of geologic structures.
- Verifying groundwater levels in the highwall slopes by installation of groundwater monitoring instruments (standpipes, vibrating wire piezometers) as part of any future borehole investigations.
- Additional laboratory testing of representative rock lithologies and fault gouge zones.

6.0 CONCLUSION

This report provides the analysis and supporting information needed to demonstrate that Lehigh Southwest Cement Company's plan for reclamation operations at the North Quarry meets SMARA and associated design and performance requirements. The North Quarry will be excavated so that stable slopes remain, and positive drainage will remain for the reclamation periods. The geotechnical assessment provided in this report demonstrates that the proposed Reclamation Plan meets or exceeds the SMARA requirements for factors of safety under static and seismic conditions, and that these stable conditions are met during both the operational and reclamation periods.

This report has been prepared for Lehigh Southwest Cement Company to provide them with geotechnical guidance in support of the development and reclamation of the North Quarry. As mutual protection to Lehigh, the public, and Stantec, this report and its figures are submitted for exclusive use by Lehigh Cement Company. Our report and recommendations should not be reproduced in whole or in part without our express written permission, other than as required in relation to agency review and submittals. The drawings included with the report are for regulatory review and are not intended as detailed construction drawings. All information and design results contained herein have been prepared by the authors who have signed below and attached drawings have been certified by Nelson Kawamura, California, PE. A draft of this report was reviewed by personnel from Lehigh Southwest Cement Company.

Stantec Consulting Ltd.

Paul Kos P.E.
Senior Geological Engineer
Phone: 720-889-6122
paul.kos@stantec.com

Nelson Kawamura G.E.
Principal, Civil Engineer, Waterpower & Dams
Phone: 503-220-5424
nelson.kawamura@stantec.com

April 5, 2019

7.0 REFERENCES

Bieniawski, Z.T. 1989. Engineering Rock Mass Classifications. New York: Wiley. 1989.

Bray, J. D., and Travasarou, T., 2007. “Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements”, Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Foruria, J. September 2004. GEOLOGY OF THE PERMANENTE LIMESTONE & AGGREGATE QUARRY, SANTA CLARA COUNTY, CALIFORNIA. 2004.

Golder Associates, November 2011. GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS (REVISED). Permanente Quarry Reclamation Plan Update, Santa Clara County, California. 2011.

Hoek et al, November 2000. Rock slopes in Civil and Mining Engineering. Proceedings of the International Conference on Geotechnical and Geological Engineering, GeoEng2000. Melbourne. 2000.

Hustrulid, William A., McCarter, Michael K., Van Zyl, Dirk J.A. 2000. Slope Stability in Surface Mining. Society for Mining, Metallurgy, and Exploration, Inc. (SME), Littleton, Colorado. 2000.

Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth S., 2008. Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008–1128, 61 p.

Seed, H. B., 1979. “Considerations in the Earthquake-Resistant Design of Earth and Rockfill Dams,” Geotechnique, vol. 29, No. 3, pp. 215-263.

FIGURES

Figure 1.1 Permanente Quarry Regional Location Map

Figure 1.2 Permanente Quarry Project Overview

Figure 2.1 Permanente Quarry Regional Geology Map

Figure 2.2 Permanente Quarry North Highwall Reserve Geology Map

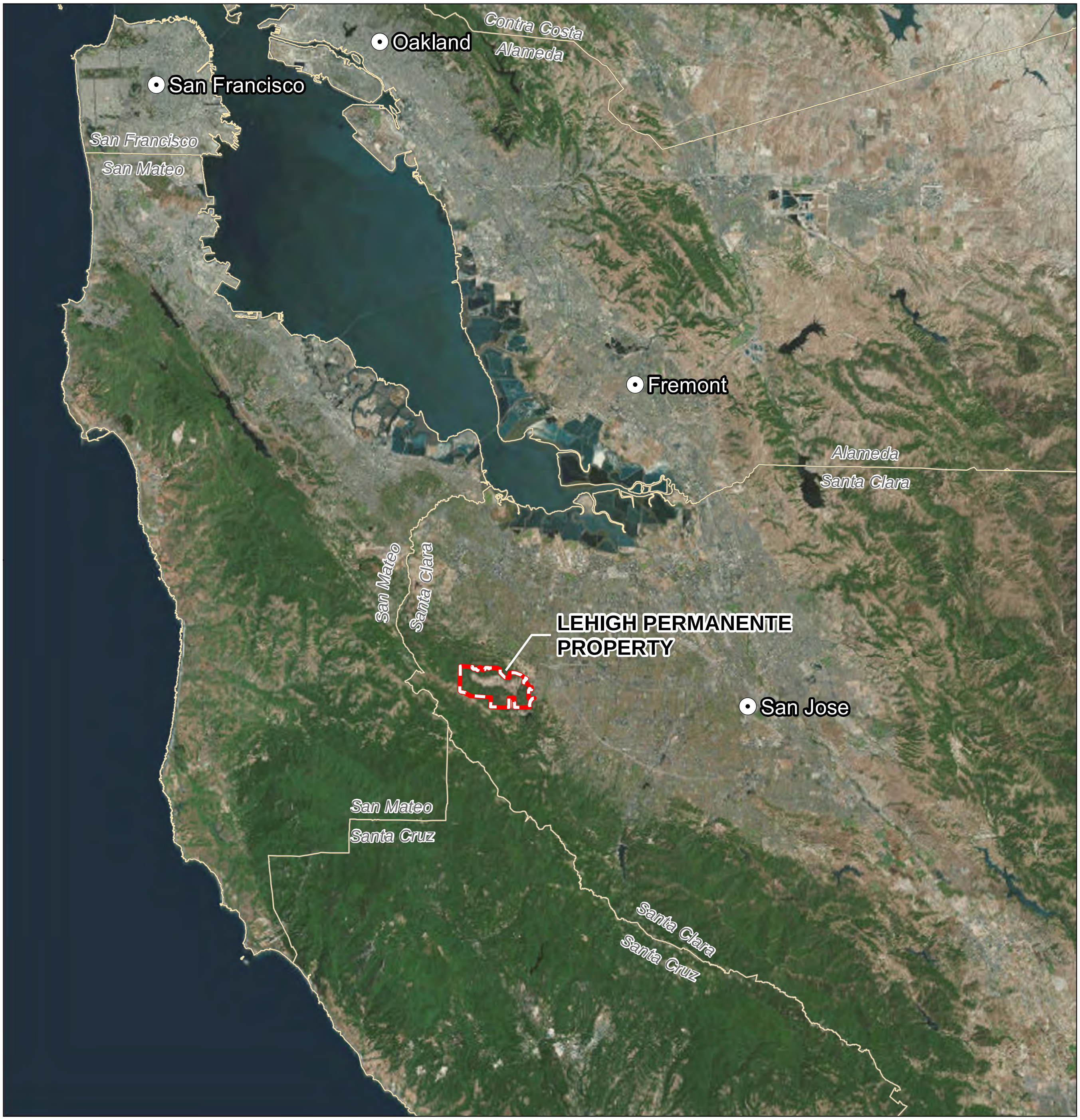
Figure 2.3 Permanente Quarry North Quarry Fault and Discontinuity Mapping

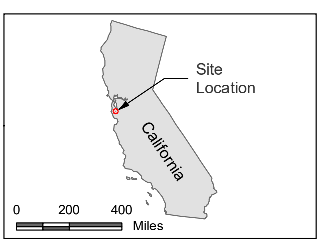
Figure 3.1 Permanente Quarry North Highwall Reserve Existing Topography

Figure 3.2 Permanente Quarry North Highwall Reserve Extent of Mining Topography

Figure 3.3 Permanente Quarry North Highwall Reserve Reclamation Topography

Figure 3.4 Permanente Quarry North Highwall Reserve Cross-Sections





City

Lehigh Permanente Property

County

0 4 8 Miles

(At original document size of 8.5x11)
1:500,000

N

Stantec

Project Location
T07N, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-12-20
Technical Review by PK on 2018-12-20
Finalized on 2019-04-05

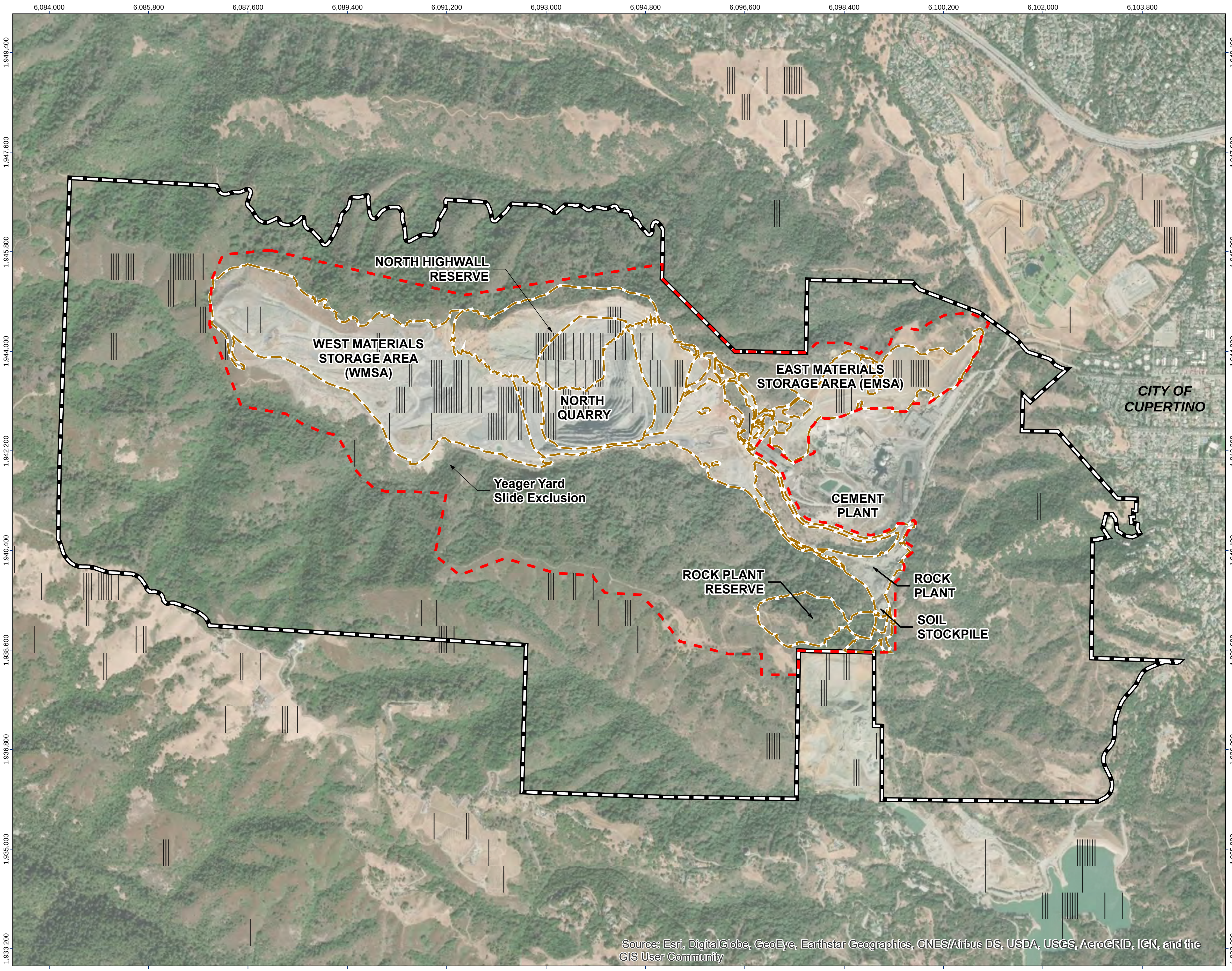
Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
1.1

Title
Regional Location Map

Notes
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

U:\233001289\gis_MXDs\Lehigh_Permanente_Regional_Location_11x17_Landsc_20181220.mxd Revised: 2018-12-20 By: cbolen



Stantec

Project Areas

RPA Boundary

Property Boundary

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Basemap Image: DigitalGlobe (8/28/2017)

Project Location

T07S, R02W
Santa Clara County, CA

Review

Prepared by CBB on 2018-12-18
Technical Review by PK on 2018-12-19
Finalized on 2019-04-05

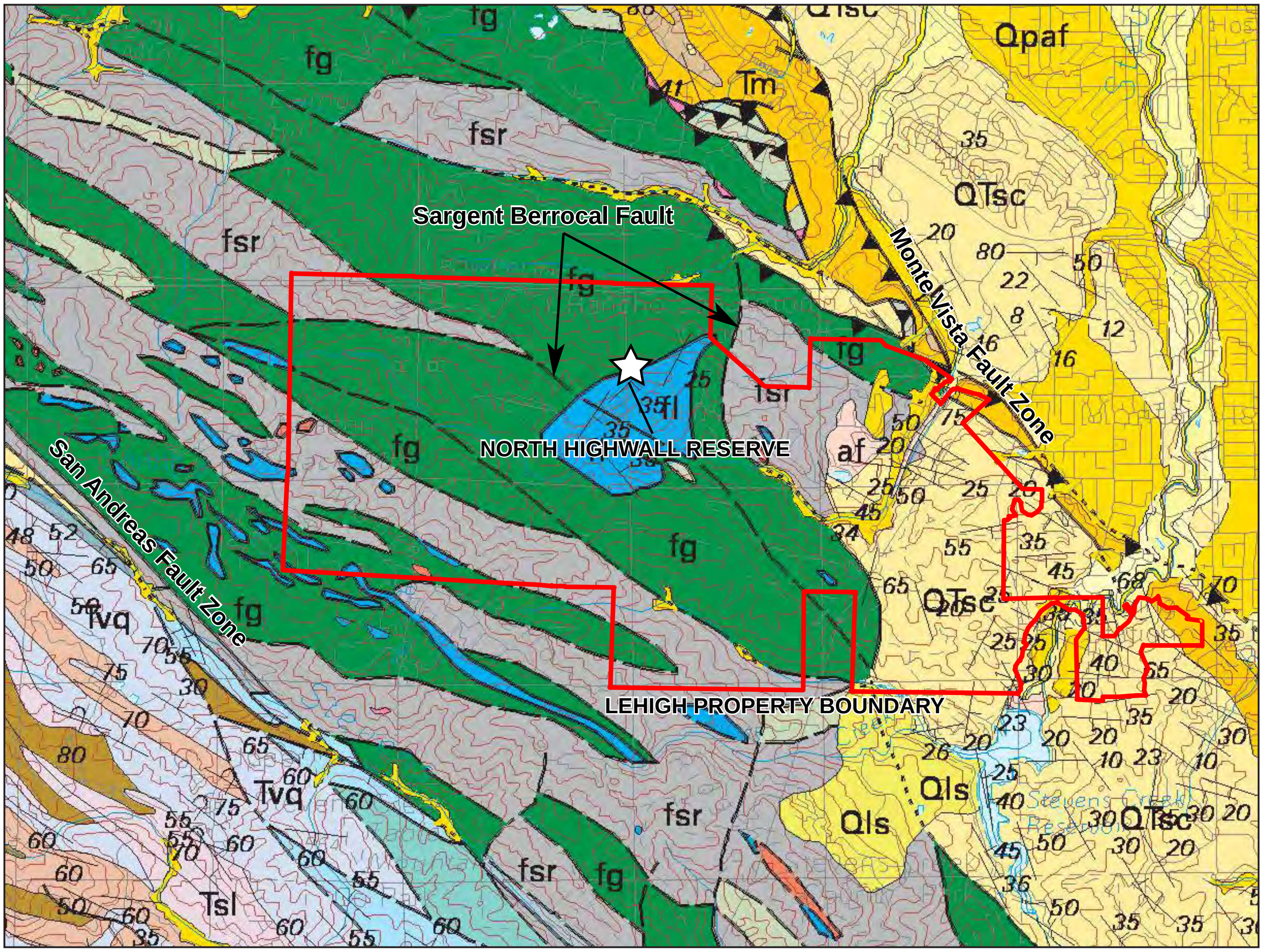
Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
1.2

Title

Project Overview



Explanation

Map symbols

Contact - dashed where approximately located; dotted where covered by alluvium

Fault - Dashed where approximately located; short dashed where inferred; dotted where concealed by alluvium.

Reverse or Thrust Fault - Dashed where approximately located, dotted where concealed by alluvium. Sawteeth on hanging wall

60 Strike and dip of bedding

80 Strike and dip of overturned bedding

Map units

af	artifical fill
Qls	landslide deposits
Qpaf	alluvial fan and fluvial deposits
QTsc	Santa Clara Fm (conglomerate, sandstone, mudstone)
Tm	Monterey Fm (shale)
Tvq	Tvq - Vaqueros Sandstone (sandstone/mudstone/shale)
Tsl	San Lorenzo FM (shale/mudstone/siltstone)
Tbu	Butano Formation - undifferentiated (sandstone/conglomerate/shale)
Tblc	Butano Conglomerate
Tbs	Butano Sandstone
db	db - diabase and gabbro
	Franciscan Assemblage Rocks
fl	fl - limestone
fs	fs - sandsone
fc	fc - chert
fg	fg - greenstone (metabasalt)
fsr	fsr - sheared rock (melange)

N

0 1 2 Miles

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Brabb, E.E., Graymer, R.W., and Jones, D.L., 2000, Geologic map and map database of the Palo Alto 30' X 60' quadrangle, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2332, U.S. Geological Survey, Menlo Park, CA.

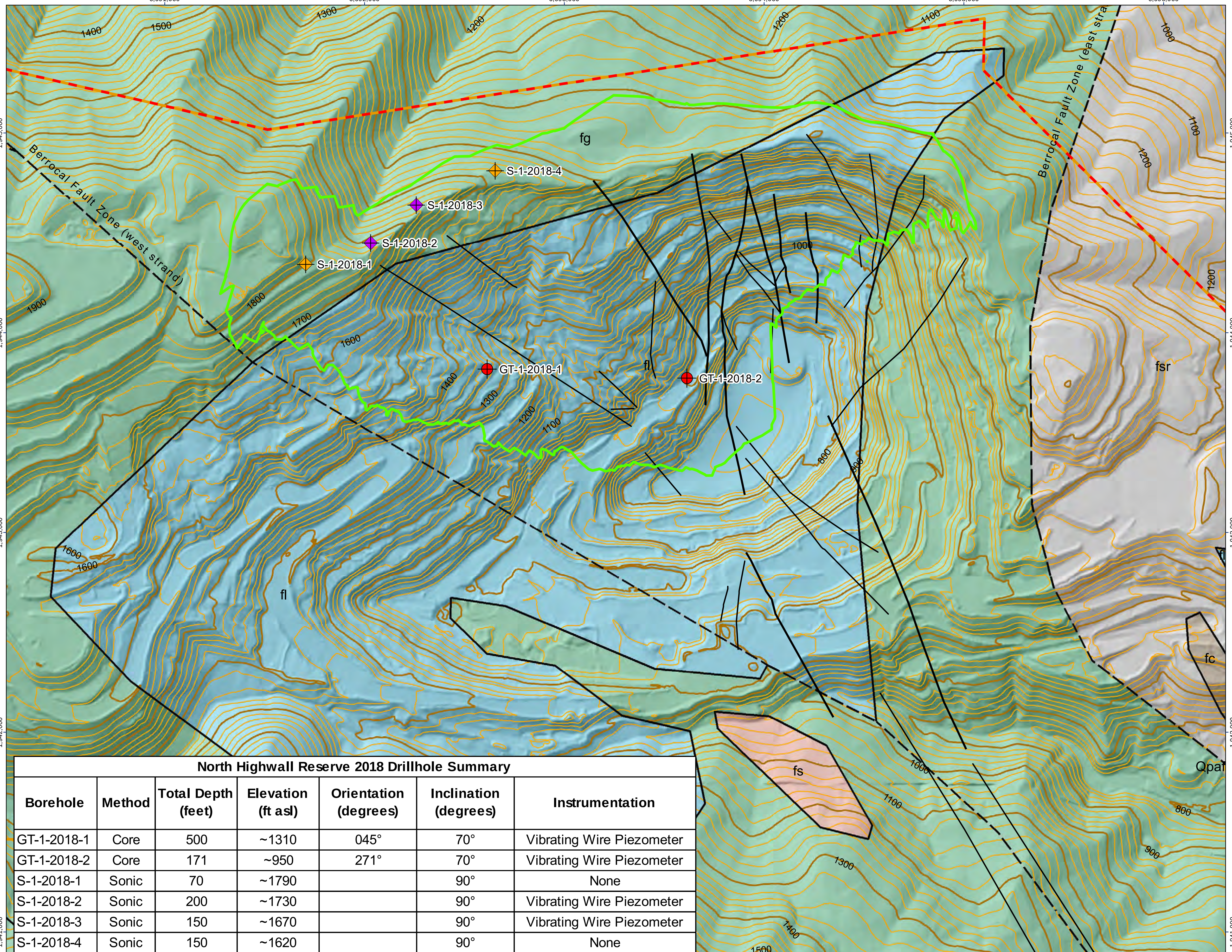
Project Location
T07S, R02W
Santa Clara County, CA

Review
Prepared by EDZ on 2018-07-05
Technical Review by JVP on 2018-07-05
Finalized on 2019-04-05

Client/Project
Lehigh Southwest Cement
Permanente Quarry Project

Figure No.
2.1

Title
Regional Geology Map



North Highwall Reserve 2018 Drillhole Summary

Borehole	Method	Total Depth (feet)	Elevation (ft asl)	Orientation (degrees)	Inclination (degrees)	Instrumentation
GT-1-2018-1	Core	500	~1310	045°	70°	Vibrating Wire Piezometer
GT-1-2018-2	Core	171	~950	271°	70°	Vibrating Wire Piezometer
S-1-2018-1	Sonic	70	~1790		90°	None
S-1-2018-2	Sonic	200	~1730		90°	Vibrating Wire Piezometer
S-1-2018-3	Sonic	150	~1670		90°	Vibrating Wire Piezometer
S-1-2018-4	Sonic	150	~1620		90°	None

Stantec

- Drill Hole (2018) - Core
- Drill Hole (2018) - Sonic
- Drill Hole (2018) - Sonic Vibrating Wire Piezometer
- North Highwall Reserve Project Boundary
- Contour 20 ft
- Contour 100 ft
- 2012 RPA Boundary
- Proposed RPA Boundary
- Fault, moderate to large scale, dashed where certain
- Fault, small to moderate scale, dashed where uncertain
- Qpaf - Alluvial fan and fluvial deposits (Pleistocene)
- fc-Franciscan complex, chert
- fg - Franciscan complex, greenstone
- fl - Franciscan complex, limestone
- fs-Franciscan complex, sandstone
- fsr - Franciscan complex, sheared rock (melange)

N

0 500 1,000 Feet

1:6,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Brabb, E.E., Graymer, R.W., and Jones, D.L., 2000, Geologic map and map database of the Palo Alto 30' X 60' quadrangle, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2332, U.S. Geological Survey, Menlo Park, CA.

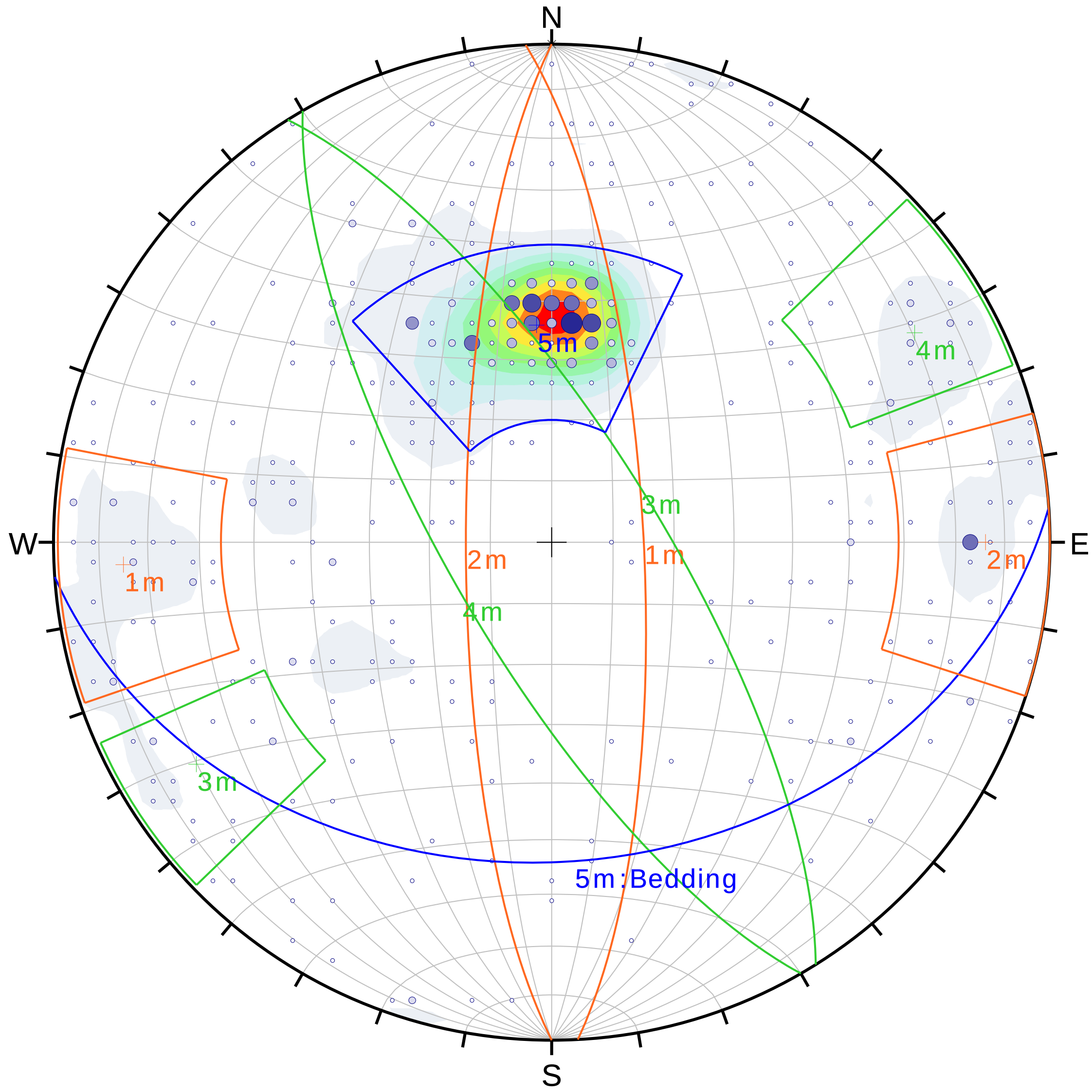
Project Location
T07S, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-11-20
Technical Review by JVP on 2018-11-20
Finalized on 2019-04-05

Client/Project
Lehigh Southwest Cement
Permanente Quarry Project

Figure No.
2.2

Title
North Highwall Reserve Geology Map



Symbol	Scatter
	1 Pole Vectors
	2 Pole Vectors
	3 Pole Vectors
	4 Pole Vectors
	5 Pole Vectors
	6 Pole Vectors
	7 Pole Vectors

Color	Density Concentrations
	0.00 - 1.50
	1.50 - 3.00
	3.00 - 4.50
	4.50 - 6.00
	6.00 - 7.50
	7.50 - 9.00
	9.00 - 10.50
	10.50 - 12.00
	12.00 - 13.50
	13.50 - 15.00

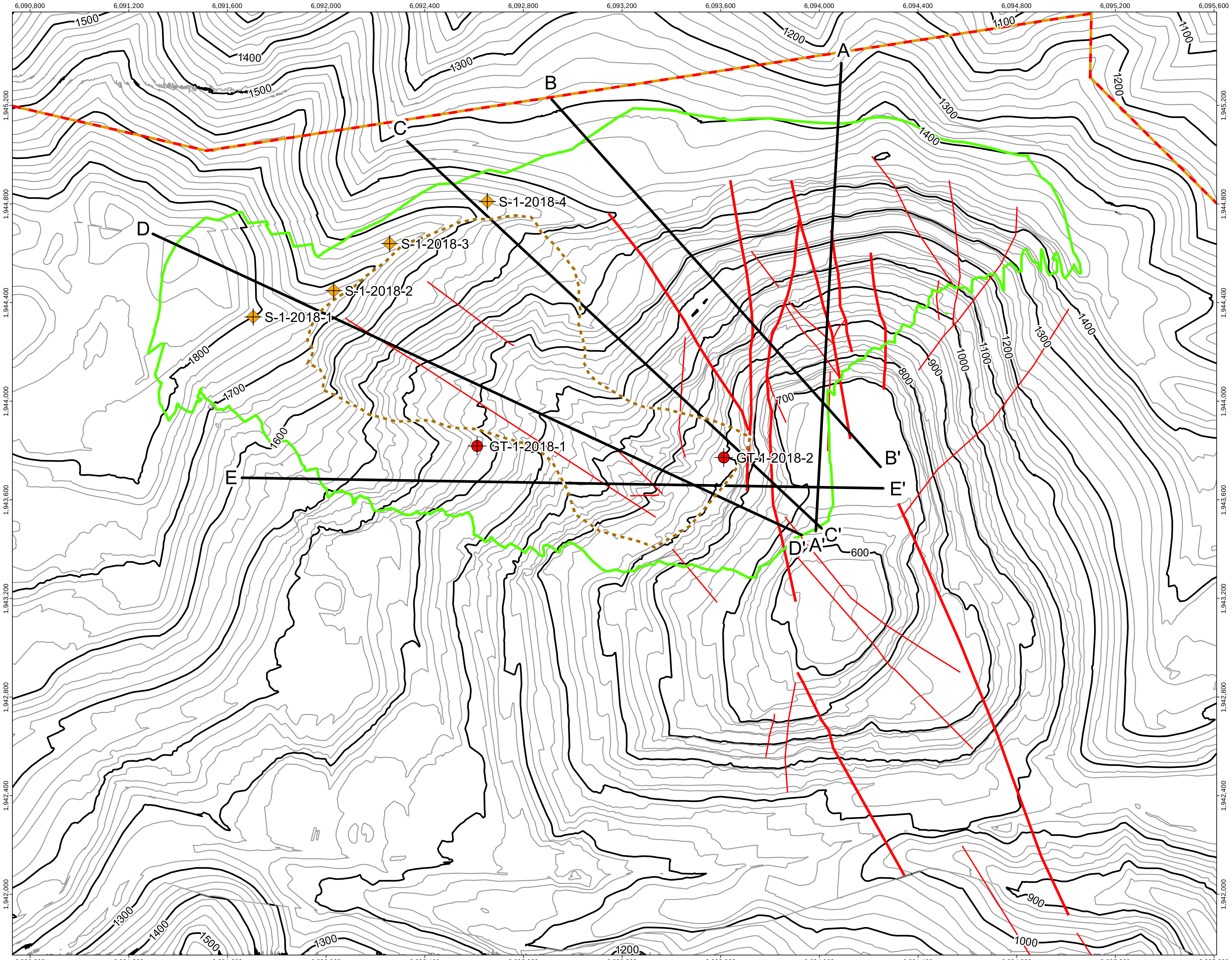
Contour Data	Pole Vectors
Maximum Density	14.89%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		75	87	N-S Fault/joint
2m		76	270	N-S Fault/joint
3m		73	58	NW-SE Joint/faul
4m		73	240	NW-SE Joint/faul
5m		36	176	Bedding

Plot Mode	Pole Vectors
Vector Count	431 (431 Entries)
Hemisphere	Lower
Projection	Equal Area

Project	Figure 2.3 North Quarry Fault and Discontinuity Mapping
Analysis Description	
Drawn By	J. Van Pelt
Company	Stantec
Date	04/05/2019, 9:29:21 AM
File Name	Fault and discontinuities mapping with downhole data.dips7

DIPS 7.006



Stantec

- Drill Hole (2018) - Core
- Drill Hole (2018) - Sonic
- North Highwall Reserve Project Boundary
- Main Slide Boundary
- Cross-Section
- Major Fault
- Fault
- 100 ft Index Contour
- 20 ft Contour
- 2012 RPA Boundary
- Proposed RPA Boundary

N

0 400 800 Feet

1:4,800 (At original document size of 11x17)

Note

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

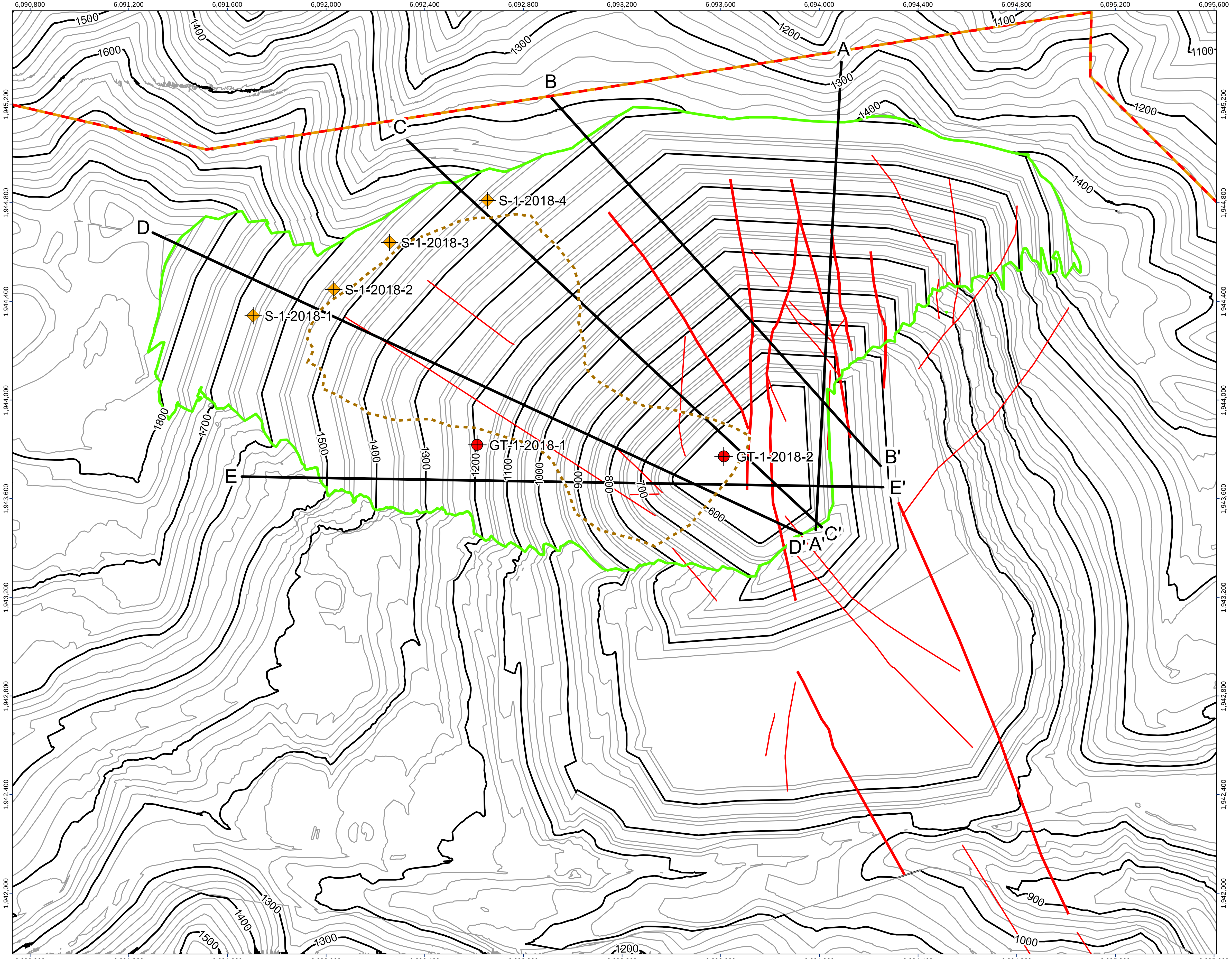
Project Location
T07S, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-12-18
Technical Review by PK on 2018-12-19
Finalized on 2019-04-05

Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
3.1

Title
North Highwall Reserve
Existing Topography



Stantec

- Drill Hole (2018) - Core
- Drill Hole (2018) - Sonic
- North Highwall Reserve Project Boundary
- Main Slide Boundary
- Cross-Section
- Major Fault
- Fault
- 100 ft Index Contour
- 20 ft Contour
- 2012 RPA Boundary
- Proposed RPA Boundary

N

0 400 800 Feet

1:4,800 (At original document size of 11x17)

Note

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

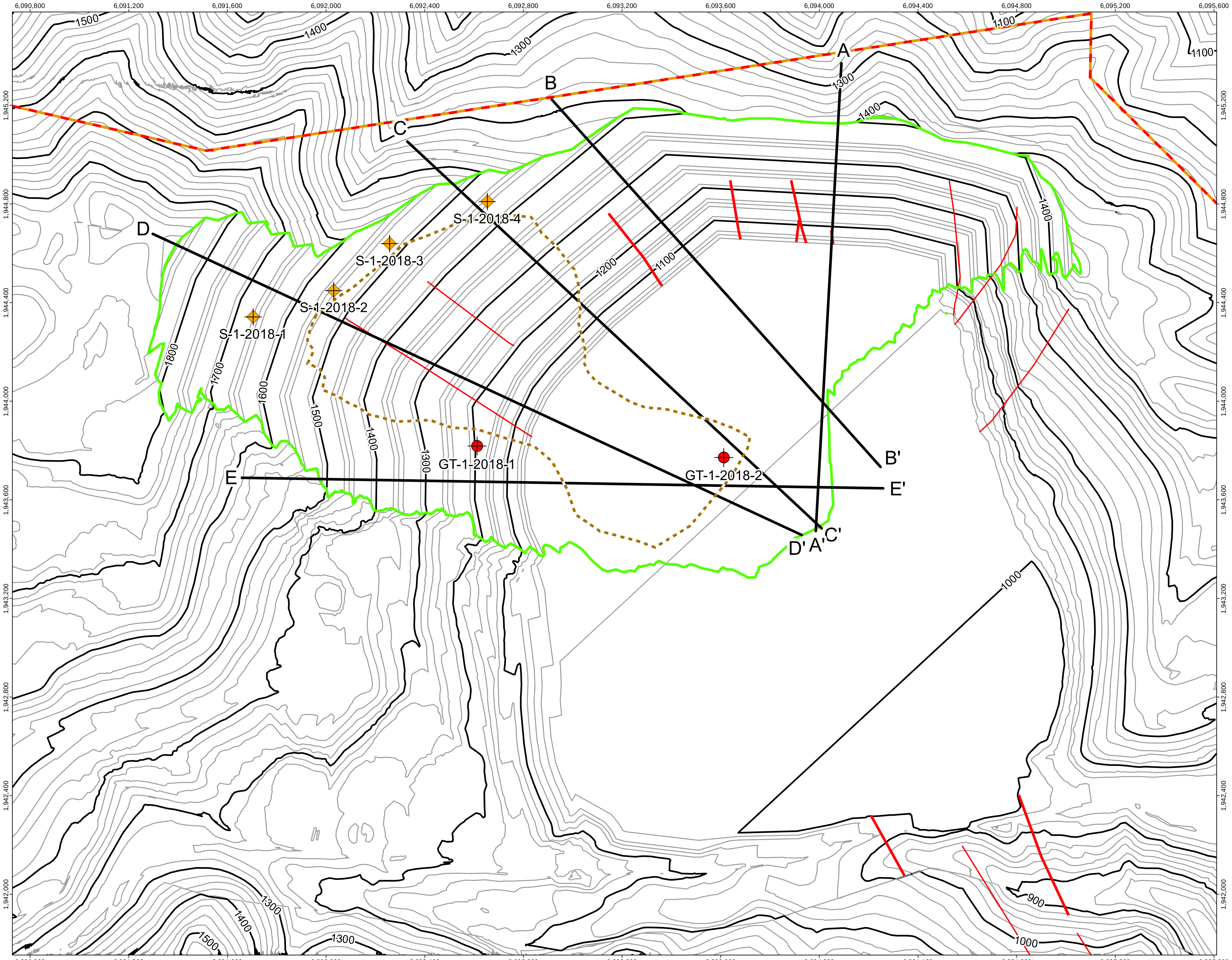
Project Location
T07S, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-12-18
Technical Review by PK on 2018-12-19
Finalized on 2019-04-05

Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
3.2

Title
North Highwall Reserve
Extent of Mining Topography



Stantec

Drill Hole (2018) - Core

Drill Hole (2018) - Sonic

North Highwall Reserve Project Boundary

Main Slide Boundary

Cross-Section

Major Fault

Fault

100 ft Index Contour

20 ft Contour

2012 RPA Boundary

Proposed RPA Boundary

N

0 400 800 Feet

1:4,800 (At original document size of 11x17)

Note

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

Project Location	Review
T07S, R02W Santa Clara County, CA	Prepared by CBB on 2018-12-18 Technical Review by PK on 2018-12-19 Finalized on 2019-04-05

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

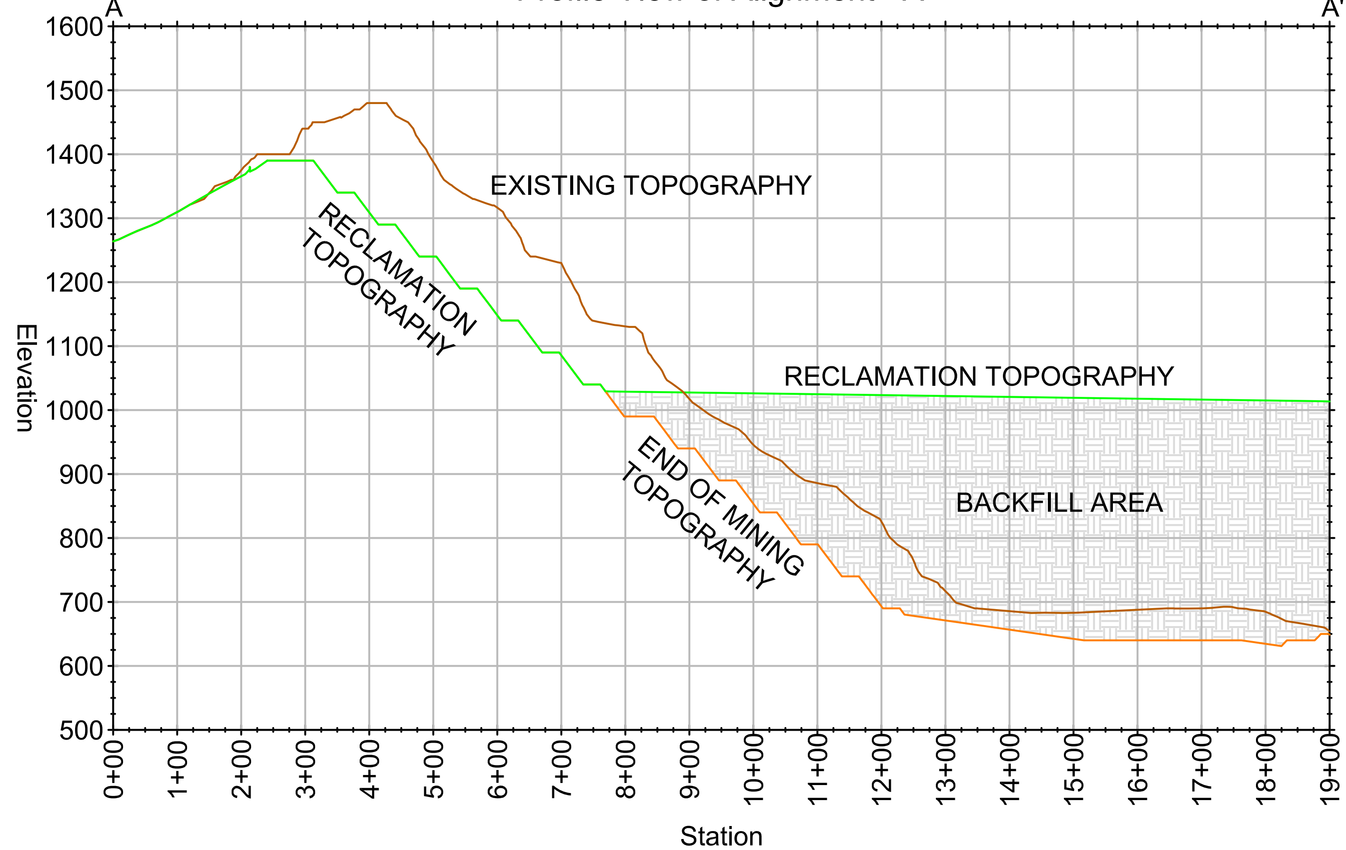
Figure No.

3.3

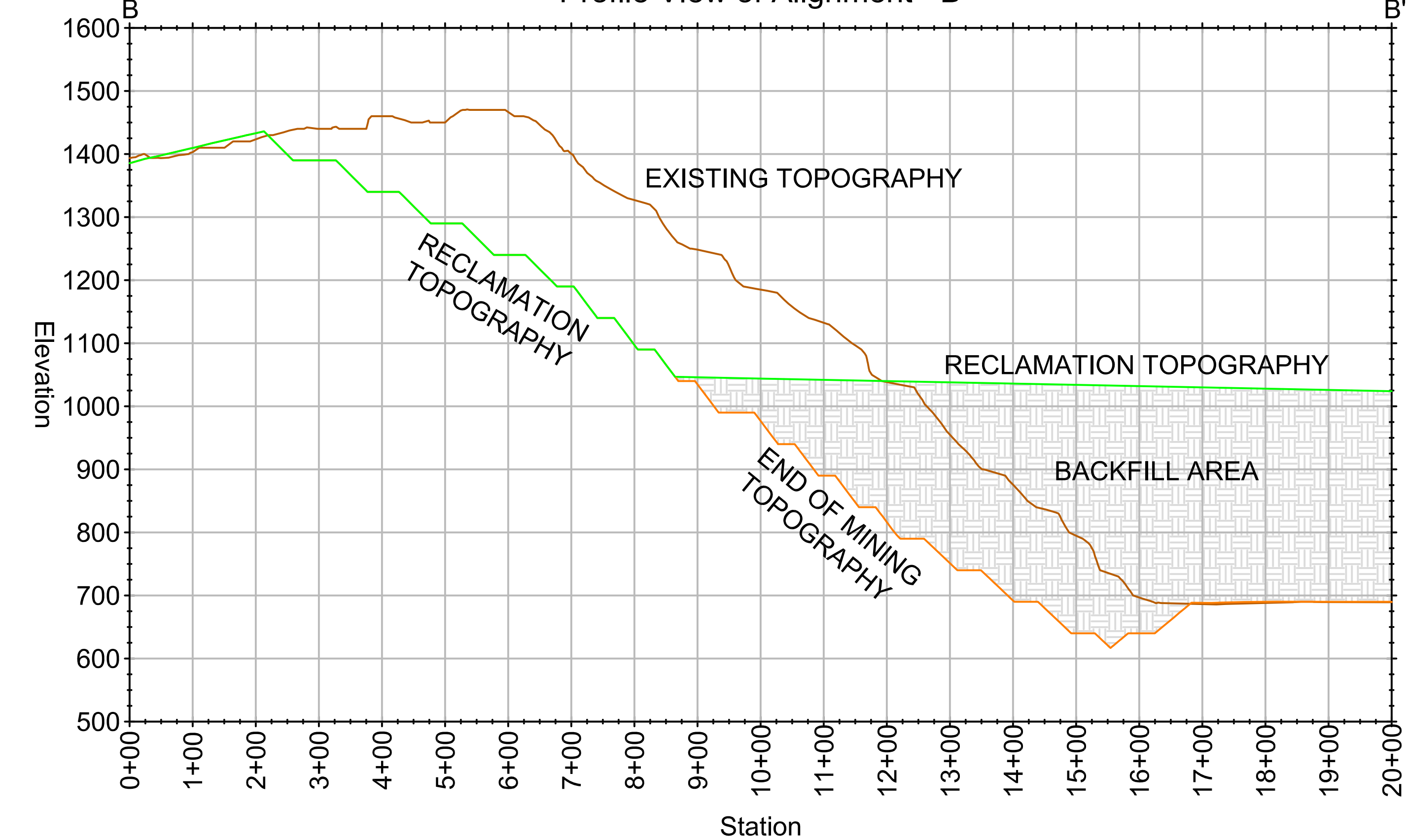
Title

North Highwall Reserve Reclamation Topography

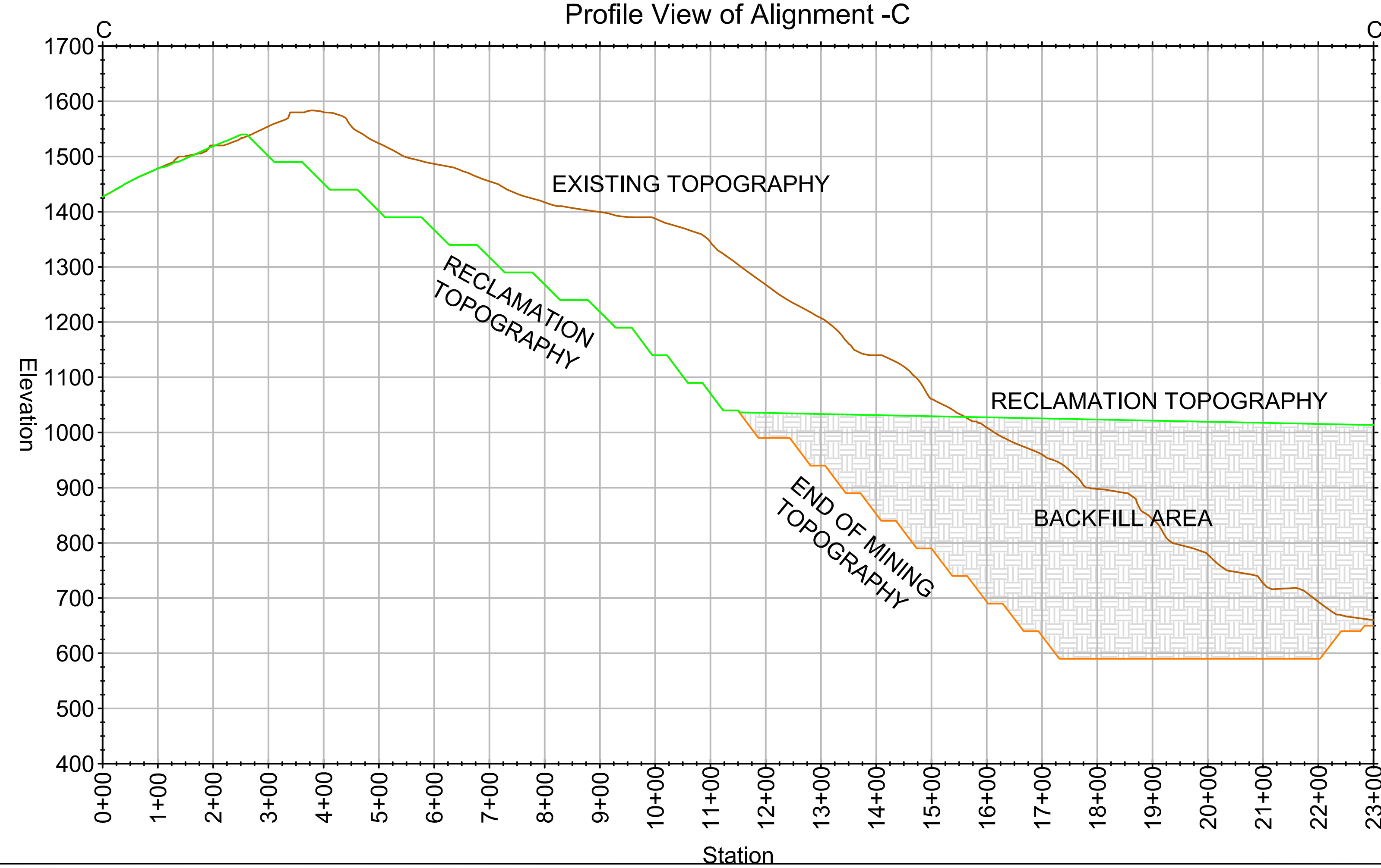
Profile View of Alignment - A



Profile View of Alignment - B



Profile View of Alignment -C



N

0 300 600 Feet

1:3,600 (At original document size of 11x17)

Stantec

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

Figure No.

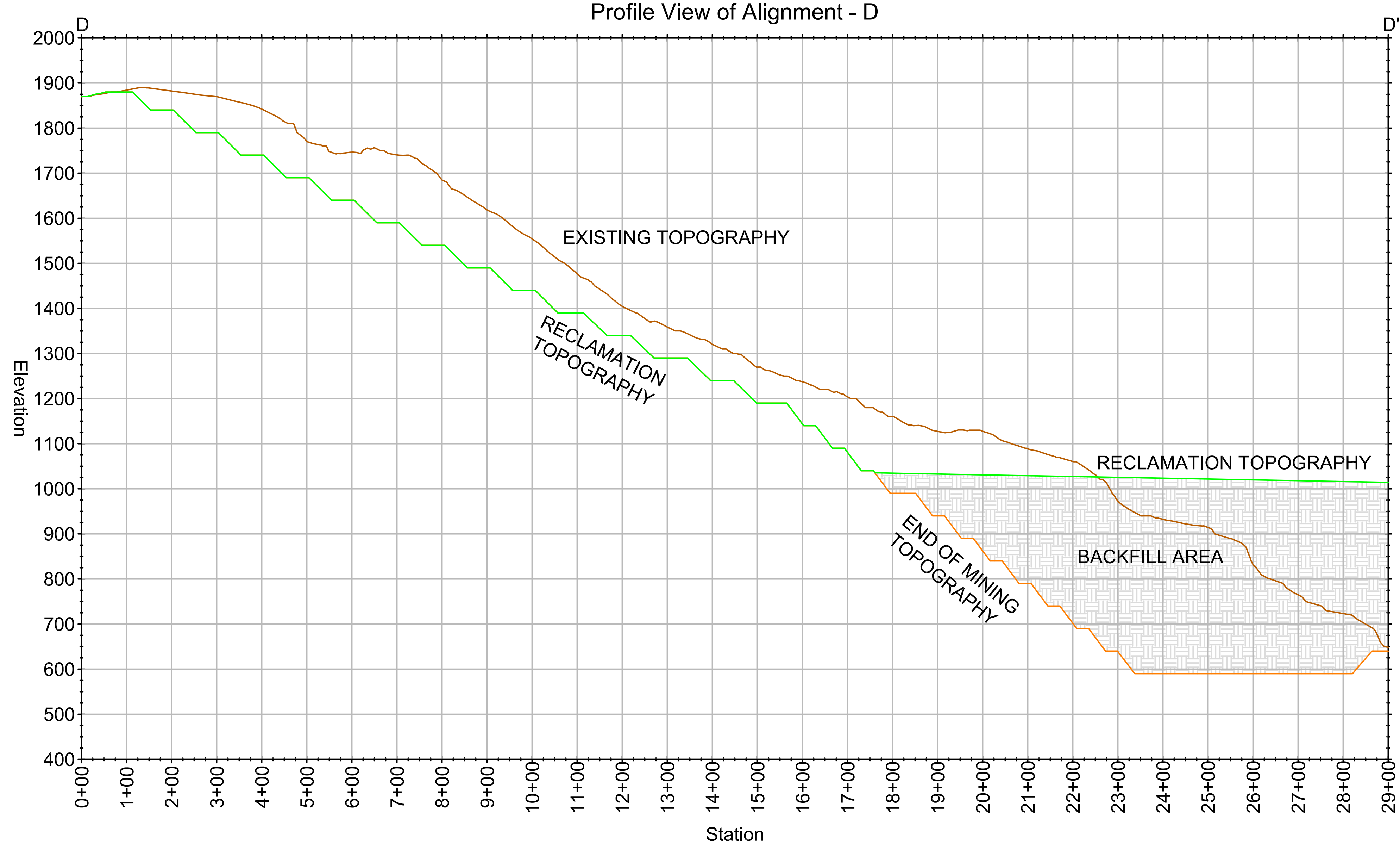
3.4a

Title

North Highwall Reserve Cross-Section

Plotted: Apr 05, 2019 - 11:26am By: pkos DWG: V:\2274\active\233001289\Lehigh_S_437\437-3, 223001328_PermanentSeesaw\Disc\CAD\Working\C3D\NHR_04feb2019.dwg

Profile View of Alignment - D



N

0 300 600 Feet

1:3,600 (At original document size of 11x17)

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

Figure No.

3.4b

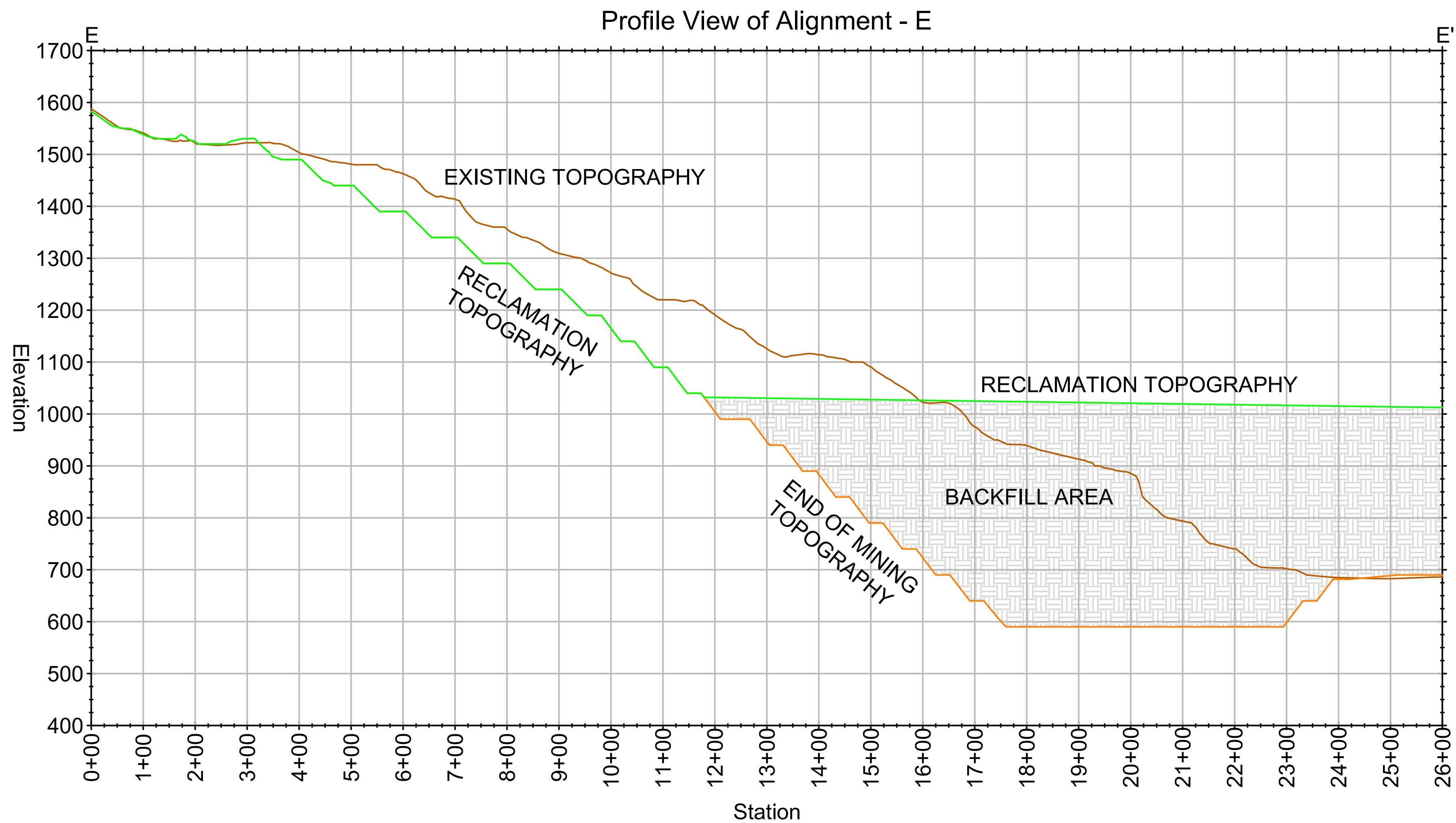
Title

North Highwall Reserve
Cross-Section

Stantec

Plotted: Apr 05, 2019 - 11:26am By: pkos

DWG: V:\2274\active\233001289\Lehigh_S_437\437-3, 223001328_PermanenteSeesaw\Disc\CAD\Working\C3D\NHR_04feb2019.dwg



Plotted: Apr 05, 2019 - 11:27am By: pkos DWG: V:\2274\active\233001289\Lehigh_S_437\437-3, 223001328_PermanentSeesaw\Disc\CAD\Working\C3D\NHR_04feb2019.dwg

N

0 300 600 Feet

1:3,600 (At original document size of 11x17)

Stantec

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

Figure No.

3.4c

Title

North Highwall Reserve
Cross-Section

APPENDIX A

Drilling Logs

CORE LOG GT-1-2018-1

Sheet No. 1 of 51

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
	0–2		1/1			OVERBURDEN - Yellowish-brown, 10YR 5/4, fractured, weathered, oxidized	50	16	>10 >10									
	2–4			W4	R0-R1				>10 >10			BZ						
	4–5			W3	R2-R3	LIMESTONE - 10B 6/1 blueish-gray, slightly to moderately weathered, weak to moderately strong, abundant calcite filled fractures			1		90 45	J MB				Pl Ir	R R	4.2-5' Retained for analysis
	5–7		2/1	W3	R2		40	7	>10 >10		90 45	J J BZ				Ir Ir	R R	
	7–9.5								>10 >10 >10									
	9.5–		3/2	W3	R1-R2	METABASALT/Greenstone - 5G 3/1 very dark greenish-gray, slightly to moderately weathered, very weak to weak, calcite veins, brecciated	24	0	>10									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Sheet No. 2 of 51

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade		
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core		
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE, continued												
				W3	R1-R2					>10			BZ						
										>10									
	12		3/2					24	0	>10									
										>10									
	14									>10									
										>10									
	16		4/2	W2-W4	R1-R2			63	0	>10									
										>10			BZ						
	18		5/2	W2-W4	R1-R2			91	24	2		45	J	Vn	Cl, Fe	Fi	Ir	Vr	
												45	J	Vn	Cl, Fe	Pa	Pl	Sr	
										0									
			6/3	W2-W4	R1-R2			33	0										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** **Sheet No. 3 of 51**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE, continued			>10									
										>10									
			6/3					33	0										
	22									>10			BZ						
				W2-W3	R1-R2														
										>10									
	24									>10									
										>10			BZ						
				W3	R0-R1														
	26		7/3					62	26										
							becomes brecciated, slightly to moderately weathered, weak			7		45	J	Vn	Ca, Fe	Pa	Pl	Sr	
												40	J	Vn	Fe, Ca	Fi	Pl	Sr	
												20	J	Vn	Fe, Ca	Fi	Pl	R	
												75	J	Vn	Ca, Fe	Fi	Pl	Sr	
				W2-W3	R2					5		70	J	Vn	Fe, Ca	Fi	Pl	S	
												18	J	Vn					
												50	J	Vn	Ca, Fe	Fi	Pl	Sr	
	28											85	J	Vn	Ca, Fe	Fi	Pl	Sr	
												50	MB J	Vn	Ca	Pa	Pl	Sr	
										>10			BZ						
			8/3	W3	R0-R1			100	0										
										>10		50	J	Vn	Fe	Fi	Ir	R	
			9/4	W2-W3	R2			71	34			60	J	Vn	Fe	Fi	Pl	R	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 4 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Columns: Elevation, ft MSL | Depth, ft | Drill Time (min) | Run No./Box No. | Weathering Index | Strength Index | Graphic Log | Description | Recovery % (20 40 60 80) | RQD % (20 40 60 80) | Fractures per ft. | Discontinuities (Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness) | Comments

Description: METAVOLCANIC/GREENSTONE/BRECCIA, continued

Depth markers: 32, 34, 36, 38

Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
9/4	W3	R1-R2	71	34
10/4	W2-W3	R1-R2	58	48
11/4			0	0
12/5			4	0

Fractures per ft. (top to bottom): 4, 8, >10, >10, 3, >10, >10, >10, >10, >10

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
70	J	Vn	Ca, Fe	Pa	Wa	Sr
0	J	Vn	Ca, Fe	Pa	Wa	R
70	J	Vn	Ca/Cl		Pl	Sr
45	J	Vn	Ca, Fe	Pa	Pl	Sr
	BZ					
45	J	Vn	Ca, Fe	Pa	Pl	Sr
0	J	Vn	Ca	Pa	Pl	Sr
	BZ					
35	J	Vn	Ca, Fe	Fi	Pl	R
30	J	Vn	Ca, Fe, Cl	Fi	Pl	Sr
30	J	Vn	Ca, Fe, Cl	Fi	Pl	Sr
	BZ					

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** **Sheet No. 5 of 51**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METAVOLCANIC/GREENSTONE/BRECCIA, continued			>10								
							>10								
42	12/5	W2-W3	R1-R2		4	0	>10								
							>10								
44							>10		BZ						
	13/5	W2-W3	R1-R2		100	40	>10	50	J	Vn	Fe, Ca	Fi	Pl	Sr	
								20	J	Vn	Fe, Ca	Fi	Pl	Sr	
								30	J	Vn	Fe	Pa	Pl	R	
								15	J	Vn	Fe	Pa	Pl	R	
46								20	J	Vn	Cl, Fe	Fi	Pl	R	
							8	50	J	Vn	Cl, Fe	Fi	Pl	R	
								20	J	Vn	Fe, Ca, Cl	Fi	Pl	R	
								20	J	Vn	Cl, Fe	Fi	Pl	Sr	
								50	J	Vn	Cl, Fe	Fi	Pl	Sr	
									BZ						
	14/5	W3	R0-R1		88	60	>10								
48							0								
									BZ						
	15/6	W3	R0-R1		50	20	>10								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METAVOLCANIC/GREENSTONE/BRECCIA, continued			>10								
							>10								
52															
	15/6	W3	R1		50	20	5	40	J	Vn	Fe, Ch	Pa	Pl	R	
								40	J BZ	Vn	Fe, Ca	Fi	Ir	R	
								10	J	Vn	Ca, Cl	Fi	Pl	S	
							4	75	J	Vn	Ca, Fe	Fi	Ir	R	
								80	J	Vn	Fe, Ca, Cl	Fi	Pl	Vr	
54							5	40	C	Vn	Ca	Fi	Pl	S	
			R4	LIMESTONE - grey to black to white, fine to medium grained, slightly weathered to fresh, with intervals of moderate weathering, moderately strong to weak, occasionally very weak, moderately soft to moderately hard, occasional sheared zones, carbonaceous				50	J	Vn	Ca	Fi	Pl	Sr	
								60	J	Vn	Ca	Fi	Pl	Sr	
								40	J	Vn	Ca	Fi	Pl	R	
								10	J	Vn	Ca	Pa	Wa	R	
							7	40	J	Vn	Ca	Fi	Pl	S	
								40	J	Vn	Ca	Fi	Pl	R	
								10	J	Vn					
56									MB BZ		Ca				BZ = Numerous calcite veins
	16/6	W1	R3		89	11	>10								
							>10								
58															
							7								
									BZ						BZ = Numerous calcite veins
	17/6	W2	R2		86	11	8								
								50	J	Vn	Ca	Fi	Pl	S	
								50	V	Vn	Ca	Cm			

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 7 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				LIMESTONE, continued					MB	Vn			Ir	R	
								50	J	Vn		No	Pl	S	
							4	50	J	Vn		No	Pl	S	
								50	J	Vn		No	Pl	S	
								50	J	Vn		No	Pl	S	
		W2	R2					50	J	Vn		No	Pl	S	
	17/6				86	11		50	J	Vn		No	Pl	S	
							3	50	J	Vn		No	Pl	S	
								50	MB	Vn		No	Pl	R	
62											Cl		Ir	R	
		W1	R4				>10								
									Fz				Ir	R	
								50	J	Vn		No	Pl	S	
								50	J	Vn		No	Pl	S	
									MB				Ir	R	
		W2	R2				2								
64									Fz				Ir	R	
							4		Fz						
	18/7				52	34			Fz				Ir	R	
									Fz				Ir	R	
							>10								
66							>10								
							1	70	V	Vn	Ca, Cl				
68									MB				Pl	R	
									MB				Pl	R	
	19/7	W1	R2		92	92	1								
								45	J				Pl	Sr	
									MB				Pl	R	68.8-69.2' Retained for analysis
							2								
	20/7	W1	R3		50	40		90	Fz		No		Ir	R	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 8 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Columns: Elevation, ft MSL | Depth, ft | Drill Time (min) | Run No./Box No. | Weathering Index | Strength Index | Graphic Log | Description | Recovery % (20 40 60 80) | RQD % (20 40 60 80) | Fractures per ft. | Discontinuities: Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness | Comments

Depth markers: 72, 74, 76, 78

Description:
LIMESTONE, continued, dark gray-black, sheared

shear zone

Run No./Box No.	Recovery %	RQD %
20/7	50	40
21/8	72	40
22/8	70	52

Weathering Index: W2; Strength Index: R1-R2, R1, R1-R2, R0-R1 (run 21/8); W2, R0-R1 (run 22/8)

Fractures per ft.: 2, 3, >10, >10, >10, 4, 2, 3, >10, 1

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
90	J	Vn	Ca	Pa	Pl	R
80	J	Vn	Ca	Pa	Pl	
80	J	Vn	Ca	Pa	Pl	
80	Fz	Vn	No	Pa	Ir	Sr
80	Fz	Vn	No	Pa	Ir	Sr
30	J	Vn	Ca	Pa	Ir	Sr
80	J	Vn				
80	J	T	Ca	Fi		
80	J	T	Ca	Fi		
	J	T	Ca	Fi		
80	J	Vn	Cl	Pa	Pl	R
80	J	Vn	Cl	Pa	Pl	R
80	J	Vn	Cl	Pa	Pl	R
80	J	Vn	Cl	Pa	Pl	R
80	J	Vn	Cl	Pa	Pl	R
80	J	Vn	Ca	Fi	Pl	Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Columns: Elevation, ft MSL; Depth, ft; Drill Time (min); Run No./Box No.; Weathering Index; Strength Index; Graphic Log; Description; Recovery %; RQD %; Fractures per ft.; Discontinuities (Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness); Comments

Depth markers: 82, 84, 86, 88

Description

LIMESTONE, continued, sheared

81-81.5 numerous wavy calcite filled veins

METAVOLCANIC/GREENSTONE/BRECCIA, sheared

LIMESTONE, continued, sheared

Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
22/8	W2	R0-R1	70	52
23/8	W1-W2	R1	78	72
23/9	W1-W2	R1; R1-R2	78	72
24/9	W1	R1	106	82

Fractures per ft. (top to bottom): 3, 1, 4, >10, >10, 1, 2, 0, >10, 4

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
45	J	Vn	Cl, Ca	Pa	Pl	R
80	J	Vn	Cl	Pa	Pl	R
60	J	Vn	Cl	Pa	Pl	R
45	J	Vn	Cl, Ca	Pa	Pl	Sr
45	J	Vn	Cl, Ca	Pa	Pl	Sr
60	J	Vn	Cl	Pa	Pl	R
80	J	Vn	Cl	Pa	Ir	R
80	J	Vn	Cl	Pa	Ir	R
	BZ					
45	Fz	Vn	Ca	Pa	Pl	R
45	Fz	Vn	Ca	Pa	Pl	R
45	Fz	Vn	Ca	Pa	Pl	R

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 10 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
			R1	LIMESTONE, continued, gray to black			0								
			R1-R2				2	45	J	Vn	Ca	Fi	Ca	Sr	
				METABASALT/GREENSTONE, grayish-green, fine to medium grained, fresh, weak to moderately strong, hard, chloritized				25	J	Vn	Ca	Fi	Wa	S	
92	24/9	W1	R2-R3		106	82	5	45	J	Vn	Ca	Pa	Pl	Sr	
									BZ						
								10	J	Vn	Ca	Fi	Pl	Sr	
							4	20	J	Vn	Ca		Ir	R	
94								80	J	Vn	Ca	Pa	Pl	S	
								40	J	Vn	Ca	Pa	Pl	R	
							0								
							0								
96								20	J	Vn	Ca	Sp	Pl	R	
							3	20	J	Vn	Ca	Sp	Pl	R	
	25/10	W1	R1-R2		100	88		20	J	Vn	Ca	Sp	Pl	R	
								20	J	Vn	Ca	Sp	Pl	R	
							6	20	J	Vn	Ca	Sp	Pl	R	
								20	J	Vn	Ca	Sp	Pl	R	
98								20	J	Vn	Ca	Sp	Pl	R	
								20	J	Vn	Ca	Sp	Pl	R	
							5	45	J	Vn	Ca	Sp	Pl	R	
								45	J	Vn	Ca	Sp	Pl	R	
								45	J	Vn	Ca	Sp	Pl	R	
							1								
	26/10	W1	R2		98	98									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 11 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Columns: Elevation, ft MSL | Depth, ft | Drill Time (min) | Run No./Box No. | Weathering Index | Strength Index | Graphic Log | Description | Recovery % (20 40 60 80) | RQD % (20 40 60 80) | Fractures per ft. | Discontinuities: Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness | Comments

Description

METABASALT/GREENSTONE, continued

BRECCIA, with metavolcanic gray wacke clasts, sheared matrix, purplish-gray, locally black, occasional veins of calcite, 4mm clasts of shale, limestone and gray wacke to 10-inches in matrix of sheared clay/claystone, soft and moldable when wet and hard when dry, shearing in 50 degrees to core axis, variably matrix or clast supported

Depth markers: 102, 104, 106, 108

Runs

Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
26/10	W1	R2 / R1	98	98
27/11	W1-W2	R1-R2	102	100
28/11	W1-W2	R1-R2	102	100

Fractures per ft.: 1, 2, 1, 0, 0, 1, 0, 1, 0, 2

Discontinuities

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
50	J	Vn			Pl	Sr
50	J	Vn	Ca	Sp	Pl	Sr
50	J	Vn	Ca	Sp	Pl	Sr
50	J	Vn	Ca	Sp	Pl	Sr
	MB					
50	J	Vn	Cl	Fi	Pl	R
50	J	Vn	Sp		Wa	R
50	J	Vn	Sp		Wa	R
50	J	Vn	Cl	Fi	Pl	Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	**Sheet No. 12 of 51**
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							BRECCIA, continued			0			MB						Mechanical Breaks from boxing
													MB						
			28/11	W1-W2	R1-R2			102	100	0			MB						
	112									1		60	J	Vn	Cl	Pa	Pl/Ir	R	
													MB						
													MB						
			28/12					102	100	0			MB						
	114												MB						
													MB						
										0									
										0			MB						
	116												MB						
										0			MB						
			29/12	W1-W2	R1-R2			102	100	0									
	118												MB						
										0									
													MB						
			30/12	W1-W2	R1-R2 / R3			98	92	0									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 13 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							BRECCIA, continued, sheared												
			30/12	W1	R1-R2			98	92	0									
										1		35	J	Vn	No		Pl	S	
	122											50	J BZ	Vn	Cl	Su	Pl	Sr	
										5		90	J	Vn			Ir	Vr	
			31/13	W1	R1-R2			98	92			90	J	Vn			Ir	Vr	
												50	J	Vn	No		Wa	Sr	
										3		30	J	Vn	No		Wa	S	
	124									0									
												50	J	Vn	Cl		Pl	R	
										3		50	J	Vn	Cl		Pl	R	
	126											50	J	Vn	Cl		Wa	R	
										0									
			32/13	W1-W2	R1-R2			100	88				MB						
										1		40	J	Vn	Cl	Su	Pl	R	
	128												MB						
										1		50	J	Vn	Cl		Pl	Sr	128.1-128.8' Retained for analysis
										3			MB BZ						
			33/13	W1	R3			98	98				MB						

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
			33/13				BRECCIA, continued, sheared, with shale and clay	98	98										
										1									
												90	J	Vn	Ca	Fi	Ir	Vr	
													MB						
													MB						
					R3					0									
	132			W1									MB						
			33/14					98	98	0									
													MB						
							increased clay matrix												
					R1-R2					1			MB						
												50	J	Vn	No		Pl	S	
	134																		
										0									
													MB						
										0									
													MB						
	136																		
										0									136.2-137' Retained for analysis
			34/14	W1	R2-R3			102	100				MB						
										1									
												70	J	Vn	Ch	Fi	Pl	S	
	138																		
										0			MB						
													MB						
							matrix supported, clayey, very weak												
										0									
			35/15	W1	R1			102	100										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 15 of 51**	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							BRECCIA, continued, sheared			0			MB						No natural joints or fractures observed
										0			MB						
	142		35/15	W1	R2			102	100	0									
										0									
	144									0									
							METABASALT/GREENSTONE BRECCIA, dusky grayish-green to dark green, fine grained, fresh, weak to moderately strong, hard, choloritized, meta basalt clasts, localized abundant veining of calcite			1		60	J	Vn	Ch	Su	Pl	Sr	
	146		36/15	W1	R1-R3			96	90	1		70	J	Vn	Ch/Ca	Ja	Pl	R	
										0									
	148									0			MB MB BZ						
			36/16					96	90	0									
			37/16	W1	R2-R3			100	100										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 16 of 51**	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Description: METABASALT/GREENSTONE BRECCIA, continued, chert clasts scattered throughout

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Surface Shape	Roughness
							60	J	Vn	No	Pl	Sr
						3	60	J	Vn	No	Pl	R
							80	Fz	Vn	No	Pl	R
						2	80	Fz	Vn	No	Pl	R
152							80	Fz	Vn	No	Pl	R
	37/16	W1	R2-R3	100	100	2	80	Fz	Vn	No	Pl	R
							80	Fz	Vn	No	Pl	R
						2	80	Fz	Vn	No	Pl	R
154							80	Fz	Vn	No	Pl	R
						0						
						1	50	J	Vn	No	Pl	Vr
156	38/16			98	98							
		W1	R2-R3			1	80	Fz	Vn	No		Vr
						1	80	Fz	Vn	No		Vr
158												
	38/17			98	98	1	80	Fz	Vn	No		Vr
						0						
	39/17	W1	R2-R3	100	86							

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 17 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			0									
										0			MB						
	162		39/17	W1	R2-R3			100	86	0			MB						
										0			MB						
	164									3			MB BZ						
										1			MB						
	166		40/17	W1	R3			102	100			50	J	Vn	Ch		Pl	Slk	
										1		50	J	Vn	Ch		Pl	R	
										1			MB						
	168		40/18					102	100	0									
			41/18	W1	R2			98	94	0									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 18 of 51**	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
					R2	METABASALT/GREENSTONE BRECCIA, continued			0		MB						
											MB						
									0		MB						
	172		41/18	W1	R3		98	94	0								
									0		MB						
	174								2		MB						
										40	J	Vn	Ch/Cl	Pa	Wa	Sr	
										0-10	J	Vn	Ch	Pa	Wa	Sr	
			42/18				102	96	4	30	V/J	Vn	Ca	Pa	Wa	Sr	
										40	V/J	Vn	Ch	Pa	Pl	Sr	
										50	J	Vn	Ch	Pa	Pl	Sr	
	176									30	J	Vn	Ch	Pa	Pl	Sr	
				W1	R2-R3				1	35	J	Vn	Cl	Pa	Pl	Sr	
			42/19				102	96	1	35	J	Vn	Ch/Ca	Pa	Pl	S	
	178								1	50	MB						
										35	J	Vn	Ch	Pa	Pl	Sr	
											MB						
			43/19	W1	R2-R3		102	100	0								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 19 of 51**	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			3		50	J	Vn	Ch/Cl	Pa	Pl	Sr	
												70 50	J J	Vn Vn	Ch/Cl	Pa	Pl	S	
										1		65	J	Vn	Ch/Cl	Pa	Ir	Sr	
	182		43/19	W1	R2-R3			102	100	0			MB						
													MB						
													MB						
										0			MB						
	184									1									
			44/19					100	100										
												60	J	Vn	No		Pl	Sr	
										0									
	186									2		35	J	Vn	Ch	Fi	Pl	S	
												35	J	Vn	Ch	Fi	Pl	S	
			44/20	W1	R2-R3			100	100	2									
	188											35 30	J J	Vn Vn	Ch Ch	Fi Fi	Pl Pl	Sr Sr	
										4		35	J	Vn	Ch	Fi	Pl	Sr	
												35	J	Vn	Ch	Fi	Pl	Sr	
												10 35	J J	Vn Vn	Ch Ch/Cl	Fi Fi	Pl Pl	Sr Sr	
										0									
			45/20	W1	R2-R3			100	100				MB						

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 20 of 51**	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			1		40	J	Vn	Ch	Fi	Pl	S	
										0									
	192		45/20	W1	R2-R3			100	100	1		40	J	Vn	Ch	Fi	Pl	S	
										1		35	J	Vn	Ch, Cl	Fi	Pl	S	
													MB						
	194		45/21					100	100	0									
							195.05-195.4 calcite veins to 0.5 inches thick, plane, well healed			0									
	196									1		50	J	Vn	Ca	Su	Pl	S	
			46/21	W1	R2-R3			100	100	0									
	198									0									
										0									
			47/21	W1	R2-R3			100	100										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METABASALT/GREENSTONE BRECCIA, continued											No natural joints or fractures observed
							1	50	J	Vn	Ch	Su	Pl	S	
	47/21				100	100	1	60	J	Vn	Ch	Su	Pl	S	
202		W1	R3				1	75	J	Vn	Ch	Su	Pl	S	
	47/22				100	100	0								
204							1	60	J/V	Vn	Ca	Fi	Pl	S	
							1	75	J/V	Vn	Ca, Ch	Fi	Pl	S	
206								40	J	Vn	Ch	Su	Wa	S	
	48/22	W1	R3		100	92	1	45	J	Vn	Ch	Su	Wa	S	
							3	55	J	Vn	Ch	Su	Wa	S	
								40	J	Vn	Ch	Su	Pl	S	
208							1	35	J	Vn	Ch	Su	Pl	S	
	49/22	W1	R2		94	92	0								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Sheet No. 22 of 51

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METABASALT/GREENSTONE BRECCIA, continued					MB						
							0								
	49/22	W1	R2		94	92	0								
212							1	15	V		Ca	Fi	Pl	S	
	49/23		R3		94	92	1								
214								20	J	Vn	Ch	Su	Wa	S	
							0		MB						
							0								
216	50/23	W1	R2-R3		100	90	0								
							0								
218							2	40	J	Vn	Ch	Su	Pl	S	
								80	J	Vn	Ch	Su	Pl	Slk	
							0								
	51/23	W1	R2-R3		100	92									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			0									
			51/23	W1	R2-R3			100	92										
										2		15	J		Ch	Su	Wa	S	
												40	S		Ch	Pa	Pl	S	
	222									1		10	MB J		Ch	T	Pl	S	
			51/24					100	92	0									
	224									0									
										0									
	226									0									
			52/24	W1	R3			100	100			50	J		No		Wa	S	
										1									
	228									0									
										0									
			53/24	W1	R3			95	78.2										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1
Sheet No. 24 of 51

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
	53/24		R3	METABASALT/GREENSTONE BRECCIA, continued, grayish-green, variable between clast and matrix supported, fresh to slightly weathered, weak rock, matrix is fragile, indented with fingernail, calcite veins in some cracks	95	78.2		85	J/S	Vn	No	No	Ir	Slk	
							1								
			R1				0								
232		W1					1								
	53/25				95	78.2									
								65	J/S	Vn	Cl	Fi	Pl	S	
			R2-R3				0								
234									MB						
									MB						
									MB						
							0								
							0								
236							0	40	V	T	Ca	Cm	Ir/Pl	S	
								40	V	T	Ca, Mn	Cm	Ir/Pl	S	
	54/25	W1	R2-R3	some slickensides on joint surfaces	100	91.6									
							3	35	J	Vn		No	Pl	Slk	
								60	J	Vn		No	Pl	Slk	
								60	J	Vn		No	Pl	Slk	
238							2	70	J	Vn		No	Pl	Slk	
								70	J	Vn		No	Pl	S	
							0								
	55/26	W1-W2	R2-R3		58	58									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
		W1	R2	METABASALT/GREENSTONE BRECCIA, continued			0								*3.0' ol
							0								
242	55/26			soft, altered matrix around 242'	58	58	1	90	J	Vn	Cl, Cl		Ir	Slk	
							7		BZ	Vn	Ch, Cl	Pa	Pl	S	
244									Fz	Vn	Ch, CL	Fi	Ir	Sr	
							>10		Fz	Vn	Ch, Cl	Fi	Ir	Sr	
							1	25	J	Vn	Ch, Cl	Fi	Pl	S	
246	56/26	W1	R2		100	80		90	J	Vn	Ch, Cl	Sp	Wa	Slk	
							1	80	J	Vn	Linear Slk	Sps	Pl	Slk	
								15	S	Vn	Slk	Fi	Wa	Slk	
							3	20	S	Vn	Slk	Fi	Wa	Slk	
248				248-248.5' soft matrix material					Fz	Vn	Cl, Sd	Fi	Ir	S	*0.5' ol run 56 rec in run 57
	57/26	W1	R2		75	75	3		BZ	Vn	Cl, Sd	Pa	Ir	Sr	
							>10		BZ		Ch, Cl		Pl	Sr	
	58/27	W1	R2-R3		100	100									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotite Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** Sheet No. 26 of 51
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Description: METABASALT/GREENSTONE BRECCIA, continued

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
						2	90	J	Vn	Ch, Cl	Pa	Ir	Vr
							70	J	Vn	Ch, Cl	Pa	Ch	Sr
						3	50	J	Vn	Ch, Cl	Pa	Pl	R
							50	J	Vn	Ch, Cl	Fi	Pl	Sr
252	58/27	W1	R2-R3	100	100		60	J	Vn	Ch, Cl	Pa	Pl	Sr
							50	J	Vn	Ch, Cl	Fi	Pl	S
						3	60	J	Vn	Ch, Cl	Pa	Pl	Sr
							75	J	Vn	Ch, Cl	Fi (H)	Pl	Sr
								MB					
						0		MB					
254							60	J	Vn	Ch, Cl	Fi	Pl	S
						2	55	J	Vn	Ch, CL	Fi	Pl	S
								MB					
							35	J	Vn	Ch, Cl	Fi	Wa	S
						7		BZ	Vn	CH, CL	Pa	Pl	S
	59/27			100	100								
256													
		W1	R2-R3			1	55	J	Vn	Ch, Cl	Pa	Pl	S
						0							
258													
	59/28			100	100	0							
	60/28	W1	R2-R3	100	100	0							

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** Sheet No. 27 of 51	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core		
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			0									
										1		55	J	Vn	Ch, Cl	Fi	Pl	S	
	262		60/28	W1	R2-R3			100	100										
										1		75	J	Vn	Ch, Cl	Fi	Pl	S	
										0									
	264									0									
			61/28					100	100	4		45	J	Vn	Ch, Cl	Pa	Pl	S	
												45	J	Vn	Ch, Cl	Pa	Pl	S	
												75	J	Vn	Ch, Cl	Pa	Pl	S	
												80	J	Vn	Ch, Cl	Pa	Pl	S	
	266			W1	R3					0									
										0									
	268		61/29					100	100	0									
			62/29	W1	R2-R3			100	100	0									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			0									
										1		75	J	Vn	Ch	Fi	Pl	S	
	272		62/29	W1	R2-R3			100	100	1		65	J	Vn	Ch, Cl	Fi	Pl	S	
										0									
	274		63/29					100	100	0									
										0									
	276		63/30	W1	R2-R3			100	100	0									
										1		70	J	Vn	Ch	Fi	Pl	S	
	278									1		70	J	Vn	Ch	Fi	Pl	S	
			64/30	W1	R2-R3			100	100	0									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METABASALT/GREENSTONE BRECCIA, continued			0								
	64/30	W1	R2-R3		100	100	1	60	J	Vn	Ch	Fi	Pl	S	
282							0								
	64/31				100	100	0								
284							1	80	J	Vn	Ch	Fi	Wa	S	284-284.8' Retained for analysis
							1	50	J	Vn	Ch	Fi	Pl	S	284.8-285.5' Retained for analysis
286	65/31	W1	R2-R3		100	100	0								
							0								
288							0								
	66/31	W1	R2-R3		100	100	0								

DISCONTINUITY TYPE	APERTURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** **Sheet No. 30 of 51**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METABASALT/GREENSTONE BRECCIA, continued			4		BZ	Vn	Ch	Fi	Pl	S	
	66/31	W1	R2-R3		100	100	0								
292							0								
	66/32				100	100	3	50	V	Vn	Ca (H)	Fi	Pl	S	
								50	J	Vn	Ch	Fi	Pl	S	
								70	J	Vn	Ch	Fi	Pl	S	
294							2	80	J	Vn	Ch	Fi	Pl	S	
								30	J	Vn	Ch	Fi	Pl	S	
							0								
296	67/32	W1	R2-R3		100	100	0								
							0								
298							0	60	J	Vn	Ch	Fi	Pl	S	
	68/32	W1	R2-R3		100	100	1								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** Sheet No. 31 of 51
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
			68/32				METABASALT/GREENSTONE BRECCIA, continued	100	100	0									
										6		85	J	Vn	Ch	Fi	Pl	S	
													BZ	Vn	Ch	Fi	Pl	S	
				W1	R2-R3							40	J	Vn	Ch, Ca	Fi	Pl	S	
	302												BZ	Vn	Ch	Fi	Ir	S	
			68/33					100	100	5									
										0									
	304									1									
												65	J	Vn	Ch	Fi	Pl	S	
										0									
	306																		
			69/33	W1	R2-R3			100	100	0									
										0									
	308									0									
			70/33					100	100										
				W1	R2-R3					1									
			70/34					100	100			40	V	Vn	Ca	Fi	Pl	S	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 32 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			1		60	J	Vn	Ch	Fi	Wa	Sr	
												70	J	Vn	Ch	Fi	Pl	S	
										1									
	312		70/34	W1	R2-R3			100	100										
										0									
										1		90	J	Vn	Ch	Fi	Pl/Wa	S	
	314									0									
			71/34	W1	R2-R3			100	100										
							315.4-315.9' calcite infilling			0									
	316									0									
			72/34					100	100										
										1		55	J	Vn	Ch	Fi	Pl	S	
	318			W1	R2-R3														
			72/35					100	100	0									
										0									
			73/35	W1	R2-R3			100	100										

DISCONTINUITY TYPE	APERTURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** **Sheet No. 33 of 51**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			0									
										3		65	J	Vn	Ch	Fi	Pl	S	
												45	J	Vn	Ch	Fi	Pl	S	
												40	J	Vn	Ch, Ca	Fi	Pl	S	
	322		73/35	W1	R2-R3			100	100	1		75	J	Vn	Ch, Ca	Fi	Pl	S	
										0									
	324									1									
			74/35					100	100	2		30	J	Vn	Ch	Fi	Pl	S	
												25	J	Vn	Ch, Ca	Fi	Pl	S	
												30	J	Vn	Ch	Fi	Pl	S	
	326			W1	R2-R3					1		60	J	Vn	Ch	Fi	Pl	S	
										0									
	328		74/36					100	100	3		35	J	Vn	Ch	Fi	Pl	S	
												80	J	Vn	Ch	Fi	Pl	S	
												80	J	Vn	Ca, Ch	Fi	Pl	S	
			75/36	W1	R2-R3			100	100	1		70	J	Vn	Ch	Fi	Pl	S/Slk	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	CORE LOG GT-1-2018-1
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	Sheet No. 34 of 51
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METABASALT/GREENSTONE BRECCIA, continued			0								
							1	20	V/J	Vn	Ca, Ch	Fi	Pl	S	
332	75/36	W1	R2-R3		100	100	1	40	J	Vn	Ch	Fi	Pl	S/Slk	
								10	J	Vn	Ch	Fi	Pl	S	
							3	85	J	Vn	Ch	Fi	Pl	S	
334								20	J	Vn	Ch, Cl	Fi	Wa	S	
								20	J	Vn	Ch, Cl	Fi	Wa	S	
							1								
							2	65	J	Vn	Ch, Cl	Fi	Pl	S	
									MB						
								40	J	Vn	Ch, Cl	Fi	Pl	S	
336							0								
	76/37	W1	R2-R3		100	100	0								
338							1	35	J	Vn	Ch, Cl	Fi	Pl	S	
									BZ	Vn	Ch	Fi	Pl	S	
							3								
	77/37	W1	R2-R3		100	100									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	CORE LOG GT-1-2018-1 Sheet No. 35 of 51
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			4			BZ	Vn	Ch	Fi	Pl	S	
			77/37					100	100	0									
	342			W1	R2-R3					0									
			77/38					100	100	1									
	344											20	J	Vn	Ch	Fi	Pl	Sr	
										0									Driller dropped 0.1 ft
										0									
	346									0									
			78/38	W1	R2-R3			100	100			65	J	Vn	Ch	Fi	Pl	Sr	
										1									
	348									2		50	J	Vn	Ch	Fi	Pl	Sr	
												40	J	Vn	Ch, Cl	Fi	Pl	Sr	
										0									
			79/38	W1	R2-R3			100	100										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt

Total Depth: 500.0 feet
Groundwater Data: ft bgs,

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
			79/38				METABASALT/GREENSTONE BRECCIA, continued	100	100	2		70	J	Vn	Ch	Fi	Pl	Slk	
										1		60	J	Vn	Ch, Cl	Fi	Pl	R	
	352			W1	R2-R3					0		50	J	Vn	Ch, Cl	Fi	Pl	R	
			79/39					100	100	0									
	354									0									
										7		50 60	J Fz J	Vn Vn Vn	Ch, Ca Cl Cl, Ch	Fi Fi Fi	Pl Ir Pl	Sr R	
	356		80/39	W1	R2-R3			90	88	0									
										0									
	358									5		50 60	J Fz J	Vn Vn Vn	Ch, Cl Cl, Ch Ch, Cl	Fi Fi Fi	Pl Ir Pl	S S S	
										0									
			81/40	W1	R2-R3			96	96										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** **Sheet No. 37 of 51**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued												
										1		65	J	Vn	Ch	Fi	Pl	S	
										2		55	J	Vn	Ch, Cl	Fi	Pl	S	
												40	J	Vn	Ch, Ca, Cl	Fi	Pl	S	
	362		81/40	W1	R2-R3			96	96	0									
										0									
	364									1			MB						
												55	J	Vn	Ch, Cl	Fi	Pl	S	
										0									
	366		82/40	W1	R2-R3			100	100	0									
										0									
	368												BZ	Vn	Ch, Cl	Fi	Pl	S	
			82/41					100	100	6		10	J	Vn	Ch, Cl	Fi	Pl	S	
												60	J	Vn	Ch, Cl	Fi	Pl	S	
			83/41	W1	R3-R4			100	100	0									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	Total Depth: 500.0 feet	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	Groundwater Data: ft bgs,	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez		
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke		
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued			1		60	J	Vn	Ch	Fi	Pl	S	
										1		70	J	Vn	Ch	Fi	Pl	S	
	372		83/41	W1	R3-R4			100	100	1		50	J	Vn	Ch	Fi	Pl	S	
										0									
	374									0									
			84/41					100	100	2		60	J	Vn	Ch, Cl	Fi	Pl	S	
												70	J	Vn	Ch	Fi	Pl	S	
	376									1		45	J	Vn	Cl, Ch	Pa	Pl	S	
			84/42	W1	R3-R4			100	100	1		60	J	Vn	Ch	Pa	Pl	S	
	378									0									
										1		70	J	Vn	Ch, Cl	Fi	Pl	S	
			85/42	W1	R3-R4			100	100										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** Sheet No. 39 of 51
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued												
										1		20	J	Vn	Ch, Cl	Fi	Pl	Sr	
			85/42	W1	R3-R4			100	100	1									381.15-381.9' Retained for analysis
	382											80	J	Vn	Ch, Cl	Fi	Pl	Sr	
										0									
										2									
			85/43					100	100			75	J	Vn	Ch	Fi	Pl	S	
												70	J	Vn	Ch, Cl	Fi	Pl	S	
	384																		
										1		60	J	Vn	Ch	Fi	Pl	S	
										1									384.7-385.55' Retained for analysis
												40	J	Vn	Ch, Cl	Fi	Pl	S	
	386																		
										4		35	J	Vn	Cl, Ch	Fi	Pl	S	
													BZ	Vn	Cl, Ch	Pa	Pl	S	
			86/43	W1	R3			100	100										
										1									
	388											30	J	Vn	Cl, Ch, Ca	Fi	Pl	S	
										0									
													BZ	Vn	Cl, Ch	Fi	Pl	S	
										5									
			87/43	W1	R3			100	100										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 40 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued												
			87/43					100	100	2		70	J	Vn	Ch	Fi	Pl	S	
												5	J	Vn	Ch, Cl	Fi	Pl	Sr	
										0									
	392																		
				W1	R3					0									
			87/44					100	100										
										4		80	J	Vn	Ch	Fi	Pl	S	
												50	J	Vn	Ch	Fi	Pl	S	
												50	J	Vn	Ch	Fi	Pl	S	
	394											55	J	Vn	Ch, Cl	Fi	Pl	S	
										0									
												35	J	Vn	Ch	Fi	Pl	S	
												35	J	Vn	Ch	Fi	Pl	S	
										4		45	J	Vn	Ch, Cl	Fi	Pl	S	
												50	J	Vn	Ch, Cl	Fi	Pl	Sr	
	396																		
										0									
			88/44	W1	R3			100	100										
										0									
	398																		
										4		25	J	Vn	Ch, Cl	Fi	Pl/Wa	Sr	
													BZ	Vn	Ch, Cl	Fi	Ir	Sr	
										3		60	J	Vn	Ch, Ca	Fi	Pl	S	
			89/45	W1	R3			100	100										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 41 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued 400.5-401' weakly cemented breccia, easily friable			1		35	J	Vn	Ch, Cl	Fi	Pl	S	
										0									
	402		89/45	W1	R3			100	100	0									
										1		30	J	Vn	Ch, Cl	Fi	Pl	Sr	
	404									1		70	J	Vn	Ch, Cl	Fi	Pl	Sr	
										1		65	J	Vn	Cl, Ch	Fi	Pl	Sr	
	406		90/45	W1	R3			100	100	1		35	J	Vn	Ch, Cl	Fi	Pl	S	406-406.7' Retained for analysis
										0									
	408									1		40	J	Vn	Ch	Fi	Pl	S	
			90/46					100	100	1		45	J	Vn	Ch, Cl (HL3)	Fi	Pl	S	
			91/46	W1	R2-R3			100	100										

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** Sheet No. 42 of 51	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core		
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METABASALT/GREENSTONE BRECCIA, continued			0								
							1	85	J	Vn	Cl, Ch	Fi	Pl	S	
412	91/46	W1	R2-R3		100	100	0								
							4	65	J	Vn	Ch, Cl	Fi	Pl	S	
								55	J	Vn	Cl	Fi	Pl	S	
414									Fz		Cl, Ch	Fi	Pl	S	
							5	30	J	Vn	Ch, Cl	Fi	Ir	S	
							2	40	J	Vn	Ch, Ca	Fi	Pl	S	
								35	J	Vn	Cl, Ch	Fi	Pl	S	
416	92/46				100	100	1	55	J	Vn	Cl	Fi	Pl	S	
		W1	R2-R3				0								
418	92/47				100	100	0								
	93/47	W1	R2-R3		100	100	0								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Description: METABASALT/GREENSTONE BRECCIA, continued

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
422–424.5	93/47	W1	R2-R3	100	100
424.5–426.5	94/47			100	92
426.5–429.5	94/48	W1	R2-R3	100	92
429.5–	95/48	W1	R2-R3	100	100

Fractures per ft.
8
1
1
1
5
8
1
4
6
4

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
70	J	Vn	Ch, Cl	Fi	Pl	S
	BZ	Vn	Ch, Cl	Fi	Ir	S
50	J	Vn	Cl, Ch	Fi	Pl	S
55	J	Vn	Ch, Cl	Fi	Pl	S
60	J	Vn	Cl, Ch	Fi	Pl	Sr
35	J	Vn	Ch	Fi	Pl	Sr
	Fz	Vn	Cl, Ch	Fi	Ir	Sr
35	J	Vn	Ch	Fi	Pl	S
70	J	Vn	Ch, Cl	Fi	Pl	S
	BZ	Vn	Ch, Cl	Fi	Ir	S
55	J	Vn	Ch	Fi	Pl	S
	MB					
60	J	Vn	Ch	Fi	Pl	S
	Fz	Vn	Ch, Cl	Fi	Ir	S
	BZ	Vn	Ch, Cl	Pa	Pl	S
55	J	Vn	Ch	Fi	Pl	S
	BZ	Vn	Cl	Pa	Ir	Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** Sheet No. 44 of 51	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core		
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ		
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet	
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt		

Description: METABASALT/GREENSTONE BRECCIA, continued

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
						0							
						0							
432	95/48	W1	R2-R3	100	100	6		Fz	Vn	Cl, Ch	Fi	Ir	R
							50	J	Vn	Ch, Cl	Fi	Pl	R
						0							
434						0							
						1	30	J	Vn	Ch	Fi	Pl	Sr
436						1	65	J	Vn	Cl, Ch	Fi	Pl	S
	96/49	W1	R2-R3	100	100	3	20	J	Vn	Ch	Fi	Pl	S
							40	J	Vn	Ch, Cl	Fi	Pl	S
							40	J	Vn	Ch	Fi	Pl	S
438						0							
							60	J	Vn	Ch, Cl	Fi	Pl	Sr
						2	75	J	Vn	Ch, Cl	Fi	Pl	S
	97/49	W1	R2-R3	100	100								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** Sheet No. 45 of 51
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

METABASALT/GREENSTONE BRECCIA, continued

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
	97/49			100	100	0								
						0								
442														
	97/50	W1	R2-R3	100	100	2	60	J	Vn	Ch, Cl	Fi	Pl	S	
							50	J	Vn	Ch, Cl	Fi	Pl	Sr	
							35	J	Vn	Ch	Fi	Wa	S	
								BZ	Vn	Ch	Fi	Wa	Sr	
						7	70	J	Vn	Ch, Cl	Fi	Pl	S	
444						0								444.4-444.9' Retained for analysis
						0								
446	98/50	W1	R2-R3	100	100	4		Fz	Vn	Ch, Cl	Fi	Ir	R	
							50	J	Vn	Ch, Cl	Fi	Pl	Sr	
						0								
448	98/51			100	100	0								
								BZ	Vn	Ch	Fi	Ir	Sr	
	99/51	W1	R2-R3	50	20	9								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				METABASALT/GREENSTONE BRECCIA, continued friable material, likely mechanical breakage creating large broken zones					MB						
	99/51	W1	R1-R2		50	20	0								
							0								
452				452-452.5' very weak, friable material					MB						
	100/51	W1	R1-R2		100	0	>10								
							>10	60	J BZ	Vn	Ch, Cl	Fi	Pl	S	
454				454-455.8' very weak, friable material			>10		BZ						
	101/51	W1	R1-R2		100	0									
							1	70	V MB	Vn	Ca	Fi	Pl	R	
	102/51				100	31.8									
456							4	45	J BZ	Vn Vn	Ch, Cl Ch, Cl	Fi Fi	Pl Ir	Sr Sr	
		W1	R1-R2				>10		BZ						
458	102/52				100	31.8			BZ						
							>10		BZ						
									MB BZ						
	103/52	W1	R2		100	25.9	>10								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 47 of 51**
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE BRECCIA, continued												
										1		65	J	Vn	Ch, Cl	Pa	Ir	R	
													MB						
			103/52	W1	R2			100	25.9										
										0									
							461.8-465.4' semi-healed breccia, very weak												
	462												MB						
										0									
			104/52					92	48										
										0									
	464																		
										0									
				W1	R2-R1														
			104/53					92	48	0									
	466																		
										0									
													MB						467.2' Redrilled
										0									
	468																		
			105/53	W1	R2			65.2	35	0									
										0			MB						
			106/53	W4	R2			100	66										

DISCONTINUITY TYPE
F - Fault
J - Joint (Discontinuity)
Fz - Fracture Zone
S - Shear
Sz - Shear Zone
V - Vein
Fo - Foliation
B - Bedding Joint
MB - Mechanical Break
Bz - Broken Zone

APERATURE
Tight (T) 0"
Very Narrow (Vn) <0.05"
Narrow (N) 0.05-0.1"
Open (O) 0.1-0.5"
Wide (W) >0.5"

INFILLING TYPE
Bi - Biotitie; Cl - Clay; Ca - Calcite; Ch - Chlorite; Ep - Epidote; Fe - Iron Oxide; Gy - Gypsum; H - Healed; Mi - Mica
Mn - Manganese; My - Mylonite; No - None; Py - Pyrite; Qz - Quartz; Sd - Sand; Si - Silt; Un - Unknown

INFILLING AMOUNT
Clean (No)
Stained (Su)
Spotty (Sp)
Partial Filled (Pa)
Filled (Fi)
Cemented (Cm)

SHAPE
Wa - Wavy
Pl - Planer
St - Stepped
Ir - Irregular

ROUGHNESS
Slickensided (Slk) Visual evidence of polishing and striations
Smooth (S) Surface appears and feels smooth
Slightly Rough (Sr) Asperities are distinguishable and can be felt
Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive
Very Rough (Vr) Near-vertical ridges occur on surface

DISCONTINUITY SPACING
Extremely Wide (EW) >6ft
Wide (W) 2ft-6ft
Moderate (M) 8in-2ft
Close (C) 2.4in-8in
Very Close (VC) 0.75in-2.4in
Extremely Close (Ex) <0.75in

WEATHERING
Fresh (W1)
Slightly (W2)
Moderately (W3)
Highly (W4)
Completely (W5)
Residuum (W6)

STRENGTH
Extremely Weak (R0)
Very Weak (R1)
Weak (R2)
Moderately Strong (R3)
Strong (R4)
Very Strong (R5)
Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Description: METABASALT/GREENSTONE BRECCIA, continued

Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
106/53	W4	R2	100	66
106/54			100	66
107/54	W4	R2	92	82
108/54	W1	R2	100	68

Depth markers: 472, 474, 476, 478

Fractures per ft. (top to bottom): 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0

Discontinuities:

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
		MB					
		MB					
	55	V	Vn	Ca	Fi	Pl	S
	35	J	Vn	Ch, Cl	Fi	Pl	Sr
	55	J	Vn	Ch, Cl	Fi	Pl	S
	75	J	Vn	Ch	Fi	Pl	S

Comments:
- 469.9-470.8' Retained for analysis
- 473.7-474.1' Redrilled

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1

Sheet No. 49 of 51

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Column headings: Elevation, ft MSL | Depth, ft | Drill Time (min) | Run No./Box No. | Weathering Index | Strength Index | Graphic Log | Description | Recovery % (20 40 60 80) | RQD % (20 40 60 80) | Fractures per ft. | Discontinuities: Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness | Comments

Description: METABASALT/GREENSTONE BRECCIA, continued

Depth marks: 482, 484, 486, 488

Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
108/54	W1	R2	100	68
108/55			100	68
109/55	W1	R3	100	100
110/55	W1	R3	100	96

Fractures per ft. (top to bottom): 1, 2, 6, 2, 4, 0, 0, 0, 0, 0

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
35	J	Vn	Ch	Fi	Pl	S
70	J	Vn	Ch, Cl	Fi	Pl	S
75	J	Vn	Ch, Cl	Fi	Pl	S
	BZ	Vn	Ch	Fi	Ir	Sr
40	J	Vn	Ch	Fi	Ir	S
40	J	Vn	Ch	Fi	Ir	S
	BZ	Vn	Ch, Cl	FI	Ir	S

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-1
Sheet No. 50 of 51

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Depth, ft	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
				METABASALT/GREENSTONE BRECCIA, continued										
	110/55				100	96	0							
492		W1	R2				0							
	110/56				100	96	1	40	J	Vn	Ch	Fi	Pl	S
							1	50	J	Vn	Ch	Fi	Pl	S
494								65	J	Vn	Ch	Fi	Pl	S
							1							
							0							
496							0							
	111/56	W1	R2-R3		96	96	0							
498							0							
									Fz	Vn	Ch, Cl	Fi	Ir	S
	112/56	W4	R3		100	100	6							

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 9/23/18 End: 10/8/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-1** **Sheet No. 51 of 51**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857033.632 / Easting: 592478.831	Drill Bit Type/Size: HQ	
Surface Elevation: 1330 feet AMSL	Logged By: D. Loveday, S. Brinton, L. Rodriguez	Total Depth: 500.0 feet
Bottom Elevation: 860 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 045 / Inclination: 20	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery % (20 40 60 80)	RQD % (20 40 60 80)	Fractures per ft.	Discontinuities: Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							Total depth = 500 FT below ground surface Vibrating wire piezometer installed 10/8/2018, grouted in neat cement												

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-2

Sheet No. 1 of 18

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt

Total Depth: 171.0 feet

Groundwater Data: ft bgs,

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery % (20 40 60 80)	RQD % (20 40 60 80)	Fractures per ft.	Discontinuities: Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
	0–1.4						SOIL - limestone, sandy clay, dark reddish brown/dark gray, 10-20% coarse sands, 40-50% firm to coarse sand, clays, moderate plasticity, platform material [FILL] 0.6-1.4' limestone, similar to above, easily broken by hand, consolidated			>10 >10									
	1.4–5 (2, 4)	20	1/1	W2-W3	R1-R2		METAVOLCANIC/GREEENSTONE BRECCIA - grayish-green, fine to coarse grained, slightly to moderately weathered, very weak to weak, chloritized	60	18	>10 >10 >10 >10 >10									
	5–10 (6, 8)	20	2/1	W2-W3	R1			6	0	>10 >10 >10 >10 >10 >10 >10									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-2

Sheet No. 2 of 18

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.
	10	3/1	W2	R5	METAVOLCANIC/GREENSTONE BRECCIA, continued	50	0	>10
12	15	4/1	W2	R4	CHERT - dark red, fine grained, slightly weathered, weak to moderately strong, hematite alteration; quartz vein	77	0	>10, >10, >10
	10	5/1	W2	R4		50	0	
14	30	6/1	W2	R4	black	70	0	>10
16	35	7/1	W2	R4		100	21	>10, >10, >10
	15	8/2	W2	R4	LIMESTONE with chert, light gray to white, fine to medium grained, fresh to slightly weathered, strong, hard, highly fractured, weakly bedded to deformed bedding	50	0	>10
18	35	9/2	W2	R4		87.5	0	>10
	20	10/2	W2	R4		100	0	>10

Discontinuities

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
0	V	Vn	Ca	Fi	Pl	S
	Fz	Vn	Cl	Fi		
40	MB V	Vn	Qz	Fi	Wa	S
55	J	Vn	Cl carb.	Fi	Pl	S/Slk
	MB					
	MB					
50	J	Vn	Cl carb.	Fi	Pl	Slk
55	B	T	No	No	Wa	S
50	B	T	No	No	Pl	S
55	B	Vn	Cl	Fi	Pl	S
60	B	Vn	Cl	Fi	Pl	S
55	V	Vn	Qtz	Fi	Pl	S
45	J	Vn	Fe Ox	Su	Pl	Slk
60	J	T			Pl	Sr
55	J	T			Pl	S
30	J	T	Fe Ox	Su	Pl	S
	Fz	Vn	Ca, Cl	Pa/Fi	Ir	Sr
35	J/F	T	Qz	Fi	Pl	Slk
	Fz	T	Qz, Ca	Pa	Ir	Slk
	MB					
65	J	Vn	Ca	Fi/Pa	Pl	Sr
	MB					
60	S	Vn	Cl, Ca	Fi	Pl	S
35	S	Vn	Cl, Ca	Fi	Pl	S

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie; Cl - Clay; Ca - Calcite; Ch - Chlorite; Ep - Epidote; Fe - Iron Oxide; Gy - Gypsum; H - Healed; Mi - Mica; Mn - Manganese; My - Mylonite; No - None; Py - Pyrite; Qz - Quartz; Sd - Sand; Si - Silt; Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	# CORE LOG GT-1-2018-2
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 3 of 18**
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Comments
			10/2	W2	R5		LIMESTONE - light gray to white, very fine grained, locally with thin quartz veining, pyrite	100	0	>10	
	22	40	11/2	W2	R4		22.5-27' moderate quartz veining, brecciated with dark gray to black matrix, silicified	100	60	>10, >10, >10, >10, >10	25.6-25.8' Some washout
	26	25	12/3	W1	R4			93.3	47	7	
	28	21	13/3	W1	R5			90.9	22	5, >10	
			14/3	W1	R5			75	0		
			15/3	W1	R4			37.5	0	>10	

Discontinuities

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
		Fz	Vn	No	No	Ir	S
		Fz	Vn	Cl, Sd	Pa	Ir	S
		Fz	Vn	No	No	Pl	Sr
		Fz	Vn	No	No	Ir	Sr
		MB					
		MB					
	Var.	V	Vn	Qz	Fi	Ir	R
		MB					
	35	J	T	No	No	P	Sr
		MB					
		MB					
		MB					
		MB					
		MB					
		MB					
		MB					
		MB					
		MB					
		MB					
		MB					

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 4 of 18**
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Depth, ft: 32, 34, 36, 38

Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.
	15/3			Limestone	LIMESTONE with chert, light gray to tan, fine grained, fresh to slightly weathered, strong, hard, moderately fractured	37.5	0	4
	16/3	W1-W2	R4	Limestone		86.6	60	8, >10, >10
20	17/3	W1-W2	R4	Limestone		80	13.3	>10, >10, >10
12	18/3	W1-W2	R4	Limestone		80	33.3	>10, >10
16	19/4	W1-W2	R4	Limestone	small mineralized vugs, pyrite	100	27.3	>10
17	20/4		R4	Limestone		100	85	

Discontinuities

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
		MB						
		Fz	Vn	No	No	Ir	Sr	
		Fz	Vn	No	No	Fr	Sr	
	40	J	Vn	No	No	Pl	Sr	Frequent mechanical breaks from drilling
		Fz	Vn	No	No	Ir	Sr	
		Fz	Vn	No	No	Ir	Sr	
	20	V	Vn	Ca	Fi	Pl	S	
		BZ						Mechanically broken rounded gravels
		MB						
		MB						
		MB						
		Fz	T		No	Pl	Sr	
	0	J	Vn	Cl	Pa	Ir	Sr	
		FZ						Some chatter on rig (mislatch) rig is having a hard time cutting through rock without breaking may change bit
	25	J	Vn	No	No	Pl	Sr	
	25	J	Vn	No	No	Pl	Sr	
	50	V	Vn	Ch, Qzm Un, H	Fi/Cm	Pl	S	
		MB						Frequent mechanical breaks
		MB						
		MB						
		MB						
		MB						

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-2

Sheet No. 5 of 18

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Description: LIMESTONE with chert, continued

Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %	Fractures per ft.	Comments
		20/4	W1-W2	R4	100	85	>10	Down to replace bit CDLP at bay checking stock
	14	21/4	W1-W2	R4	50	100	>10	CDLP back replacing bit; Back drilling high mechanical breaks very low sample recovery drill water is moderatly cloudy/opaque
42	141	22/4	W1-W2	R4	88.9	71	>10; >10	
44	10	23/4	W1-W2	R4	100	100	0	
46	20	24/4	W1-W2	R4	90.5	24	>10; 8	Rig chattering slow drilling to get run return water nearly clear chattered less near end of run 24
	15	25/4	W1-W2	R4	100	100	0	Rig chattering less reduced to near zero no obvious loss of returns cloudy
48	15	26/4	W1-W2	R4	100	100	2	
		26/5			100	100		
	10	27/5	W1-W2	R4	55.5	0	>10	
	20	28/5	W1-W2	R4	100	100		

Discontinuities

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	MB					
	Fz	Vn	No		Ir	Sr
	MB					
	MB					
50	V	Vn	Ca, Un	Fi	Pl	S
	MB					
	MB					
35	V	Vn	Si, Ca, Cl	Fi	Pl	Sr
80	V	T			Pl	Sr
10	J	T			Pl	Sr
80	Fz	T			Pl	S
	Fz	T	Ca, Cl	Pa	Ir	S
	MB					
	MB					
	MB					
	MB					
	Fz	T	Ca	Pa	Ir	Sr
	MB					
	MB					
	MB					
	Fz	T	Ca	Fi	Ir	Sr
	MB					
	MB					
	MB					
	MB					
	MB					
	MB					
	MB	T	No	No	Ir	Sr
70	Fz	T	Ca	Pa	Ir	Sr
	J					
55	J	T			Ir	Sr
	MB					
	MB					
35	MB J/V	Vn	Ca	Fi	Pl	Sr
	MB					

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2**	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 6 of 18**	
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ		
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet	
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt		

Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Comments
	20	29/5	W1-W2	R4	LIMESTONE with chert, continued	100	33.3	>10	
52	20	30/5	W1-W2	R4		90	26.7	>10, >10, 8	
54	18	31/5	W1-W2	R4	small vugs to 0.25 inches	100	0	>10	Issues with pump on rig difficultly extracting run 32
	37	32/5	W1-W2	R4		100	58.3	7	Tripping out to check bit CDLP noted that they were working on getting a #10 bit to site ASAP Frequent mechanical breaks
56	15	33/5	W1-W2	R4		100	100	4	
		34/5				75	0		
58	15	35/5	W1 / W1-W2	R4	increased chert LIMESTONE with chert, carbonaceous, dark bluish-gray to medium bluish-gray with white, mottling, fine grained, strong, hard, deformed, white veining throughout	33.3	33.3	>10	
	20	36/6	W1-W2	R4		100	0	>10, >10	

Discontinuities

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
40	V	Vn	Ca	Fi	Pl	S
	MB					
	MB					
	MB					
	MB					
	Fz	Vn	Un, Cl	Sp	Ir	R
	Fz	Vn	No	No	Ir	Sr
50	J	Vn	Cl	Sp	Ir	Sr
10	J	Vn	Ca	Sp	Ir	Sr
Var.	Fz	Vn	Ca	Sp	Ir	Sr
	V	Vn	Ca	Fi	Ir	R
	MB					
	MB					
17	J	T	No	No	Pl	S
55	J	T	No	No	Pl	S/Slk
30	J	T	No	No	Pl	S
45	J	T	No	No	Pl	Sr
	Fz	Vn	Cl	Sp	Ir	Sr
	MB					
	MB					
	MB					
	MB					
	MB					
30	J	Vn	Ca	Sp	Pl	Sr
	MB					
	MB					
	MB		Qz			
	Vn					
	MB					
	MB					
	MB					
	MB					
Var.	V	Vn	Ca	Fi	Ir	Sr
	MB					
Var.	Fz	Vn	Ca, Qz	Pa	Ir	S
0	J	Vn	Ca/Qz, H	Fi	Pl	S
	Fz	Vn	Ca/Qz	Pa	Ir	Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2** Sheet No. 7 of 18
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
					LIMESTONE with chert, continued					MB		No				Very poor recovery some redrill
	15	37/6	W2	R4		60	100	>10		MB						
										MB						
	15	38/6	W2	R4		60	100	>10		MB						Rig continues to chatter varying degrees poor recovery
62										MB						
								>10		MB Fz	Vn	Ca	Pa	Ir	Sr	
	20	39/6	W2	R4		71.4	0									
								>10		MB						
									50	MB J	T	No	No	Pl	S	
64																Some redrill at top of extracted core
								5		MB MB						
										MB						
	20	40/6	W1-W2	R4	increased chert, becomes fresh	92.9	35.7			Fz	Vn	Ca	Sp	Ir	Sr	
									50	J	Vn	No		Pl	Sr	
										Fz	Vn	Ca	Sp	Ir	Sr	
								8								
										Fz	Vn	Ca	Sp	Ir	Sc	
66																Mechanical breaks
	20	41/6	W1	R4		81.25	18.75	>10		Fz	Vn	Ca	Sp	Ir	Sc	
										Fz	Vn	Ca	Sp	Ir	Sc	
										MB		No				
	20	42/6	W1	R4		100	0	>10								
68																
			W1-W2	R4				5	40	J	Vn	Ca	Sp	Pl	Sr	
									85	MB J MB	Vn	Ca	Sp	Ir	Sr	
	35	43/6				90	46.7		55	J	Vn	Ca	Sp	Pl	S	
										Fz	Vn	Ca	Fi	Ir	S	
			W3-W4	R3				8		MB BZ MB	Vn	Ca	Fi	Ir	S	
				R2	69.8' brecciated with clay fracture infill					BZ	Vn	Cl carb.	Pa	Ir	S	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 8 of 18**
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Columns: Elevation, ft MSL | Depth, ft | Drill Time (min) | Run No./Box No. | Weathering Index | Strength Index | Graphic Log | Description | Recovery % (20 40 60 80) | RQD % (20 40 60 80) | Fractures per ft. | Discontinuities (Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness) | Comments

Depth marks: 72, 74, 76, 78

Run No./Box No.	Drill Time (min)	Weathering Index	Strength Index	Recovery %	RQD %
43/7		W1-W2	R2-R3	90	46.7
44/7	160	W1-W2	R1-R2, R3	64.7	0
45/7	55	W1-W2	R2-R3, R1-R2, R4, R1-R2	90	27
46/7	17	W1-W2	R2-R3	100	9

Description

LIMESTONE with chert, continued

healed fractures with clay

fracture zone, 30% calcite grains (from veins), 40% limestone, 30% clasts (carbonated, slightly gritty), decomposted limestone material at 72.5'

LIMESTONE with chert, medium gray to white, fresh to slightly weathered, weak to moderatly strong, locally very weak, hard, carbonaceous

Fractures per ft.: 3, >10, >10, >10, 8, >10, 5, 3, >10, >10

Discontinuities

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	Fz	Vn	Ca carb.	Fi	Ir	Sr
	Fz	Vn	Ca, Cl carb.	Fi	Ir	Sr
	MB					
60	J	T			Ir	Sr
65	J	T	Ca, Cl	Pa	Pl	Sr
	BZ	Vn			Ir	Sr
	MB					
65	J	Vn	Ca	Sp	Pl	S
75	J	Vn	Cl carb.	Pa	Pl	R
85	Fz	Vn	Ca, Cl	Pa	Ir	Sr
60	V	Vn	Ca, H	Fi	Pl	Sr
45	J	Vn	Ca	Pa	Pl	Sr
95	J	Vn	Ca	Fi	Pl	S
	MB	Vn	Ca	Sp	Pl	Sr
	J	Vn	Ca, Cl	Pa	Ir	Sr
	Fz					
75	J	Vn	Ca	Pa	Pl	S
	Fz	Vn	Ca, Cl carb.	Fi	Ir	Sr
	MB					
65	Fz	Vn	Ca, Cl carb.	Fi	Ir	Sr
	Fz	Vn	Ca, FeO	Sp	Ir	S
60	J	Vn	Ca	Sp	Pl	Sr
	BZ	T	No	No	Ir	Sr
90	J	Vn	Ca	Sp	Pl	Sr
	Fz	Vn	Ca, Cl	Sp	Ir	Sr
	BZ	Vn	Ca, Cl carb.	Pa	Ir	Sr

Comments

Changed bit from #8 to #10

Tripping in casing
starting next run with new bit
chattery
cloudy return water

Rig down for 10 minutes to put some poles on the gearbox

Note: mechanical breaks between run 45 and run 46
cone total was 0.6'
added 0.3 RQDL to run 45 and run 46

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 9 of 18**
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Comments
			46/7	W1-W2	R4		LIMESTONE with chert, continued	100	9	>10	
	82	28	47/8	W1-W2	R4			96.1	13.4	7, >10, >10	
	84, 86	20	48/8	W1-W2	R4			93.6	17	>10, 9, 9, 9	
	88	20	49/8	W1-W2	R4			100	29.6	7, 7	

Discontinuities

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
		BZ	Vn	Ca, Cl	Pa	Ir	Sr
	65	J	Vn	Ca, Cl	Fi	Pl	Sr
		BZ	Vn			Pl	Slk
		MB					
		BZ	Vn			Ir	Sr
	60	J	Vn	Cl, Ca	Pa	Pl	S
		BZ	Vn	Ca	Sp	Ir	Sr
	35	S	Vn	Cl, Ca	Fi	Pl	S
		BZ	Vn	Cl	Sp	Pl	Sr
	25	J	Vn	Ca, Cl carb.	Pa	Pl	S
		BZ	Vn	Ca, Cl	Pa	Pl/Ir	Sr
	55	J	Vn	Ca, Cl carb.	Fi	Pl	S
		BZ	Vn	Ca	Pa	Ir	Sr
	25	J	Vn	Cl, Ca	Fi	Pl	Sr
		BZ	Vn	Ca	Fi	Ir	Sr
	55	J	Vn	Ca, Cl	Pa	Pl	S
	40	J	Vn	Cl, Ca	Pa	Pl	S
	40	Sz	Vn	Cl, Ca	Fi	Ir	S
	50	S	Vn	Cl, Ca	Fi	Pl	S
		J	Vn	Ca	Pa	Pl	Sr
	30	MB	Vn	Ca, Si	Sp	Pl	Sr
		J	Vn	Ca, Cl carb.	Fi	Pl	Sr
		Fz					
	45	J	Vn	Ca, Cl carb.	Fi	Pl	Sr
		MB					
	20	J	Vn	Cl	Pa	Wa	Sr
	15	J	Vn	Cl, Ca	Pa	Pl	S
		Fz	Vn	Ca, Cl carb.	Fi	Ir	R
	40	J	Vn	Cl carb.	Fi	Pl	S
	30	J	Vn	Ca	Pa	Pl	Sr
		BZ	Vn	Cl carb.	Pa	Ir	Sr/R
	25	J	Vn	Cl carb.	Pa	Pl	S
	15	J	Vn	Cl carb.	Pa	Pl	S
	60	J	Vn	Cl carb.	Fi	Wa/Pl	S
		BZ	Vn	Cl carb.	Pa	Ir	Sr
		BZ	Vn	Ca	Pa	Pl	Sr
	90	J	T	No	No	Pl	Sr
		MB					
		MB					
	55	J	Vn	Cl carb.	Pa	Pl	Sr
	25	J	Vn	Cl carb.	Pa	Pl	Sr
		J	Vn	Cl carb.	Fi	Ir	Sr
	65	J	Vn	No		Pl	Sr
	50	J	Vn	Cl carb.	Sp	Pl	Sr
	40	J	Vn	Cl carb.	Sp	Pl	Sr
	35	J	Vn	Cl carb.	Sp	Wa	R

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 10 of 18**
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							LIMESTONE with chert, continued					55	J	Vn	Cl carb.	Fi	Pl	Sr	
												45	J	Vn	No		Pl	Sr	
			49/8	W1-W2	R4-R5			100	29.6	2									
													MB						
													MB						
													MB						
												55	J	Vn	Cl carb., H	Fi	Ir	R	
										8			BZ	Vn	Ca	Pa	Ir	Sr	
												30	S	Vn	Cl, H	Pa	W	Sr	
	92																		
												30	J	Vn	Ca	Pa	Pl	S	
							stylolites, ~30 degrees to core axis, preferentially breaks along stylolites			6		50	Fz	Vn	Ca	Pa	Ir	S	
													J	Vn	Ca	Sp	Pl	S	
												35	J	Vn	Cl, Ca	Pa	Pl	Sr	
												80	J	Vn	No	No	Pl	S	
		15	50/9	W1-W2	R4-R5			100	47	6			BZ	Vn	No	No	Ir	S	
												45	V	T	Ca, H	Fi	Pl	S	
												40	J	Vn	Cl carb.	Fi	Pl	Sr	
												80	J	Vn	No	No	Pl	S	
	94												BZ	Vn	Cl carb.	Sp	Pl	S	
										8									
												25	S	Vn	Cl carb., H	Sp	Ir	R	
										3		30	F	Vn	Cl, Ca carb.	Fi	Pl	S	
													V	Vn	Ca	Fi	Ir		
	96																		
										2		65	V/J	Vn	Ca	Fi	Pl	Sr	
												65	J	T			Pl	S	
												20	MB J	Vn	Cl carb.	Fi	Pl	Sr	
				W1-W2	R4-R5					7		30	J	Vn	Ca, Cl	Pa	Pl	S	
												30	J	Vn	Ca, Cl	Pa	Pl	S	
													Fz	Vn	Ca, Cl	Sp	Ir	S	
	98	15	51/9					80	30			20	MB J	Vn	Ca	Sp	Pl	Sr	
													BZ	Vn	Ca, Cl	Sp	Ir	S	
										6		40	J	Vn	Ca, Cl	Fi	Pl	S	
												40	J	Vn	Ca, Cl	Fi	Pl	Sr	
												50	J	Vn	Ca	Sp	Pl	S	
							99-101' brecciated with clay infilling, iron oxidation along discontinuities					65	J	Vn	Ca	Sp	Pl	S	
													Fz	Vn	Cl	Pa	Ir	Sr	
				W2	R2					>10		~40	BZ	Vn	Cl, Fe Ox	Fi	Ir	Sr	
													BZ	Vn	Cl, Ca, Fe	Pa	Ir	Sr	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %	Comments
(to ~101)		51/9			80	30	
~101–105.6	20	52/10	W1	R4	100	68.9	
~105.6–(bottom)	15	53/10	W1	R4	100	48.9	105.5-106.1' Retained for analysis

Depth marks: 102, 104, 106, 108

Description: LIMESTONE with chert, dark bluish-gray to medium bluish-gray, fine grained, fresh, strong, hard, deformed, some bedding visible, ~30 degrees to core axis, stylolites, carbonaceous, calcite veining throughout

Fractures per ft. (top to bottom): >10, 6, 9, 1, 4, 0, 10, 7, 1, 6

Discontinuities

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	Fz	Vn	Cl, Ca	Pa	Ir	Sr
70	J	Vn	Ca	Pa	Pl	Sr
40	J	Vn	Ca, Cl carb.	Pa	Pl	S
25	BZ	Vn	Ca, Cl	Pa	Pl	Sr
70	J	Vn	Cl	Pa	Pl	S
75	J	Vn	Cl	Sp	Pl	S
30	J	Vn	Cl, Ca	Sp	Pl	S
70	J	Vn	Cl	Sp	Pl	Sr
45	J	Vn	Cl	Sp	Pl	Sr
40	J	Vn	Cl carb.	Pa	Pl	Sr
55	J	Vn	Cl carb.	Pa	Pl	Sr
50	J	Vn	Ca	Pa	Pl	S
35	S	Vn	Ca, Cl carb.	Fi	Pl	S
70	J	Vn	Ca, Cl	Fi	Pl	Sr
25	J	Vn	Cl	Pa	Ir	Sr
	MB					
	MB					
	MB					
	BZ	Vn	Ca	Pa	Ir	Sr
45	J	Vn	Cl carb.	Pa	Pl	R
	BZ	Vn	Ca	Pa	Ir	Sr
70	J	Vn	Ca	Pa	Pl	Sr
40	J	Vn	Cl	Pa	Pl	R
55	J	Vn	Ca	Pa	Pl	Sr
35	J	Vn	Ca	Pa	Pl	Sr
75	J	Vn	Cl	Pa	Pl	Sr
70	J	Vn	Ca, Cl	Fi	Pl	Sr
20	J	Vn	Ca, Cl	Pa	Pl	Sr
60	J	Vn	Ca	Fi	Pl	Sr
55	J	Vn	Ca, Cl	Pa	Pl	R
70	J	Vn	Ca, Cl	Fi	Pl	S
60	BZ	Vn	Cl	Su	Ir	Sr
40	J	Vn	Ca, Cl	Fi	Pl	Sr
35	J	Vn	Ca	Pa	Pl	R

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-2

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	Total Depth: 171.0 feet
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	Groundwater Data: ft bgs,
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Comments
		53/10	W1	R4	LIMESTONE with chert, continued	100	48.9	
		54/10				100	32.5	
112	20	54/11	W1	R4-R5, R2, R4		100	32.5	
114–116	25	55/11	W1	R4-R5		100	38	
118	5	56/11	W1	R4-R5		100	55.6	119.3-120.1' Retained for analysis

Fractures per ft.: 5, 8, >10, 10, >10, 0, 1, 7, 5, 2

Discontinuities

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
40	J	Vn	Cl carb.	Fi	Pl/Wa	Sr
	BZ	Vn	Cl	Su	Ir	Sr
60	J	Vn	Cl	Su	Pl	Sr
45	J	Vn	Ca, Cl	Pa	Pl	Sr
65	J	T	Ca	Su	Pl	Sr
25	J	Vn			Pl	Sr
40	J	Vn	Ca	Su	Pl	S
55	J	Vn	Cl carb.	Fi	Pl	S
30	J	Vn	Ca	Fi	Pl	S
45	Fz	Vn	Ca, Cl	Fi	Ir	S
	J	Vn	Ca	Su	Pl	S
60	J/S	Vn	Cl	Fi	Pl	S
55	J	Vn	Ca	Sp	Pl	Sr
35	S	Vn	Cl carb.	Fi	Pl	S
70	S	Vn	Cl carb.	Fi	Pl	S
70	S	Vn	Cl	Fi	Pl	S
30	S	Vn	Cl	Fi	Pl	S
45	J	Vn	Ca	Fi	Pl	S
	BZ	Vn	Ca	Sp	Ir	Sr
25	J	Vn	Ca	Pa	Pl	S
60	J	Vn	Cl	Fi	Pl	S
60	J	Vn	Cl	Pa	Pl	S
40	J	Vn	Cl	Fi	Ir	Sr
60	J	Vn	No	No	Pl	Sr
40	J	Vn	Cl, Sd	Pa	Ir	Sr
60	J	Vn	Cl, Sd	Pa	Pl	Sr
Var	J	Vn	No	No	Ir	Sr
75	J	Vn	Ca	Pa	Ir	Sr
55	J	Vn	Cl, Ca	Fi	Pl	R
55	J	Vn	Cl	Pa	Pl	Sr
55	J	Vn	Cl	Pa	Pl	Sr
30	J	Vn	Cl	Pa	Pl	Sr
35	J	Vn	Cl	Pa	Pl	Sr
60	J	Vn	Ca	Su	Pl	Sr
50	J	Vn	graph.	Su	Wa	Slk
55	J	Vn	Cl	Fi	Pl	Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2** **Sheet No. 13 of 18**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Columns: Elevation, ft MSL | Depth, ft | Drill Time (min) | Run No./Box No. | Weathering Index | Strength Index | Graphic Log | Description | Recovery % (20 40 60 80) | RQD % (20 40 60 80) | Fractures per ft. | Discontinuities (Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness) | Comments

Depth markers: 122, 124, 126, 128

Description:
LIMESTONE with chert, continued
black carbonaceous bed, ~1-inch thick
black carbonaceous layer, ~1-inch thick

Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
5	56/12	W1	R4	100	55.6
110	57/12	W1	R4	100	54
15	58/12	W1	R4	100	70
	58/13			100	70

Fractures per ft.: 3, 4, 1, 5, 6, 3, 1, 3, 0, 2

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
60	J	Vn	Cl carb.	Fi	Pl	Sr
45	J	Vn	Cl, Ca	Fi	Pl	Sr
55	J	Vn	No	No	Pl	Sr
50	BZ	Vn	Ca	Pa	Ir	Sr/Slk
55	J	Vn	Cl	Pa	Pl	Sr
50	B	T			Pl	S
40	S	Vn	Cl, Ca carb.	Fi	Pl	S
55	J	Vn	Cl, Ca	Fi	Pl	S
60	J	Vn	Cl, Ca	Pa	Wa	Sr
	BZ	Vn	Cl	Pa	Ir	R
55	J	Vn	Cl, Sd	Pa	Pl	Sr
60	J	Vn	Cl	Pa	Pl	Sr
40	J/B	Vn	Cl, Ca	Fi	Pl	S
40	J	Vn	Cl, Ca	Fi	Pl	S
70	J	Vn	Cl, Ca	Pa	Pl	Sr
40	J	Vn	Cl	Fi	Pl	S
40	J	Vn	Cl	Pa	Pl	R
50	J	Vn	Cl, Ca	Fi	Pl	S
50	J	Vn	Cl carb.	Fi	Pl	S
40	J	Vn	Cl	Pa	Wa	R
75	J	Vn	Cl	Pa	Pl	Sr
60	J	Vn	Cl	Pa	Pl	Sr
40	J	Vn	Cl, Ca	Pa	Pl	Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2**
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	**Sheet No. 14 of 18**
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Description: LIMESTONE with chert, continued

Depth, ft marks: 132, 134, 136, 138

Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
	58/13	W1	R4	100	70
25	59/13	W1	R4, R2	100	48.9
50	60/13	W1	R4	100	48.1
40	61/14	W1	R4	100	33.3

Fractures per ft. (top to bottom): 0, 1, 3, >10, 9, >10, 10, 5, 8, 9

Discontinuities

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	MB					
35	J	Vn	Cl carb.	Su	Pl	Sr
75	J	Vn	Ca	Su	Pl	R
75	J	T	No	No	Pl	Sr
50	J	Vn	Carb, graph?	Su	Pl	Slk
40	J	Vn	Cl, Sd	Fi	Pl	Sr
	BZ	Vn	No	No	Ir	S
30	J	Vn	Ca	Su	Pl	S
25	J	Vn	Ca	Su	Pl	S
15	J	Vn	Ca	Su	Pl	S
60	J	Vn	Cl, Ca	Fi	Pl	Sr
80	J	Vn	Ca	Pa	Pl	Sr
70	J	Vn	Cl, Ca	Pa	Pl	Sr
35	J	Vn	Cl	Fi	Pl	S
	Fz	Vn	Ca, Cl	Pa	Ir	Sr
0	J	Vn	Ca	Pa	Pl	S
55	J	Vn	Ca	Pa	Pl	S
60	J	Vn	Ca	Pa	Pl	S
70	J	Vn	Ca	Pa	Pl	S
50	J	T	Ca, Cl	Pa	Pl	Sr
	Fz/J	Vn			Ir	Sr
25	J	Vn	Cl	Pa	Pl	Sr
75	J	Vn	Ca	Pa	Pl	Sr
25	J	Vn	Cl	Fi	Pl	Sr
50	S	Vn	Cl, Ca	Fi	Pl	S
20	J	Vn	Cl	Pa	Pl	Sr
	BZ	Vn	Ca	Pa	Pl	S
	MB BZ	Vn	Ca	Fi	Ir	R
45	J	Vn	Ca	Pa	Pl	Sr
30	J	Vn	Cl	Pa	Pl	Slk
40	J	Vn	Cl	Pa	Pl	S
	Fz	Vn	Cl carb.	Fi	Ir	R
45	J	Vn	Cl	Fi	Pl	S

Comments: Cleaned out muck tank tightened bolts on gearbox (due to vibration)

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	**CORE LOG GT-1-2018-2** Sheet No. 15 of 18	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core		
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ		
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet	
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt		

Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
		61/14	W1-W2	R4-R5	LIMESTONE with chert, continued	100	33.3	5	10	V	Vn	Ca, H	Fi	Pl	S	
									30	S	Vn	Cl	Fi	Pl	S	
										Fz	Vn	Cl	Fi	Ir	S	
										MB						
			W4	R1	carbonaceous vein, ~1-inch thick, 40 degrees to core axis											
		62/14	W1-W2	R4-R5		92.5	35	1	42	V	Vn	Ca debris, H	Fi	Pl	S	
										MB						
142								6	50	J	Vn	Cl, Ca	Pa	Pl	S	
										Fz	Vn	Cl, Ca	Pa	Ir	Sr	
										MB						
										MB						
	15							9	30	MB						
										Fz	Vn	Cl, Ca	Pa	Ir	Sr	
										J	Vn	Cl, Ca	Pa	Ir	Sr	
144								0		MB						
		63/14	W1	R5		98	72	7	45	J	Vn	Ca	Su	Pl	S	
										BZ	Vn	Ca	Su	Ir	Sr	
146	30							2	50	J	Vn	Ca	Su	Pl	S	
									30	S	Vn	Cl, Ca	Fi	Pl	S	
								1		MB						
									30	B	T			Pl	S	
148		63/15		R5-R6		98	72	0								
									30	V	T	Ca, H	Fi	Pl	S	
								4	17	J	Vn	Ca	Su	Pl	S	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	# CORE LOG GT-1-2018-2
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	Sheet No. 16 of 18
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Description: LIMESTONE with chert, continued

breaks preferentially along bedding, ~40 degrees to core axis

Depth markers, ft: 152, 154, 156, 158

Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %	Fractures per ft.
15	64/15	W1	R4-R5	100	100	0
20	65/15	W1	R4-R5	100	72	5, 4, 2, 2, 2
16	66/15	W1	R4-R5	100	57.1	4
14	67/16	W1	R4-R5	100	53.4	1, 3, >10

Discontinuities

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
		MB						
		MB						
		BZ	T			Ir	Sr	
	60	J	T			Pl	R	151.3-151.9' Retained for analysis
	40	J	Vn	Cl carb.	Fi	Pl	Sr	
	55	J	Vn	Cl, Ca	Fi	Pl	S	
	90	J	Vn	Ca	Pa	Pl	Sr	
	50	J	Vn	Cl	Su	Ir	R	
	40	J (B)	Vn	Cl	Pa	Pl	Sr	
	40	B	Vn	Ca	Pa	Pl	S	
	40	B	Vn	Ca	Pa	Pl	S	
	40	B	Vn	Ca, Cl	Pa	Pl	Sr	
	40	J	Vn	Cl	Fi	Pl	S	
		BZ	Vn	Ca, Cl	Pa	Ir	S	155.8-156.7' Retained for analysis
	40	J (B)	Vn	Cl	Su	Pl	S	
	30	V	Vn	Ca, Cl	Fi, Su	Pl	S	
	40	J	Vn	Cl	Su	Pl	S	
	30	J	Vn	Cl	Su	Pl	S	
	40	B	T	Ca	Su	Pl	S	
		BZ	Vn	Cl, Ca	Su	Pl	Sr	
	35	J	Vn	Cl	Su	Wa	R	
	40	B	T			Pl	S	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-2

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade		
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core		
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ		
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet	
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,	
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt		

Description: LIMESTONE with chert, continued

Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
		67/16	W1	R4-R5	100	53.4	2	40	B	T			Pl	S
								15	J	Vn	Ca	Pa	Wa	Sr
	21	68/16	W1	R4-R5	71	38.7	1	45	B	T			Pl	S
162			W4-W5	R1-R2			7	40	J	Vn	No	No	Pl	S
								40	J	Vn	Cl	Sp	Pl	Sr
									Fz	Vn	Cl, Sd	Fi	Ir	Sr
							>10	40	B	Vn	Cl	Fi	Pl	S
164	12	69/16	W4-W5	R2-R3	82.8	13.8	>10		Fz	Vn	Cl, Sd	Fi	Ir	Sr
								20	J	Vn	Ca	Fi	Pl	Sr
								30	J	Vn	No	No	Wa	Sr
								0	J	Vn	Ca	Fi	Pl	Sr
			W1	R3-R4			8							
166							>10	35	J	Vn	Cl	Fi	Pl	S
								40	J	Vn	Cl	Fi	Pl	S
	22	70/17	W1	R4	100	70	1							
168			W1				2	35	J	Vn	Ca	Pa	Pl	Sr
								55	J	Vn	Ca	Su	Pl	Sr
							7	55	J	Vn	Cl, Ca	Su	Ir	Sr
									Fz	Vn	Ca, Cl	Fi	Pl	Sr
								10	J	T	Ca	Su	Pl	Sr
								30	J	Vn			Pl	Sr
								35	J	Vn	Ca	Su	Wa	Sr

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT-1-2018-2

Sheet No. 18 of 18

Date Start: 10/10/18 End: 10/19/18	Drilling Co.: Cascade	
Location: Cupertino, California	Drill Rig: LF70 / Drilling Method: Core	
Northing: 1857263.987 / Easting: 592386.067	Drill Bit Type/Size: HQ	
Surface Elevation: 939 feet AMSL	Logged By: T. Clark, L. Rodriguez	Total Depth: 171.0 feet
Bottom Elevation: 881 feet AMSL	Prepared By: S. Clarke	Groundwater Data: ft bgs,
Azimuth: 271 / Inclination: -70	Checked By: J. Van Pelt	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
			70/17	W1	R4		LIMESTONE with chert, continued	100	70	8			BZ	Vn	No	No	Ir	Sr	
												40	J	T	No	No	Pl	Sr	
												40	B	T	Carb.	Su	Pl	S	Tripped casing out of boring flushed hole for down hole geophysics VWP fulled encased in grout

Total depth = 171 FT below ground surface
Vibrating wire piezometer installed 10/21/2018

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-1 SONIC DRILLING LOG**
Northing: 6091710.708 / Easting: 1944343.702	Drilling Co.: Cascade	**Sheet No. 1 of 2**
Surface Elevation: 1797.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1727.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/19/18 End: 9/20/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 70.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	Chemistry C3S	Chemistry CaO (%)	Chemistry Chert	Chemistry Pyrite	Remarks
	0-2	1	Composite 0-10	Geotech 0-5		W4-W5		SILTY GRAVEL (GM), light brown to greenish-gray, dry, predominatly fine to coarse greenstone gravels in sandy silty matrix [WEATHERED BEDROCK]	8427	7.52			Pulverized from drilling
	2-4								8321	2.64			
	4-6			Geotech 5-10					8323	3.64	Waste	Waste	
	6-8								8325	3.61			
	8-10							Grades with few limestone clasts	8359	5.03			<1 ft recovery
	10-12		Composite 10-20	Geotech 10-15		W4			8261	1.04	Waste	Waste	
	12-14								8304	3.22			
	14-16			Geotech 15-20					8367	5.07	Waste	Waste	
	16-18								8325	4.11			
	18-20								8299	2.59			
	20-22		Composite 20-30	Geotech 20-25		W2-W1		METAVOLCANIC/GREENSTONE BRECCIA, light grayish-green, slightly weathered to fresh	8305	3.09	Waste	Waste	
	22-24								8316	3.16			
	24-26			Geotech 25-30					8318	3.51	Waste	Waste	
	26-28								8315	3.4			
	28-30								8319	3.62	Waste	Waste	
	30-32		Composite 30-40	Geotech 30-35					8314	3.4			
	32-34					W2-W1			8319	2.23			
	34-36			Geotech 35-40					8294	2.43	Waste	Waste	
	36-38								8318	3.34			
	38-40								8307	2.48			

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-1 SONIC DRILLING LOG**
Northing: 6091710.708 / Easting: 1944343.702	Drilling Co.: Cascade	**Sheet No. 2 of 2**
Surface Elevation: 1797.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1727.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/19/18 End: 9/20/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 70.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	Chemistry C3S	Chemistry CaO (%)	Chemistry Chert	Chemistry Pyrite	Remarks
	41							METAVOLCANIC/GREENSTONE BRECCIA, continued	8344	3.66	Waste	Waste	Evidence of calcium carbonate from veins
	42												
	43			Geotech 40-45					8316	2.74			
	44												
	45		Composite 40-50			W2-W1			8310	2.74	Waste	Waste	
	46												
	47			Geotech 45-50					8312	2.96			
	48												
	49								8337	3.19	Waste	Waste	
	50												
	51								8324	2.46			
	52			Geotech 50-55									
	53								8335	3.35			
	54												
	55	2	Composite 50-60						8320	2.1	Waste	Waste	
	56												
	57			Geotech 55-60					8335	2.33			
	58					W2-W1							
	59								8348	3.19			
	60												
	61								8332	3.7	Waste	Waste	
	62			Geotech 60-65									
	63								8333	4.82			
	64												
	65		Composite 60-70						8317	2.71	Waste	Waste	
	66												
	67			Geotech 65-70					8302	2.57			
	68					W2-W1							
	69								8320	3.03	Waste	Waste	
	70												
	71												
	72												
	73												
	74												
	75												
	76												
	77												
	78												
	79												

Total depth = 70 FT below ground surface
Backfilled with neat cement on 10/6/2018

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-2 SONIC DRILLING LOG**
Northing: 6092047.462 / Easting: 1944477.481	Drilling Co.: Cascade	**Sheet No. 1 of 6**
Surface Elevation: 1710.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1510.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/27/18 End: 10/4/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 200.0 feet	Checked By: J. Van Pelt	Azimuth: N/A / Inclination: 90

Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Description	C3S	CaO (%)	Chert	Pyrite	Remarks
0–3	1	Composite 0-10	Geotech 0-5		W3-W4	SILTY GRAVEL					
3–5						SOIL, brown, organics	8270	0.92	Waste	Waste	
5–17			Geotech 5-10			SILT and GRAVEL, light brown, moist					
		Composite 10-20	Geotech 10-15				8291	1.68	Waste	Waste	
			Geotech 15-20				8276	1.28	Waste	Waste	
17–40						METABASALT/GREENSTONE BRECCIA, grayish green, slightly weathered to fresh					Breccia pulverized by drilling
20–26		Composite 20-30	Geotech 20-25		W2		8323	2.75	Waste	Waste	
26–28			Geotech 25-30		W3		8314	2.51	Waste	Waste	
28–30					W2		8325	3.07	Waste	Waste	
30–32		Composite 30-40	Geotech 30-35								
32–36					W2		8355	3.87	Waste	Waste	
36–40			Geotech 35-40		W2-W1						

Location: Cupertino, California	Drill Rig: Sonic	S1-2018-2 SONIC DRILLING LOG
Northing: 6092047.462 / Easting: 1944477.481	Drilling Co.: Cascade	Sheet No. 2 of 6
Surface Elevation: 1710.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1510.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/27/18 End: 10/4/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 200.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	Chemistry C3S	Chemistry CaO (%)	Chemistry Chert	Chemistry Pyrite	Remarks
	40	2	Composite 40-50	Geotech 40-45		W1		METABASALT/GREENSTONE BRECCIA, continued	8368	2.23	Waste	Waste	Moist
	45			Geotech 45-50					8294	1.29	Waste	Waste	Inermittently moist
	50		Composite 50-60	Geotech 50-55					8301	2.01	Waste	Waste	
	55			Geotech 55-60					8326	2.1	Waste	Waste	
	58												Poor recovery ~ 20%
	60		Composite 60-70	Geotech 60-65					8356	5.02	Waste	Waste	
	65			Geotech 65-70					8388	4.16	Waste	Waste	
	68				X	X							
	70		Composite 70-80	Geotech 70-75		W1			8351	3.44	Waste	Waste	Poor recovery ~ 20%
	75			Geotech 75-80					8389	3.5	Waste	Waste	
	79								8329	2.86	Waste	Waste	

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-2 SONIC DRILLING LOG**
Northing: 6092047.462 / Easting: 1944477.481	Drilling Co.: Cascade	**Sheet No. 3 of 6**
Surface Elevation: 1710.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1510.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/27/18 End: 10/4/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 200.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	Chemistry C3S	CaO (%)	Chert	Pyrite	Remarks
	81–119	3	Composite 80-90	Geotech 80-85		W1		METABASALT/GREENSTONE BRECCIA, continued					
				Geotech 85-90									
			Composite 90-100	Geotech 90-95									
				Geotech 95-100									
			Composite 100-110	Geotech 100-105									
				Geotech 105-110									
			Composite 110-120	Geotech 110-115									
				Geotech 115-120									

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-2 SONIC DRILLING LOG**
Northing: 6092047.462 / Easting: 1944477.481	Drilling Co.: Cascade	**Sheet No. 4 of 6**
Surface Elevation: 1710.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1510.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/27/18 End: 10/4/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 200.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	Chemistry: C3S	Chemistry: CaO (%)	Chemistry: Chert	Chemistry: Pyrite	Remarks
	121–125	4	Composite 120-130	Geotech 120-125		W1		METABASALT/GREENSTONE BRECCIA, continued					
	125–130	4	Composite 120-130	Geotech 125-130		W1							
	130–135	4	Composite 130-140	Geotech 130-135		W1							
	135–140	4	Composite 130-140	Geotech 135-140		W1							
	140–145	4	Composite 140-150	Geotech 140-145		W1							
	145–150	4	Composite 140-150	Geotech 145-150		W1							
	150–155	4	Composite 150-160	Geotech 150-155		W1							
	155–159	4	Composite 150-160	Geotech 155-160		W1							

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-2 SONIC DRILLING LOG**
Northing: 6092047.462 / Easting: 1944477.481	Drilling Co.: Cascade	**Sheet No. 5 of 6**
Surface Elevation: 1710.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1510.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/27/18 End: 10/4/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 200.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	Chemistry: C3S	Chemistry: CaO (%)	Chemistry: Chert	Chemistry: Pyrite	Remarks
	160–200	5	Composite 160-170	Geotech 160-165		W1		METABASALT/GREENSTONE BRECCIA, continued					
				Geotech 165-170									
			Composite 170-180	Geotech 170-175									
				Geotech 175-180									
			Composite 180-190	Geotech 180-185									
				Geotech 185-190									
			Composite 190-200	Geotech 190-195									
				Geotech 195-200									

Depth scale: 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199

Location: Cupertino, California	Drill Rig: Sonic	S1-2018-2 SONIC DRILLING LOG
Northing: 6092047.462 / Easting: 1944477.481	Drilling Co.: Cascade	Sheet No. 6 of 6
Surface Elevation: 1710.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1510.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/27/18 End: 10/4/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 200.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	Chemistry: C3S	Chemistry: CaO (%)	Chemistry: Chert	Chemistry: Pyrite	Remarks
	201							**Total depth = 200 FT below ground surface** **Vibrating wire piezometer installed on 10/8/2018**					VWP fully encased in neat cement
	202												
	203												
	204												
	205												
	206												
	207												
	208												
	209												
	210												
	211												
	212												
	213												
	214												
	215												
	216												
	217												
	218												
	219												
	220												
	221												
	222												
	223												
	224												
	225												
	226												
	227												
	228												
	229												
	230												
	231												
	232												
	233												
	234												
	235												
	236												
	237												
	238												
	239												

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-3 SONIC DRILLING LOG** Sheet No. 1 of 4	
Northing: 6092273.392 / Easting: 1944649.592	Drilling Co.: Cascade		
Surface Elevation: 1654.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond		
Bottom Elevation: 1504.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: 100 ft	
Date Start: 9/23/18 End: 9/26/18	Prepared By: S. Clarke	Water Level: N/A ft	
Total Depth: 150.0 feet	Checked By: J. Van Pelt	Azimuth: N/A	Inclination: 90

Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Description	C3S	CaO (%)	Chert	Pyrite	Remarks
0-2	1	Composite 0-10	Geotech 0-5			SOIL, brown, organics	8212		Waste	Waste	
2-5						SILT and GRAVEL, light gray	8235		Waste	Waste	
5-6			Geotech 5-10			GREENSTONE boulders/pebbles, hard					
6-8						CLAY/GRAVEL zone					
8-16						SILT and CLAY, residual soil	8282	0.975	Waste	Waste	
10-16		Composite 10-20	Geotech 10-15								
16-20			Geotech 15-20		W3-W4	METAVOLCANIC/GREENSTONE BRECCIA, grayish-green to olive yellow	8359	4.66	Waste	Waste	
							8321	2.1	Waste	Waste	
20-30		Composite 20-30	Geotech 20-25		W3-W4						
			Geotech 25-30				8400	5.13	Waste	Waste	
30-40		Composite 30-40	Geotech 30-35		W1-W2	grayish-green, slightly weathered to fresh	8327	2.6	Waste	Waste	
			Geotech 35-40				8294	1.45	Waste	Waste	

S1-2018-3 SONIC DRILLING LOG
Sheet No. 2 of 4

Location: Cupertino, California	Drill Rig: Sonic		
Northing: 6092273.392 / Easting: 1944649.592	Drilling Co.: Cascade		
Surface Elevation: 1654.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond		
Bottom Elevation: 1504.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: 100 ft	
Date Start: 9/23/18 End: 9/26/18	Prepared By: S. Clarke	Water Level: N/A ft	
Total Depth: 150.0 feet	Checked By: J. Van Pelt	Azimuth: N/A	Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	C3S	CaO (%)	Chert	Pyrite	Remarks
	40-45	2	Composite 40-50	Geotech 40-45		W1-W2		METAVOLCANIC/GREENSTONE BRECCIA, continued	8313	2.66	Waste	Waste	
	45-50	2		Geotech 45-50					8372	5.62	Waste	Waste	
	50-55	2	Composite 50-60	Geotech 50-55					8313	2.54	Waste	Waste	
	55-60	2		Geotech 55-60					8332	2.33	Waste	Waste	
	60-65	2	Composite 60-70	Geotech 60-65					8301	2.04	Waste	Waste	
	65-70	2		Geotech 65-70					8301	2.33	Waste	Waste	
	66	2				W2-W3		light olive brown, iron oxide staining					
	70-75	2	Composite 70-80	Geotech 70-75					8521	12.62	Aggregate Clasts	Aggregate Clasts	
	75-80	2		Geotech 75-80					8360	4.23	Waste	Waste	

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-3 SONIC DRILLING LOG** Sheet No. 3 of 4
Northing: 6092273.392 / Easting: 1944649.592	Drilling Co.: Cascade	
Surface Elevation: 1654.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1504.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: 100 ft
Date Start: 9/23/18 End: 9/26/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 150.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Depth, ft	Tray #	Assay Sample	Geotech Sample	Weathering	Description	C3S	CaO (%)	Chert	Pyrite	Remarks
80-85	3	Composite 80-90	Geotech 80-85	W2-W3	METAVOLCANIC/GREENSTONE BRECCIA, continued	8279	1.44	Waste	Waste	Poor recovery ~ 30% pulverized from drilling
85-90	3	Composite 80-90	Geotech 85-90	W2-W3		8251	0.268	Waste	Waste	
						8284	1.92	Waste	Waste	
90-95	3	Composite 90-100	Geotech 90-95	W2-W3						
95-100	3	Composite 90-100	Geotech 95-100	W2-W3		8240	0.01	Waste	Waste	
100-105	3	Composite 100-110	Geotech 100-105	W2-W3 / W2		8297	1.81	Waste	Waste	
105-110	3	Composite 100-110	Geotech 105-110	W2		8322	2.7	Waste	Waste	
						8322	2.76	Waste	Waste	
110-115	3	Composite 110-120	Geotech 110-115	W3		8382	4.61	Waste	Waste	Recovery <50% (111); Recovery <50% (113)
115-120	3	Composite 110-120	Geotech 115-120	W3						

S1-2018-3 SONIC DRILLING LOG
Sheet No. 4 of 4

Location: Cupertino, California	Drill Rig: Sonic	
Northing: 6092273.392 / Easting: 1944649.592	Drilling Co.: Cascade	
Surface Elevation: 1654.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1504.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: 100 ft
Date Start: 9/23/18 End: 9/26/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 150.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Depth, ft	Tray #	Assay Sample	Geotech Sample	Weathering	Description	C3S	CaO (%)	Chert	Pyrite	Remarks
120-125	4	Composite 120-130	Geotech 120-125	W2	METAVOLCANIC/GREENSTONE BRECCIA, continued	8361	4.44	Waste	Waste	
						8361	3.95	Waste	Waste	
125-130			Geotech 125-130							
130-135		Composite 130-140	Geotech 130-135			8391	4.53	Waste	Waste	
						8463	5.89	Waste	Waste	
135-140			Geotech 135-140	W1-W2 (from 136)						
140-145		Composite 140-150	Geotech 140-145			8412	4.2	Waste	Waste	
						8318	4.49	Waste	Waste	
145-150			Geotech 145-150			8438	7.45	Waste	Waste	
150					**Total depth = 150 FT below ground surface** **Vibrating wire piezometer installed on 10/9/2018**					VWP fully encased in grout

S1-2018-4 SONIC DRILLING LOG
Sheet No. 1 of 4

Location: Cupertino, California	Drill Rig: Sonic	Casing Depth: N/A ft	
Northing: 6092659.117 / Easting: 1944812.88	Drilling Co.: Cascade	Water Level: N/A ft	
Surface Elevation: 1541.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	Azimuth: N/A	Inclination: 90
Bottom Elevation: 1391.00 feet AMSL	Logged By: D. Loveday, B. Hathaway		
Date Start: 9/20/18 End: 9/22/18	Prepared By: S. Clarke		
Total Depth: 150.0 feet	Checked By: J. Van Pelt		

Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Description
0–2	1	Composite 0-10	Geotech 0-5	X	X	SOIL, brown, some organics, moist
2–4.5	1	Composite 0-10	Geotech 0-5		W5	
4.5–6	1	Composite 0-10	Geotech 0-5 / Geotech 5-10		W4	
6–7	1	Composite 0-10	Geotech 5-10		W2-W3	GREENSTONE, with limestone clasts
7–10	1	Composite 0-10	Geotech 5-10		W2-W3	LIMESTONE, gray to black, slightly to moderately weathered
10–12	1	Composite 10-20	Geotech 10-15	X	X	
12–15	1	Composite 10-20	Geotech 10-15		W2	slightly weathered
15–16	1	Composite 10-20	Geotech 15-20		W2	
16–20	1	Composite 10-20	Geotech 15-20		W3	moderately weathered with calcite veins
20–22	1	Composite 20-30	Geotech 20-25	X	X	
22–25	1	Composite 20-30	Geotech 20-25		W3	
25–28	1	Composite 20-30	Geotech 25-30		W5	METAVOLCANIC/GREENSTONE BRECCIA, highly weathered
28–30	1	Composite 20-30	Geotech 25-30		W3	grades with less weathering to moderately weathered
30–35	1	Composite 30-40	Geotech 30-35		W3	
35–40	1	Composite 30-40	Geotech 35-40		W3	

Depth, ft	C3S	CaO (%)	Chert	Pyrite	Remarks
0–2	8783	23.23	Aggregate Clasts	Aggregate Clasts	Samples pulzerized by drilling
2–4	8748	17.72			
4–6	8504	8.11	Aggregate Clasts	Aggregate Clasts	
6–8	8885	20.66			
8–10	9252	45.06	High Grade	High Grade	
10–12	9327	47.42			
12–14	9270	46.7			Poor recovery ~ 10%
14–16	9179	29.63	High Grade	High Grade	Poor recovery ~ 50%
16–18	9219	38.59			
18–20	9048	38.52			
20–22	9114	28.97	Medium Grade	Medium Grade	
22–24	9100	40.33			
24–26	8646	22.6	Aggregate Clasts	Aggregate Clasts	
26–28	8250	0.37			
28–30	8415	8.65			
30–32	8671	17.98	Aggregate Clasts	Aggregate Clasts	Poor recovery <20%
32–34	8561	15.87			
34–36	8566	10.66			
36–38	8337	2.97			
38–40	8404	5.57			

Location: Cupertino, California	Drill Rig: Sonic	**S1-2018-4 SONIC DRILLING LOG**	
Northing: 6092659.117 / Easting: 1944812.88	Drilling Co.: Cascade	**Sheet No. 2 of 4**	
Surface Elevation: 1541.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond		
Bottom Elevation: 1391.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft	
Date Start: 9/20/18 End: 9/22/18	Prepared By: S. Clarke	Water Level: N/A ft	
Total Depth: 150.0 feet	Checked By: J. Van Pelt	Azimuth: N/A	Inclination: 90

Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description
40-44	2	Composite 40-50	Geotech 40-45		W3	Breccia	METAVOLCANIC/GREENSTONE BRECCIA, continued
44-45	2	Composite 40-50	Geotech 40-45		W4	Breccia	
45-46	2	Composite 40-50	Geotech 45-50		W4	Breccia	
46-48	2	Composite 40-50	Geotech 45-50		W1-W2	Limestone	LIMESTONE, gray to gray brown, fresh to slighly weathered
48-50	2	Composite 40-50	Geotech 45-50		W1-W2	Breccia	METAVOLCANIC/GREENSTONE BRECCIA, grayish-green to brown, fresh to moderately weathered
50-55	2	Composite 50-60	Geotech 50-55		W1-W2	Breccia	
55-56	2	Composite 50-60	Geotech 55-60		W1-W2	Breccia	
56-58	2	Composite 50-60	Geotech 55-60		W2-W3	Breccia	
58-60	2	Composite 50-60	Geotech 55-60		W2	Breccia	
60-65	2	Composite 60-70	Geotech 60-65		W2	Breccia	
65-70	2	Composite 60-70	Geotech 65-70		W2	Breccia	
70-72	2	Composite 70-80	Geotech 70-75	X	X	Breccia	
72-75	2	Composite 70-80	Geotech 70-75		W2	Breccia	
75-80	2	Composite 70-80	Geotech 75-80		W2	Breccia	

Chemistry

Depth, ft	C3S	CaO (%)	Chert	Pyrite	Remarks
41	8450	9.49	Waste	Waste	
43	8417	5.63			
45	8262	0.69	Waste	Waste	
47	8286	0.84			
49	8228				
51	8170		Waste	Waste	
53	8191				
55	8187		Waste	Waste	
57	8200				
59	8215				
61	8238		Waste	Waste	
63	8332	4.85			
65	8354	4.73	Waste	Waste	
67	8276	1.25			
69	8237		Waste	Waste	
71	8205				
73	8243	0.06			
75	8240	0.01			
77	8190		Waste	Waste	
79	8199				

S1-2018-4 SONIC DRILLING LOG
Sheet No. 3 of 4

Location: Cupertino, California	Drill Rig: Sonic	
Northing: 6092659.117 / Easting: 1944812.88	Drilling Co.: Cascade	
Surface Elevation: 1541.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	
Bottom Elevation: 1391.00 feet AMSL	Logged By: D. Loveday, B. Hathaway	Casing Depth: N/A ft
Date Start: 9/20/18 End: 9/22/18	Prepared By: S. Clarke	Water Level: N/A ft
Total Depth: 150.0 feet	Checked By: J. Van Pelt	Azimuth: N/A Inclination: 90

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	C3S	CaO (%)	Chert	Pyrite	Remarks
	80-82	3	Composite 80-90	Geotech 80-85			Breccia	METAVOLCANIC/GREENSTONE BRECCIA, continued	8314	1.88			
	82-84	3	Composite 80-90	Geotech 80-85			Breccia		8339	1.73			
	84-86	3	Composite 80-90	Geotech 80-85 / Geotech 85-90		W3	Breccia		8330	2.37	Waste	Waste	
	86-88	3	Composite 80-90	Geotech 85-90		W3	Breccia		8291	0.89			
	88-90	3	Composite 80-90	Geotech 85-90		W3	Breccia		8326	2.73			Poor recovery <10%
	90-92	3	Composite 90-100	Geotech 90-95		W4	Breccia		8361	4.04	Waste	Waste	
	92-94	3	Composite 90-100	Geotech 90-95		W4	Breccia		8422	6.39			
	94-96	3	Composite 90-100	Geotech 90-95 / Geotech 95-100		W2	Breccia		8412	6.11	Waste	Waste	
	96-98	3	Composite 90-100	Geotech 95-100		W2	Breccia		8363	3.75			
	98-100	3	Composite 90-100	Geotech 95-100		W2	Breccia		8357	4.23	Waste	Waste	
	100-102	3	Composite 100-110	Geotech 100-105		W2	Breccia		8435	5.32			
	102-104	3	Composite 100-110	Geotech 100-105		W2	Breccia		8316	2.78	Waste	Waste	
	104-106	3	Composite 100-110	Geotech 100-105 / Geotech 105-110		W2 / W3	Breccia		8306	3.04			
	106-108	3	Composite 100-110	Geotech 105-110		W1-W2	Breccia		8319	3.57			
	108-110	3	Composite 100-110	Geotech 105-110		W1-W2	Breccia		8315	3.37			
	110-112	3	Composite 110-120	Geotech 110-115		W1	Breccia		8326	3.11	Waste	Waste	
	112-114	3	Composite 110-120	Geotech 110-115		W1	Breccia		8348	3.96			
	114-116	3	Composite 110-120	Geotech 110-115 / Geotech 115-120		W1	Breccia		8321	3.24	Waste	Waste	
	116-118	3	Composite 110-120	Geotech 115-120		W1	Breccia		8296	1.92			
	118-120	3	Composite 110-120	Geotech 115-120		W1	Breccia		8297	2.47			

S1-2018-4 SONIC DRILLING LOG
Sheet No. 4 of 4

Location: Cupertino, California	Drill Rig: Sonic	Casing Depth: N/A ft	
Northing: 6092659.117 / Easting: 1944812.88	Drilling Co.: Cascade	Water Level: N/A ft	
Surface Elevation: 1541.00 feet AMSL	Drill Bit Type/Size: 6-inch Diameter Diamond	Azimuth: N/A	Inclination: 90
Bottom Elevation: 1391.00 feet AMSL	Logged By: D. Loveday, B. Hathaway		
Date Start: 9/20/18 End: 9/22/18	Prepared By: S. Clarke		
Total Depth: 150.0 feet	Checked By: J. Van Pelt		

Elevation, ft MSL	Depth, ft	Tray #	Assay Sample	Geotech Sample	Strength	Weathering	Lithology/Symbol	Description	Chemistry C3S	Chemistry CaO (%)	Chemistry Chert	Chemistry Pyrite	Remarks
	120-122	4	Composite 120-130	Geotech 120-125		W1		METAVOLCANIC/GREENSTONE BRECCIA, continued	8323	3.13	Waste	Waste	
	122-124	4	Composite 120-130	Geotech 120-125		W1			8325	3.08			
	124-126	4	Composite 120-130	Geotech 120-125 / Geotech 125-130		W1			8295	2.17	Waste	Waste	
	126-128	4	Composite 120-130	Geotech 125-130		W1			8305	2.72			
	128-130	4	Composite 120-130	Geotech 125-130		W1			8321	2.46			
	130-132	4	Composite 130-140	Geotech 130-135		W1			8338	2.41	Waste	Waste	
	132-134	4	Composite 130-140	Geotech 130-135		W1			8332	3.37			
	134-136	4	Composite 130-140	Geotech 130-135 / Geotech 135-140		W1			8341	3.1	Waste	Waste	
	136-138	4	Composite 130-140	Geotech 135-140		W1			8332	3.41			
	138-140	4	Composite 130-140	Geotech 135-140		W1			8329	4.33			
	140-142	4	Composite 140-150	Geotech 140-145		W1			8284	1.55	Waste	Waste	Poor recovery <10%
	142-144	4	Composite 140-150	Geotech 140-145	X	X			8310	2.99			
	144-146	4	Composite 140-150	Geotech 140-145 / Geotech 145-150		W1			8297	2.01	Waste	Waste	
	146-148	4	Composite 140-150	Geotech 145-150		W1			8296	1.89			
	148-150	4	Composite 140-150	Geotech 145-150		W1			8338	3.63	Waste	Waste	

Total depth = 150 FT below ground surface
Backfilled with neat cement on 10/8/2018

Stantec

Photographic Log

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 1

Photo ID:
GT-1-2018-1 0-9.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
0-9.5' Interval

Photograph ID: 2

Photo ID:
GT-1-2018-1 9.5-19.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
9.5-19.5' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 3 **Photo ID:** GT-1-2018-1 19.5-29.5' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 19.5-29.5' Interval	
Photograph ID: 4 **Photo ID:** GT-1-2018-1 29.5-39.5' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 29.5-39.5' Interval	

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 5

Photo ID:
GT-1-2018-1 39.5-49.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
39.5-49.5' Interval

Photograph ID: 6

Photo ID:
GT-1-2018-1 49.5-62.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
49.5-62.5' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 7

Photo ID:
GT-1-2018-1 61-72'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
61-72' Interval

Photograph ID: 8

Photo ID:
GT-1-2018-1 72-85'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
72-85' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 9	
Photo ID: GT-1-2018-1 83.5-94.5'	
Survey Date: 10/21/2018	
Photo Location: GT-1-2018-1 (See Saw)	
Comments: 83.5-94.5' Interval	
Photograph ID: 10	
Photo ID: GT-1-2018-1 94.5-103.4'	
Survey Date: 10/21/2018	
Photo Location: GT-1-2018-1 (See Saw)	
Comments: 94.5-103.4' Interval	

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 11

Photo ID:
GT-1-2018-1 103.4-112.7'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
103.4-112.7' Interval

Photograph ID: 12

Photo ID:
GT-1-2018-1 112.7-121.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
112.7-121.5' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 13 **Photo ID:** GT-1-2018-1 121.5-130.4' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 121.5-130.4' Interval	
Photograph ID: 14 **Photo ID:** GT-1-2018-1 130.4-139.4' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 130.4-139.4' Interval	

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 15

Photo ID:
GT-1-2018-1 139.4-148.7'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
139.4-148.7' Interval

Photograph ID: 16

Photo ID:
GT-1-2018-1 148.7-157.6'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
148.7-157.6' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 17

Photo ID:
GT-1-2018-1 157.6-167.2'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
157.6-167.2' Interval

Photograph ID: 18

Photo ID:
GT-1-2018-1 167.2-176.2'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
167.2-176.2' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 19

Photo ID:
GT-1-2018-1 176.2-184.9'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
176.2-184.9' Interval

Photograph ID: 20

Photo ID:
GT-1-2018-1 184.9-194.1'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
184.9-194.1' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 21

Photo ID:
GT-1-2018-1 194.4-202.9'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
194.4-202.9' Interval

Photograph ID: 22

Photo ID:
GT-1-2018-1 202.9-212.1'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
202.9-212.1' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 23 **Photo ID:** GT-1-2018-1 212.1-221.4' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 212.1-221.4' Interval	
Photograph ID: 24 **Photo ID:** GT-1-2018-1 221.4-230.4' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 221.4-230.4' Interval	

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 25

Photo ID:
GT-1-2018-1 230.4-239.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
230.4-239.5' Interval

Photograph ID: 26

Photo ID:
GT-1-2018-1 239.5-249.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
239.5-249.5' Interval

Stantec **Photographic Log**

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 27

Photo ID:
GT-1-2018-1 249.5-257.6'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
249.5-257.6' Interval

Photograph ID: 28

Photo ID:
GT-1-2018-1 257.6-266.7'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
257.6-266.7' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 29

Photo ID:
GT-1-2018-1 266.7-274.7'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
266.7-274.7' Interval

Photograph ID: 30

Photo ID:
GT-1-2018-1 274.7-289.0'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
274.7-289.0' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 31

Photo ID:
GT-1-2018-1 289.0-292.2'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
289.0-292.2' Interval

Photograph ID: 32

Photo ID:
GT-1-2018-1 292.2-300.6'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
292.2-300.6' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 33 **Photo ID:** GT-1-2018-1 300.6-309.5' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 300.6-309.5' Interval	
Photograph ID: 34 **Photo ID:** GT-1-2018-1 309.5-317.6' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 309.5-317.6' Interval	

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 35

Photo ID:
GT-1-2018-1 317.6-326.1'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
317.6-326.1' Interval

Photograph ID: 36

Photo ID:
GT-1-2018-1 326.1-334.6'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
326.1-334.6' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 37

Photo ID:
GT-1-2018-1 334.6-343.2'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
334.6-343.2' Interval

Photograph ID: 38

Photo ID:
GT-1-2018-1 343.2-350.8'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
343.2-350.8' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 39

Photo ID:
GT-1-2018-1 350.8-359.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
350.8-359.5' Interval

Photograph ID: 40

Photo ID:
GT-1-2018-1 359.5-368.2'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
359.5-368.2' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 41

Photo ID: GT-1-2018-1 368.2-375.8'

Survey Date: 10/21/2018

Photo Location: GT-1-2018-1 (See Saw)

Comments: 368.2-375.8' Interval

Photograph ID: 42

Photo ID: GT-1-2018-1 375.8-383.0'

Survey Date: 10/21/2018

Photo Location: GT-1-2018-1 (See Saw)

Comments: 375.8-383.0' Interval

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 43

Photo ID:
GT-1-2018-1 383.0-390.7'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
383.0-390.7' Interval

Photograph ID: 44

Photo ID:
GT-1-2018-1 390.7-399.5'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
390.7-399.5' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 45

Photo ID:
GT-1-2018-1 399.5-409.1'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
399.5-409.1' Interval

Photograph ID: 46

Photo ID:
GT-1-2018-1 409.1-417.7'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
409.1-417.7' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 47 **Photo ID:** GT-1-2018-1 417.7-426.5' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 417.7-426.5' Interval	
Photograph ID: 48 **Photo ID:** GT-1-2018-1 426.5-435.4' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 426.5-435.4' Interval	

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 49 **Photo ID:** GT-1-2018-1 435.4-440.9' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 435.4-440.9' Interval	
Photograph ID: 50 **Photo ID:** GT-1-2018-1 440.9-447.8' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 440.9-447.8' Interval	

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 51 **Photo ID:** GT-1-2018-1 447.8-456.2' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 447.8-456.2' Interval	
Photograph ID: 52 **Photo ID:** GT-1-2018-1 456.2-463.4' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 456.2-463.4' Interval	

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 53 **Photo ID:** GT-1-2018-1 463.4-473.7' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 463.4-473.7' Interval	
Photograph ID: 54 **Photo ID:** GT-1-2018-1 473.7-483.0' **Survey Date:** 10/21/2018 **Photo Location:** GT-1-2018-1 (See Saw) **Comments:** 473.7-483.0' Interval	

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 55

Photo ID:
GT-1-2018-1 483.0-491.2'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
483.0-491.2' Interval

Photograph ID: 56

Photo ID:
GT-1-2018-1 491.2-500'

Survey Date:
10/21/2018

Photo Location:
GT-1-2018-1 (See Saw)

Comments:
491.2-500' Interval

Stantec

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 1

Photo ID:
GT-1-2018-2 0-16.8'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
0-16.8' Interval

Photograph ID: 2

Photo ID:
GT-1-2018-2 16.8-26'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
16.8-26' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 3

Photo ID:
GT-1-2018-2 26-37.4'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
26-37.4' Interval

Photograph ID: 4

Photo ID:
GT-1-2018-2 37.4-48.3'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
37.4-48.3' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 5 **Photo ID:** GT-1-2018-2 48.3-58' **Survey Date:** 10/20/2018 **Photo Location:** GT-1-2018-2 (See Saw) **Comments:** 48.3-58' Interval	
Photograph ID: 6 **Photo ID:** GT-1-2018-2 58-69.5' **Survey Date:** 10/20/2018 **Photo Location:** GT-1-2018-2 (See Saw) **Comments:** 58-69.5' Interval	

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 7

Photo ID:
GT-1-2018-2 69.5-80.6'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
69.5-80.6' Interval

Photograph ID: 8

Photo ID:
GT-1-2018-2 80.6-91.0'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
80.6-91.0' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 9

Photo ID:
GT-1-2018-2 91.0-101.4'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
91.0-101.4' Interval

Photograph ID: 10

Photo ID:
GT-1-2018-2 101.4-110.8'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
101.4-110.8' Interval

Stantec

Photographic Log

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 11 **Photo ID:** GT-1-2018-2 110.8-120.1' **Survey Date:** 10/20/2018 **Photo Location:** GT-1-2018-2 (See Saw) **Comments:** 110.8-120.1' Interval	
Photograph ID: 12 **Photo ID:** GT-1-2018-2 120.1-129.7' **Survey Date:** 10/20/2018 **Photo Location:** GT-1-2018-2 (See Saw) **Comments:** 120.1-129.7' Interval	

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 13	
Photo ID: GT-1-2018-2 129.7-138.6'	
Survey Date: 10/20/2018	
Photo Location: GT-1-2018-2 (See Saw)	
Comments: 129.7-138.6' Interval	
Photograph ID: 14	
Photo ID: GT-1-2018-2 138.6-148'	
Survey Date: 10/20/2018	
Photo Location: GT-1-2018-2 (See Saw)	
Comments: 138.6-148' Interval	

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

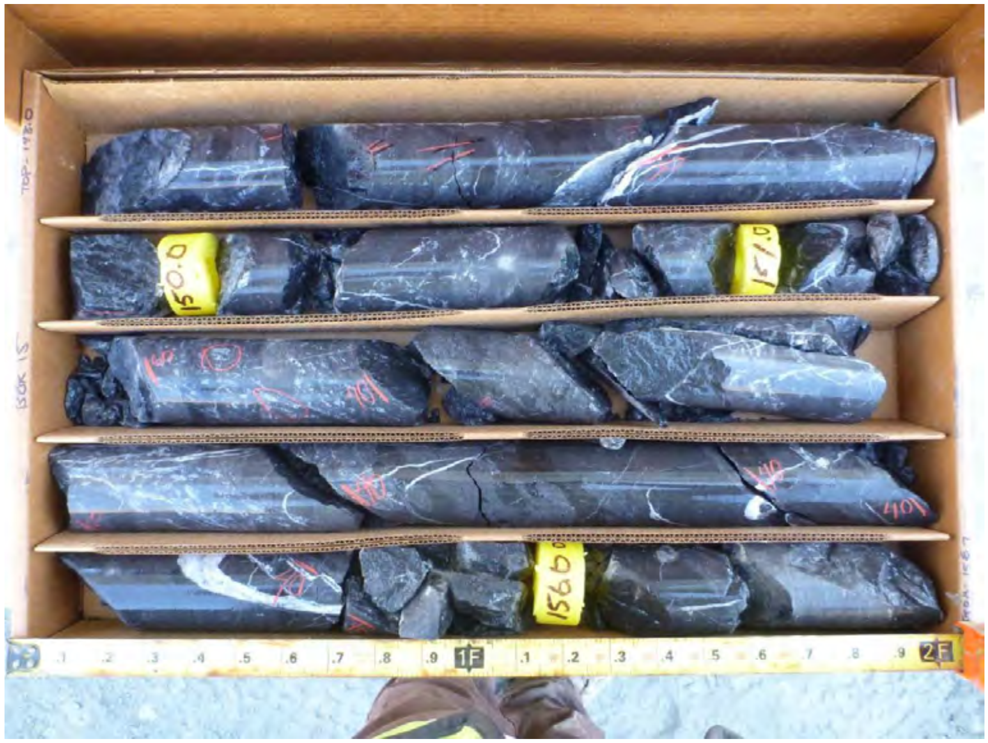
Photograph ID: 15

Photo ID:
GT-1-2018-2 148-156.7'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
148-156.7' Interval



Photograph ID: 16

Photo ID:
GT-1-2018-2 156.7-167.5'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
156.7-167.5' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 17

Photo ID:
GT-1-2018-2 167.5-171'

Survey Date:
10/20/2018

Photo Location:
GT-1-2018-2 (See Saw)

Comments:
167.5-171' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 1

Photo ID:
S-1-2018-1 0-40'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
0-40' Interval

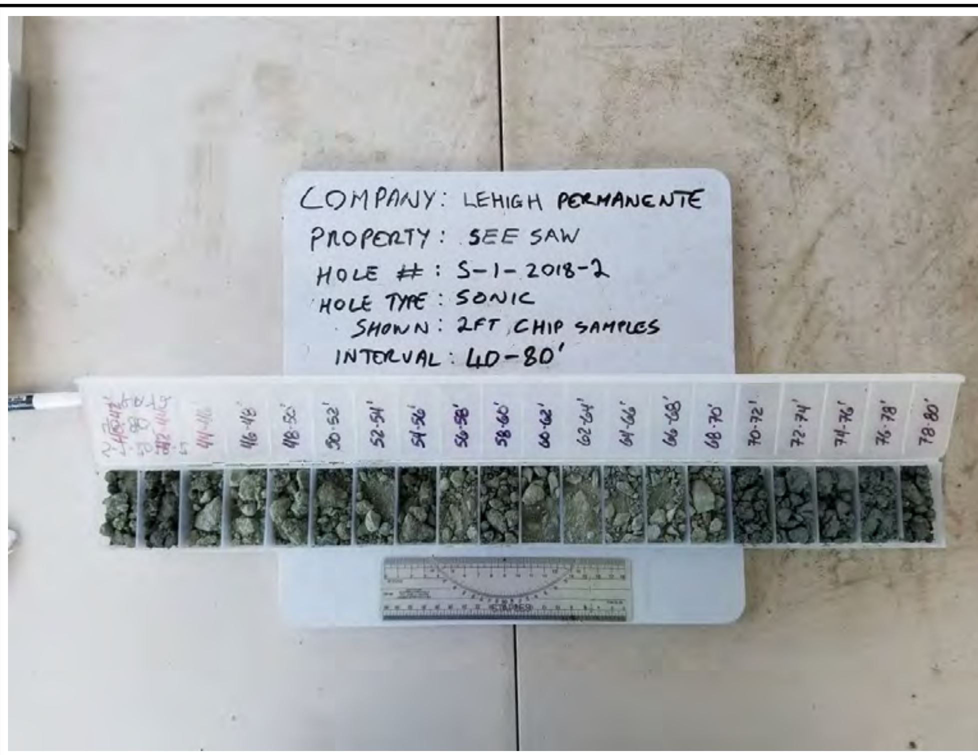
Photograph ID: 2

Photo ID:
S-1-2018-1 40-70'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
40-70' Interval



Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 1

Photo ID:
S-1-2018-1 0-10'

Date Taken:
10/3/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
0-10' Interval

Photograph ID: 2

Photo ID:
S-1-2018-1 11-20'

Date Taken:
10/3/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
11-20' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

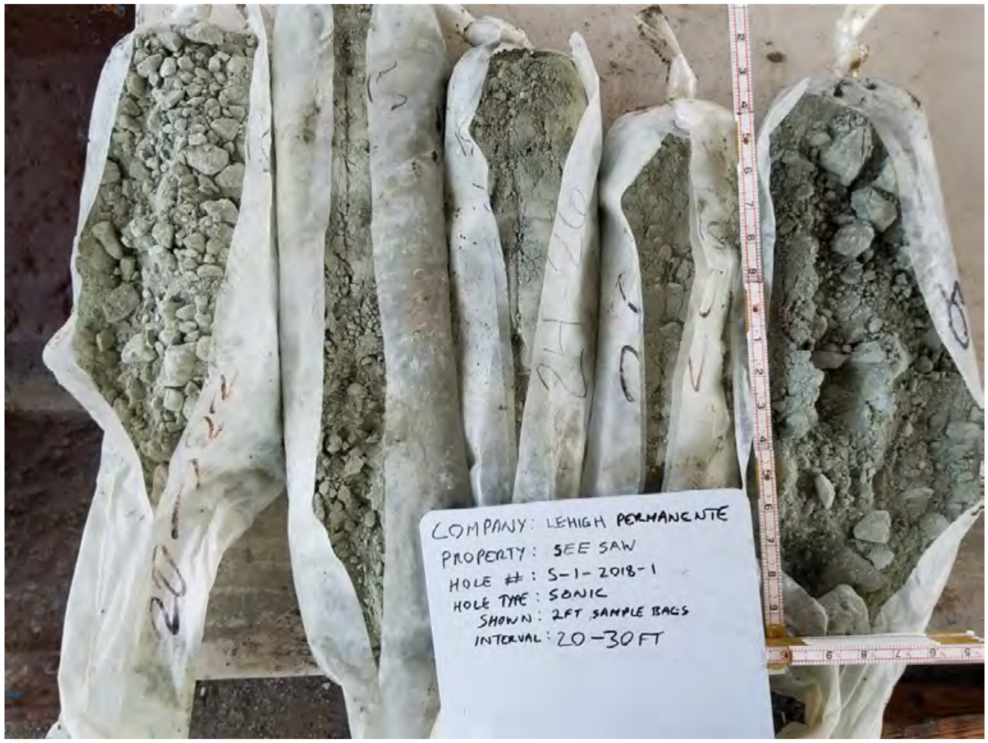
Photograph ID: 3

Photo ID:
S-1-2018-1 20-30'

Date Taken:
10/3/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
20-30' Interval



Photograph ID: 4

Photo ID:
S-1-2018-1 32-40'

Date Taken:
10/3/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
32-40' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 5

Photo ID:
S-1-2018-1 40-50'

Date Taken:
10/3/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
40-50' Interval

Photograph ID: 6

Photo ID:
S-1-2018-1 54-62'

Date Taken:
10/3/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
40-50' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 7

Photo ID:
S-1-2018-1 66-68'

Date Taken:
10/3/2018

Photo Location:
S-1-2018-1 (See Saw)

Comments:
66-68' Interval

Stantec

Photographic Log

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 1

Photo ID:
S-1-2018-2 0-40'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
0-40' Interval

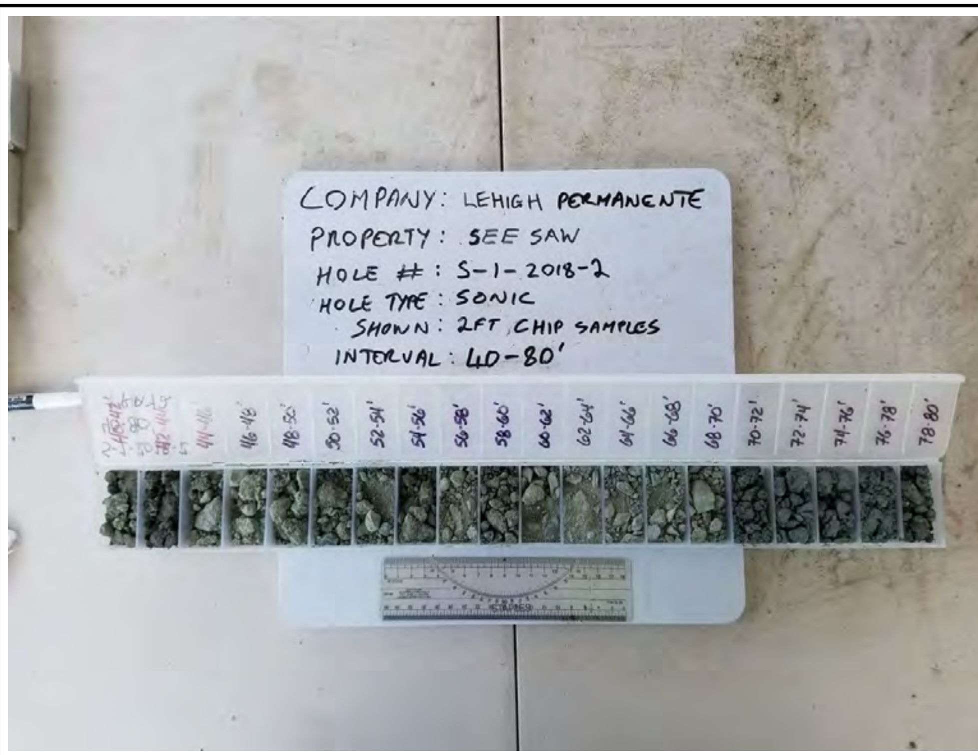
Photograph ID: 2

Photo ID:
S-1-2018-2 40-80'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
40-80' Interval



Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 1

Photo ID:
S-1-2018-2 2-10'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
2-10' Interval

Photograph ID: 2

Photo ID:
S-1-2018-2 10-18'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
10-18' Interval

Stantec

Photographic Log

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 3 **Photo ID:** S-1-2018-2 18-26' **Date Taken:** 10/4/2018 **Photo Location:** S-1-2018-2 (See Saw) **Comments:** 18-26' Interval	
Photograph ID: 4 **Photo ID:** S-1-2018-2 26-36' **Date Taken:** 10/4/2018 **Photo Location:** S-1-2018-2 (See Saw) **Comments:** 26-36' Interval	

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 5

Photo ID:
S-1-2018-2 36-40'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
36-40' Interval

Photograph ID: 6

Photo ID:
S-1-2018-2 40-48'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
40-48' Interval

Stantec **Photographic Log**

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 7

Photo ID:
S-1-2018-2 48-56'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
48-56' Interval

Photograph ID: 8

Photo ID:
S-1-2018-2 50-60'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
50-60' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 9

Photo ID:
S-1-2018-2 60-70'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
60-70' Interval

Photograph ID: 10

Photo ID:
S-1-2018-2 70-80'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
70-80' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 11

Photo ID:
S-1-2018-2 80-90'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
80-90' Interval

Photograph ID: 12

Photo ID:
S-1-2018-2 90-100'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
90-100' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 13

Photo ID:
S-1-2018-2 100-110'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
100-110' Interval

Photograph ID: 14

Photo ID:
S-1-2018-2 110-120'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
110-120' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 15

Photo ID:
S-1-2018-2 120-130'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
120-130' Interval

Photograph ID: 16

Photo ID:
S-1-2018-2 130-140'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
130-140' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 17

Photo ID:
S-1-2018-2 140-150'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
140-150' Interval

Photograph ID: 18

Photo ID:
S-1-2018-2 150-160'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
150-160' Interval

Stantec **Photographic Log**

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 19

Photo ID:
S-1-2018-2 160-170'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
160-170' Interval

Photograph ID: 20

Photo ID:
S-1-2018-2 170-180'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
170-180' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 21

Photo ID:
S-1-2018-2 194-200'

Date Taken:
10/22/2018

Photo Location:
S-1-2018-2 (See Saw)

Comments:
194-200' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 1

Photo ID:
S-1-2018-3 0-40'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
0-40' Interval

Photograph ID: 2

Photo ID:
S-1-2018-3 40-80'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
40-80' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 3

Photo ID:
S-1-2018-3 80-120'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
80-120' Interval

Photograph ID: 4

Photo ID:
S-1-2018-3 120-152'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
120-152' Interval

Stantec **Photographic Log**

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 1

Photo ID:
S-1-2018-3 0-10'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
0-10' Interval

Photograph ID: 2

Photo ID:
S-1-2018-3 16-23'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
16-23' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 3

Photo ID:
S-1-2018-3 23-34'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
23-34' Interval

Photograph ID: 4

Photo ID:
S-1-2018-3 34-50'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
34-50' Interval

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 5

Photo ID:
S-1-2018-3 50-63'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
50-63' Interval

Photograph ID: 6

Photo ID:
S-1-2018-3 63-78'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
63-78' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 7

Photo ID:
S-1-2018-3 78-90'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
78-90' Interval

Photograph ID: 8

Photo ID:
S-1-2018-3 92-100'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
92-100' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 9

Photo ID:
S-1-2018-3 100-110'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
100-110' Interval

Photograph ID: 10

Photo ID:
S-1-2018-3 111-121'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
111-121' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 11

Photo ID:
S-1-2018-3 121-132'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
121-132' Interval

Photograph ID: 12

Photo ID:
S-1-2018-3 132-142'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
132-142' Interval

Stantec

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 13

Photo ID:
S-1-2018-3 142-150'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-3 (See Saw)

Comments:
142-150' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 1

Photo ID:
S-1-2018-4 0-40'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
0-40' Interval

Photograph ID: 2

Photo ID:
S-1-2018-4 40-80'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
40-80' Interval

Stantec

Photographic Log

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 3

Photo ID:
S-1-2018-4 80-120'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
80-120' Interval

Photograph ID: 4

Photo ID:
S-1-2018-4 120-150'

Survey Date:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
120-150' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

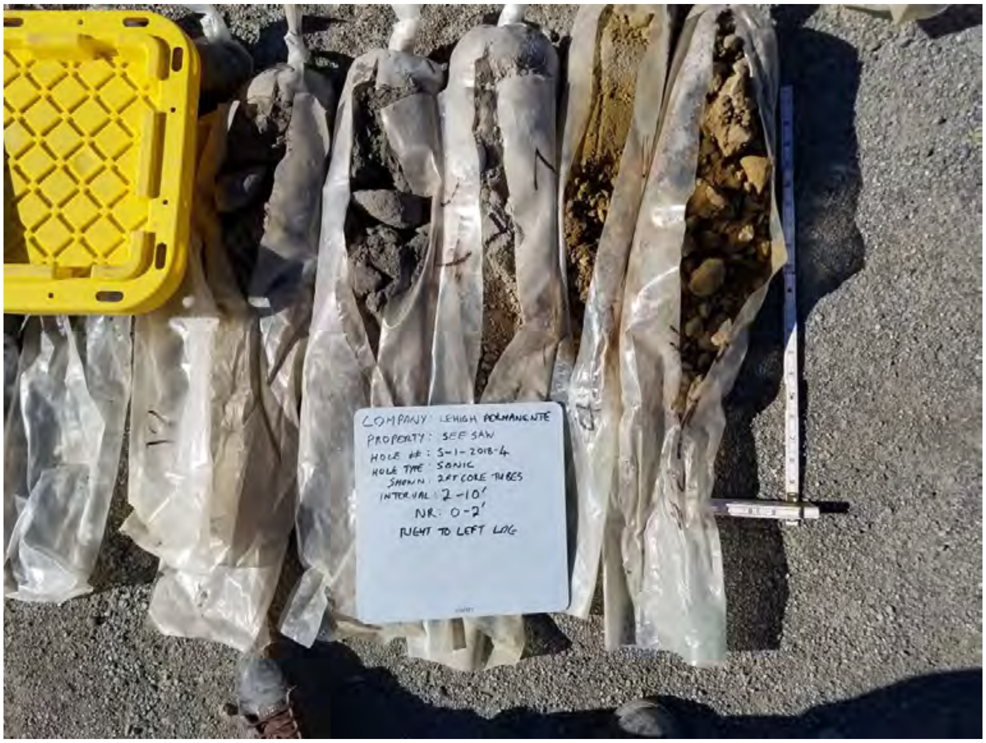
Photograph ID: 1

Photo ID:
S-1-2018-3 2-10'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
2-10' Interval



Photograph ID: 2

Photo ID:
S-1-2018-3 12-24'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
12-24' Interval

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 3

Photo ID:
S-1-2018-3 24-35'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
24-35' Interval

Photograph ID: 4

Photo ID:
S-1-2018-3 35-46'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
35-46' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 5

Photo ID:
S-1-2018-3 46-58'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
46-58' Interval

Photograph ID: 6

Photo ID:
S-1-2018-3 58-70'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
58-70' Interval

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 7

Photo ID:
S-1-2018-3 72-80'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
72-80' Interval

Photograph ID: 8

Photo ID:
S-1-2018-3 84-94'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
84-94' Interval

Stantec

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

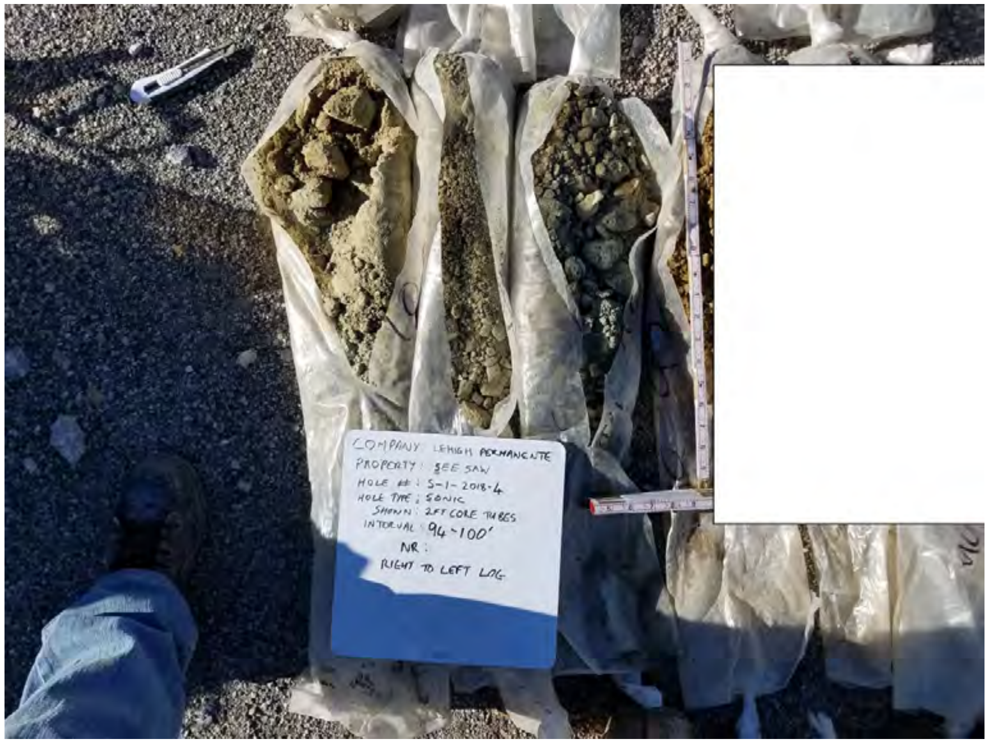
Photograph ID: 9

Photo ID:
S-1-2018-3 94-100'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
94-100' Interval



Photograph ID: 10

Photo ID:
S-1-2018-3 100-110'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
100-110' Interval

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**See Saw**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 11

Photo ID:
S-1-2018-3 110-120'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
110-120' Interval

Photograph ID: 12

Photo ID:
S-1-2018-3 120-130'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
120-130' Interval

Stantec

Photographic Log

Client:	Lehigh Hanson	Project:	Lehigh Southwest Cement
Site Name:	See Saw	Site Location:	Santa Clara County, CA

Photograph ID: 13

Photo ID:
S-1-2018-3 130-140'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
130-140' Interval

Photograph ID: 14

Photo ID:
S-1-2018-3 140-150'

Date Taken:
10/4/2018

Photo Location:
S-1-2018-4 (See Saw)

Comments:
140-150' Interval

NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

December 12, 2018

STANTEC
1340 Treat Blvd., Suite 300
Walnut Creek, CA 94597

Subject: Borehole Geophysical Logging Survey
Lehigh Quarry
Cupertino, California

NORCAL Job No: NS185080

Attention: Jennifer Van Pelt

This report presents the findings of a borehole geophysical investigation performed by NORCAL Geophysical Consultants, Inc. at Lehigh Quarry. This investigation was part of a geotechnical slope stability analyses in support of Lehigh's continued mining operations, reclamation of the North Quarry, and mitigation of the historic landslide in the North Quarry. The survey was performed during two separate mobilizations on October 6 and 7, and on October 20, 2018 by NORCAL Professional Geophysicist William J. Henrich (PGp 893). Logistical support and safety information were provided onsite by Mr. Bryan Hathaway of STANTEC.

The purpose of the geophysical logging was to delineate the distribution of in-situ fractures and provide orientations (dip direction, dip angle) of significant discontinuities.

1.0 SITE DESCRIPTION

Our work concerned geophysical logging at two borehole locations situated on pioneered roads excavated at separate elevations along the western pit area, and one location below the crest of the topographic high west to northwest of the North Quarry pit. The distribution of the geophysically logged boreholes is shown on the Location Map in Figure 1 below. Locally, this site is underlain by highly weathered to moderately weathered, weak, poorly consolidated metamorphosed volcanic rock (metavolcanic) and limestone belonging to Franciscan Formation Complex. The limestone occurs with thinly interbedded chert and shale lenses.

2.0 SCOPE

Geophysical borehole logging was conducted in a total of three boreholes labeled as GT-1-2018-1, GT-1-2018-2 and S-1-2018-2. The geophysical logging methods consisted of optical (OPTV) and acoustic (BHTV) televiewer and caliper (Borehole Diameter). The scope of work included a report detailing analysis methods and presentation of results.

Figure 1. *Location Map of Geophysically Logged Boreholes at Lehigh Quarry.*

3.0 BOREHOLE CONDITIONS

Two geotechnical exploratory boreholes labeled with the prefix "GT" were advanced with a HQ-coring method to depths ranging from 173- to 496-ft bgs. The HQ open bore diameter was approximately 4.0 inches. Inclinations of the boreholes were 70 degrees from horizontal. GT boreholes contained a shallow (30- to 50-foot deep) larger diameter (hwt. ID= 4.25 inches) steel conductor casing to prevent caving due to decomposed or highly weathered bedrock. Acoustic televiewer logging was conducted in the fluid-filled section of each borehole. Optical logging was conducted in the air-filled portion. Borehole GT-1-2018-1 was geophysically logged in five different stages. Staging means that the HQ rod (with casing shoe) was advanced to total depth then pulled back just short of an elevation in the rock formation that had in previous logging attempts, collapsed or was suspected of collapsing. This exposed the lower open rock section for geophysical logging at a reduced rock fall hazard.

Borehole S-1-2018-2 was a vertically drilled test boring advanced with a 6-inch diameter sonic drilling method to total depth of 200-ft below ground surface. Water was added to the borehole to accommodate the acoustic televiewer logging. However, water levels tended to drop rapidly, such that only the lower 80 feet of the borehole was acoustically logged. As a coincidence, the upper air-filled section was surveyed via optical (OPTV) logging. Caliper logging results indicate that the borehole diameter for most of the open borehole section was substantially greater (several inches) than the sonic drill bit thus indicating highly weathered, weak rock conditions.

4.0 GEOPHYSICAL LOGGING EQUIPMENT AND METHODOLOGY

We conducted geophysical borehole logging using a digital ***MICROLOGGER2*** System manufactured by **Robertson Geologging, Ltd.** This system consisted of the following components:

- control console,
- computer,
- motorized cable winch,
- Televiewer (acoustic and optical) probes
- 3-arm caliper probe

4.1 Televiewer

Complete descriptions of the televiewer methodology, data acquisition and data analysis procedures are presented in Appendix A.

4.2 Caliper

Caliper logs are a measure of the borehole diameter versus depth. The tool was used both as a survey technique to assess the relative consolidation of bedrock and provide depth specific borehole diameter measurements to a computer program that calculates discontinuity dip angle. The caliper tool consists of three interconnected mechanical arms that are spring loaded against the borehole wall. The horizontal deflections of the arms gauge the borehole diameter in units of inches with depth. The logging measurement was made in the up-hole direction at a speed of approximately 12-ft per minute. The data sampling rate for this instrumentation was every 0.2-ft.

5.0 RESULTS

Caliper and televiewer field logs are presented in Appendix B. The field logs show two televiewer logging runs. The purpose of the side-by-side multiple log displays is to show the consistency of the orientation (magnetic north) of common borehole features. Repeatability in orientation is an indication of the stability of the downhole compass. Using the better of the two image logs, specific interpreted log plots (Televiewer Analysis of Dips) from the televiewer logging are presented in Appendix C. Supporting numerical tables (Discontinuity Tables) that tabulate depth, dip angles, dip azimuths, aperture thickness where applicable and fracture classification are presented in Appendix D. The orientation trends with the discontinuity data can be represented as stereographic pole projections. The data manipulation and projection type are explained in the last section of Appendix A. Pole projections for each borehole are presented in Appendix E.

6.0 INTERPRETATION

6.1 Discontinuity Classifications

All discontinuities subjected to orientation analysis were classified as fractures or foliations. We subdivided or classified the fractures (synonymous with joints) based on the observable characteristics such as relative aperture width, discontinuity sinusoidal trace continuity and frequency of occurrence. Discontinuity classifications are discussed in more detail in Appendix A. However, not all visible discontinuities on the televiewer images were chosen for orientation analysis because some were either too fragmented or faint to reasonably circumscribe with an interpretative sinusoid.

6.2 Directional Discontinuity Trends

Polar projection plots (*GT* series boreholes only) presented in Appendix E show the results of contouring the distribution of poles on the projection plane. Graphically, the approximate center of the highest enclosed contours (shaded red) represent directional trends in the sampled set of interpreted discontinuities. The following Table 1 shows directional trends for each "GT" borehole based on contour intensity. The term "primary" means this population trend garnered a greater concentration of poles compared to apparent secondary trends with lower pole concentrations on the pole projection plot.

Table 1. *Directional Trends Indicated by Contouring Pole Distribution*

Borehole ID	Directional Trends (Dip Direction, Dip Angle) Primary	Directional Trends (Dip Direction, Dip Angle) Secondary	Comment
GT-1-2018-1	N060°, 35°	N247°, 72°	Weak primary and secondary fracture trends, poles to planes mostly scattered
GT-1-2018-2	N180°, 35°		Dominate attitude of foliation planes

Due to the limited amount of discontinuity features, discontinuity data from S-1-2018 was not subject to stereo graphic analysis. The paucity of discontinuity data was probably related to the highly weathered nature of the rock. Rock that is extensively deformed fails to maintain observable discrete fractures or former planar structures such as foliation.

7.0 STANDARD OF CARE

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the standard of care ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

Thank you for the opportunity to participate on this project.

Sincerely,

NORCAL Geophysical Consultants, Inc.

William J. Henrich

William J. Henrich
Professional Geophysicist PGp 893

REGISTERED GEOPHYSICIST
WILLIAM J. HENRICH
12/12/2018
No. 893
STATE OF CALIFORNIA

Donald J. Kirker

Donald J. Kirker
Professional Geophysicist PGp 997

PROFESSIONAL GEOPHYSICIST
DONALD KIRKER
No. 997
12-13-18
STATE OF CALIFORNIA

WJH/DJK/tlt
Enclosures:

Appendix A: Borehole Imaging Televiewer Surveying and Data Processing
Appendix B: Field Logs Televiewer and Caliper Survey, Boreholes GT-1-2018-1, GT-1-2018-2, S-1-2018-2
Appendix C: Interpreted Televiewer Plots, Boreholes GT-1-2018-1, GT-1-2018-2, S-1-2018-2
Appendix D: Discontinuity Tables, Boreholes GT-1-2018-1, GT-1-2018-2, S-1-2018-2
Appendix E: Polar Projections, Boreholes GT-1-2018-1, GT-1-2018-2, S-1-2018-2

NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

Appendix A:

Borehole Imaging Televiewer and Data Processing

APPENDIX A

BOREHOLE TELEVIEWER SURVEY

1.0 BOREHOLE TELEVIEWERS

1.1 METHODOLOGY

Televiewers are downhole tools that are used to produce radial images of the interior of a borehole. The images are composited sequentially using computer software to produce continuous color images. These images are like unfolded, or unwrapped, cylinders displayed on a two-dimensional surface. The "unwrapped" radial images are referenced to magnetic north by an on-board magnetic compass. In addition, an on-board three-axis magnetic inclinometer determines the inclination and azimuth of the borehole.

Televiewer images can be used to detect bedrock discontinuities (joints, fractures, bedding planes, geologic contacts, etc.) in boreholes and determine their frequency, depths and orientations. Interpretable discontinuities appear as thin sinusoidal forms that stretch across the image. Interactively fitting lines to these sinusoids provides data that computer software uses to determine the orientation and dip of the discontinuities. The midpoint or half amplitude of the sinusoid is taken as the depth of the discontinuity.

There are two types of televiewers; optical and acoustic. Optical televiewers (OPTV) use a digital optical sensor to produce radial images to a vertical resolution as fine as 0.004 feet and a radial resolution to 720 pixels. However, they can only be used in dry holes or in water filled holes with sufficient clarity to create an interpretable high resolution image. Acoustic televiewers (BHTV) require a water column to act as a medium for the transmission and reception of acoustic signals. The water does not have to be optically clear. In operation the BHTV transmits an ultrasonic signal into the borehole fluid and detects ultrasonic energy that is reflected from the borehole wall. Sidewall borehole images are created by measuring variations in the two-way travel time of the ultrasonic pulses as well as variations in the amplitude of the reflected signals.

1.2 DATA ACQUISITION

Prior to Televiewer logging we checked the correct operation of the onboard tool compass of bearing direction against the readings provided by a Brunton Compass. This procedure involves setting the probe vertically in a jig with a bar situated in the south (magnetic) direction and recording a time-drive record so that the bar forms a straight line down the center of the waterfall image. Alternately, we incline the probe (greater than 45 degrees from vertical) in an arbitrary direction and compare the bearing displayed in test mode to the bearing indicated on the Brunton compass face. Variations of 1 to 2 degrees in azimuth between the tool display and Brunton Compass bearing confirms the tools compass is operating satisfactory.

Where boreholes maintained a shallow static fluid level or in situations where we could add water continuously to bring the fluid to the tip of the conductor casing, image logging was accomplished with the acoustic method. We acquired acoustic BHTV data at a rate of approximately 1000 two-way pulses times per second. The tool was raised/lowered at a rate of 4.5-ft per minute. This resulted in a BHTV depth sample interval of 0.006 ft. Two logs were acquired in each borehole; both of these were in the up direction. This allowed us to demonstrate the tools compass stability by comparing the orientations of common features between the two logging runs.

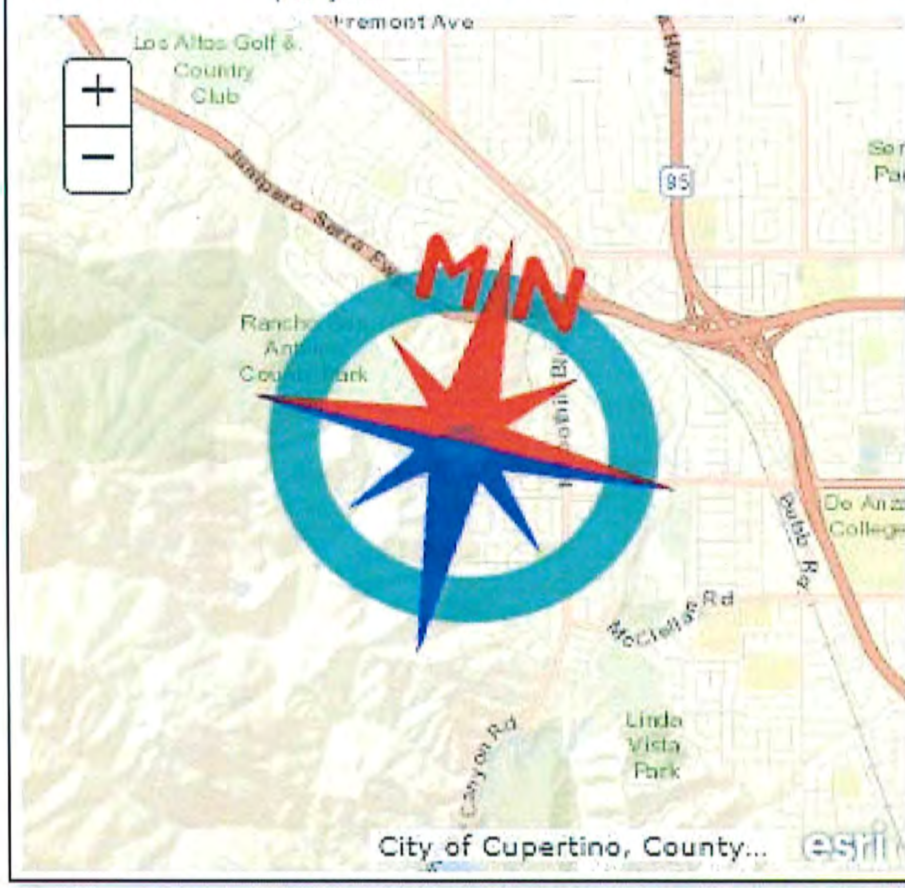
1.3 DATA ANALYSIS

We used the computer program ***WELLCAD*** (Version 5.1, ALT, and Luxemburg) to display BHTV images and to calculate the orientations of interpreted discontinuities (e.g. fractures, joints, bedding). Corrections for the magnetic declination in the survey area required adding 13.2 degrees to the magnetic compass bearings in order to orient the borehole images to true north (see Figure 1-A). Since borehole diameter is a major reduction parameter in determining dip magnitude, we input caliper log measurements. In each borehole, discontinuity analyses were performed interactively on sections of the unwrapped optical or acoustic amplitude images as viewed on a computer monitor. An interpretable discontinuity on a two-dimensional unwrapped borehole televiewer log appears as a recognizable sinusoidal trace that usually extends across the full width of the borehole image. The sinusoidal shape is a manifestation of planar discontinuities intercepting a three-dimensional cylindrical borehole. Planar discontinuities can be geologic features that include discrete fractures or joints, bedding planes and planar intrusions such as veins and geologic contacts.

Figure A-1: *Magnetic Declination Illustration from NOAA, 2018 for Lehigh Quarry Vicinity*

Declination

Model Used:	WMM2015
Latitude:	37° 19' 31" N
Longitude:	122° 4' 35" W
Date	**Declination**
2018-12-04	13° 16' E ± 0° 20' changing by 0° 6' W per year



The traces of discontinuities identified on the image logs were fitted with a bendable sinusoid overlying the trace, as shown in Figure A-2. This provided data that were used by ***WELLCAD*** to calculate a plane representing the orientation of the discontinuity in terms of dip direction and dip magnitude. This process was repeated for every significant discontinuity until the entire

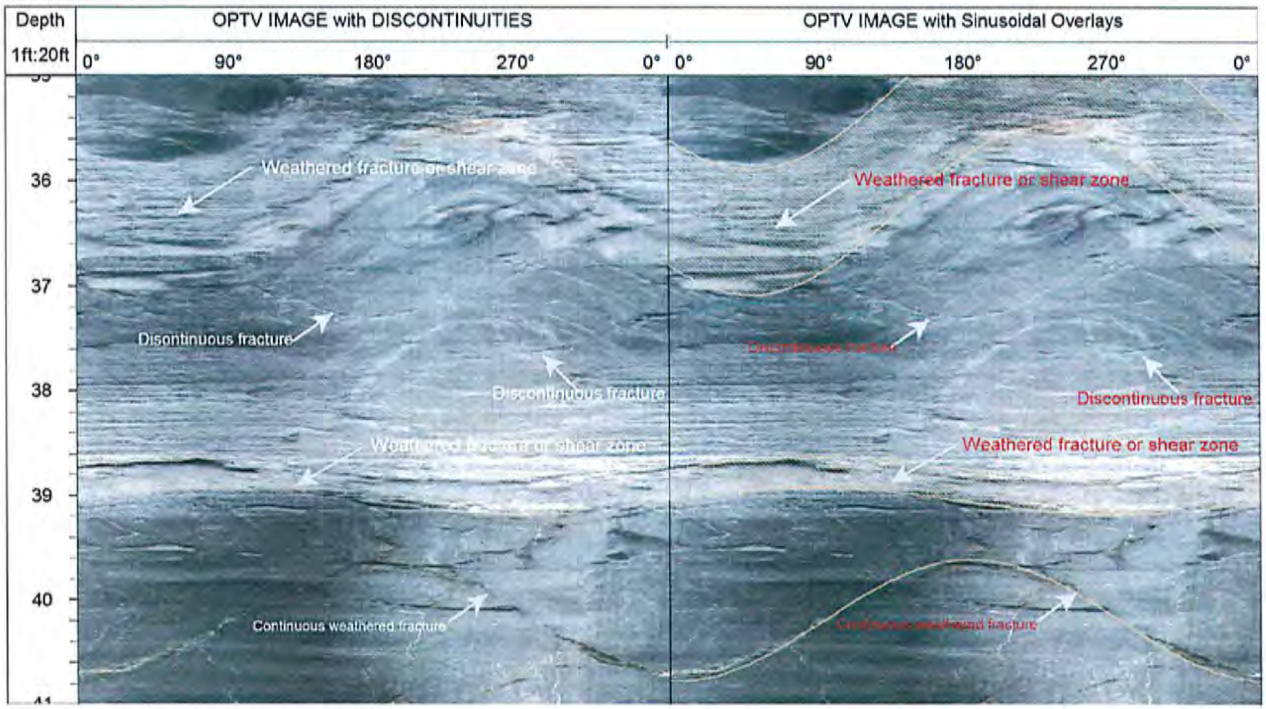


Figure A-2: *Sample OPTV section showing observable discontinuity traces left) versus the same image right) with the addition of interpreted sinusoidal overlays (brown and teal colored traces).*

borehole was interpreted. At this stage, the apparent dip direction and dip magnitude of the identified discontinuities were converted to true geographic dip azimuth and dip magnitude by factoring the borehole tilt (inclination) and azimuth at the depth of the discontinuity.

Based on observations of the core, discussions with the on-site geologist, and our own experience identifying planar features in acoustic televiewer images, we classified discontinuity features into three categories as follows:

1) "Probable Open fractures or joints". These have characteristics that are relatively wide (measureable >> 1mm) apparent apertures, continuous sinusoidal traces across the circumference of the borehole wall and show relief/breakage along the borehole wall. This relief is usually shown as diameter enlargements on the caliper log.

2) "Thin, hairline, discontinuous-irregular fractures/joints". These features have faint traces (indicative of very small apertures 1 mm or less) that are generally discontinuous or incomplete across the full 360 degrees span of the image and irregular especially if the dip angles are greater than 60 degrees.

3) "Foliation or bedding". These features appear as closely spaced, thin, sometimes wavy traces that trend in the same dip direction.

We did not tabulate (interpret) cemented or highly discontinuous or fragmented fractures.

1.4 PRESENTATIONS

Complete Field Logs showing the two complete BHTV logging runs referenced to magnetic North are presented in Appendix B. Interpreted, unwrapped televiewer plots referenced to true geographic North are presented in Appendix C. Each of these plots in Appendix C are several pages long, with header information presented at the top of the first page only. Each plot contains several columns of information described, from left to right, as follows:

COLUMN 1 – DEPTH AXIS

The depth axis indicates the relative vertical distance below the ground surface. Ground surface was set equal to zero feet. Depth values are positive and increase in the downward direction.

COLUMN 2 - TELEVIEWER IMAGE

This is an unwrapped false color (BHTV) image representing the interior of the borehole wall. On the BHTV images the relationship between color and signal amplitude is indicated by the color bar at the top of the header. Dark shades (blue) indicate relatively low amplitude and the brighter shades (yellow) indicate relatively high amplitudes. BHTV images are oriented relative to true North as indicated by the azimuth information presented in the header where North, East, South and West correspond to 0°, 90°, 180° and 270°, respectively. The diameter of the borehole is indicated by the white dashed line superimposed on the image. Solid and dashed color lines superimposed on sinusoidal fracture/joint traces depict interpreted discontinuities. The colors of the lines relate to the fracture/joint classification as follows, red = open, teal = "thin", irregular/discontinuous fractures and joints and green = foliations or bedding. Note, that due to the wide apparent thickness of some weathered fracture/joints and weathered zones, we expanded the line trace into a broader hachured sinusoidal section.

COLUMN 3 - DIPS PLOT

The Dips Plot indicates the dip of discontinuities and their direction of maximum dip. These parameters are indicated by small symbols called "tadpoles" which consist of colored circles or squares with a straight line (tail) extending from them. The position of the tadpole indicates the degree of dip, from 0° on the left to 90° on the right, according to the scale shown at the top of the column. The direction that the tail is pointing indicates the direction of dip where straight up is true north and 90° to the right indicates due east. The tadpole symbol colors relate to the three classifications of fractures and joints. A Discontinuity Legend in the sub-header related the colors to the classification. The numerical values of dip azimuth and dip angle are also presented in discontinuity tables presented at the end of this appendix.

COLUMN 4 - CORE PLOT

This plot is a graphic rendering of the OPTV/BHTV image into a 3-D core based on amplitude variations. This is basically what the image shown in Column 2 would look like if it was re-wrapped to form a cylinder where the vertical center line of the cylinder represents true north (0°), the right edge represents west (270°) and the left edge represents east (90°). South (180°) is out of view behind the core. Although the color spectrum of the core is the same as that used for the BHTV image, the core reconstruction tends to compress the amplitude spectrum into a darker range. This has the effect of making the core appear to be reddish rather than yellow. Planes drawn through the interpreted discontinuities illustrate the relative dip and dip direction of the discontinuities.

COLUMN 5 - BOREHOLE DEVIATION

This plot indicates the azimuth and tilt of the borehole. The solid blue line represents the dip direction, from 0° to 360°, according to the header scale labeled "Azimuth". The dotted green line represents the angle of the borehole from true vertical according to the header scale labeled "Tilt". This scale ranges from 0° to 4°.

1.5 DISCONTINUITY TABLES

The dip azimuth and dip angle of all interpreted discontinuities from the televiewer analysis plots (5) are tabulated in Appendix D. The tables present 5 column headers listed left to right as follows: Depth, Dip Azimuth, Dip Angle, Corrected Aperture and Discontinuity Classification. A brief description of the meaning of these terms is presented below.

Depth – relates to the center of discontinuity's sinusoid in feet below ground surface.

Dip Azimuth – dip direction of the discontinuity in degrees from true North.

Dip Angle – inclination of the plane of the discontinuity in degrees from horizontal.

Corrected Aperture – true thickness of fracture/joint corrected for dip measured in tenths of inches.

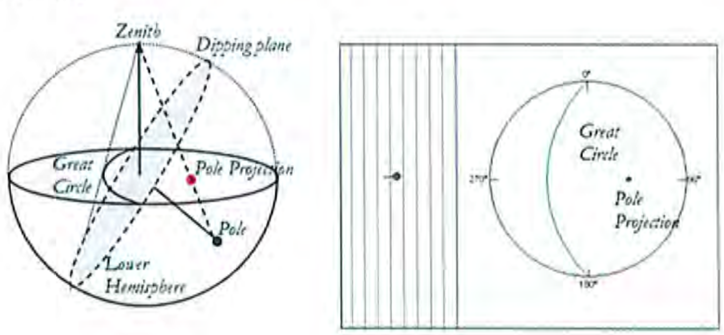
In this survey, we used this processing to indicate the true thickness of weathered/altered fractures and joints.

Discontinuity Classification – number designating classification type of fracture/joint (see Legend for explanation).

1.6 POLAR PROJECTIONS

The polar projection (stereo-nets) diagram is used to summarize the structural orientation information contained in our televiewer analysis of dips (see Dips Log). A polar projection plot displays each pair of orientation data (i.e. dip angle and dip direction) as a single point on the projection plane. Points on the projection plane are referred to as pole projections. We used the equal angle mode to populate directional data on to the projection plane. The following diagram illustrates how 3-dimensional data (e.g. dipping fracture plane) plot on an equal angle polar projection.

Equal Angle



The horizontal distance from the center of the projection plane to the pole projection represents the dip angle. The azimuth is determined by extrapolating a line from the same center through the pole projection outward until it intersects the bearing indicated on the Great Circle. Note that projection of the poles in the lower hemisphere plot in opposite direction of dip direction. Projected poles from the upper hemisphere plot in the direction of dip. The equal angle projection is used to represent high angle populations.

The purpose of the polar projection is to determine directional trends in orientation data. Trends in orientation data are represented by contouring pole density distribution on the projection plane. We used the Kamb algorithm to produce contours. The contours represent standard deviations away from the expected density of a random sample drawn from a standard distribution. Kamb's algorithm reduces the effect of sample size on contours allowing comparison of data sets with different sample sizes.

Polar projections for each dip analyzed borehole are presented in Appendix E. These plots where generated using the log computer analysis program WELLCAD, Version 5 (ALT, Luxembourg) show Dips Plots from televiewer analysis on left side and an expanded upper hemisphere polar projection on the right. All discontinuity classes are represented. A legend at the base of the projections shows the symbol classification and the associated number of poles within each class. The legend shows the average dip angle and dip azimuth for each discontinuity classification. Color shading on the projection relates to magnitude of contour values (deviations from a random sample) where the red shades indicate areas on the projection as high pole density and pale yellow shades indicate low pole density.

NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

Appendix B:

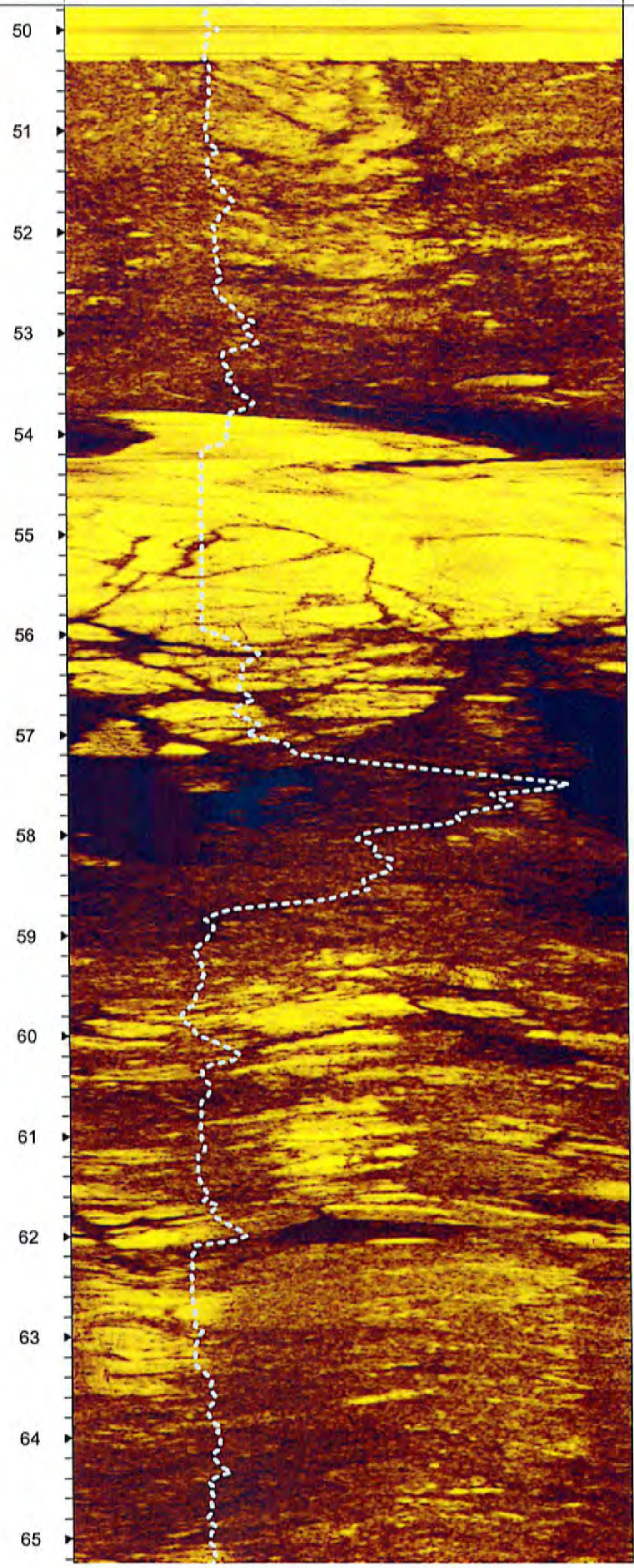
Field Logs Televiewer and Caliper

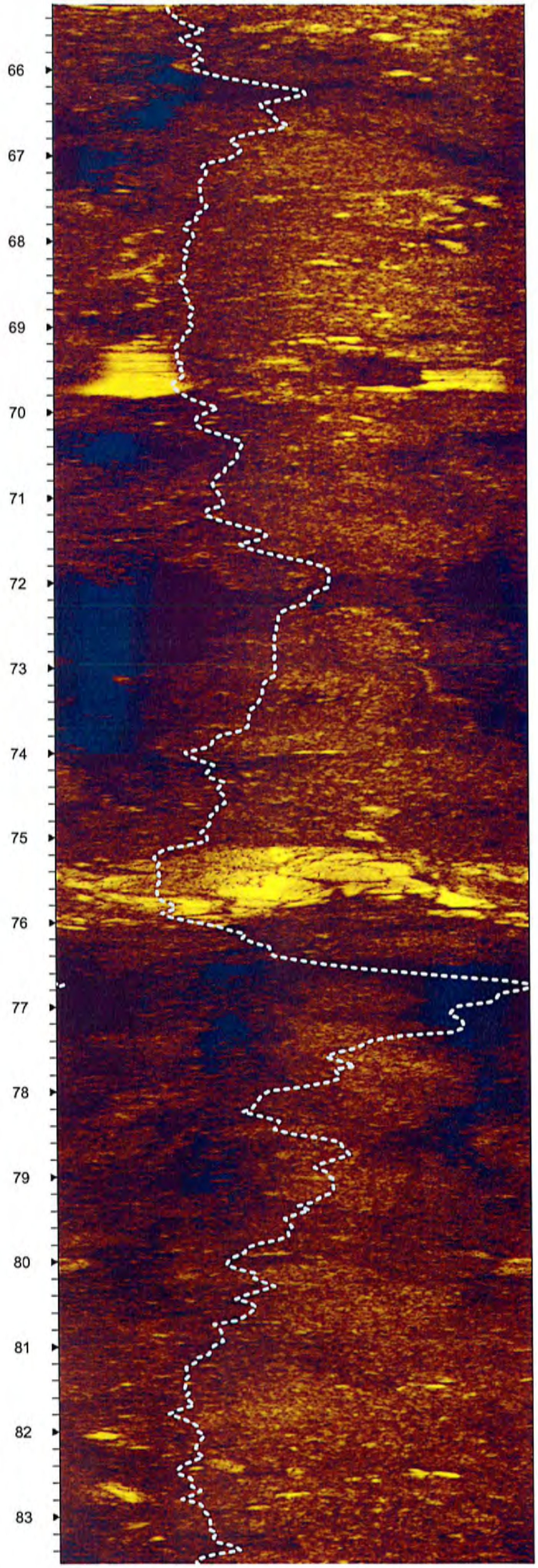
Boreholes GT-1-2018-1, GT-1-2018-2, S-1-2018-2

NORCAL GEOPHYSICAL CONSULTANTS INC. A Terracon COMPANY	ACOUSTIC TELEVIEWER AND CALIPER LOGS (MERGED)	COMPANY: STANTEC WELL ID: GT-1-2018-1 FIELD: LEHIGH QUARRY COUNTY: SANTA CLARA	DATE: Oct. 6 & 7, 2018 CASING: Hwt to 50.3-ft bgs JOB NO. NS185080 STATE: CA

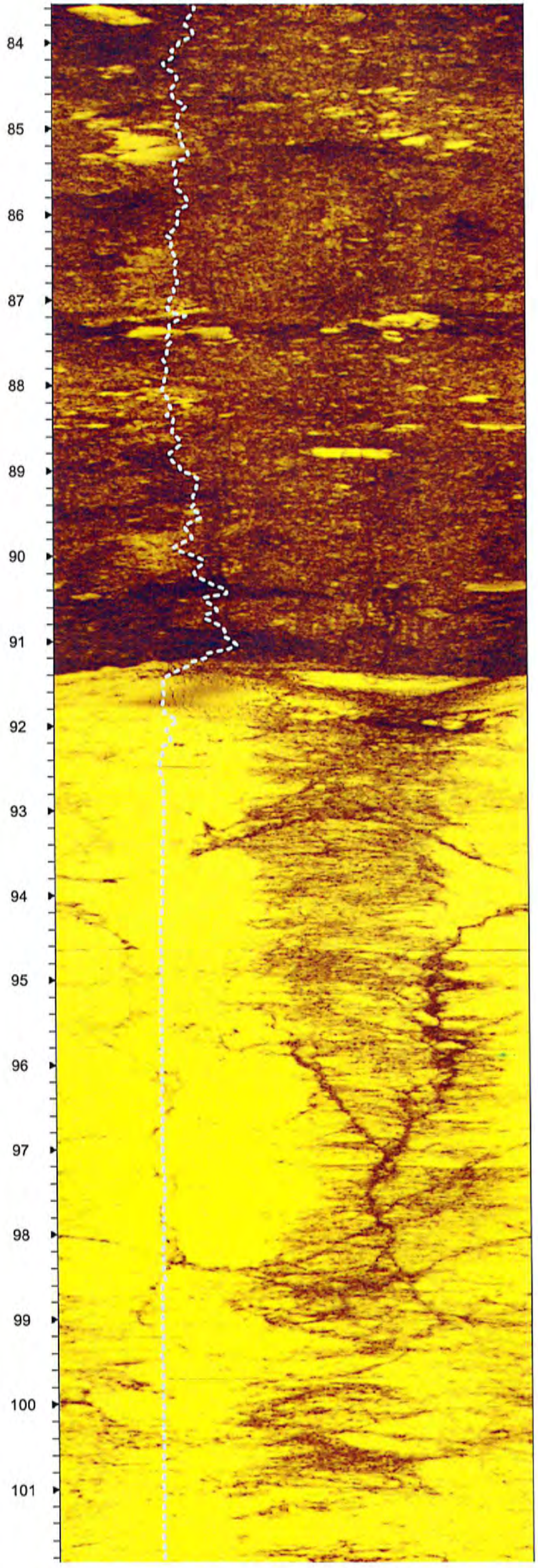
NOTES: **Images referenced to magnetic north**

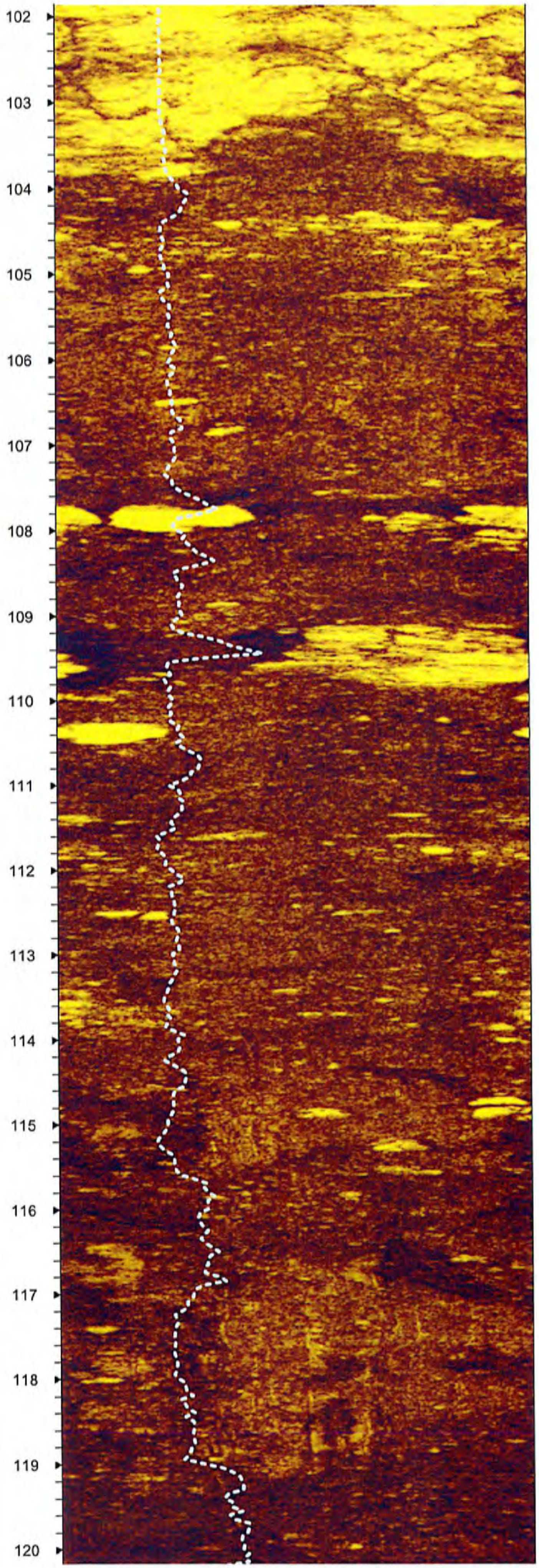
Depth 1ft:20ft	BHTV Amplitude MERGE-1-3-6-7 0° 90° 180° 270° 0° CALIPER-3-4-5 3 Inch 8	BHTV Amplitude R-4 0° 90° 180° 270° 0°

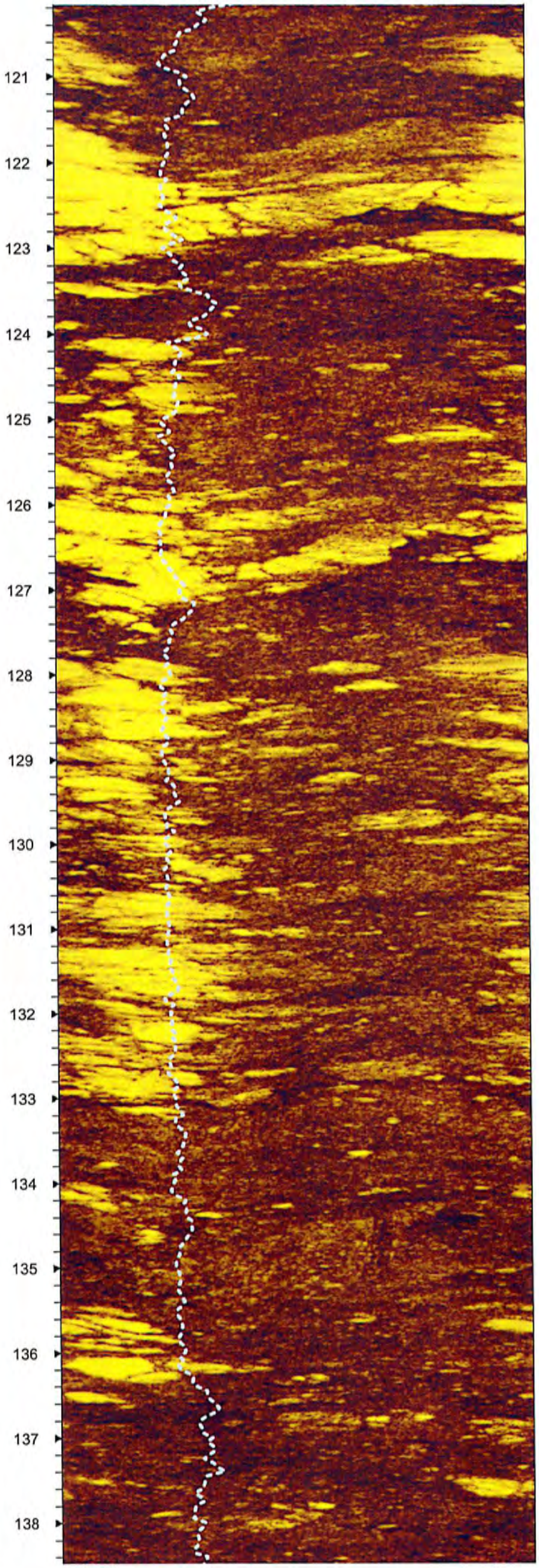


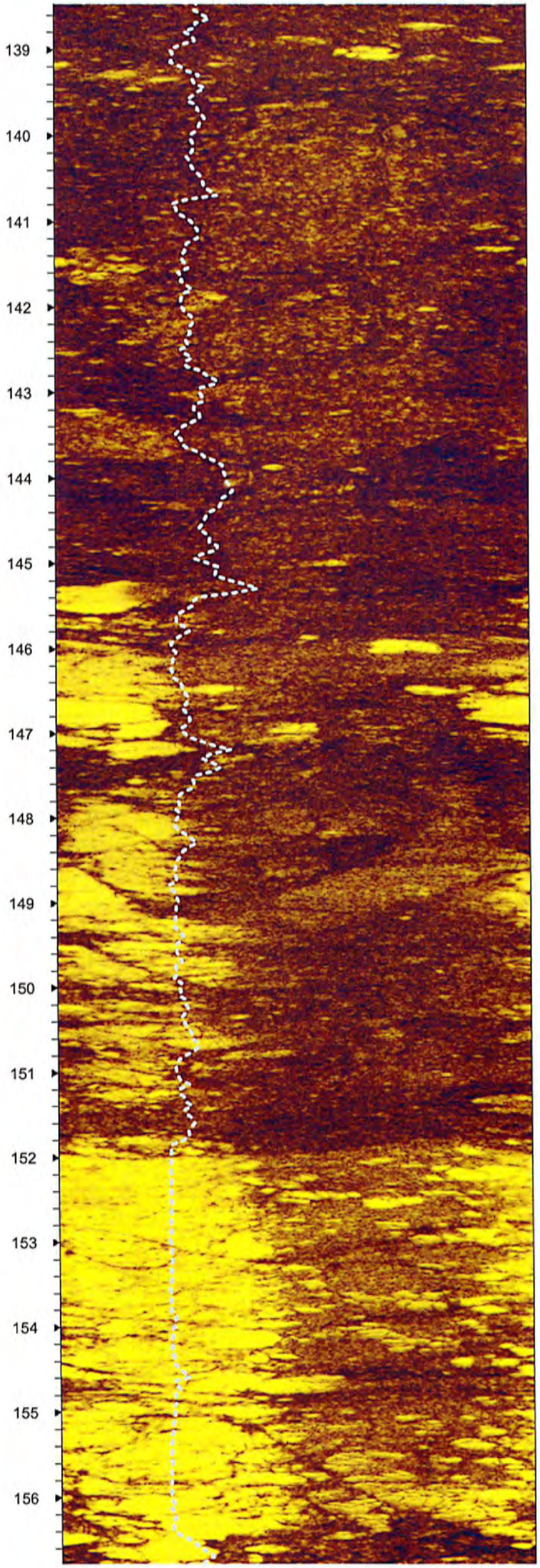


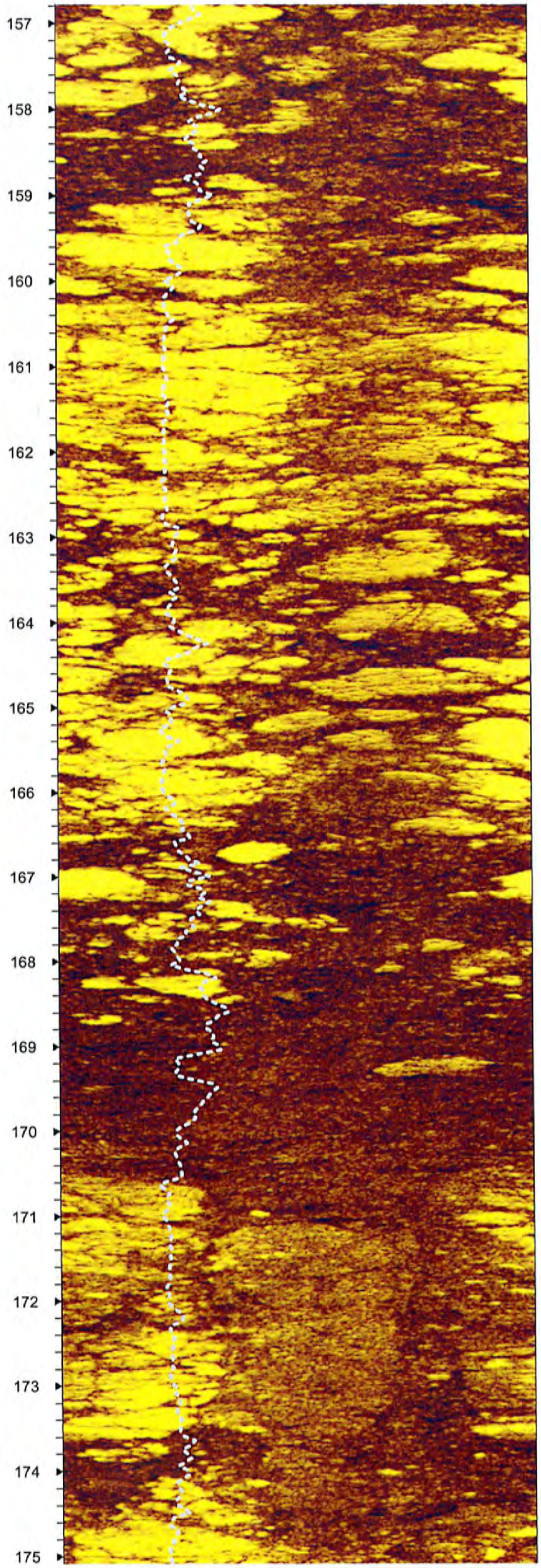
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83

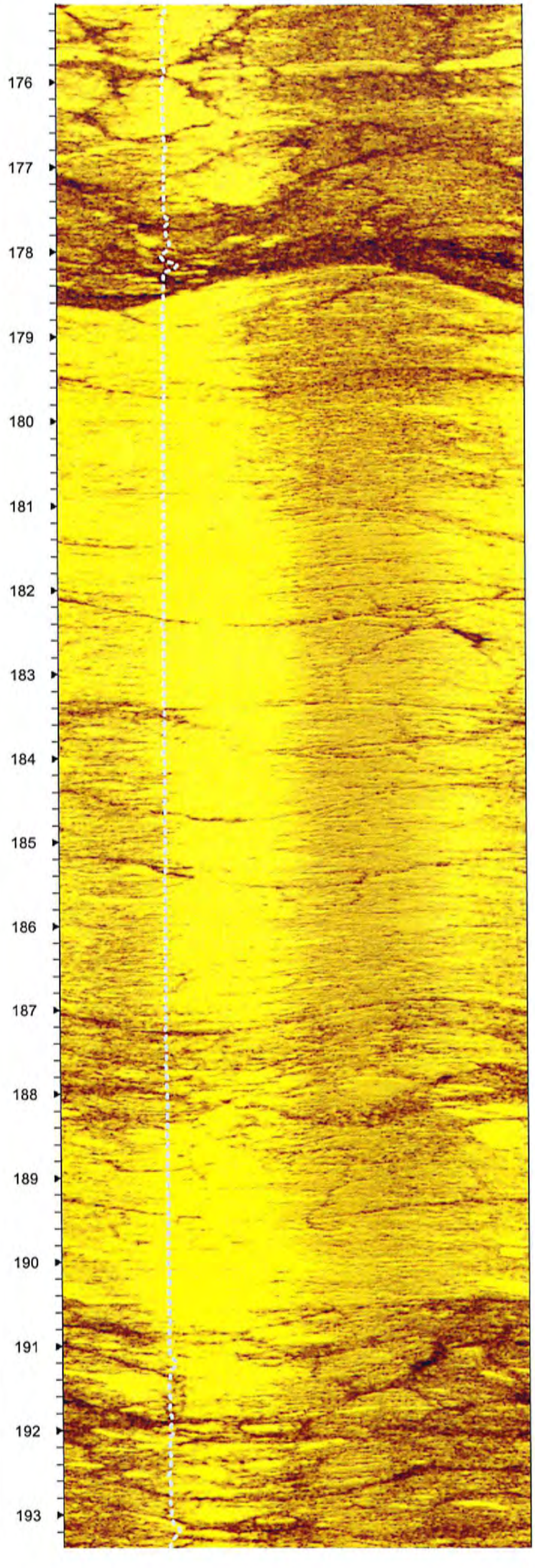

84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101

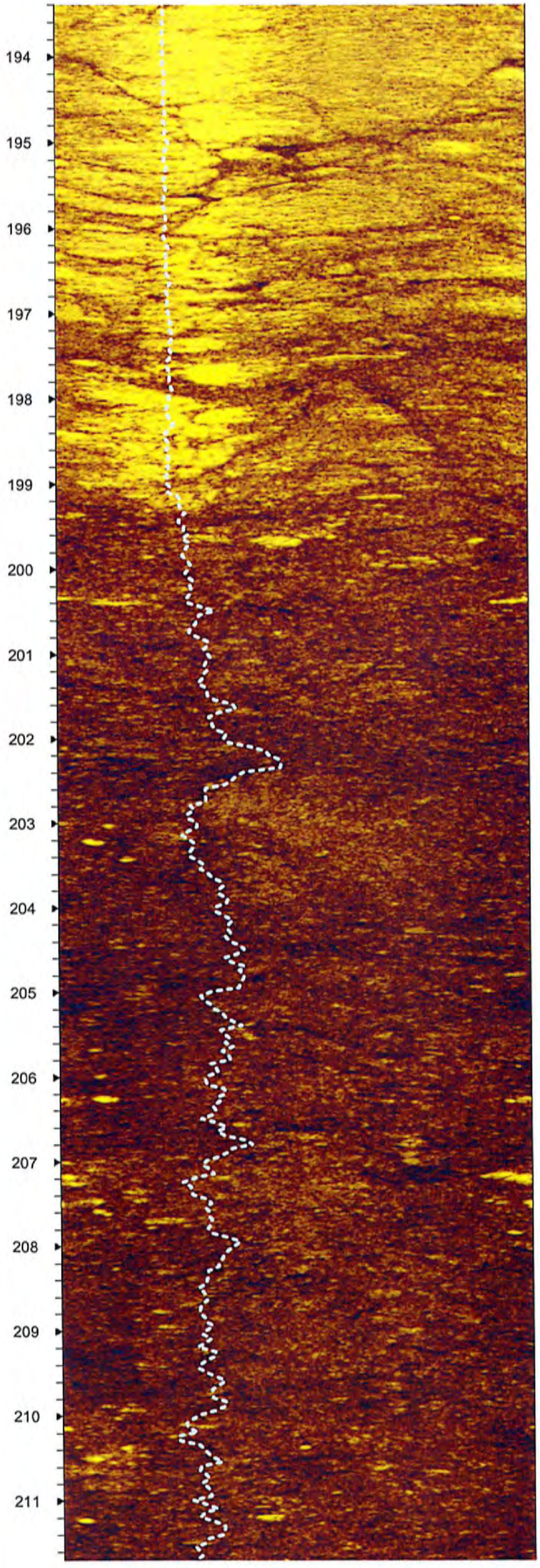

102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120

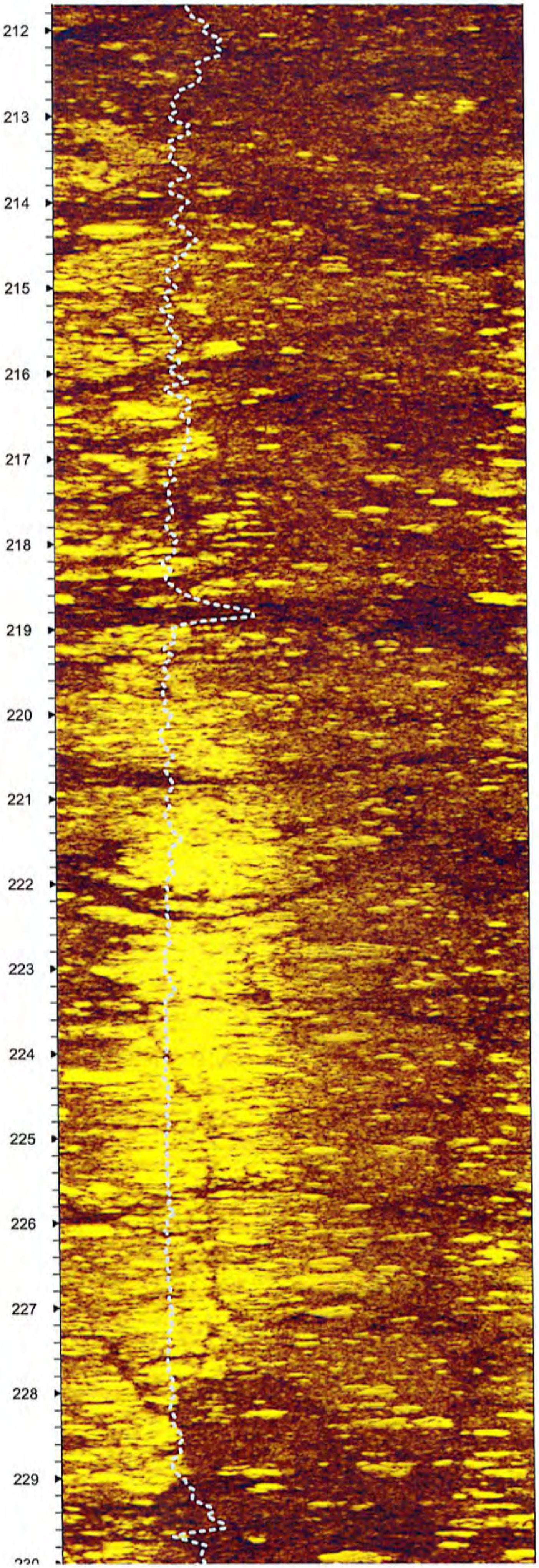

121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138

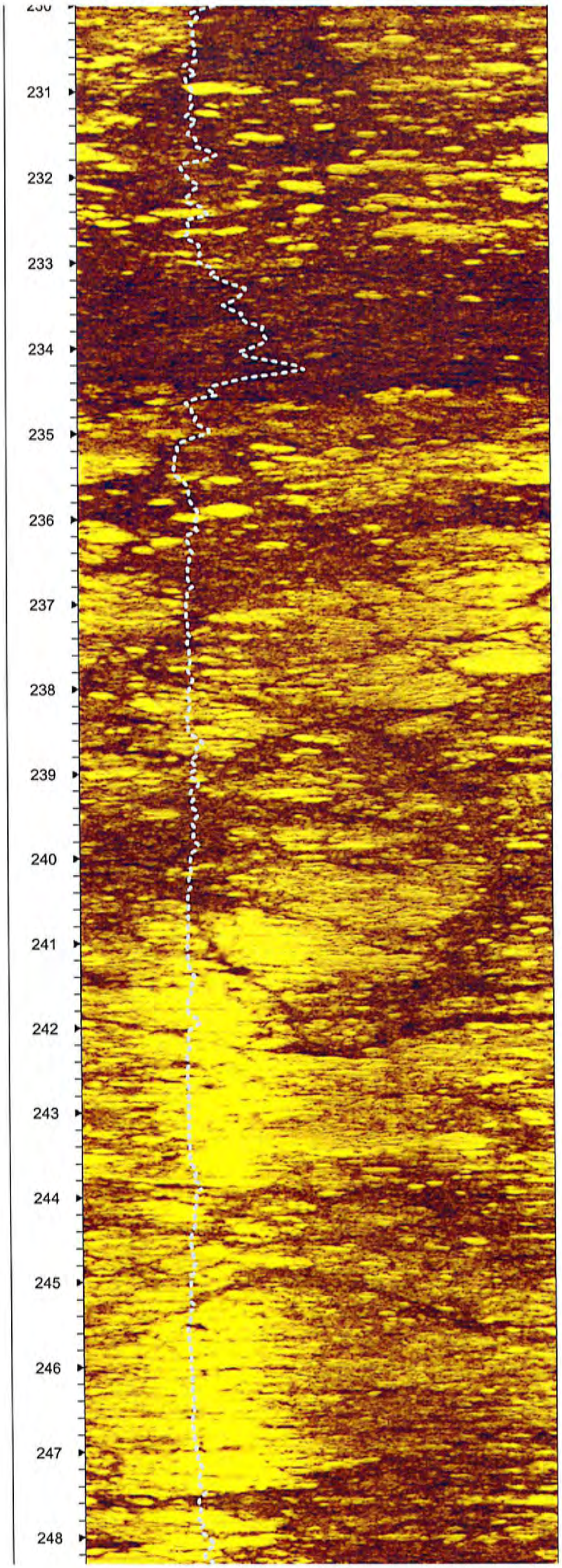

139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156

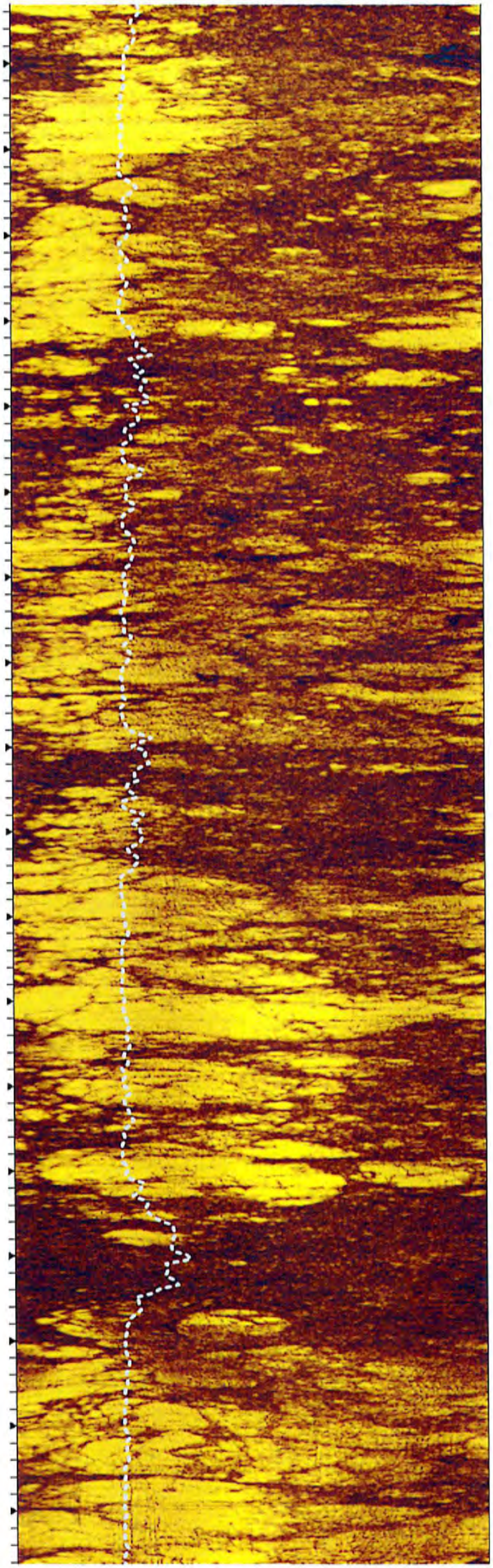

157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175


176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193

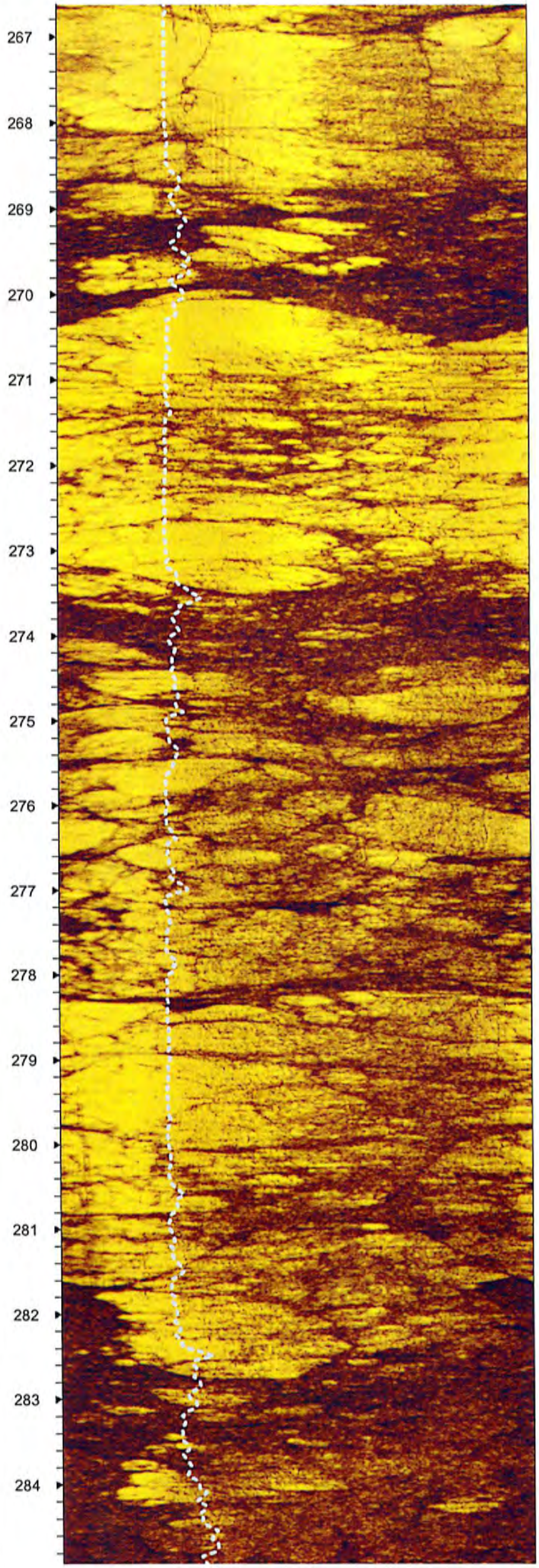

194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211

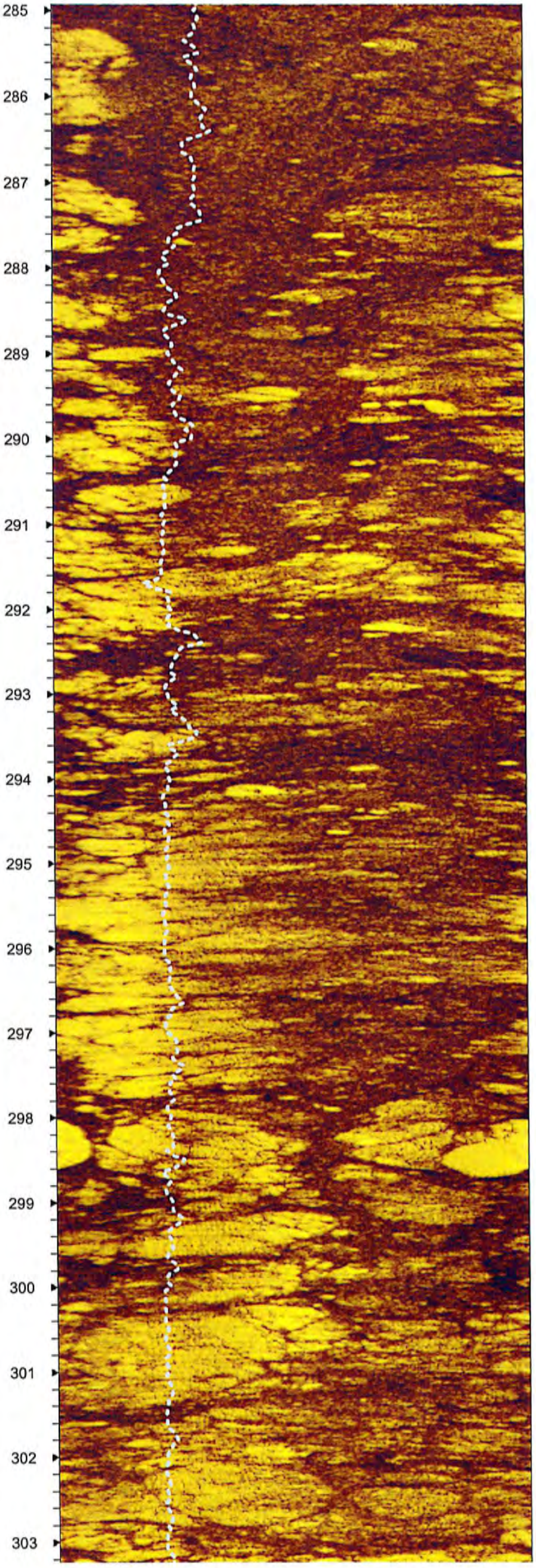

212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229

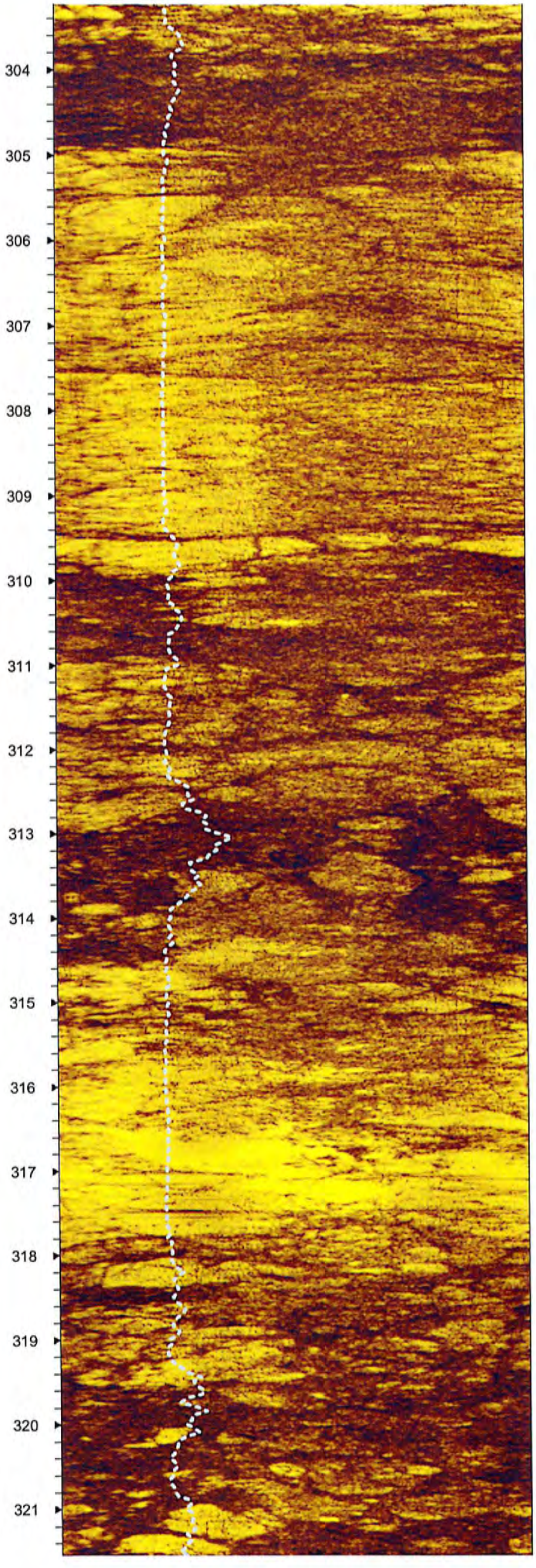

230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248

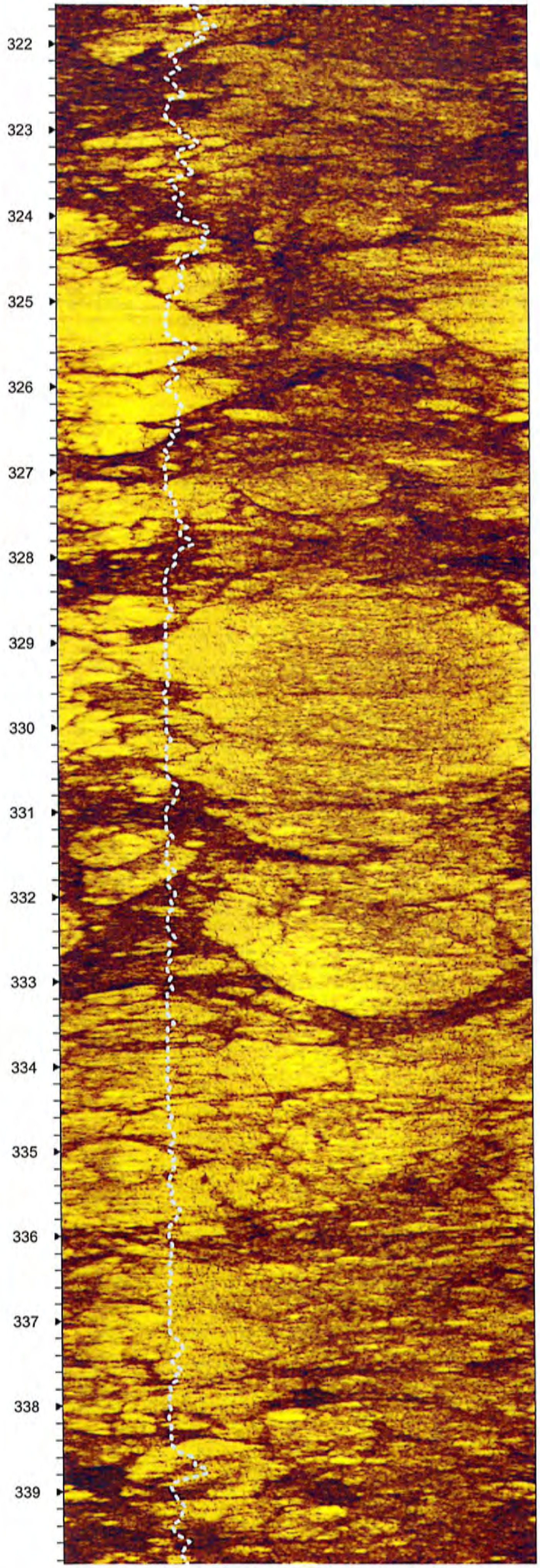


249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266

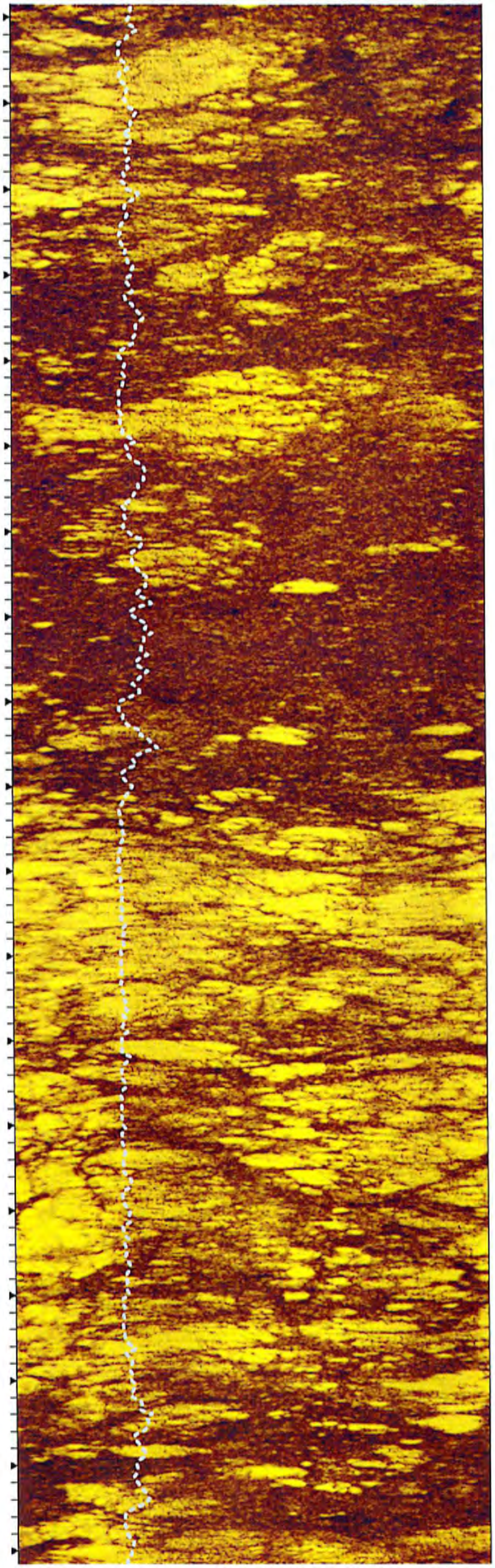

267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284

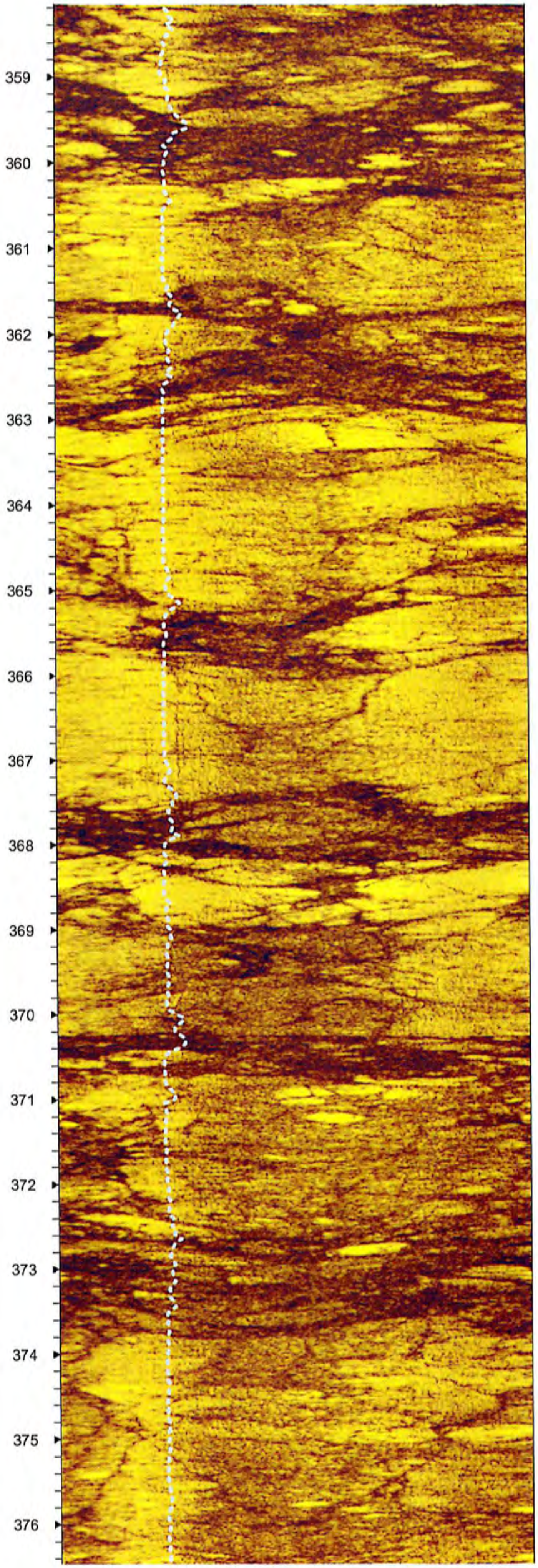

285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303

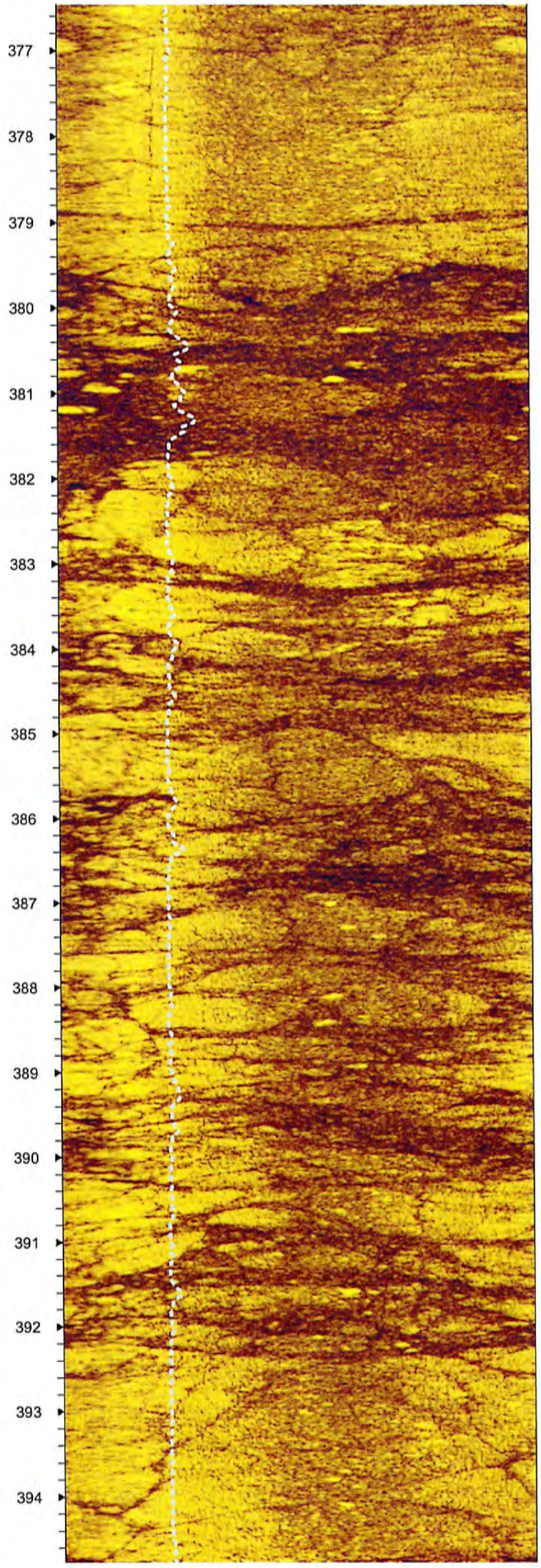

304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321

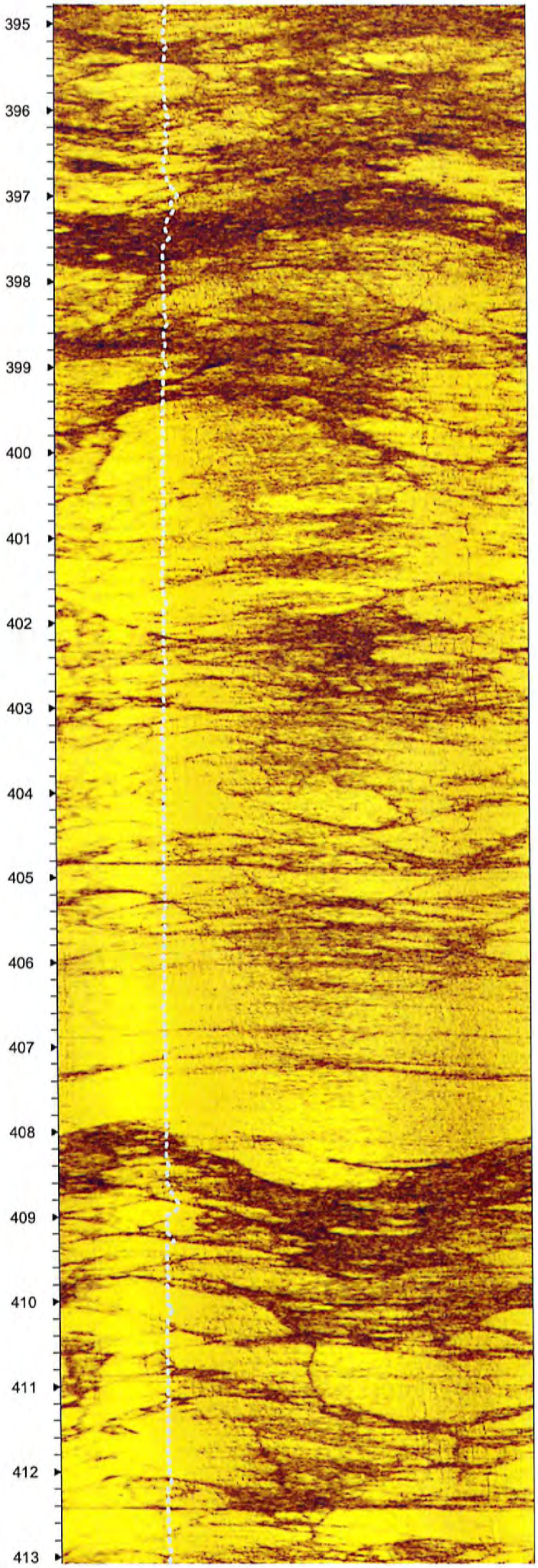

322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339

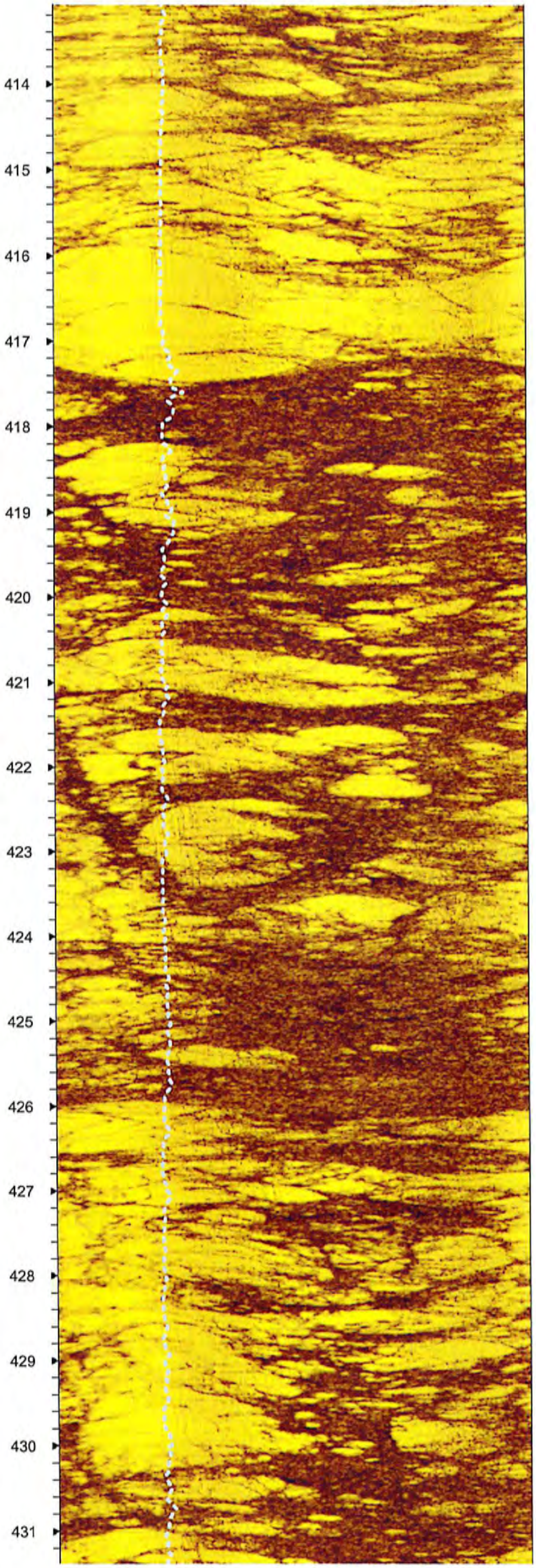
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358

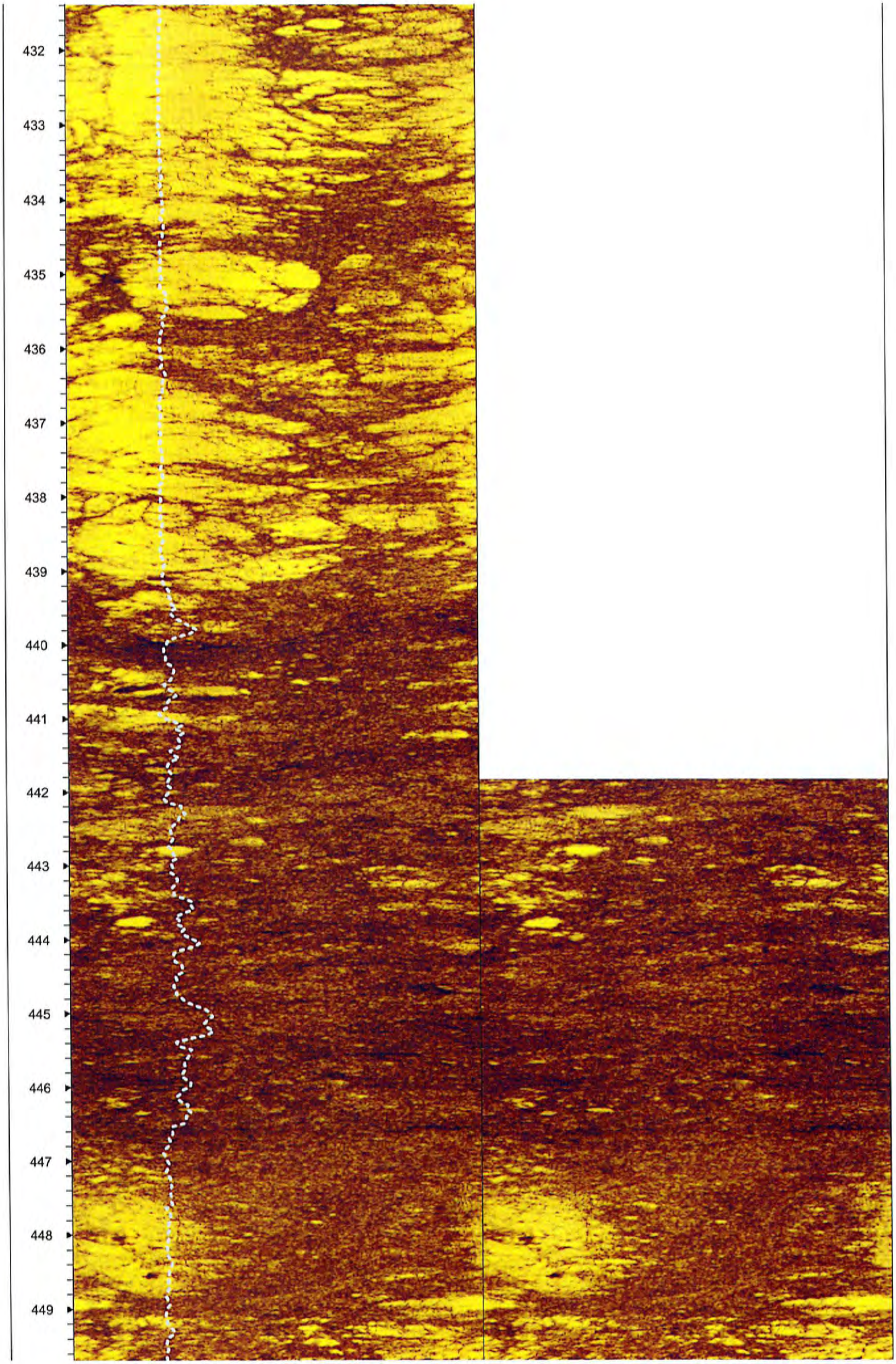


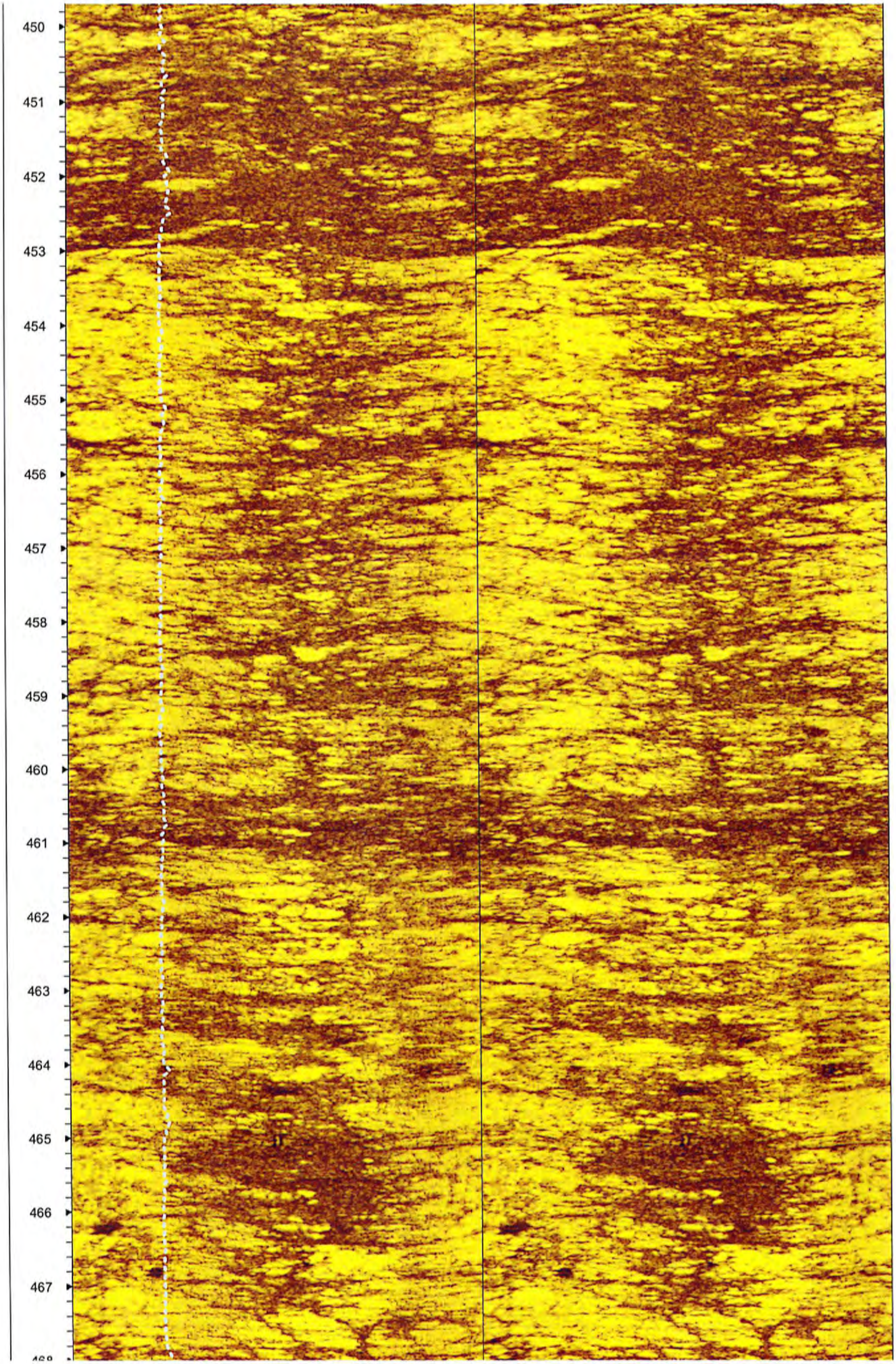

359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376

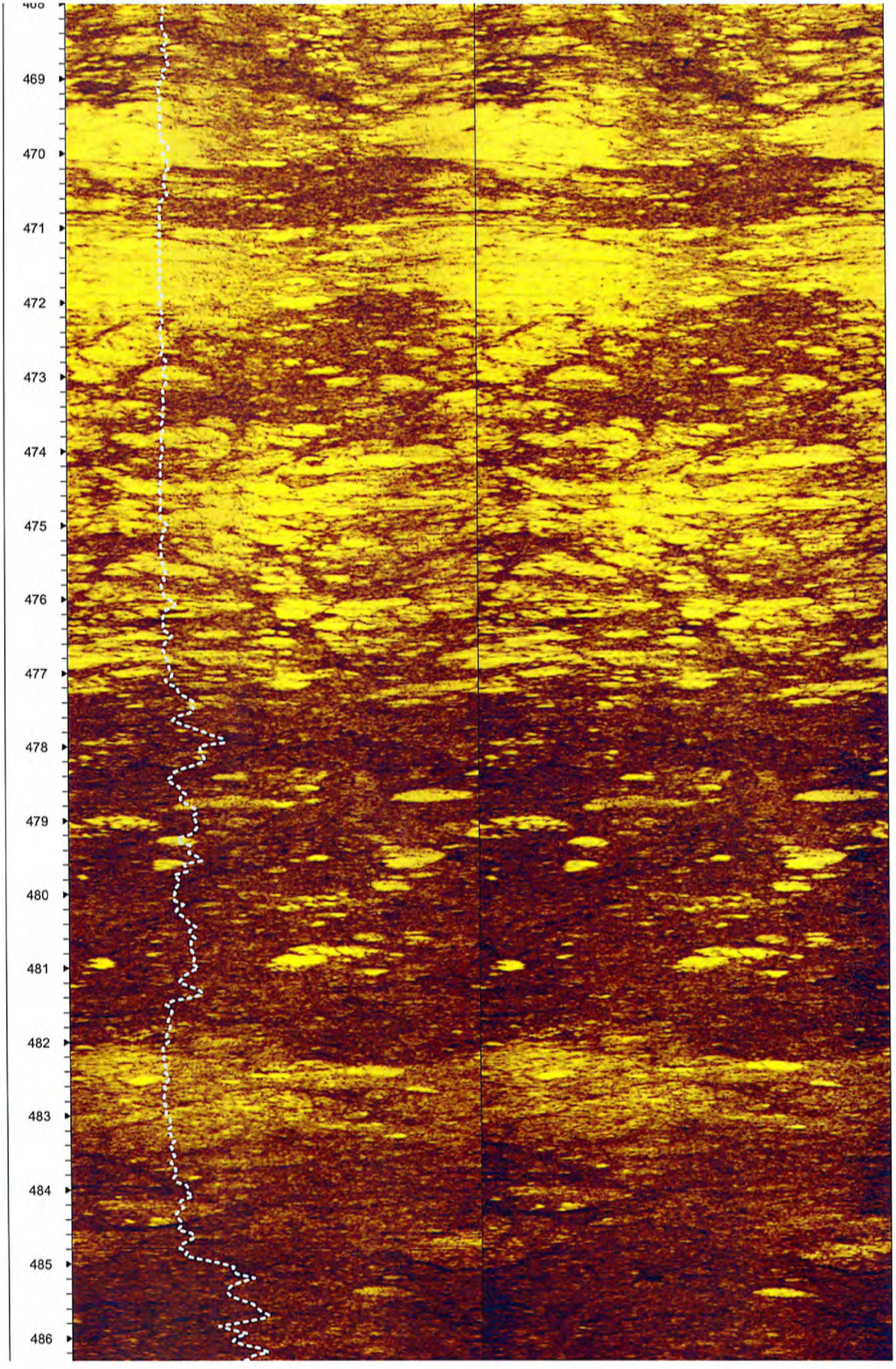

377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394

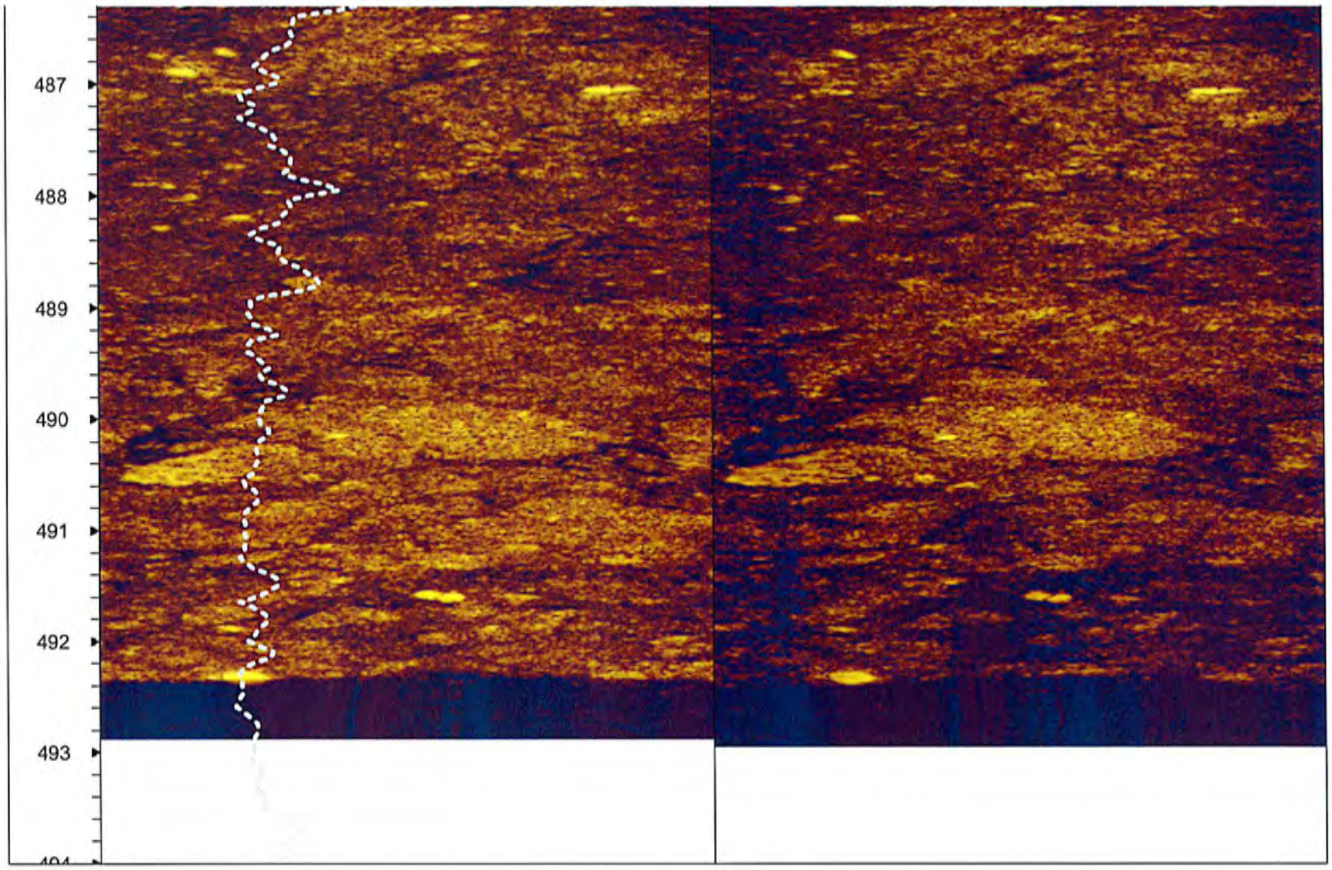

395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413


414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431


432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449


450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467

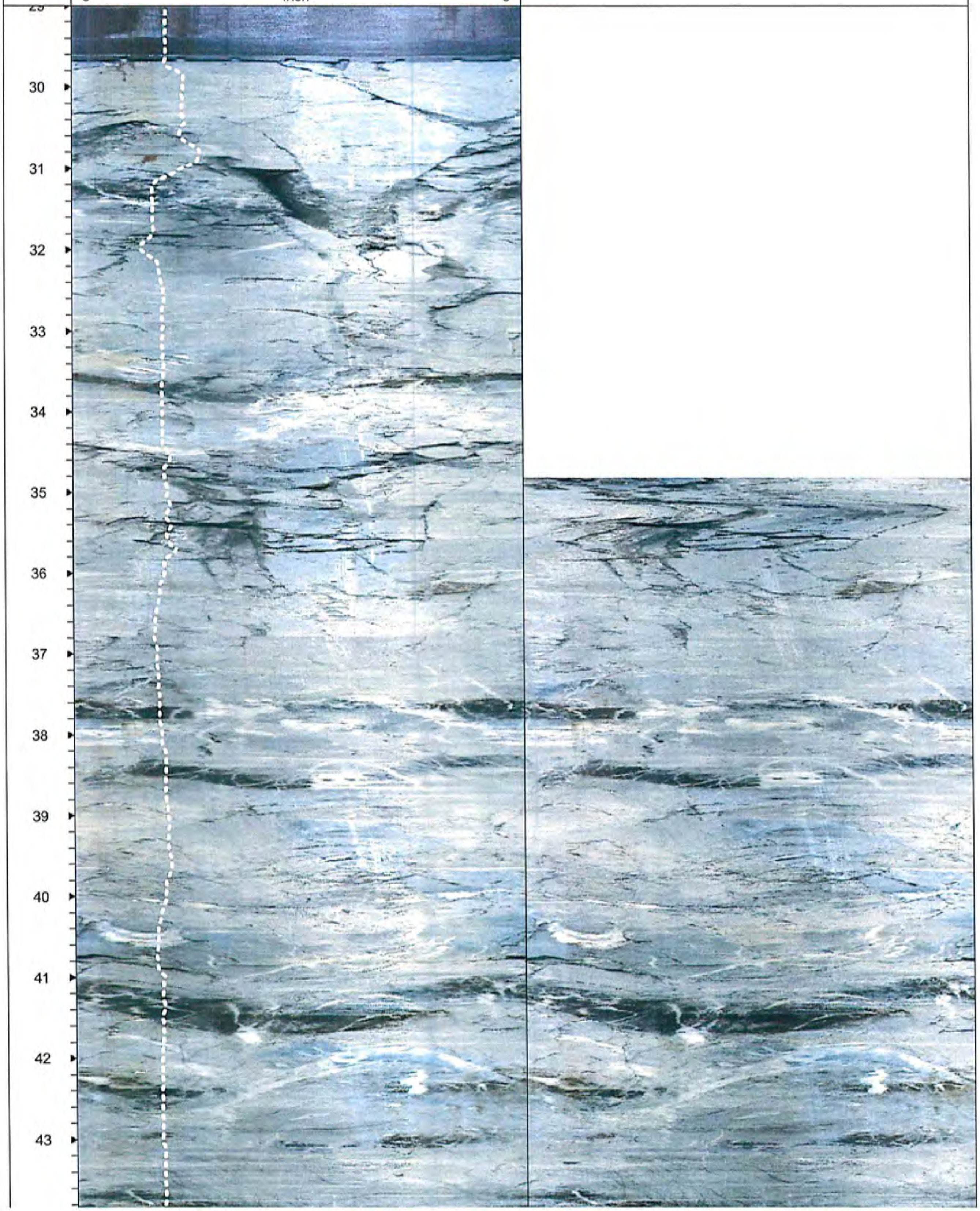

469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486

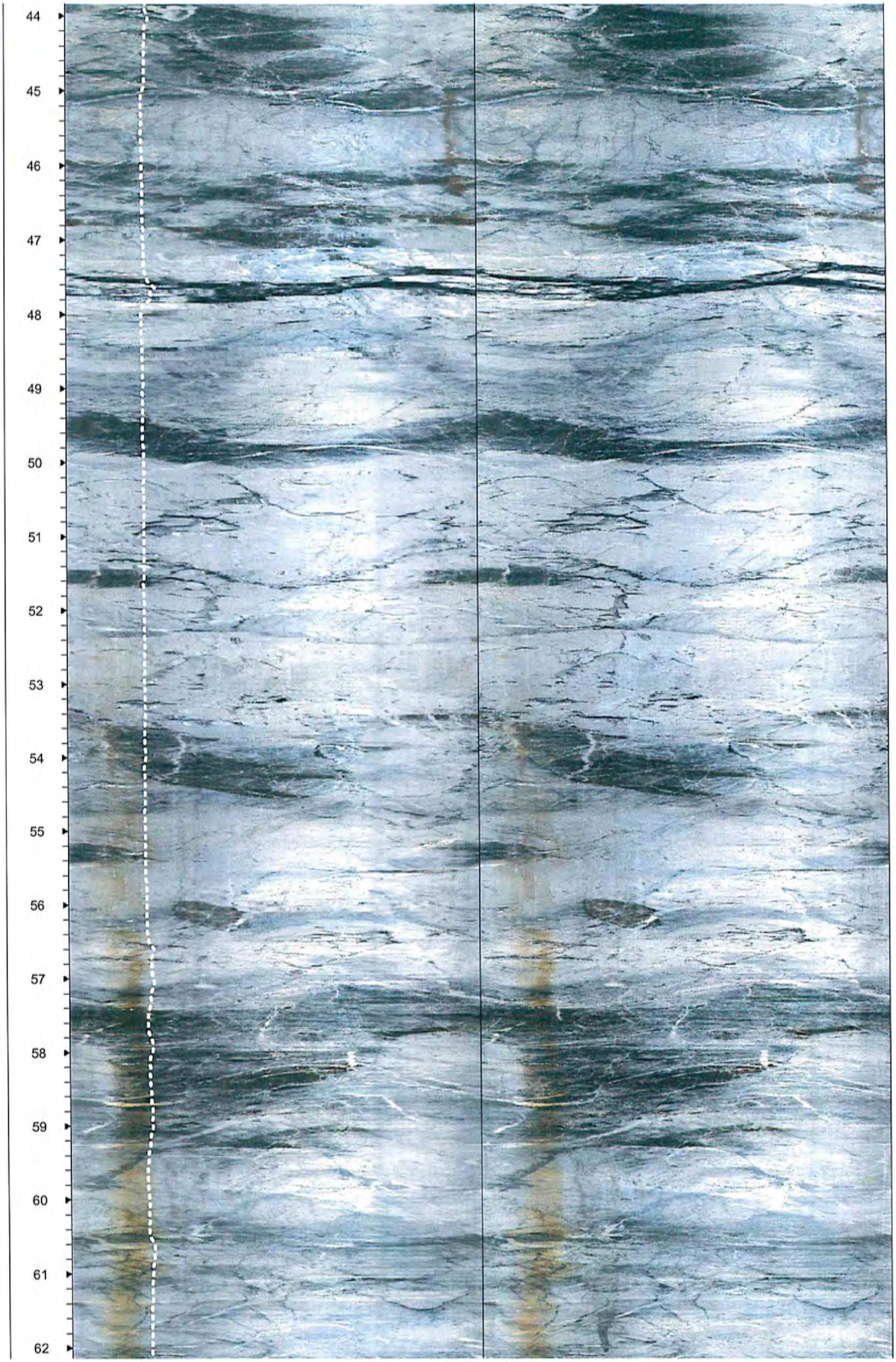

487
488
489
490
491
492
493

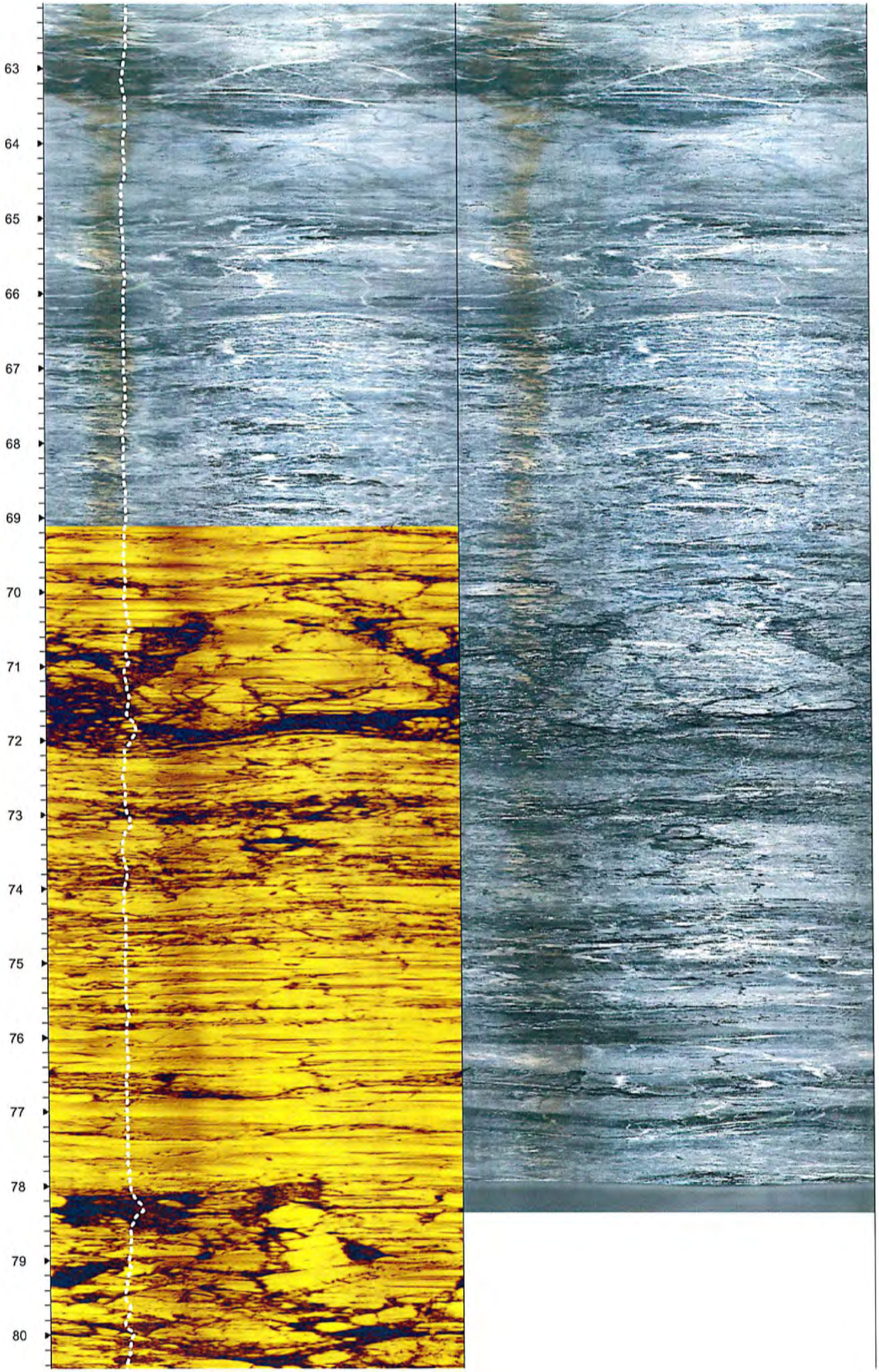
NORCAL GEOPHYSICAL CONSULTANTS INC. A Terracon COMPANY	OPTV-BHTV AND CALIPER LOGS	COMPANY: STANTEC WELL ID: GT-1-2018-2 FIELD: LEHIGH QUARRY COUNTY: SANTA CLARA	DATE: Oct. 20, 2018 CASING: Hwt to 29.6-ft bgs JOB NO. NS185080 STATE: CA

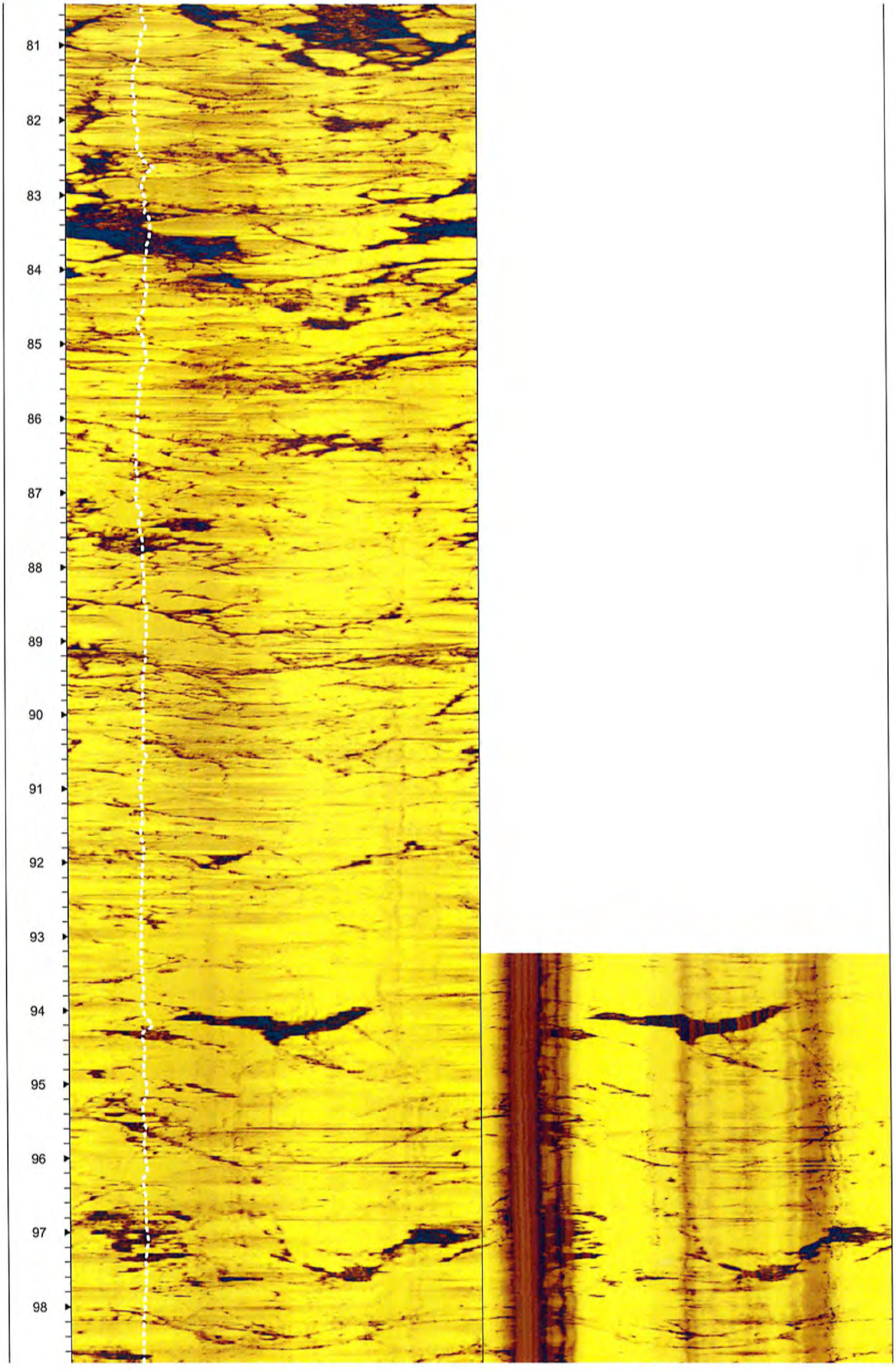
NOTES: **Images referenced to magnetic North**

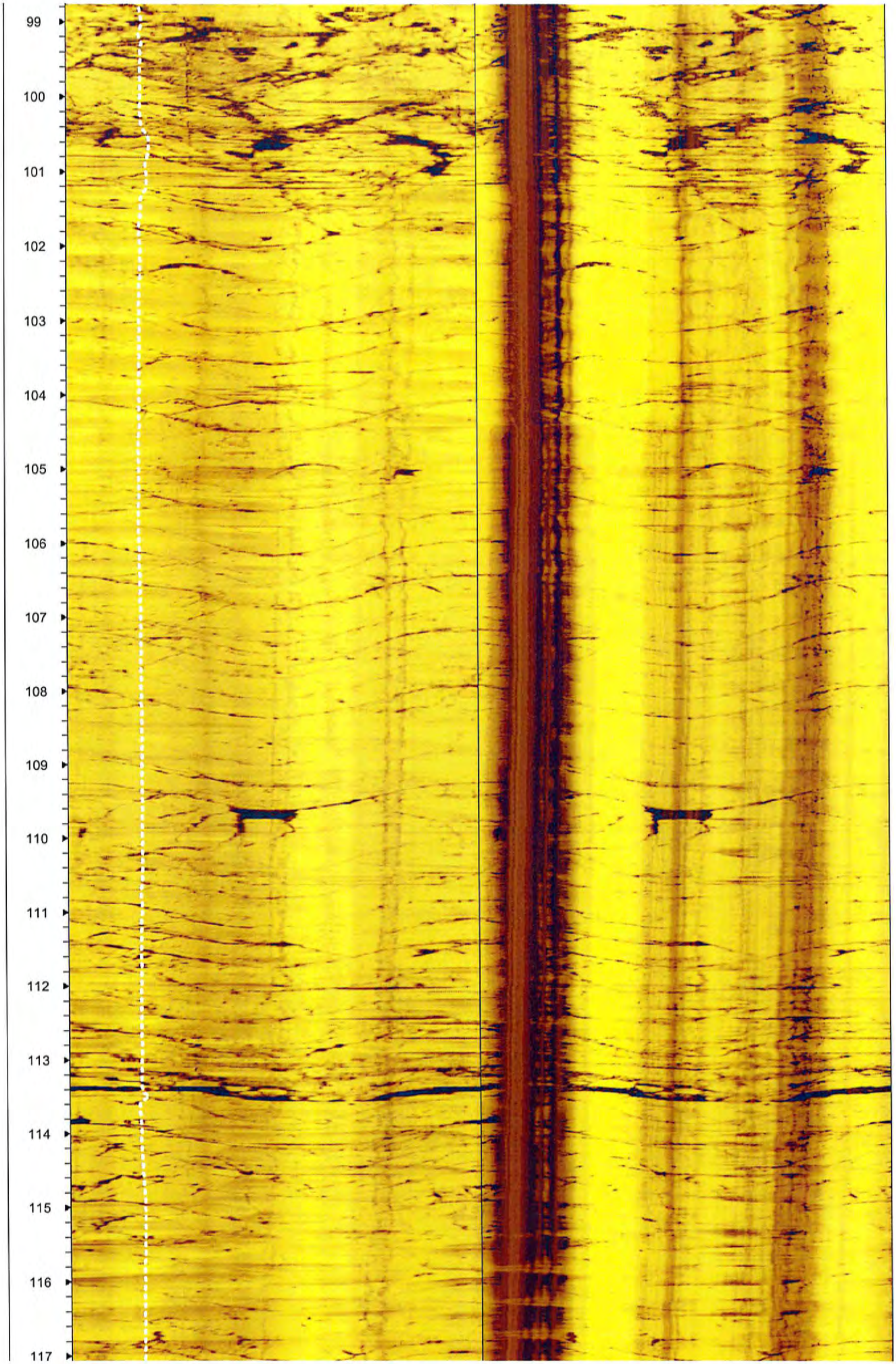
Depth 1ft:20ft	OPTV Merge R-1 & -2 0° 90° 180° 270° 0° BHTV Amplitude R-1 downgoing 0° 90° 180° 270° 0° Borehole Diameter 3 Inch 8	OPTV R-3 0° 90° 180° 270° 0° BHTV Amplitude Run-3 up gping - Static Norm. 0° 90° 180° 270° 0°

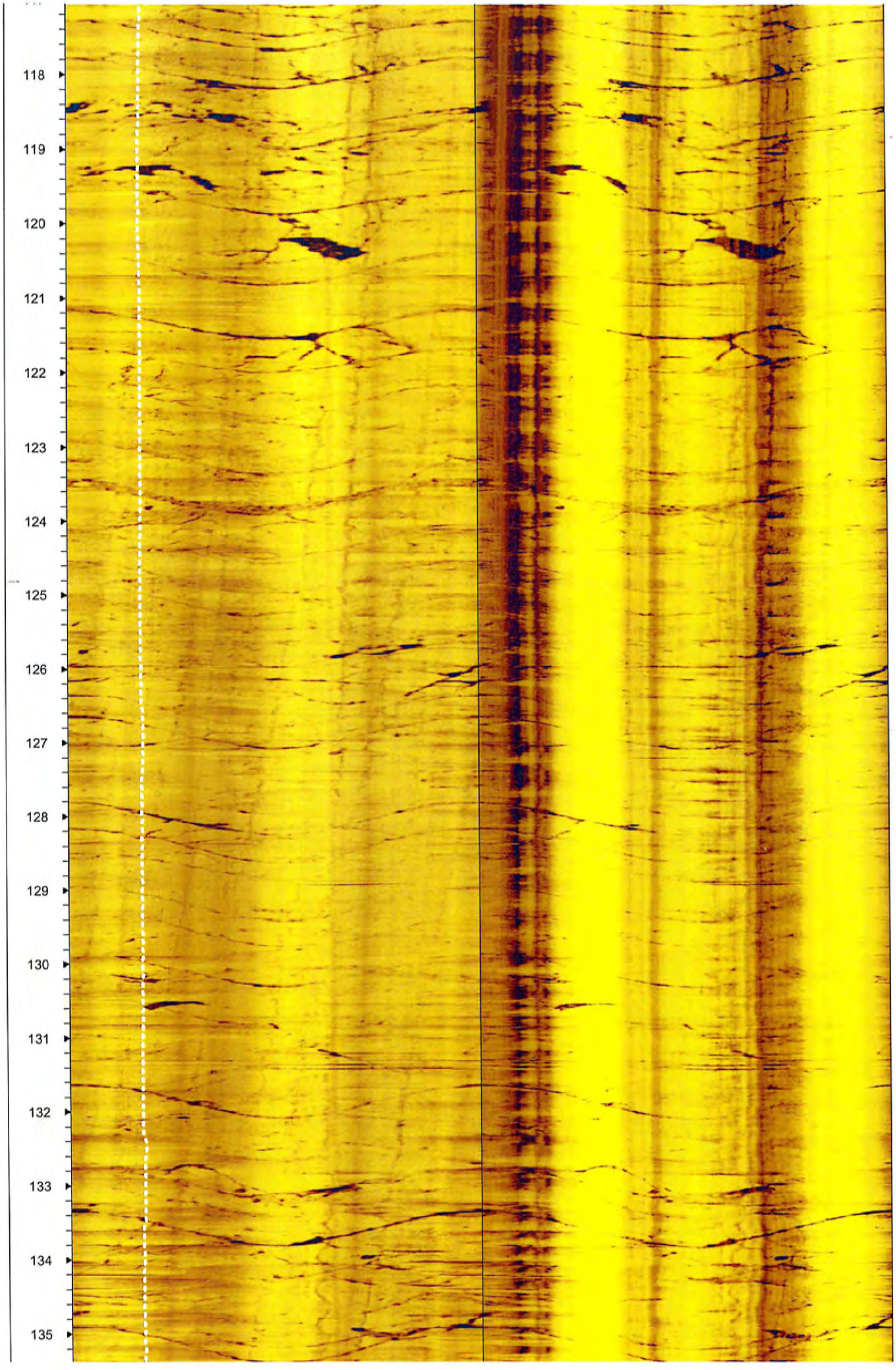


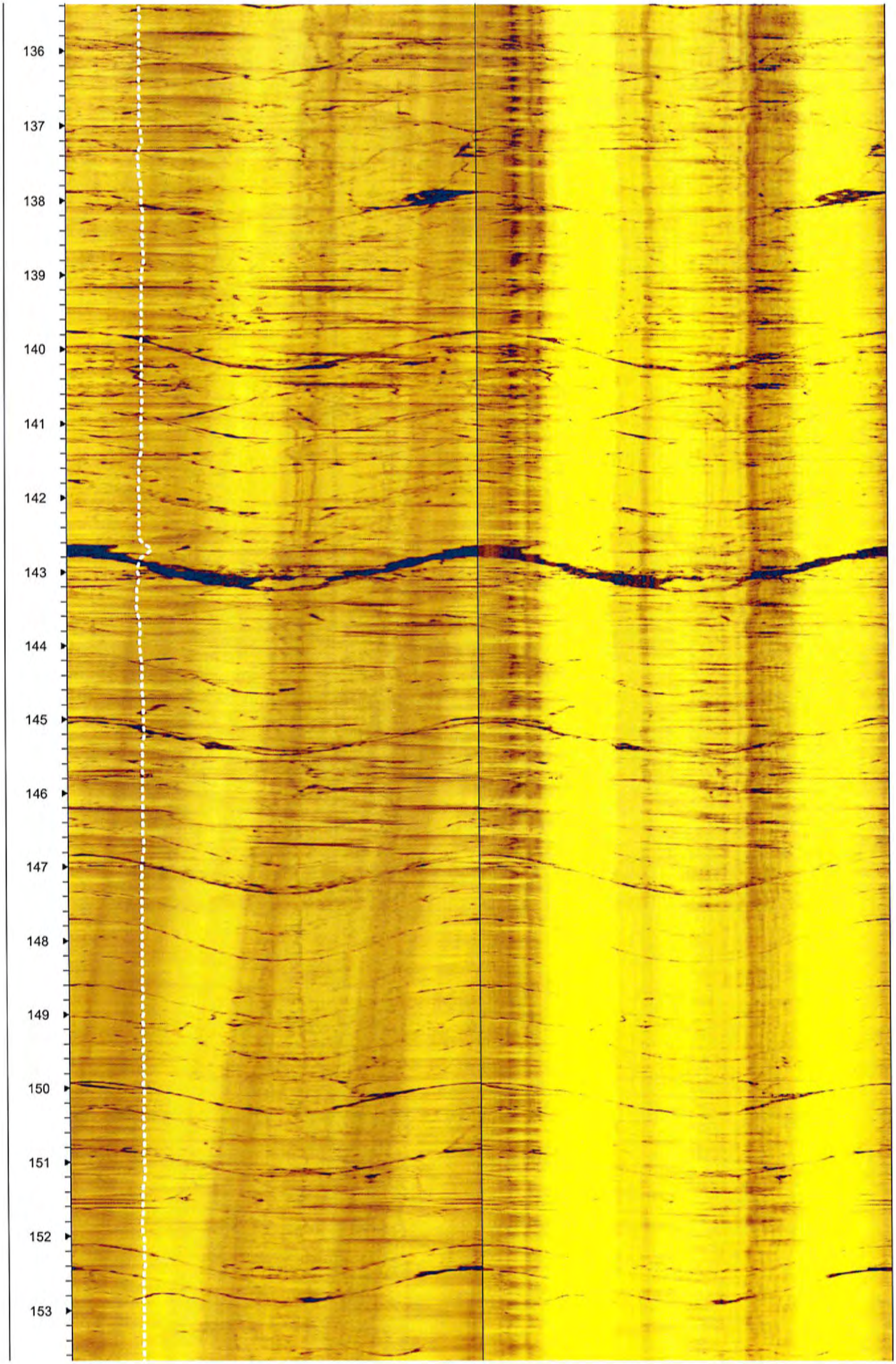

44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62

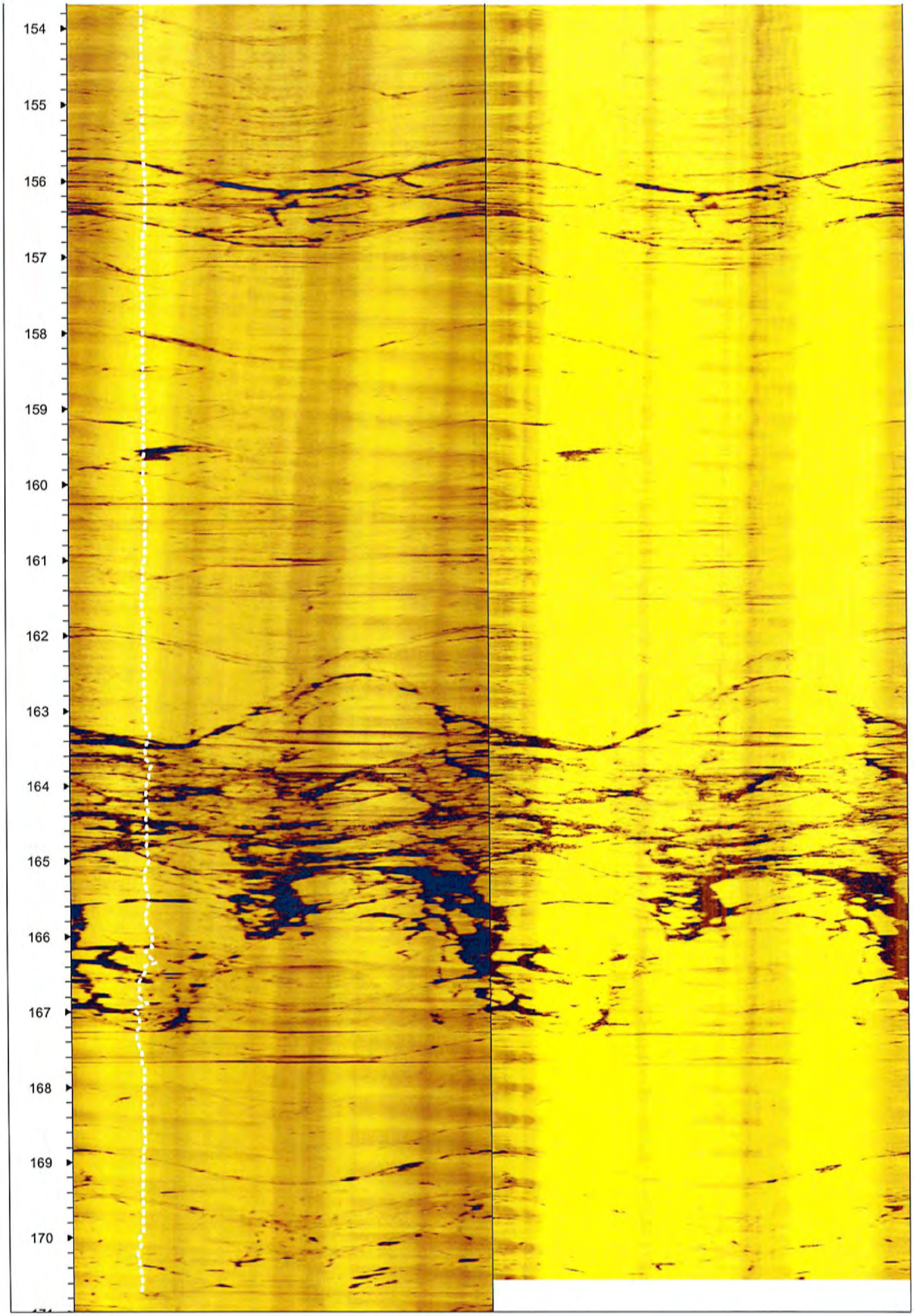

63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80


81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98


99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117

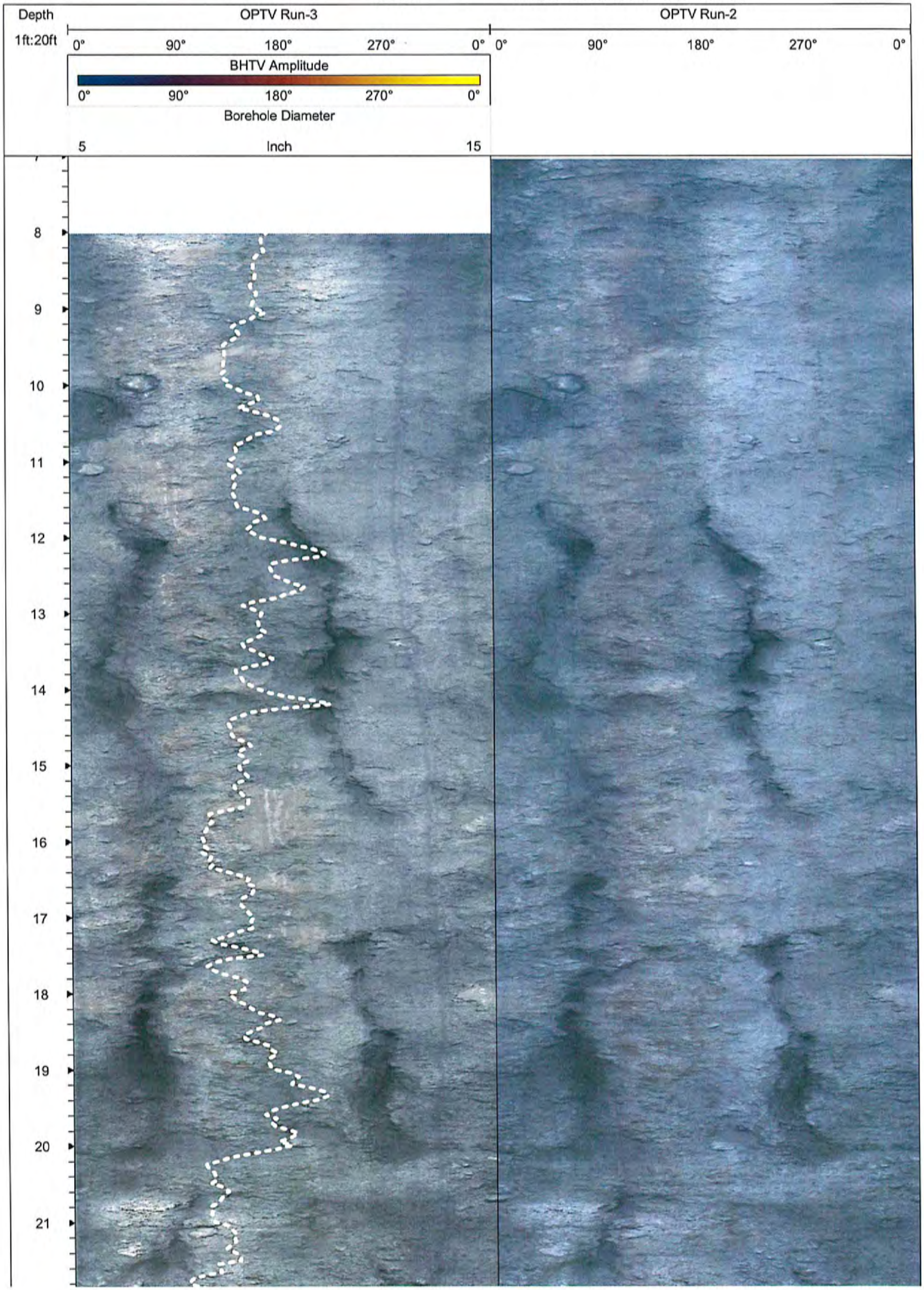

118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135

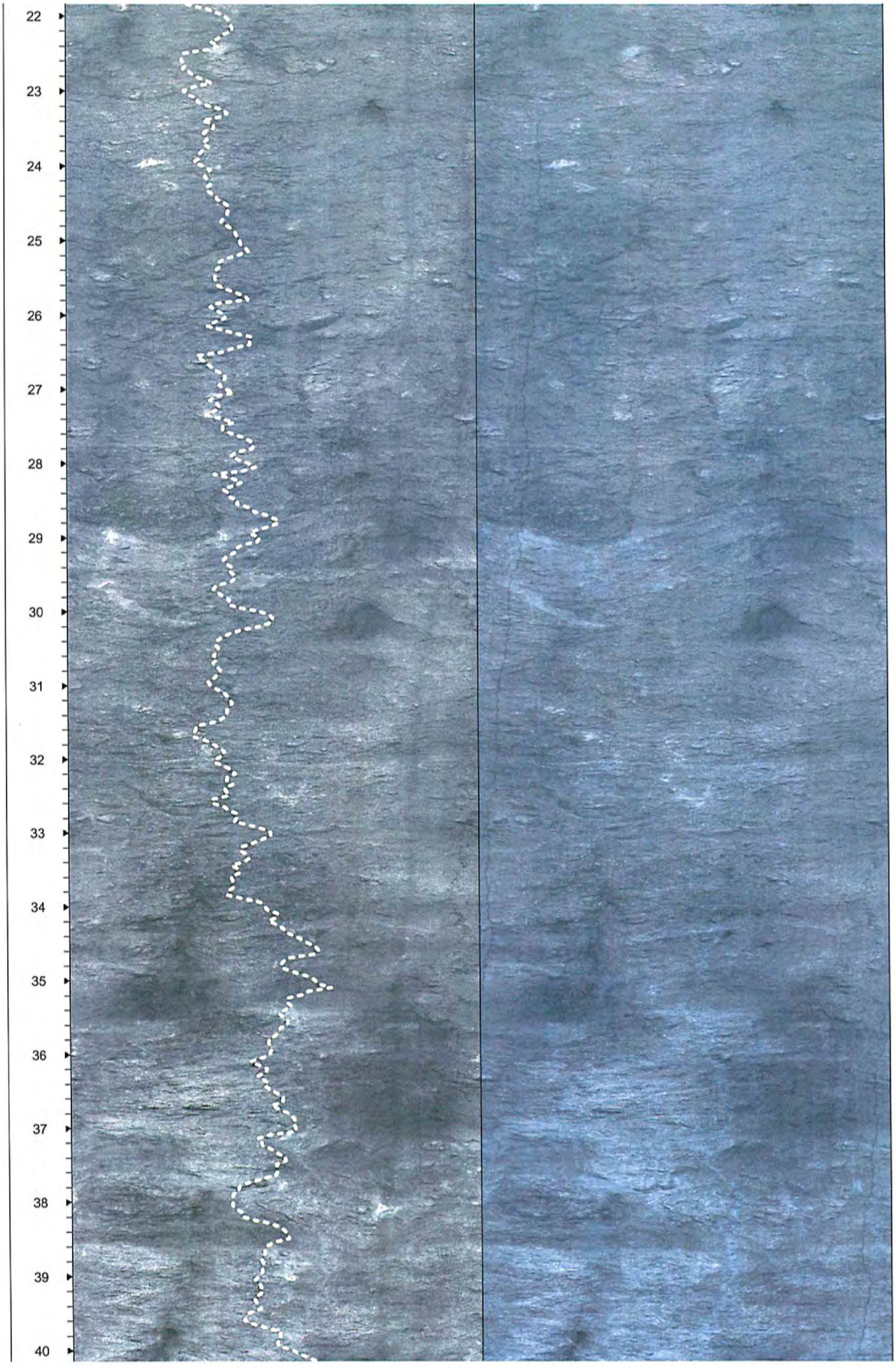

136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153

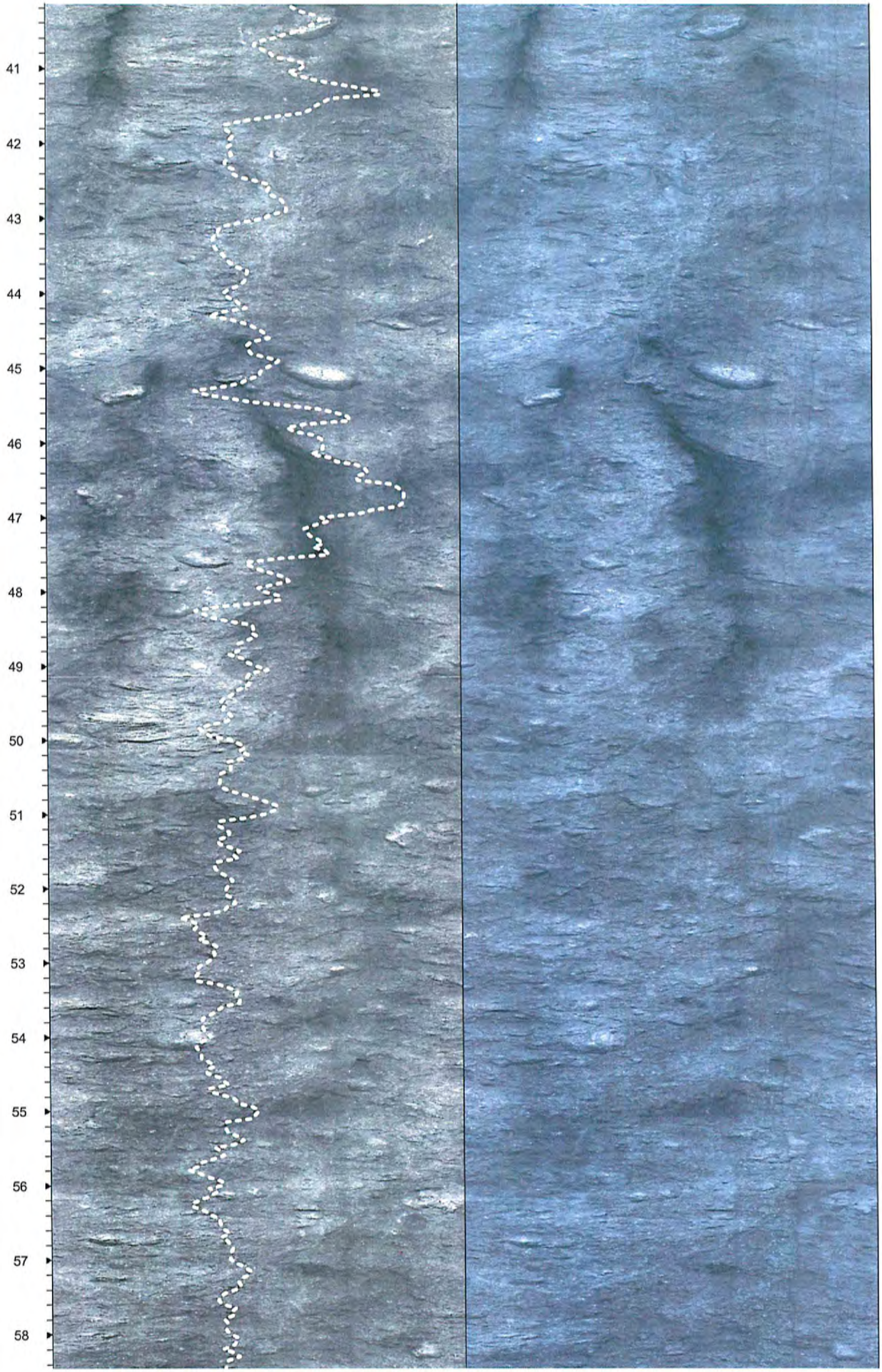

154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170

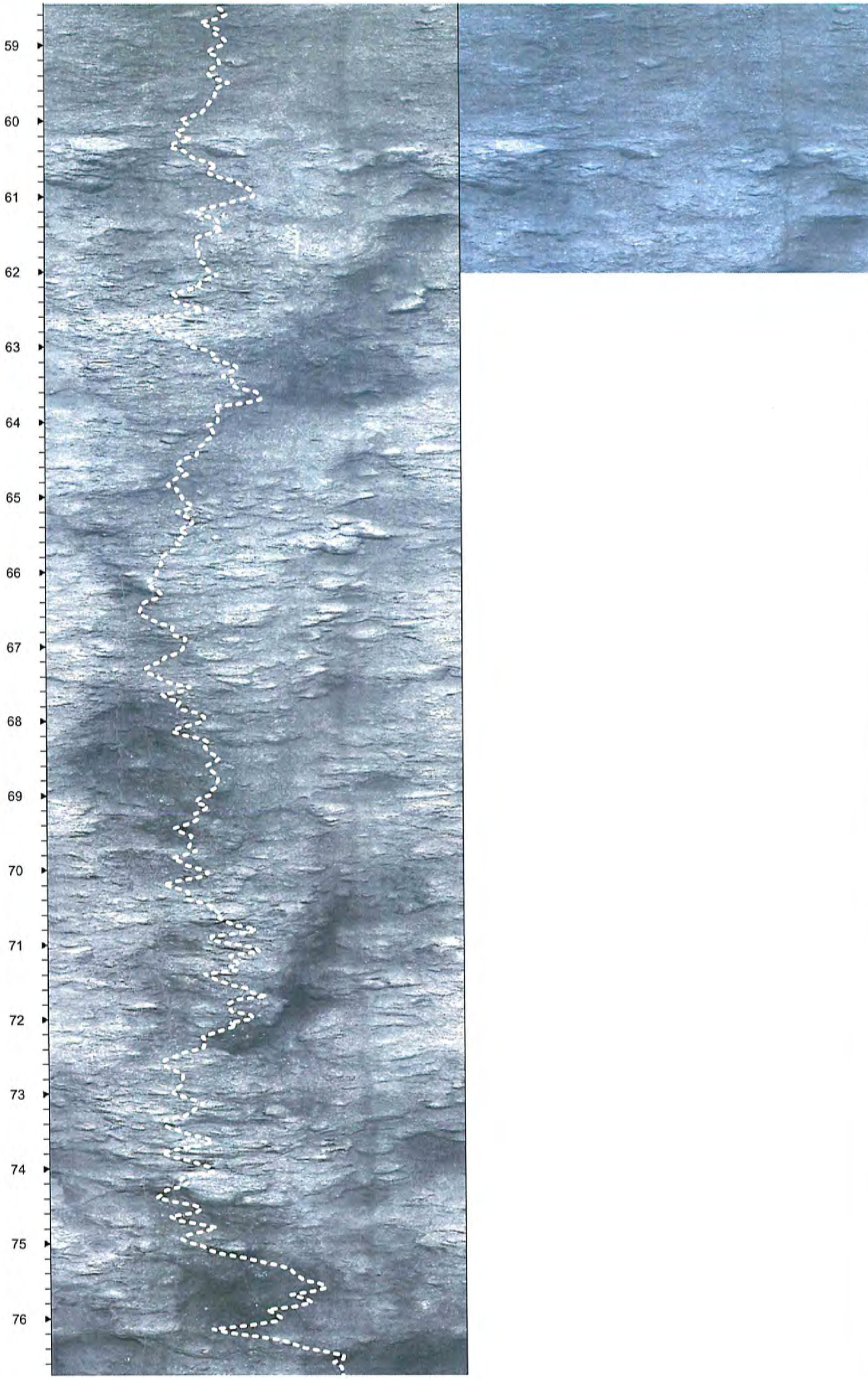
NORCAL GEOPHYSICAL CONSULTANTS INC. A Terracon COMPANY	**OPTV-BHTV and Caliper Logs**	COMPANY: STANTEC WELL ID: S-1-2018-2 FIELD: LEHIGH QUARRY COUNTY: Santa Clara	DATE: October 6, 2018 CASING: None JOB NO. NS185080 STATE: CA

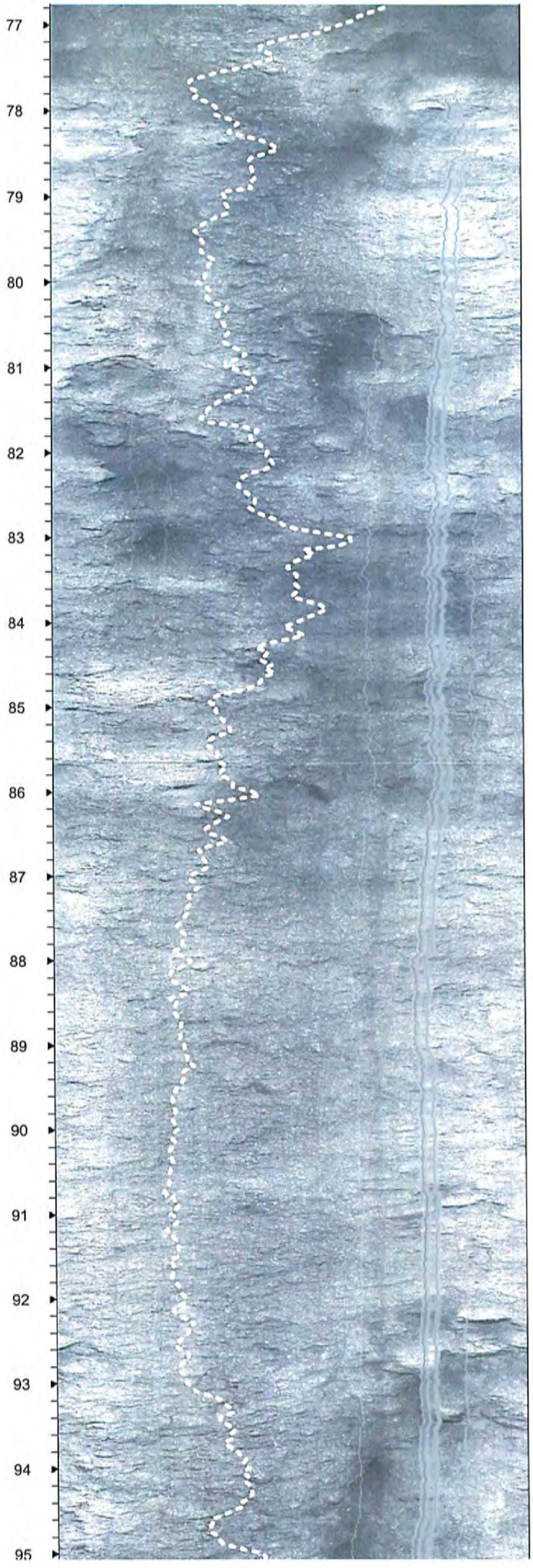
NOTES: **Images referenced to magnetic North**

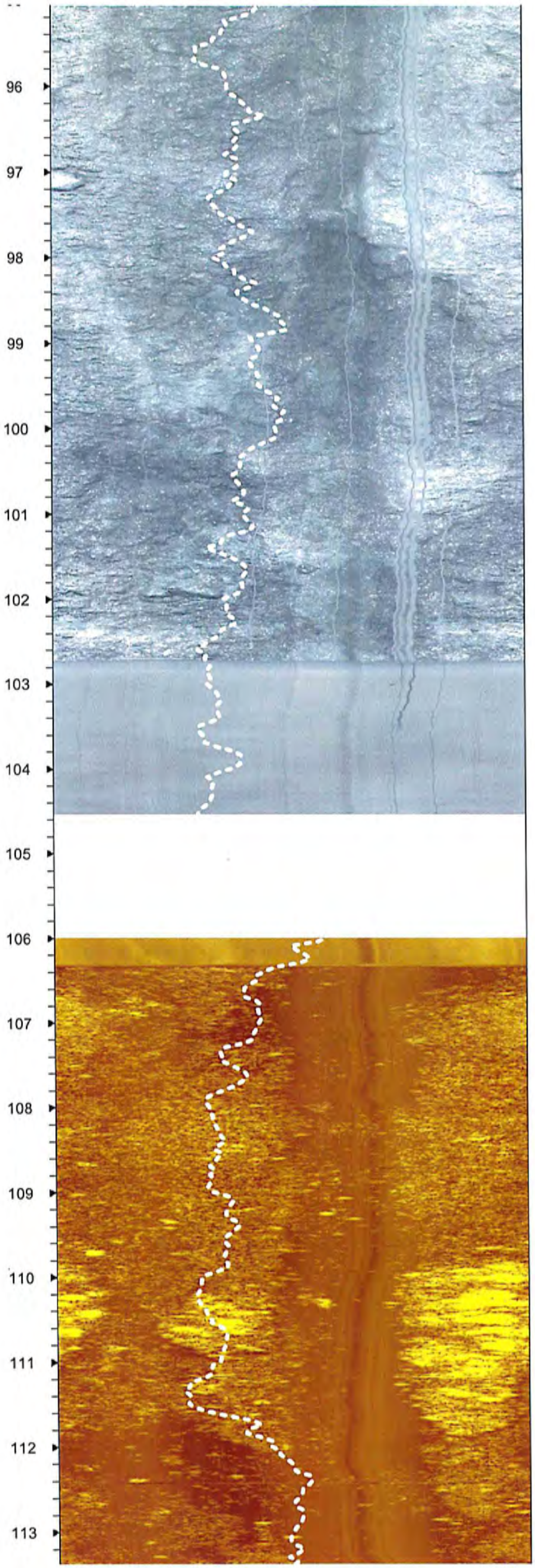



22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40

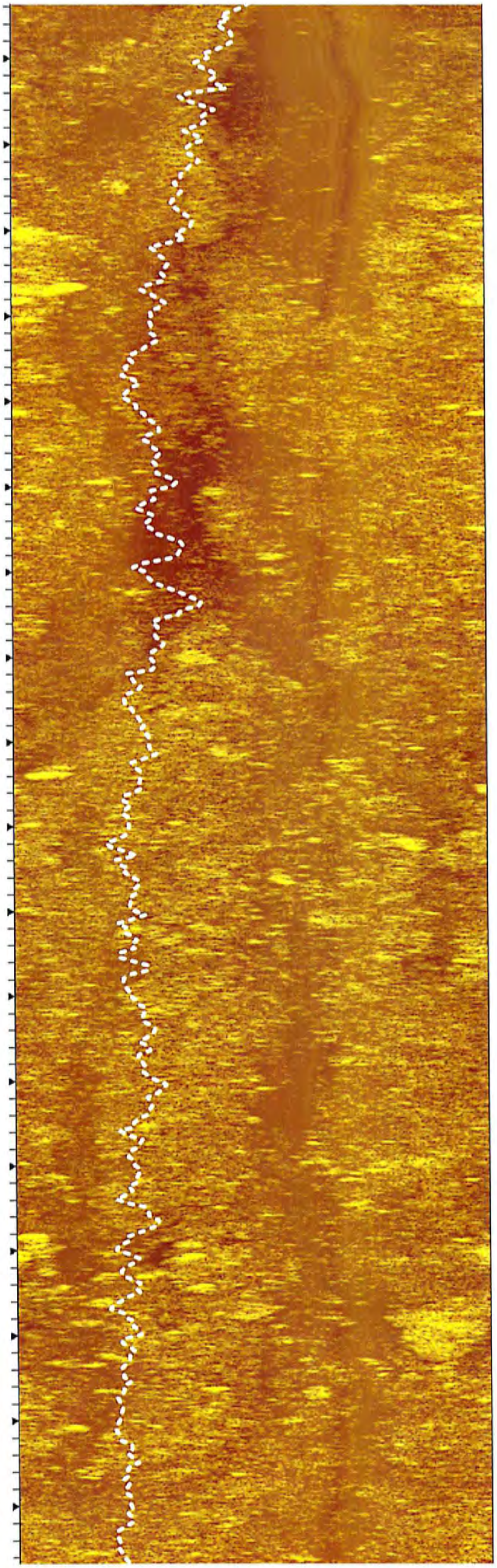

41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58

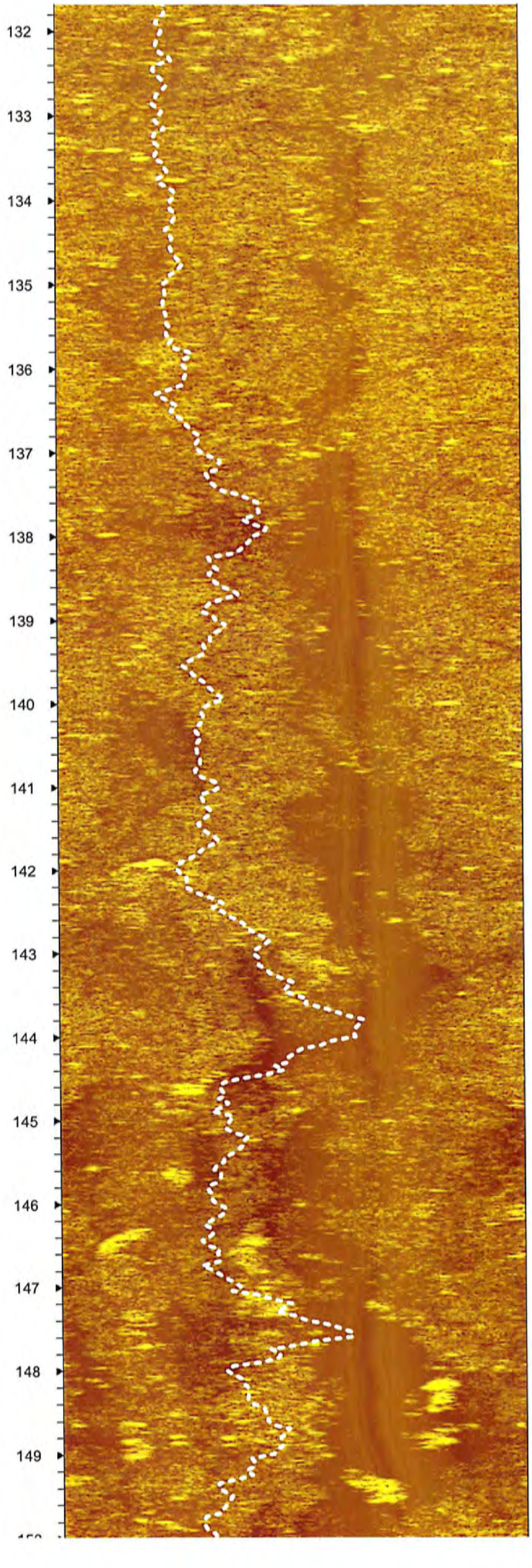

59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76

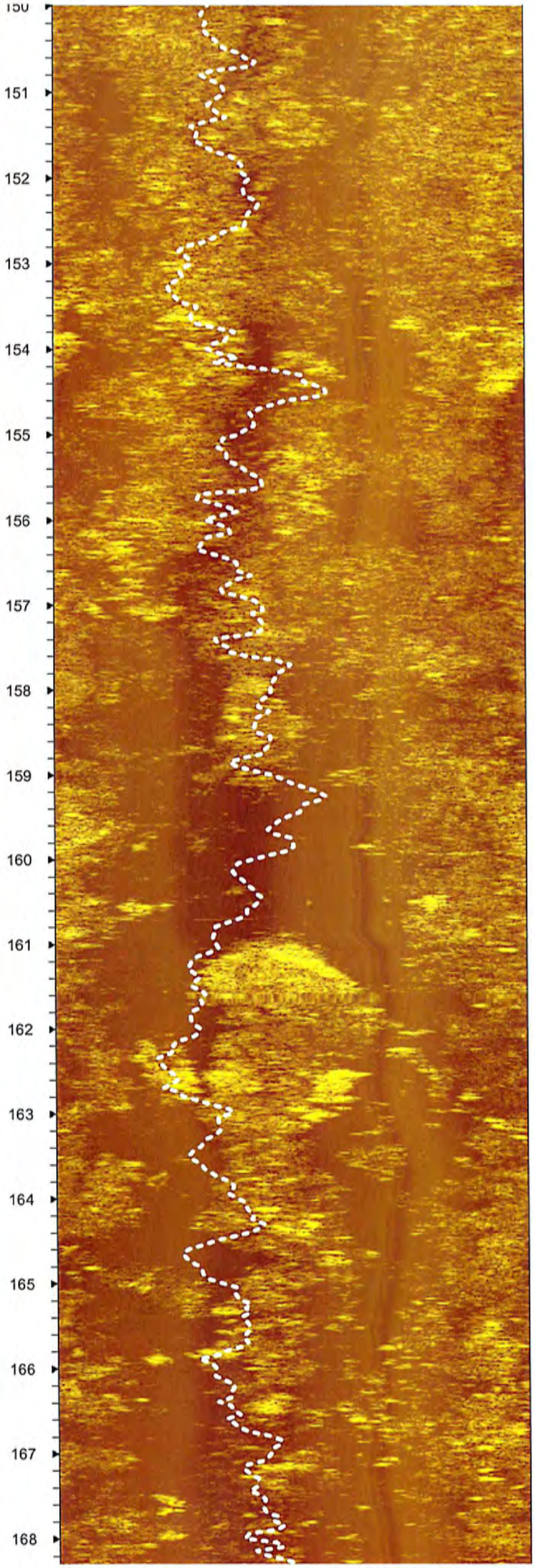

77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95

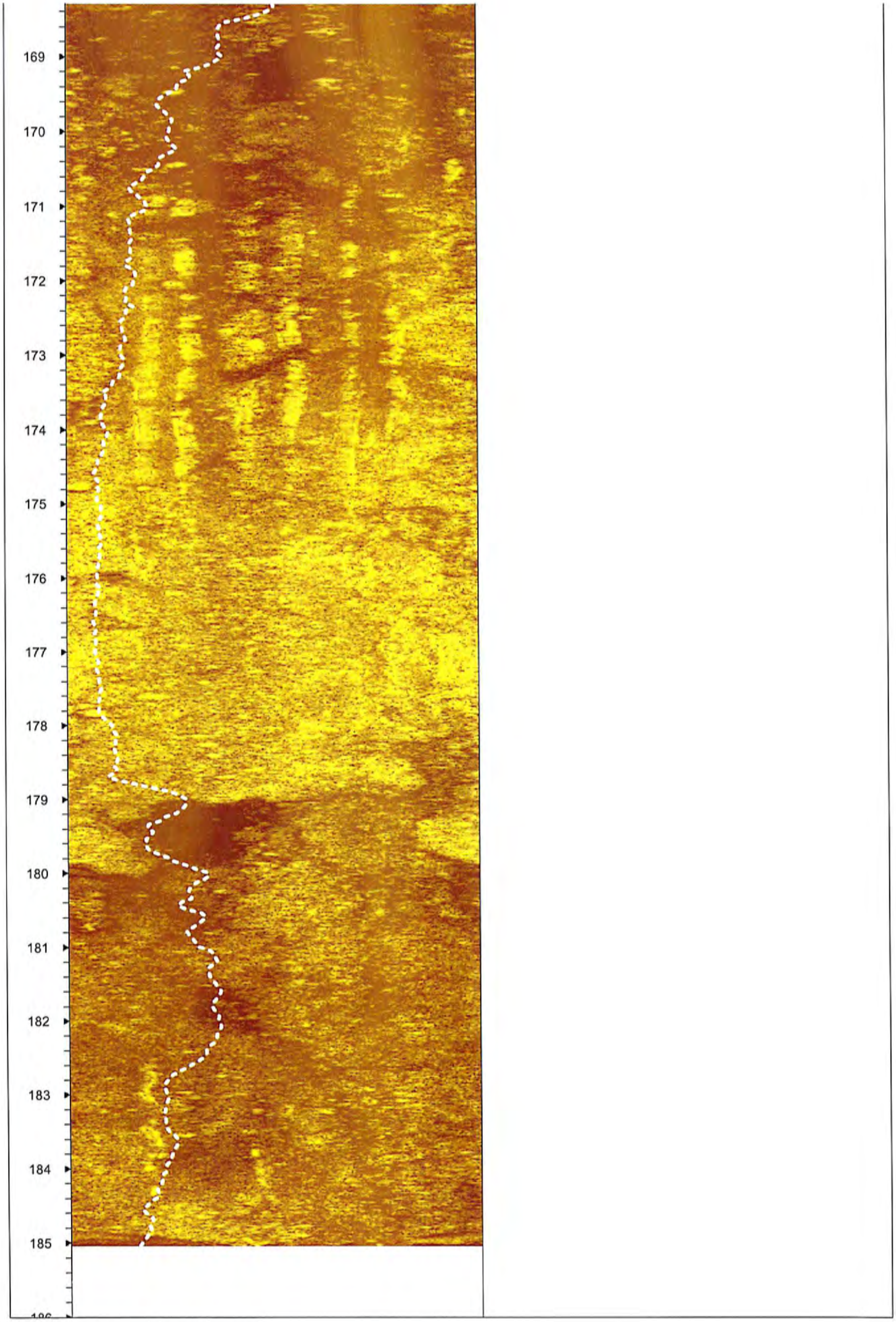

96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113

114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131




132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149


151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168


169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185

NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

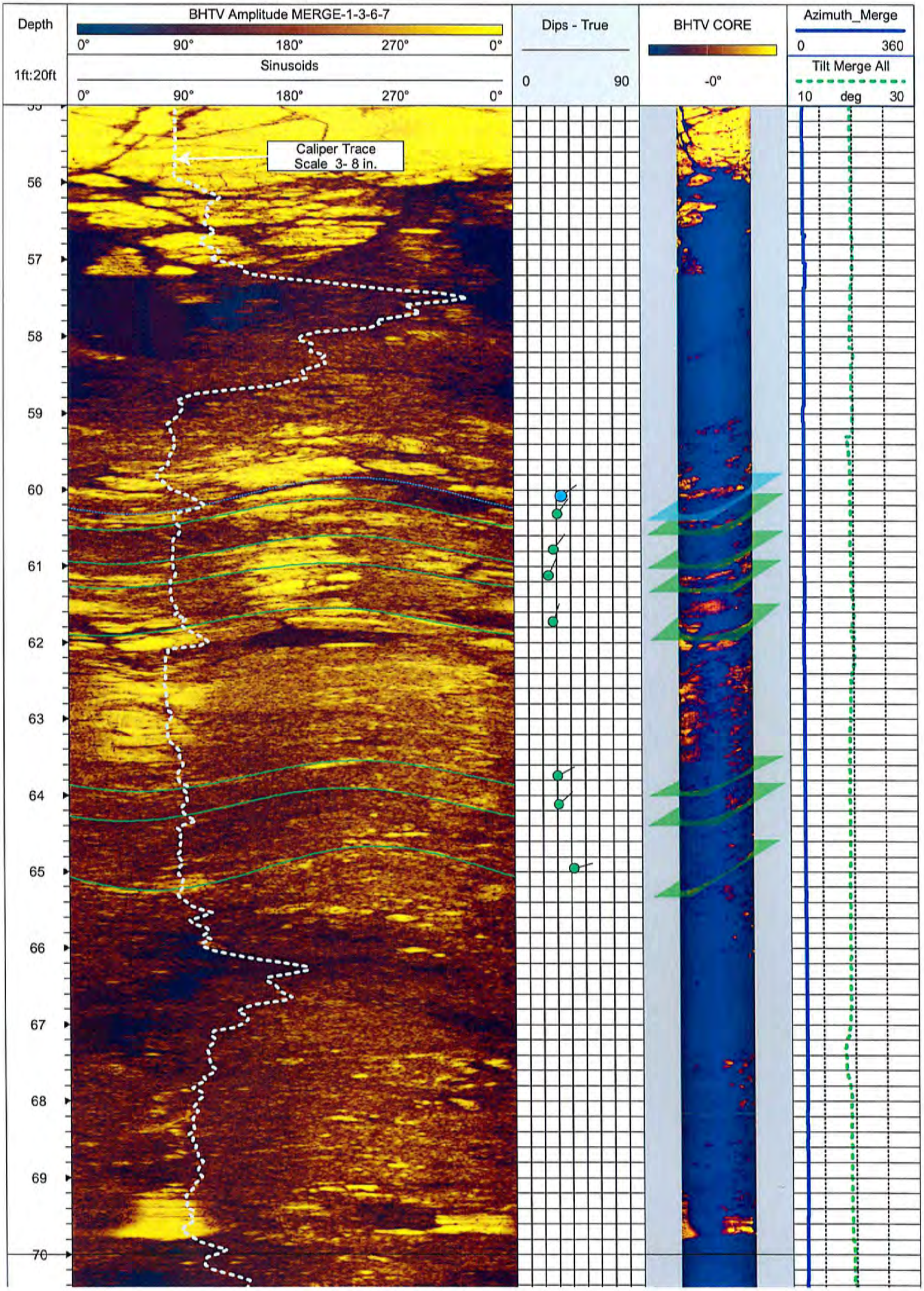
Appendix C:

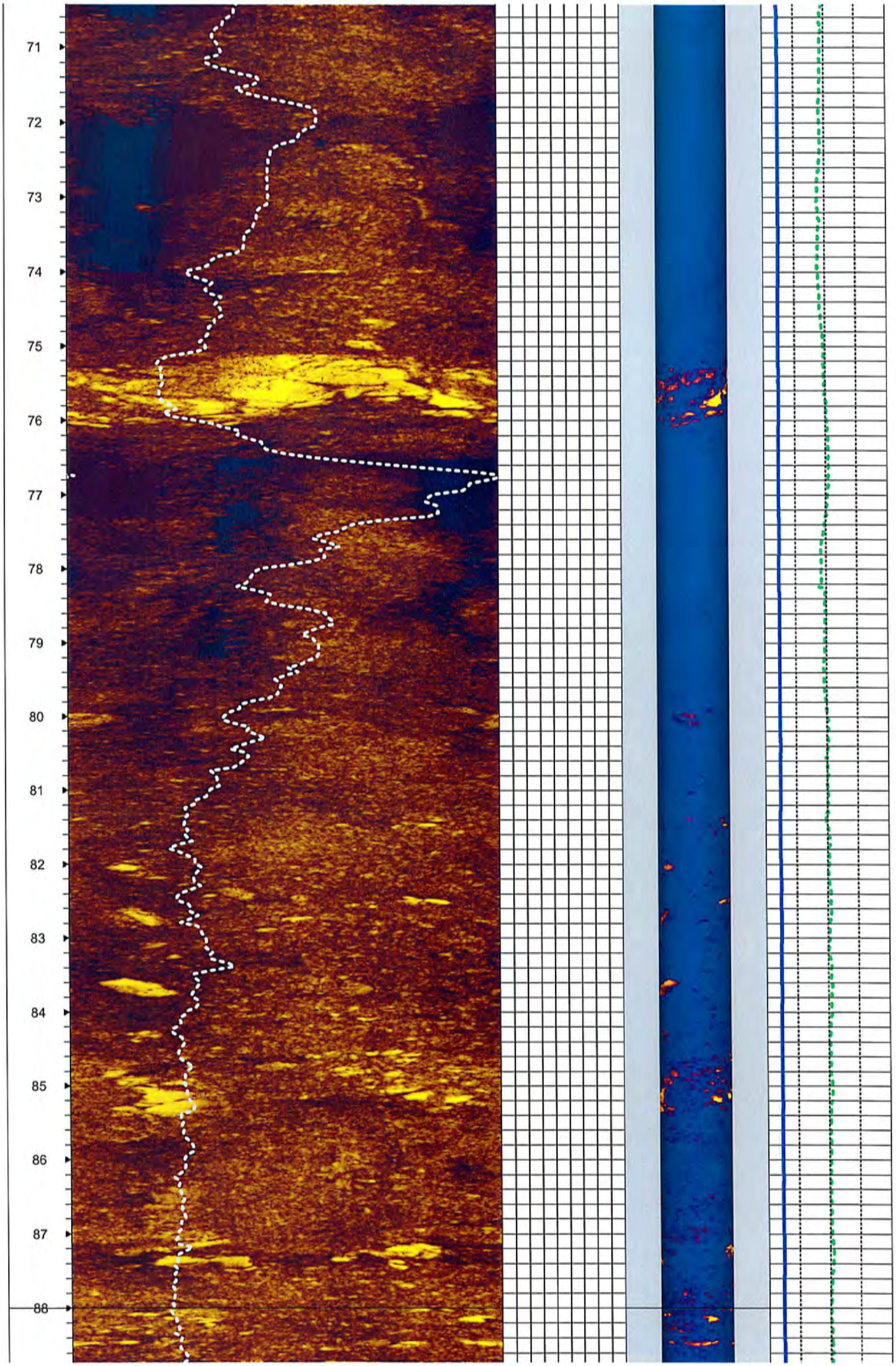
Interpreted Televiewer Plots

Boreholes GT-1-2018-1, GT-1-2018-2, S-1-2018-2

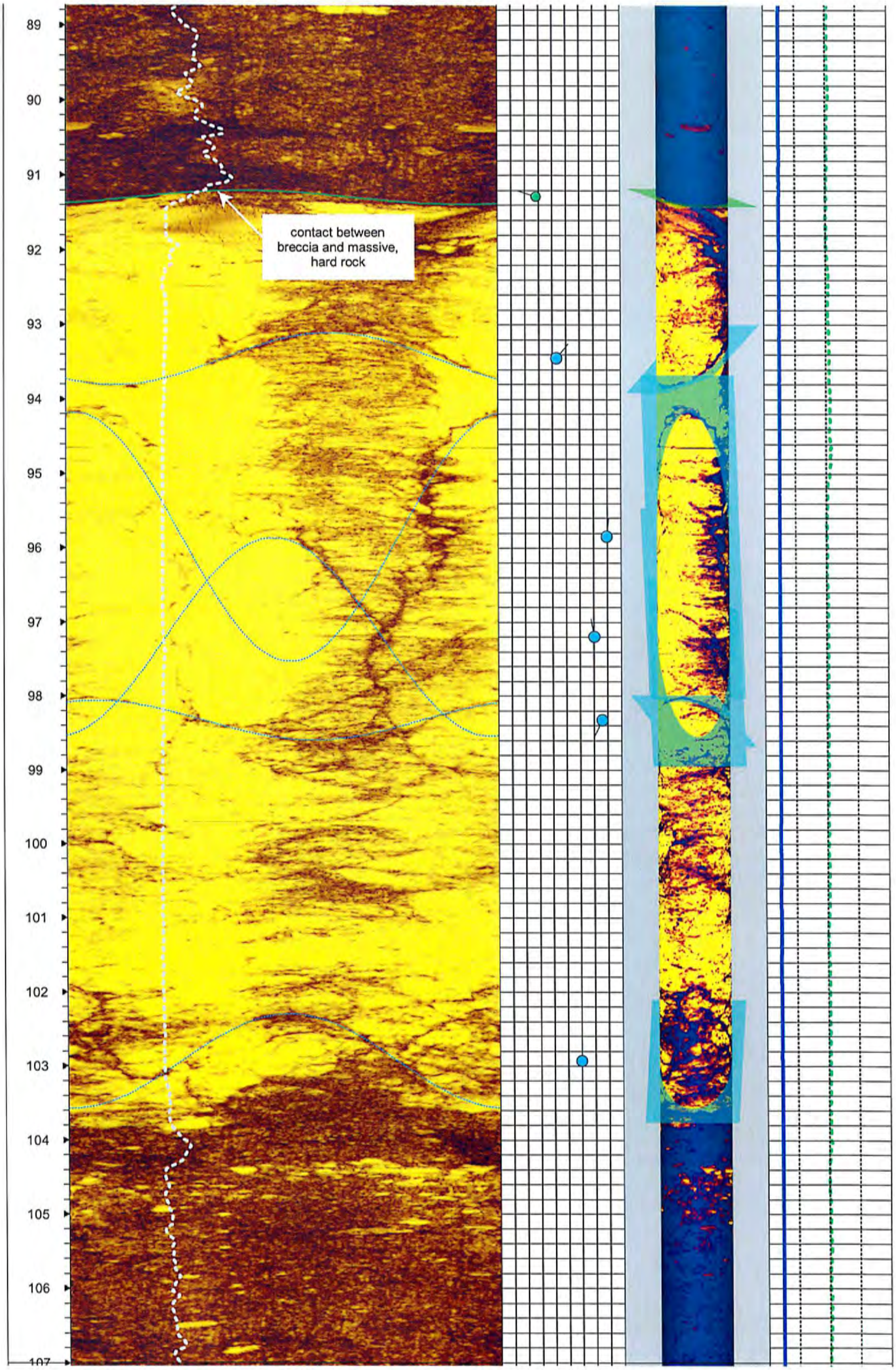
NORCAL GEOPHYSICAL CONSULTANTS, INC.	TELEVIEWER ANALYSIS	COMPANY: STANTEC WELL ID: GT-1-2018-1 FIELD: LEHIGH QUARRY COUNTY: SANTA CLARA	DATE: Oct. 6 & 7, 2018 CASING: Hwt to 50.3-ft bgs JOB NO. NS185080 STATE: CA

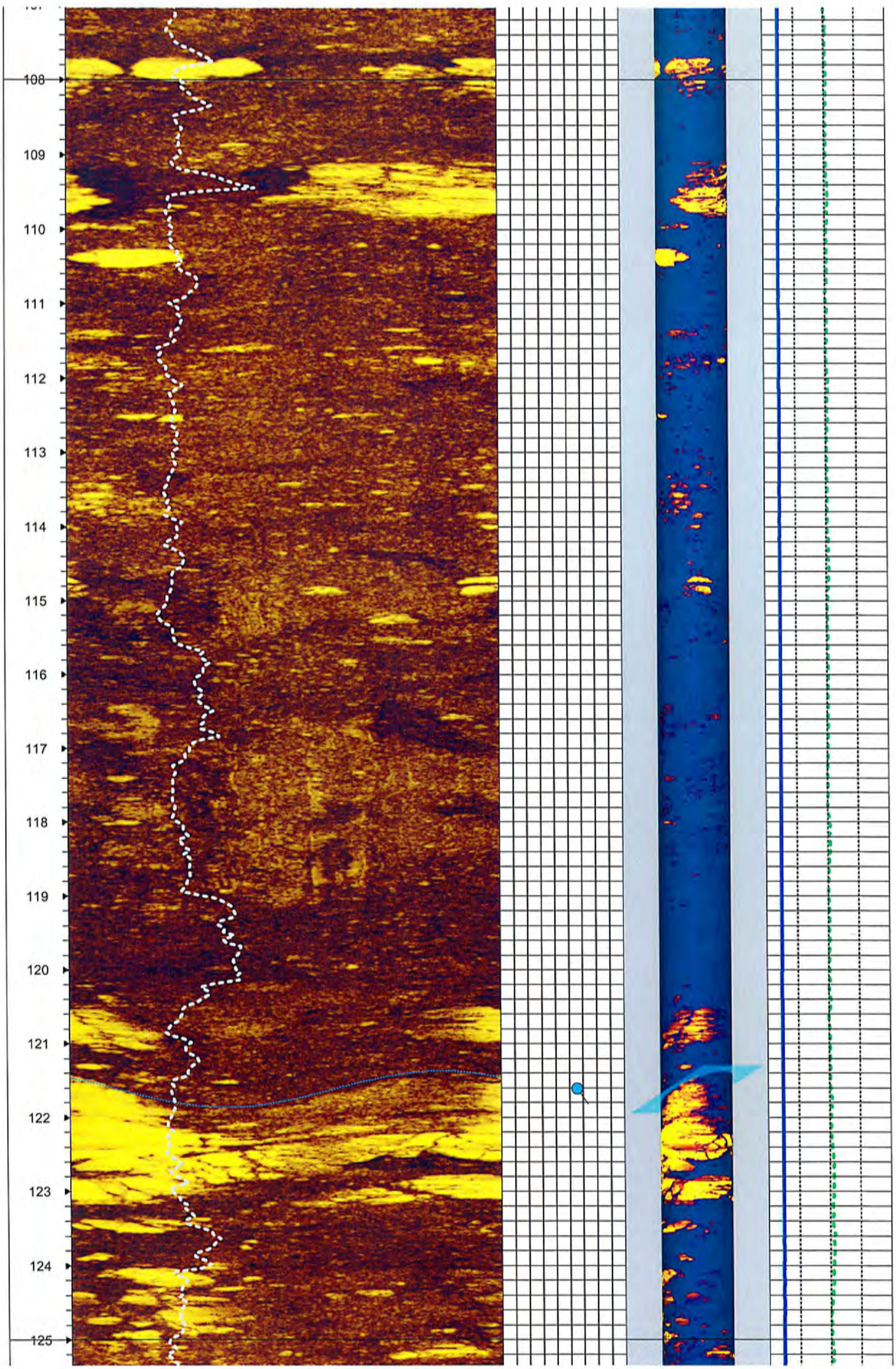
NOTES:

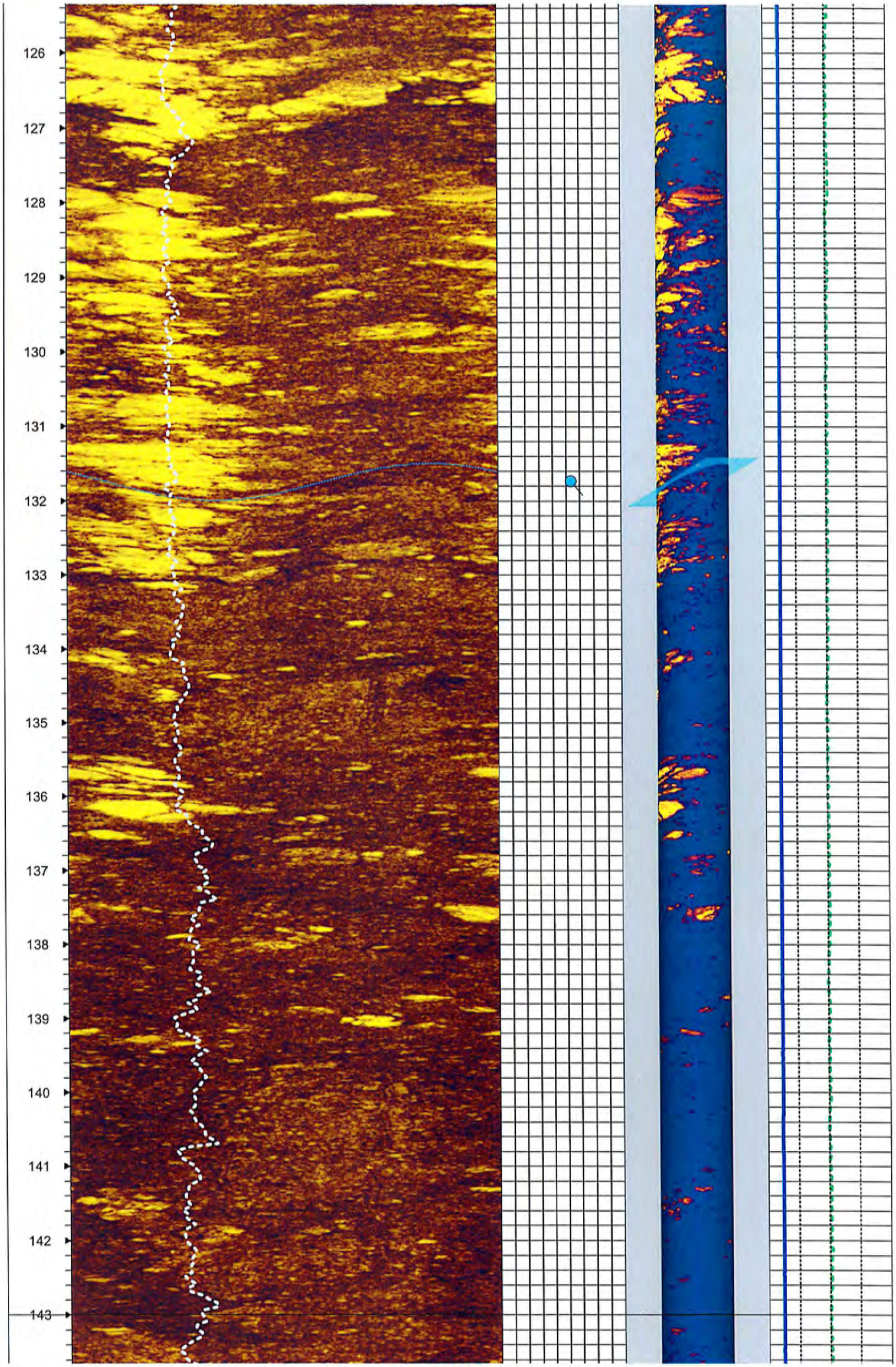


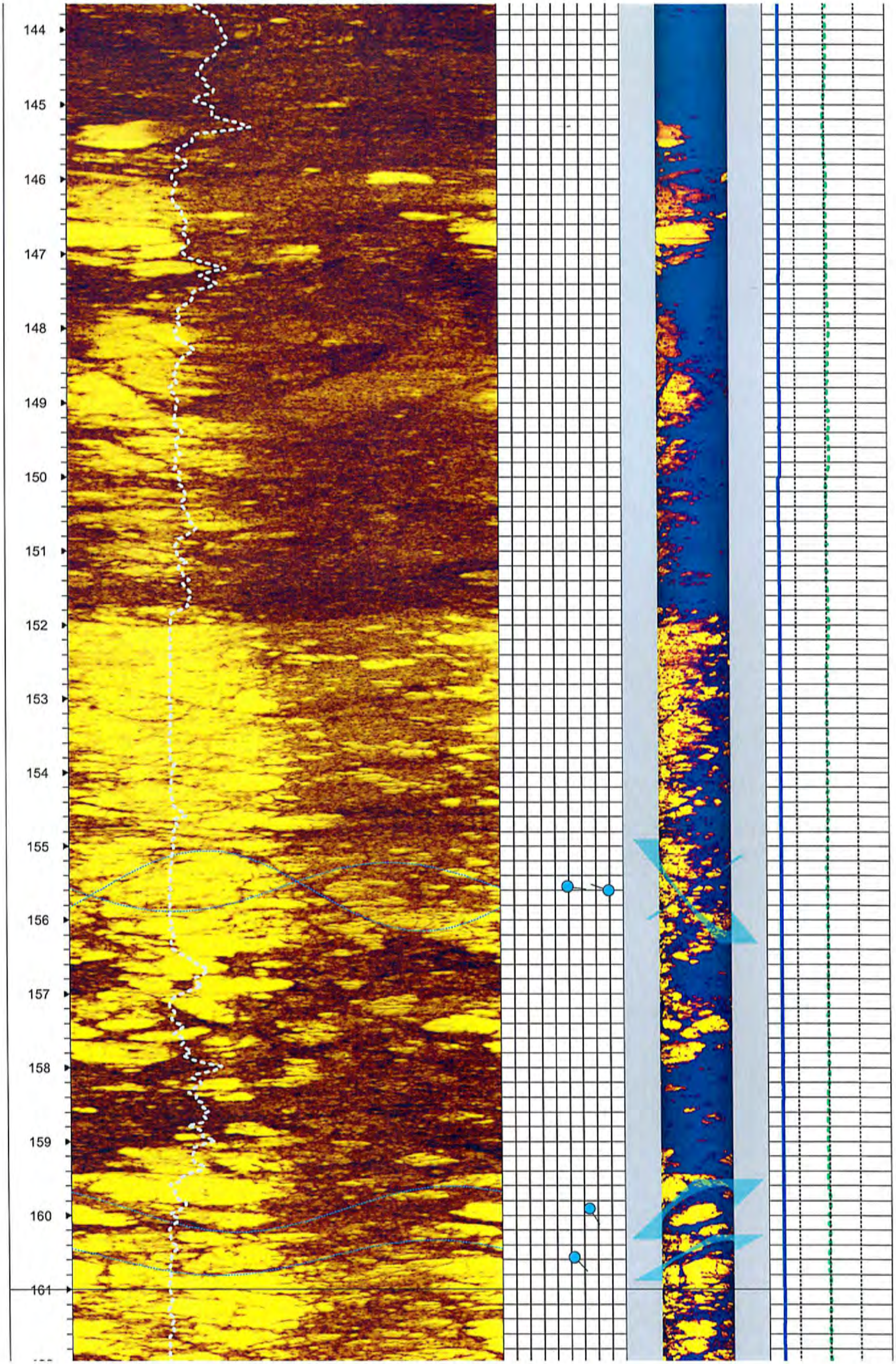


71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88

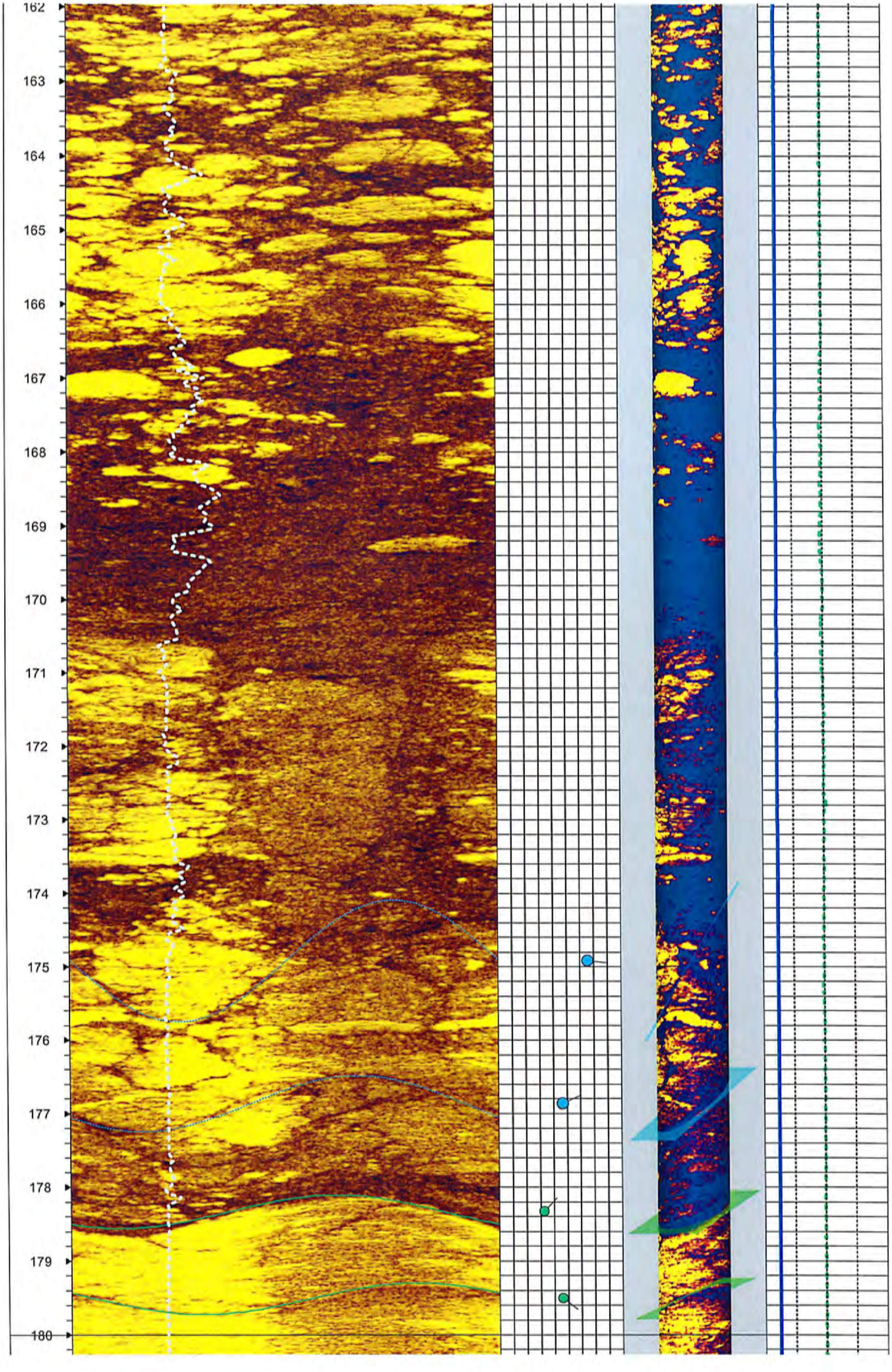

89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
contact between breccia and massive, hard rock

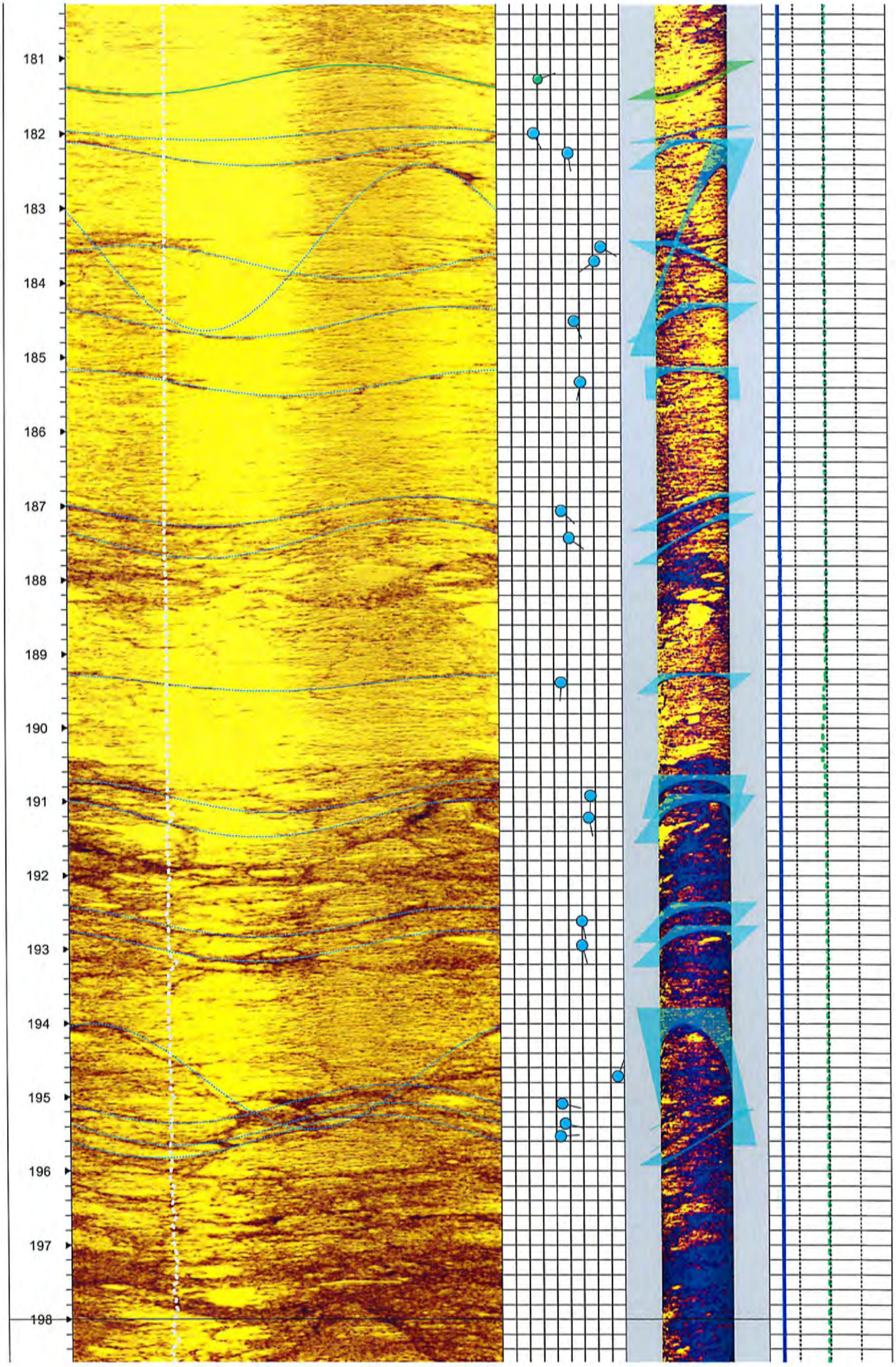

108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125

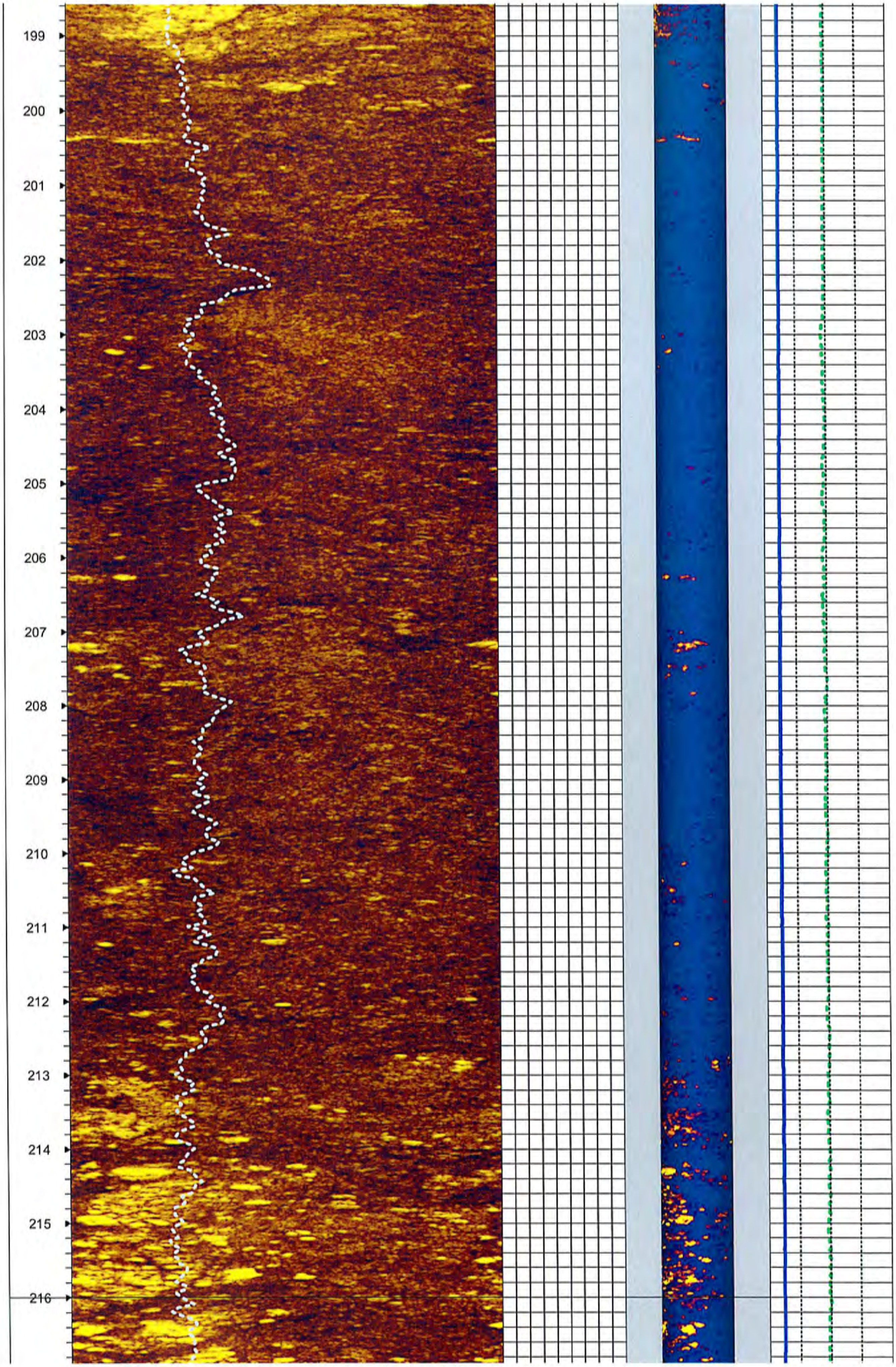

126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143

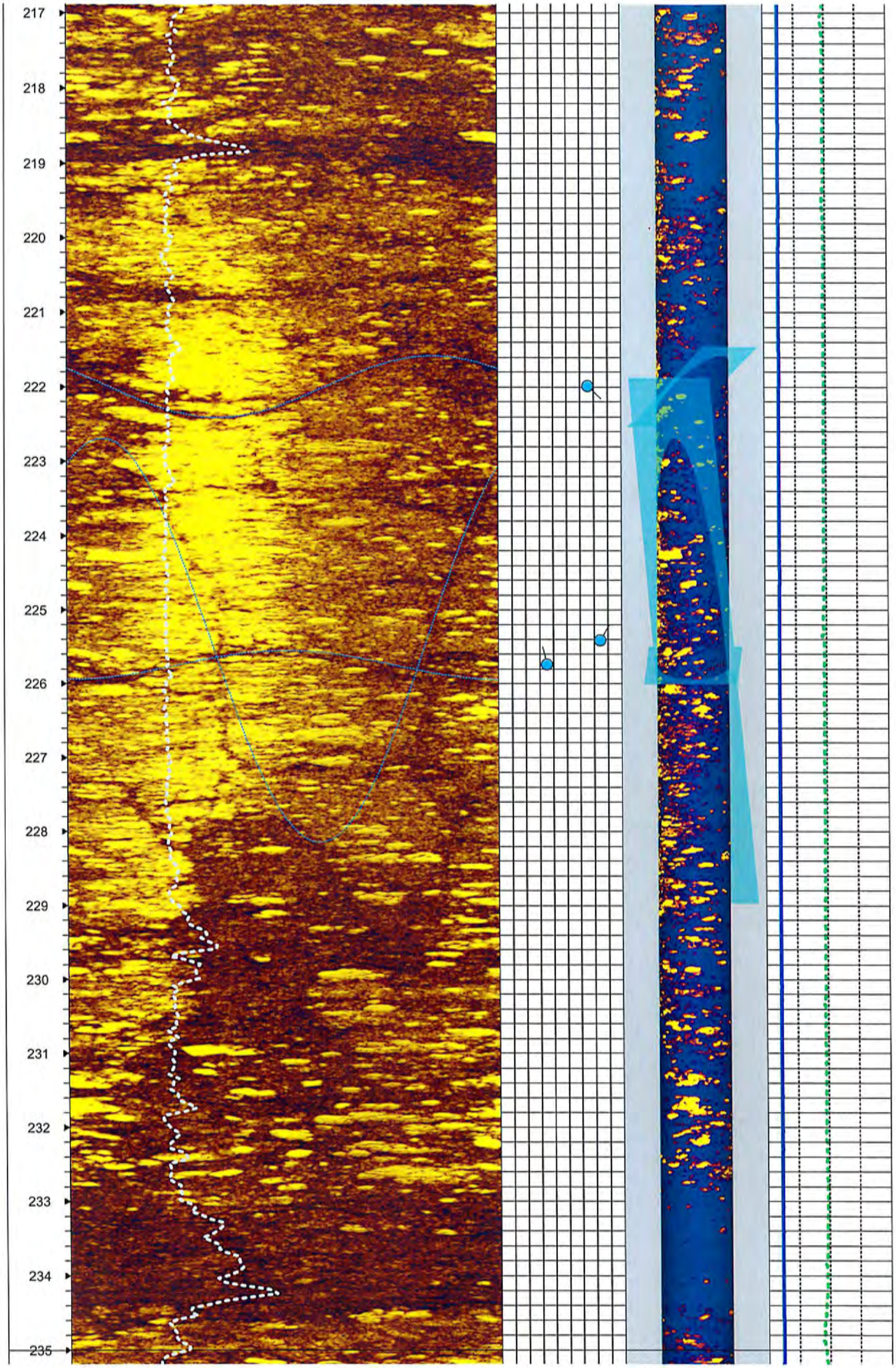


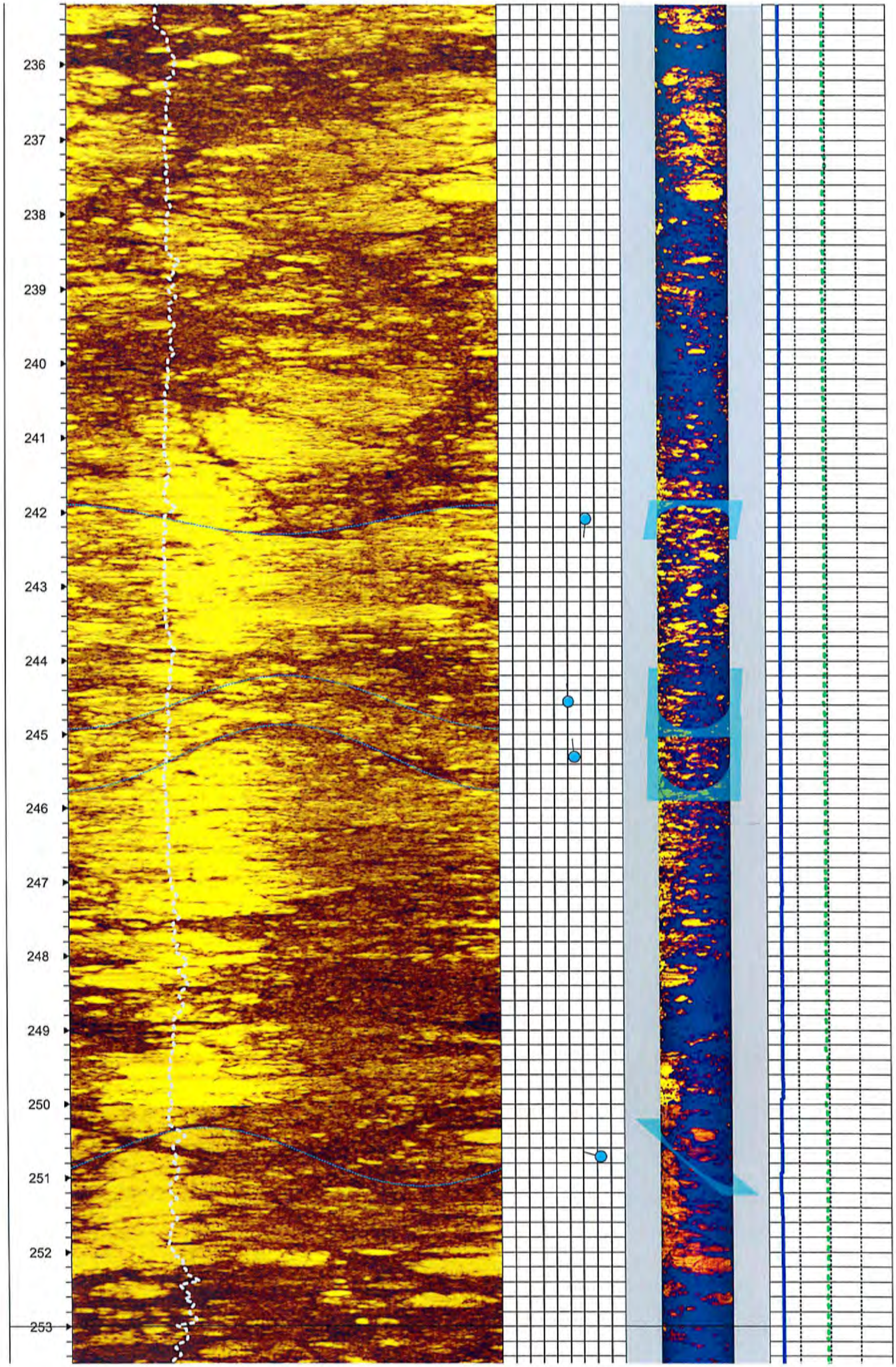
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161

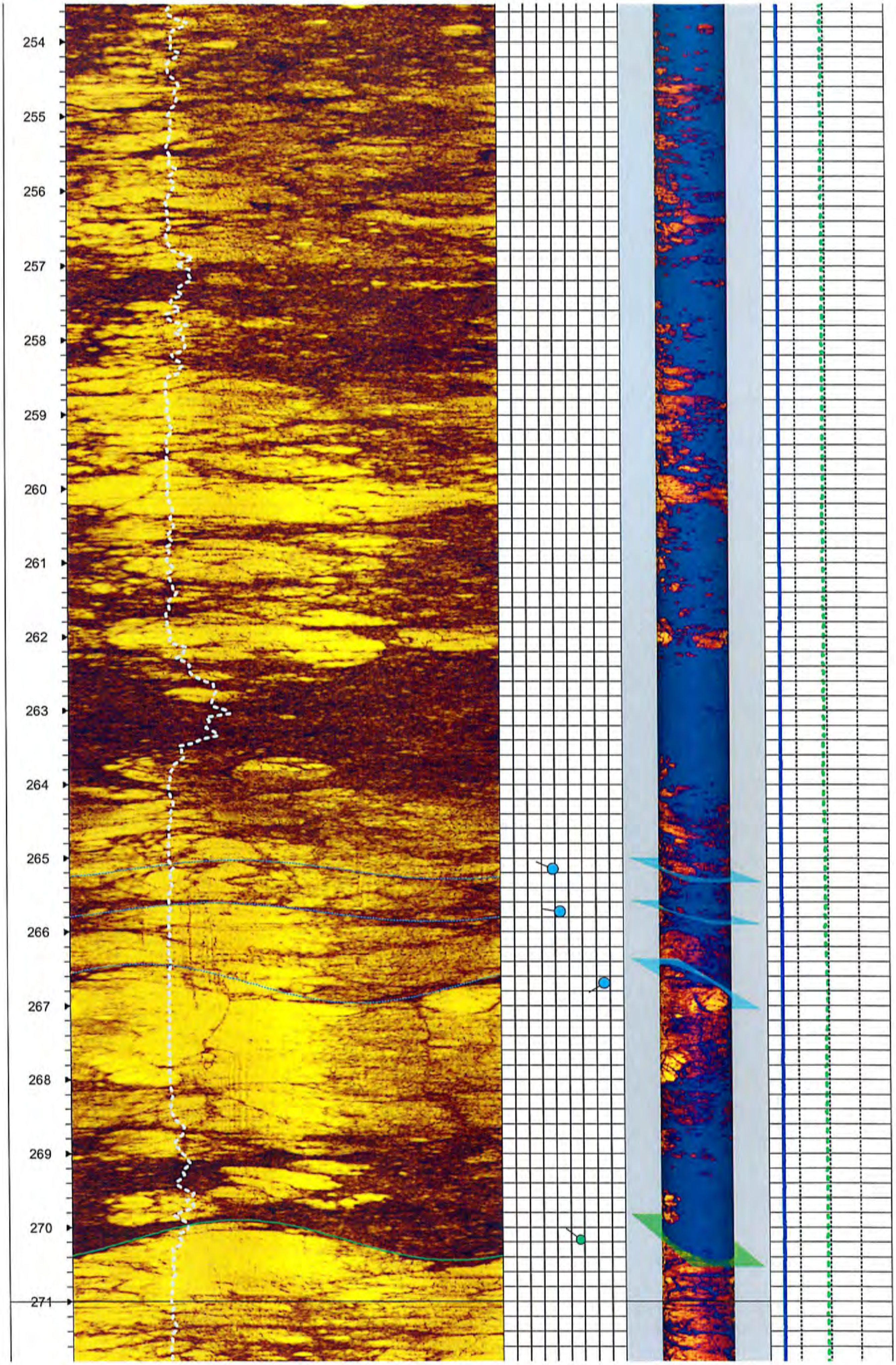

162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180

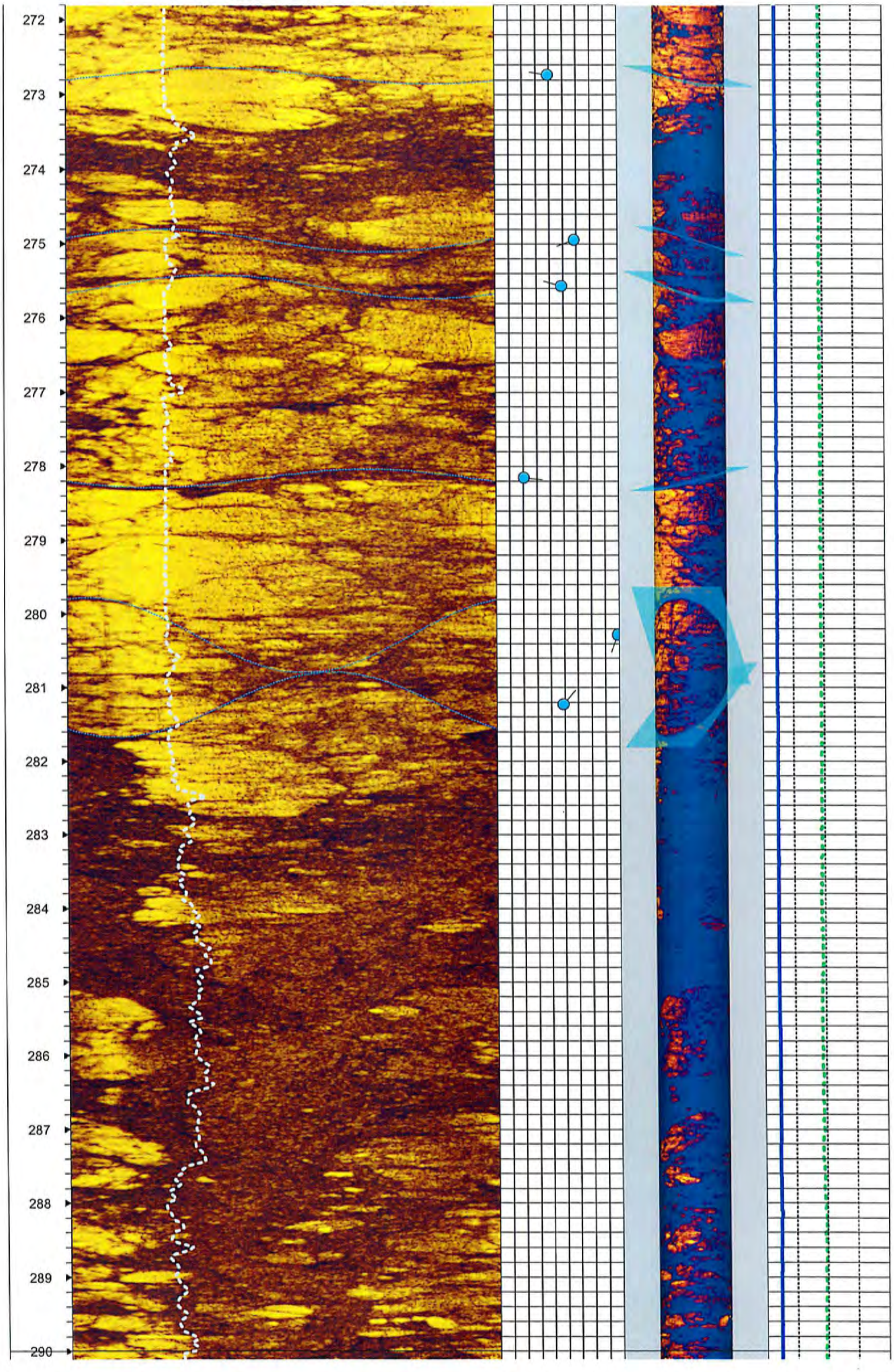

181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198

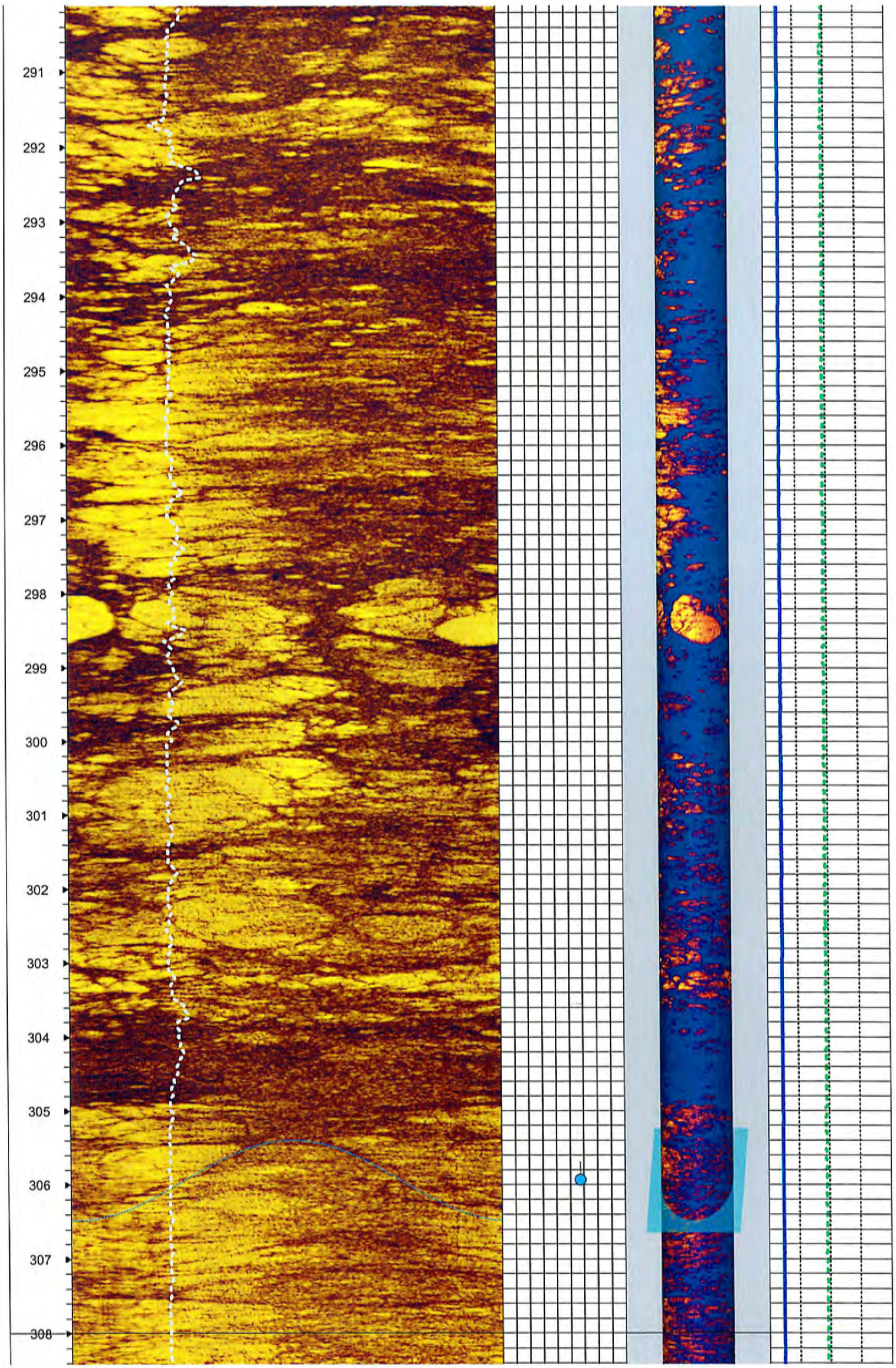

199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216

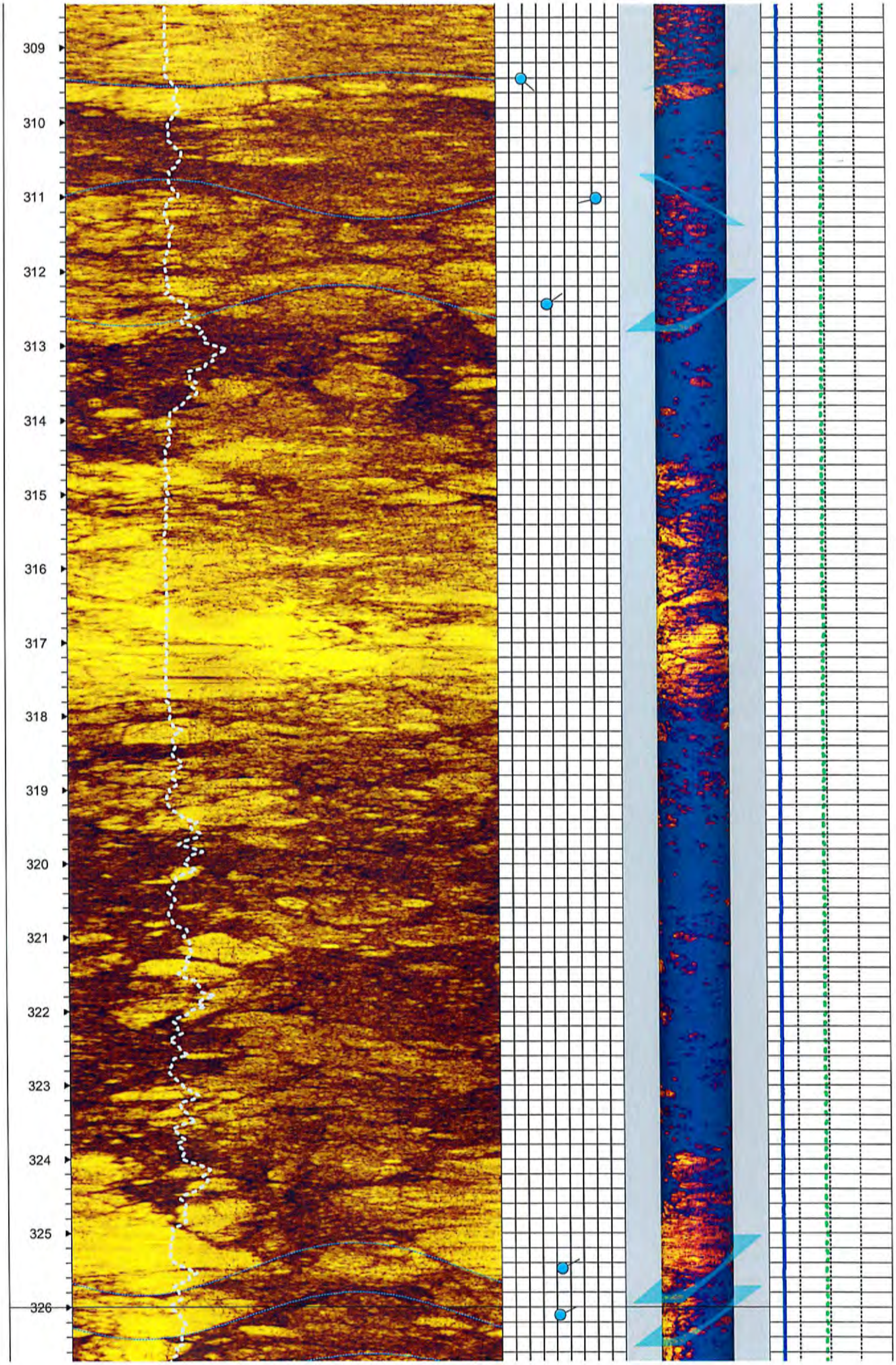

217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235

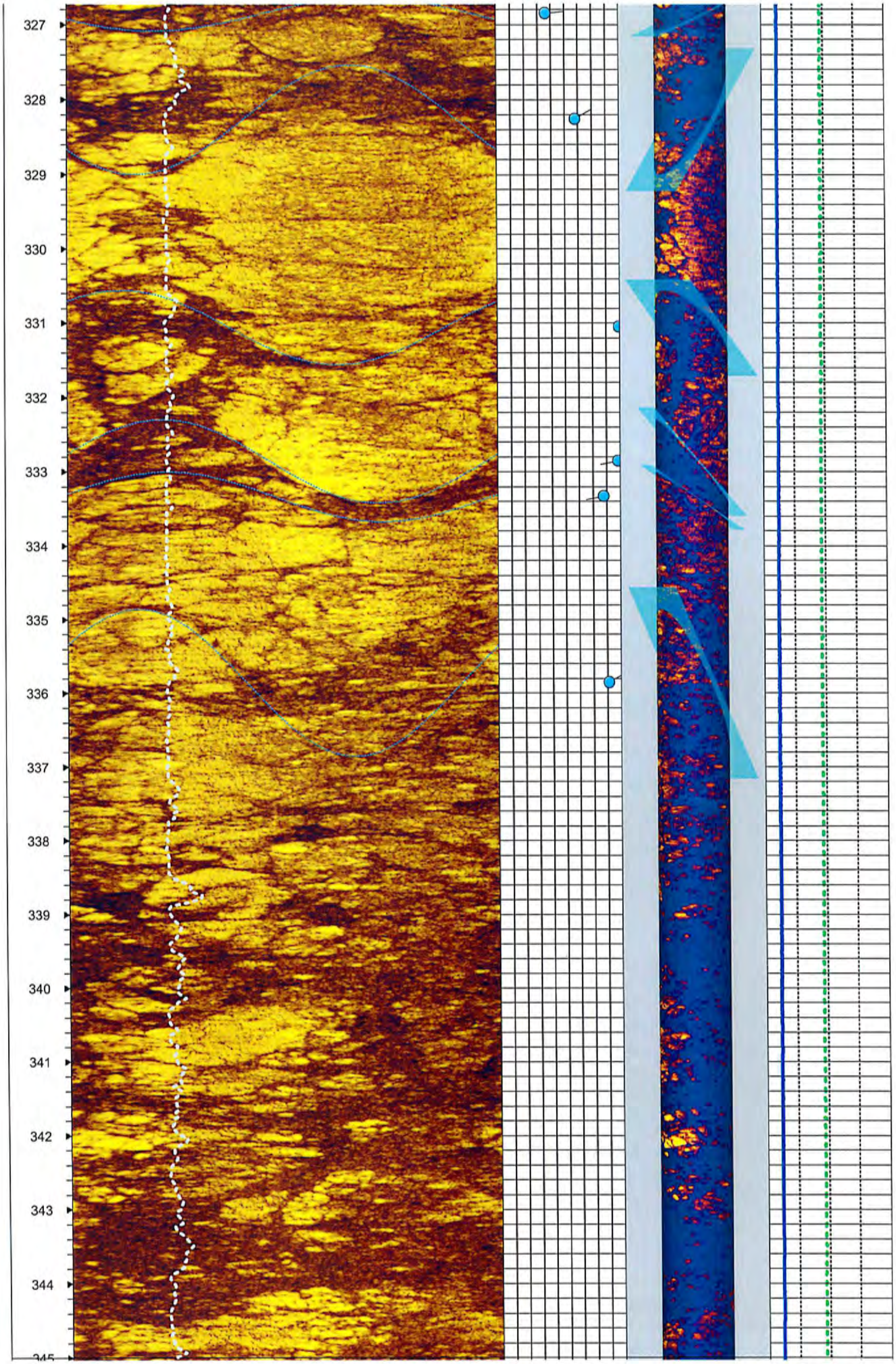

236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253

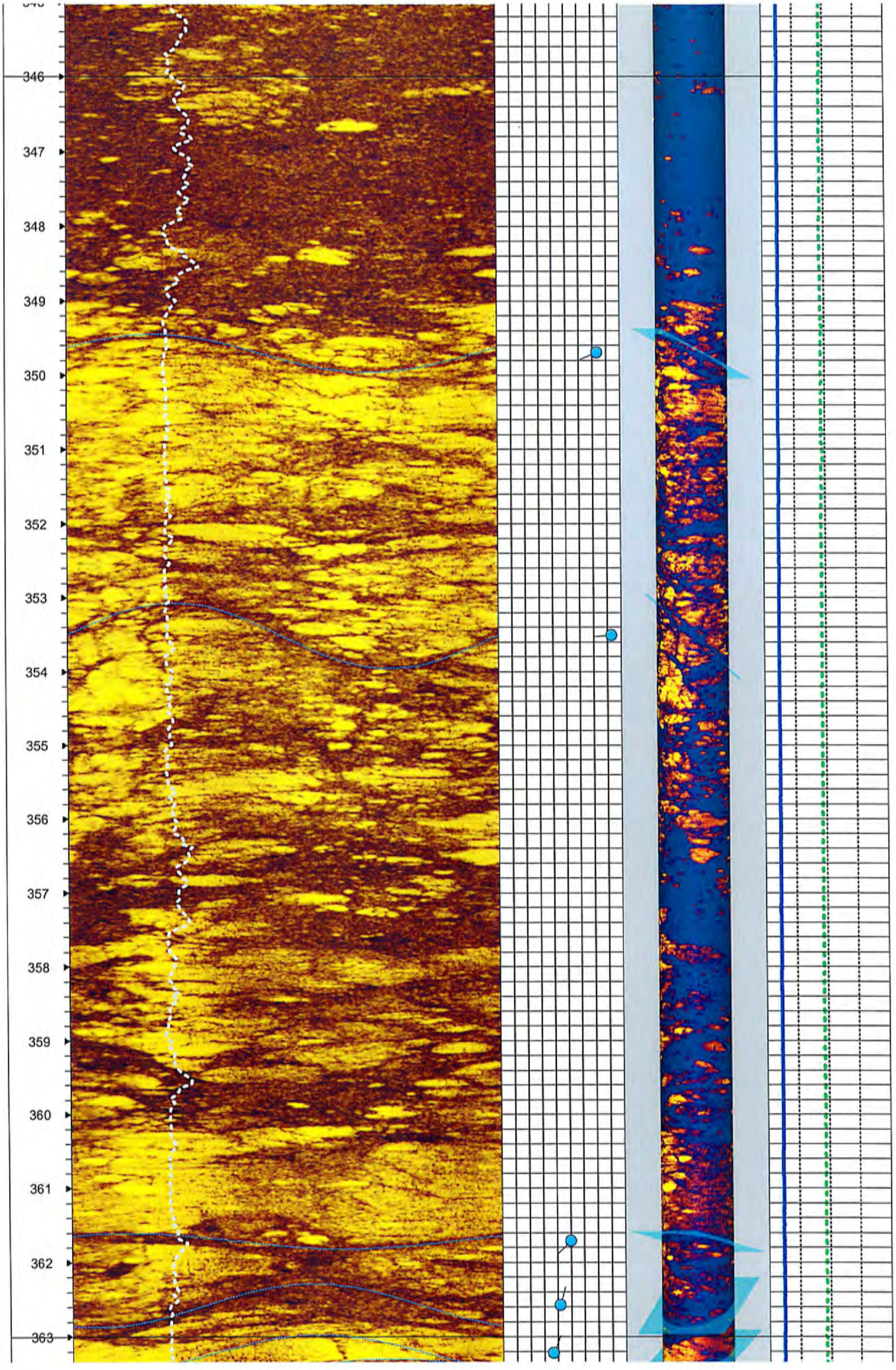

254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271

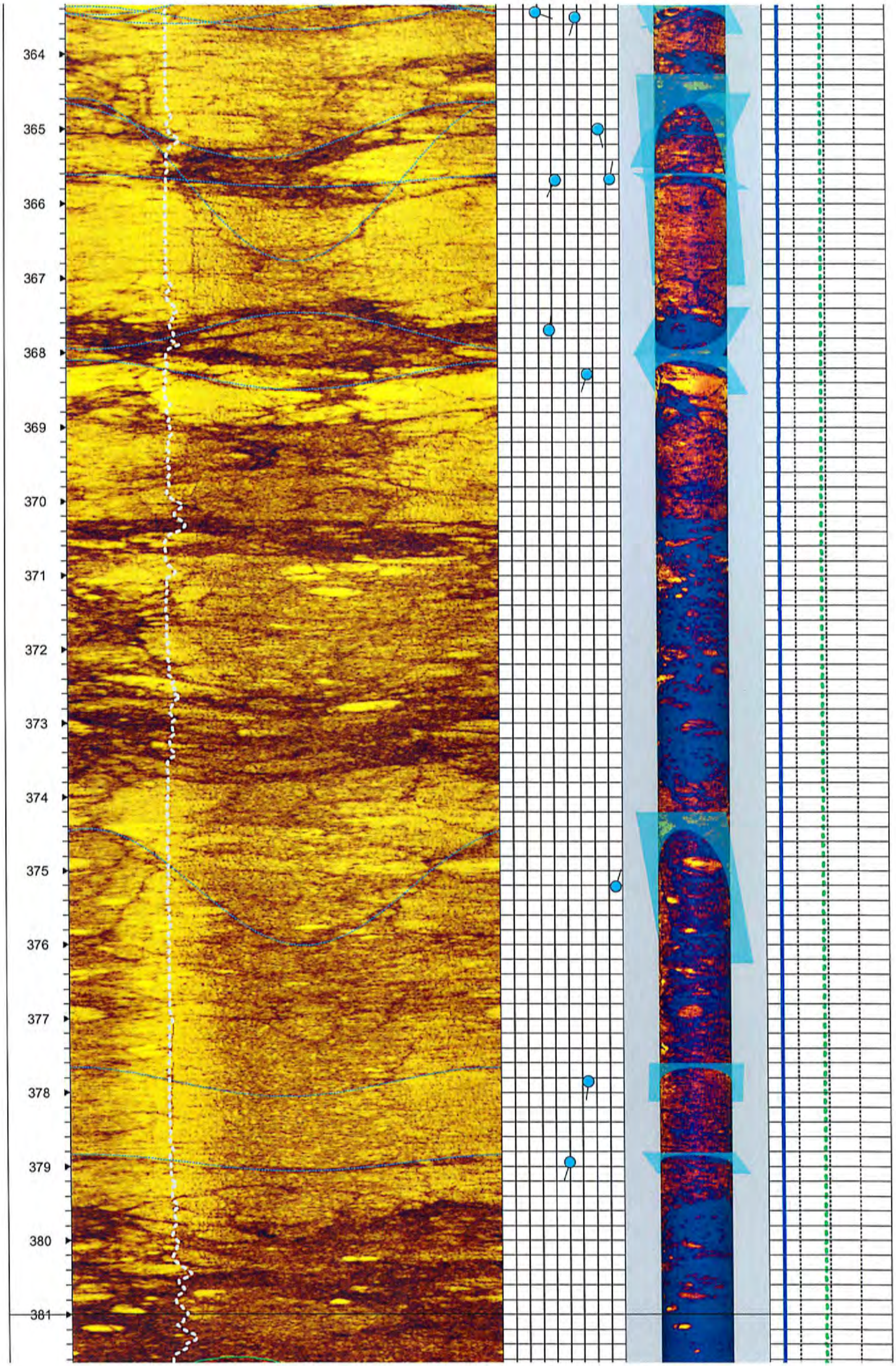

272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290

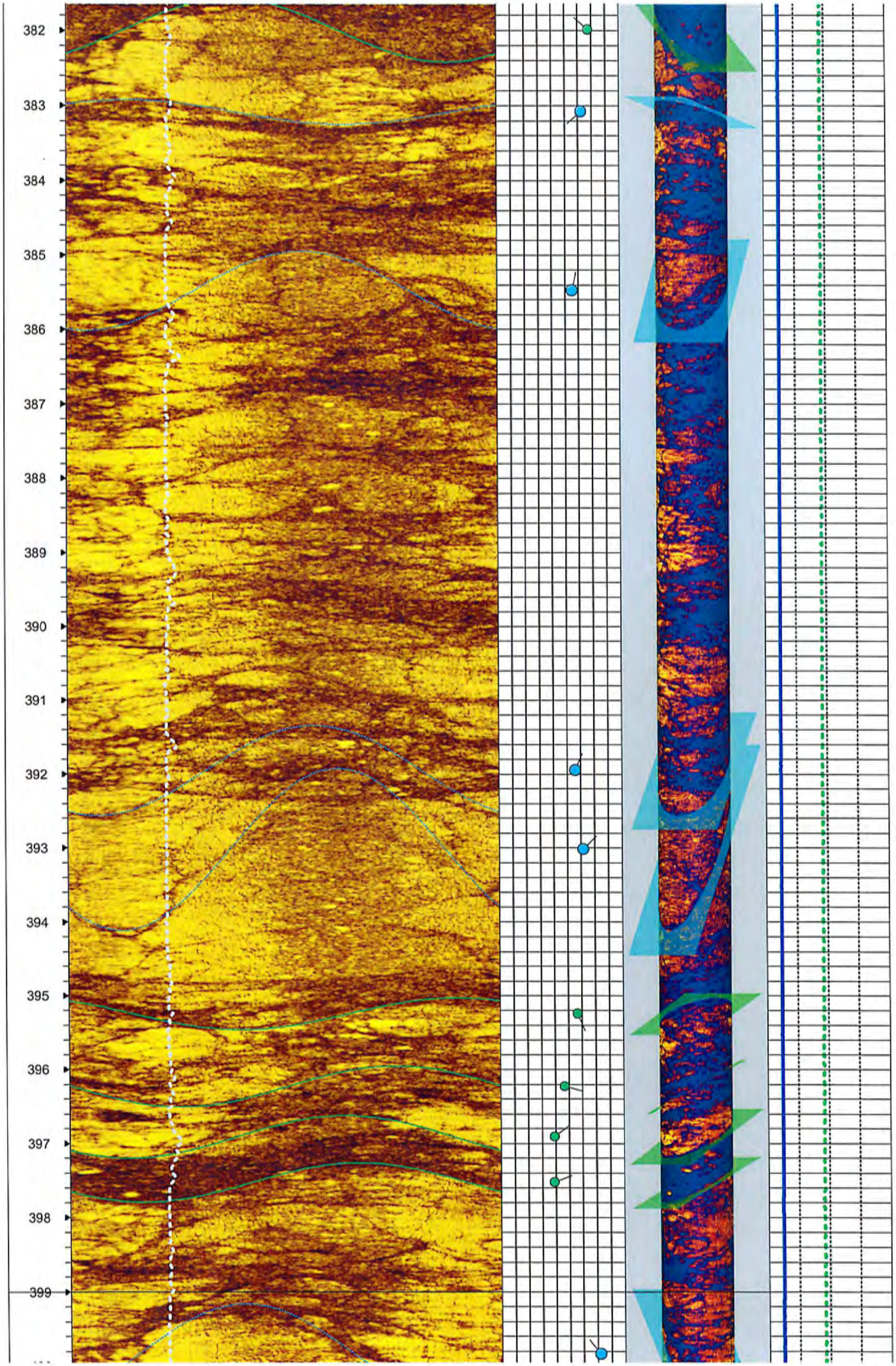

291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308

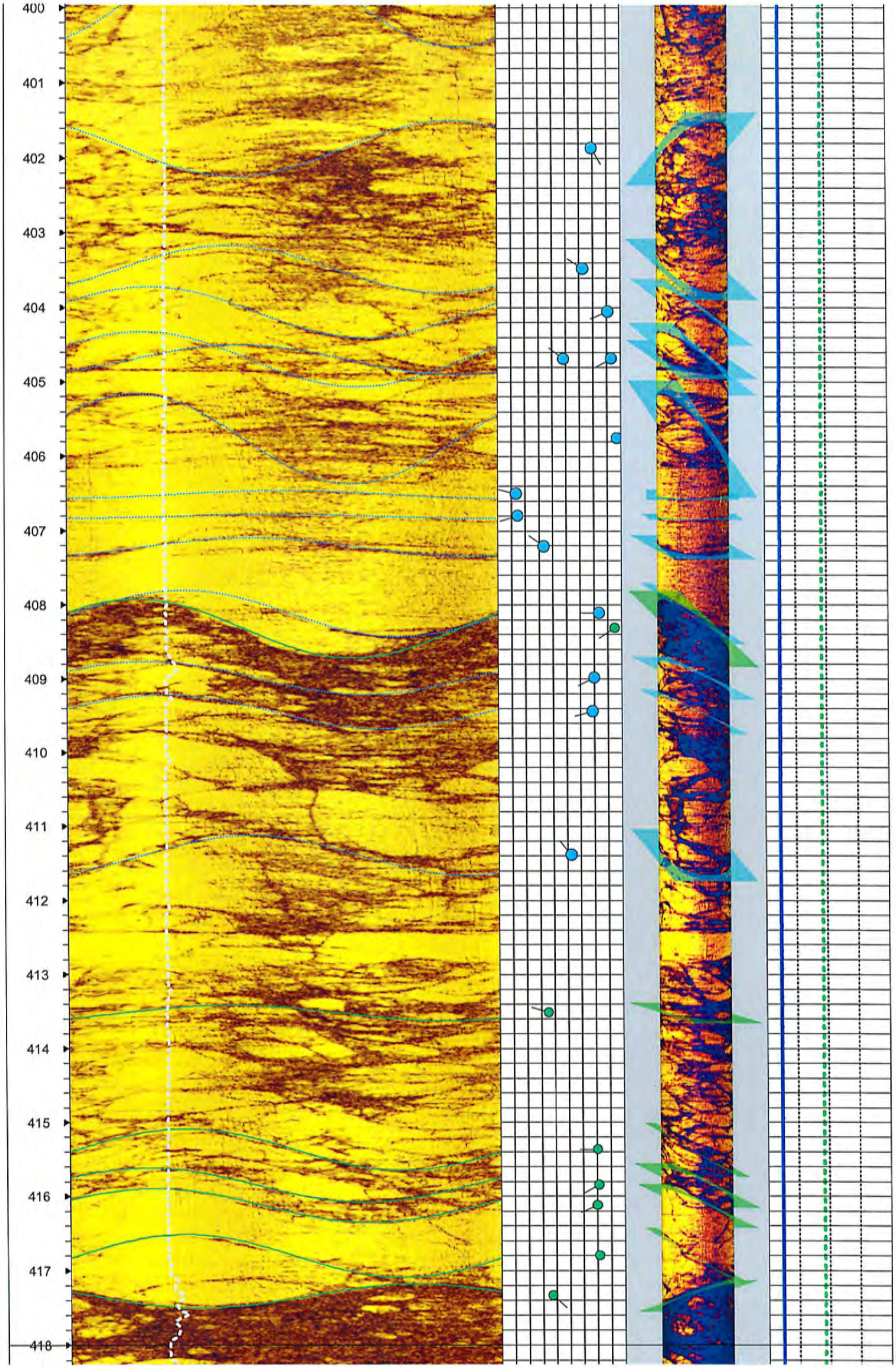

309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326

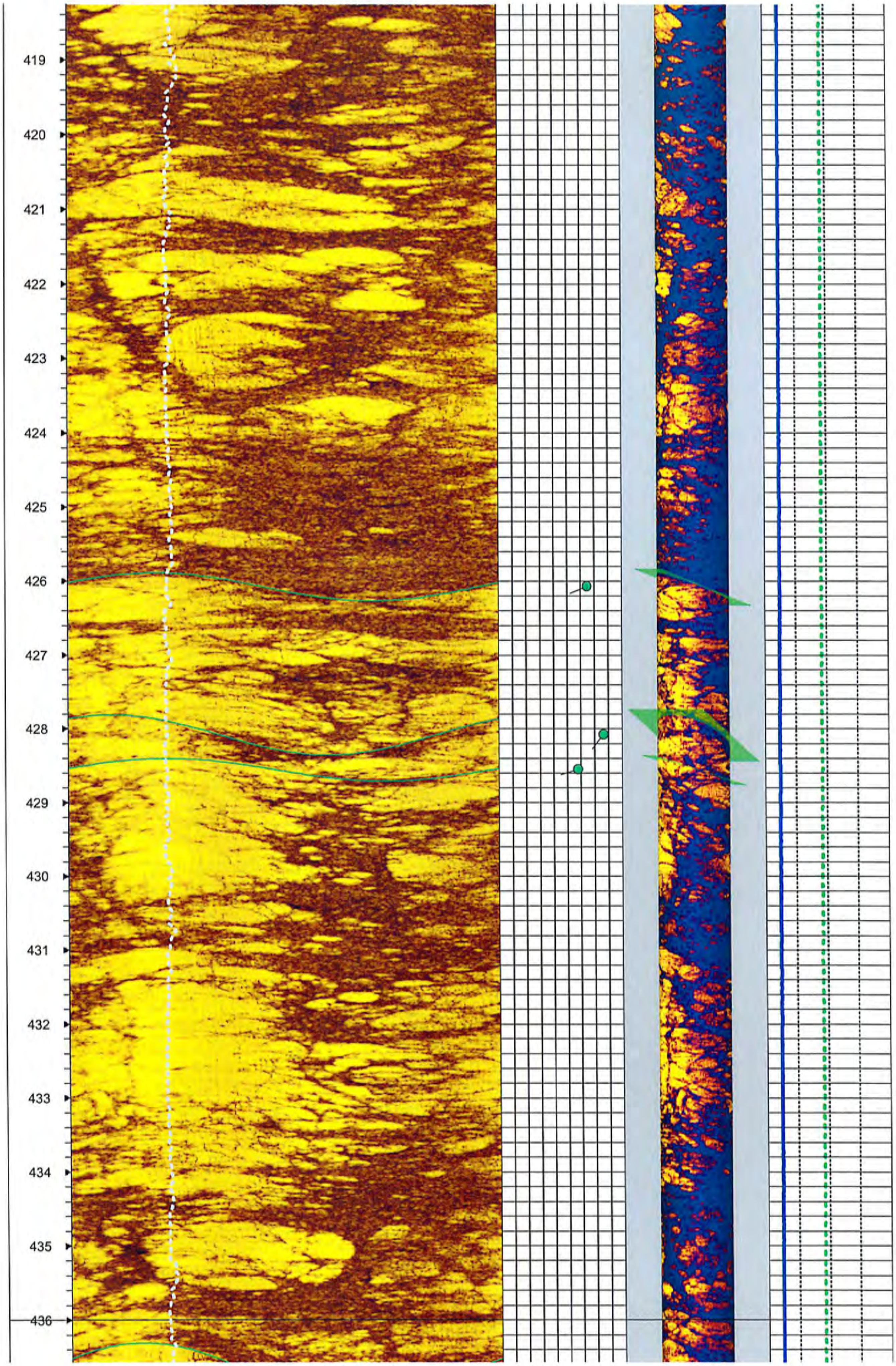

327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345

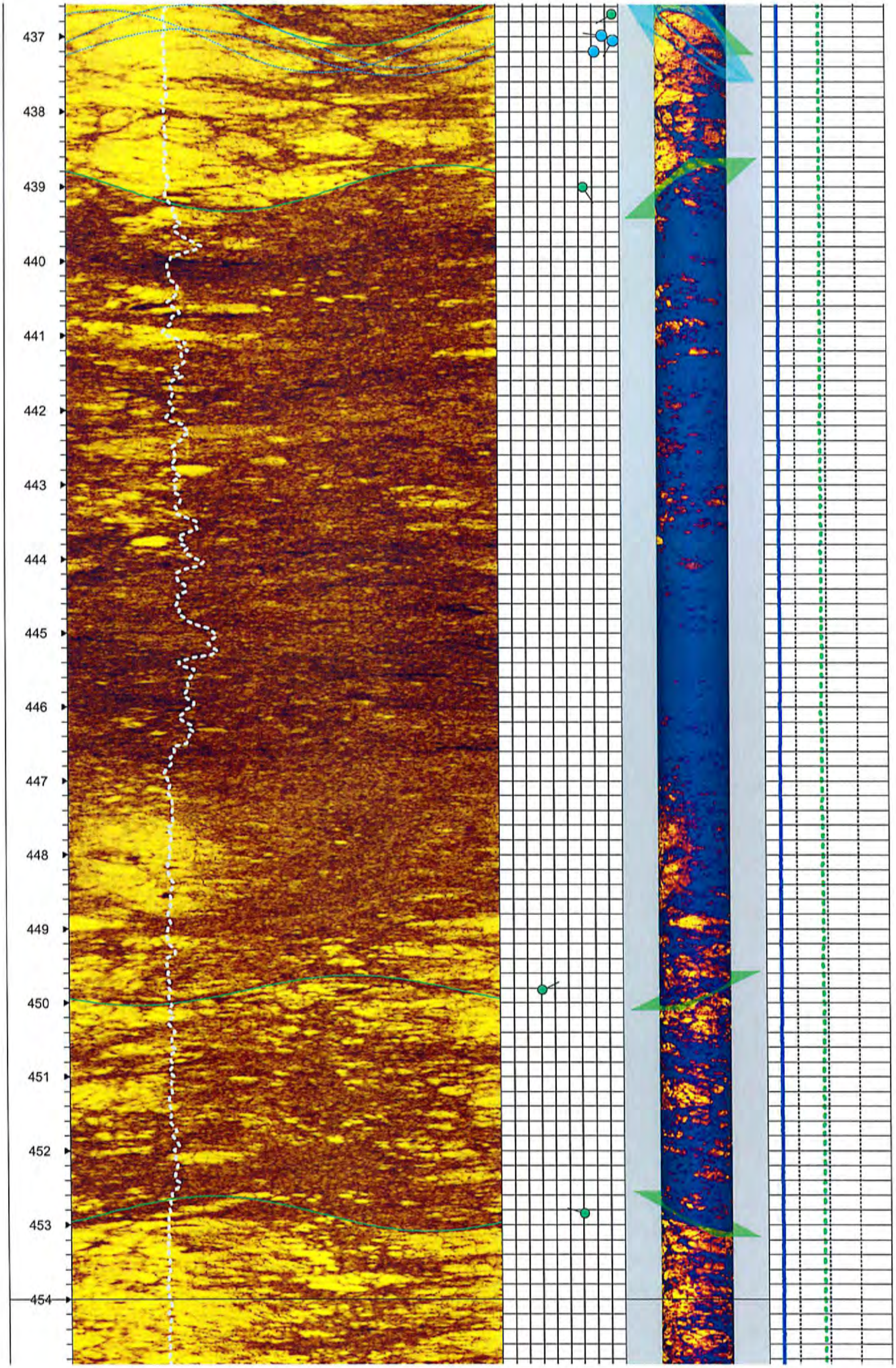

346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363

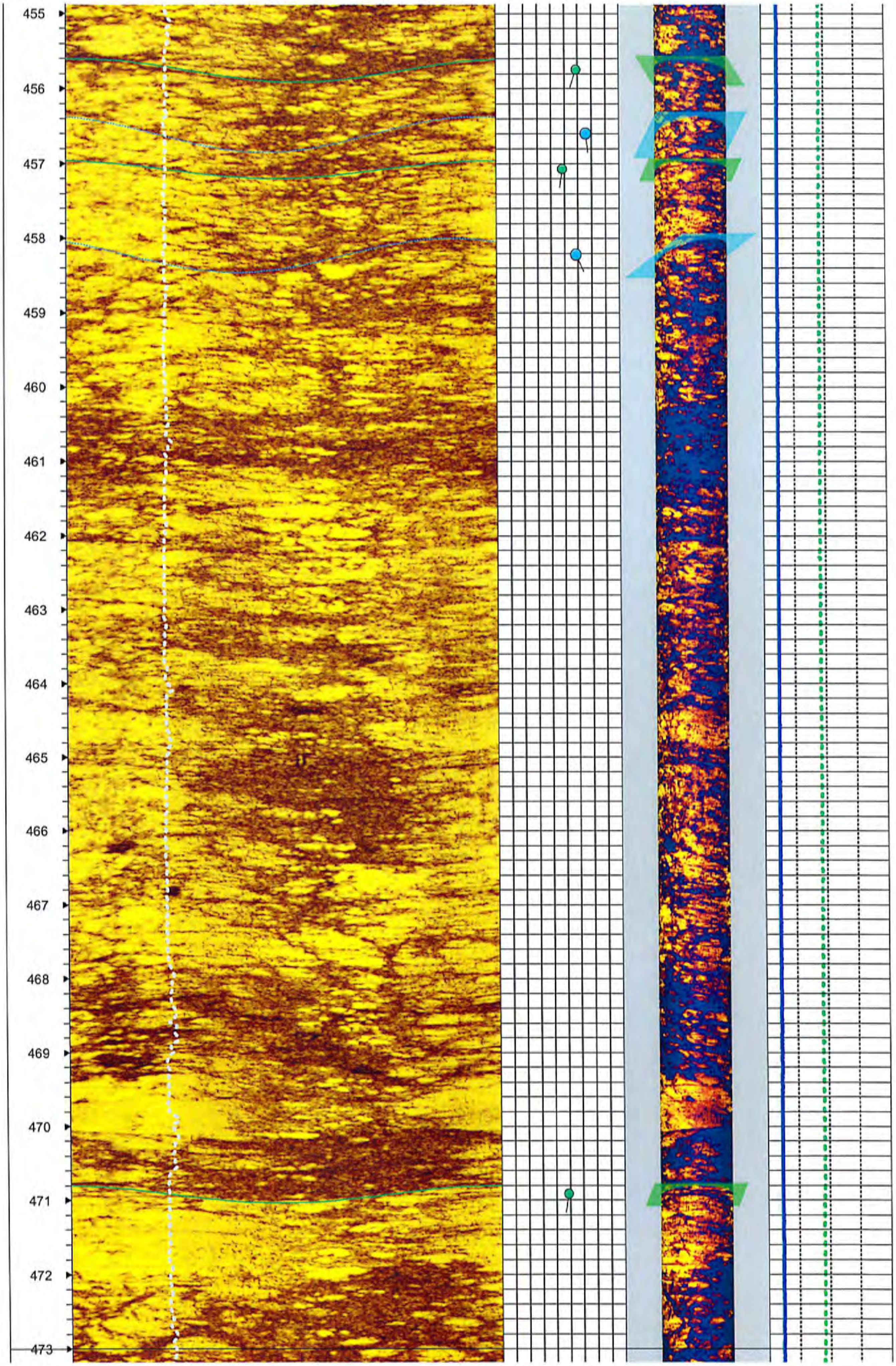

364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381

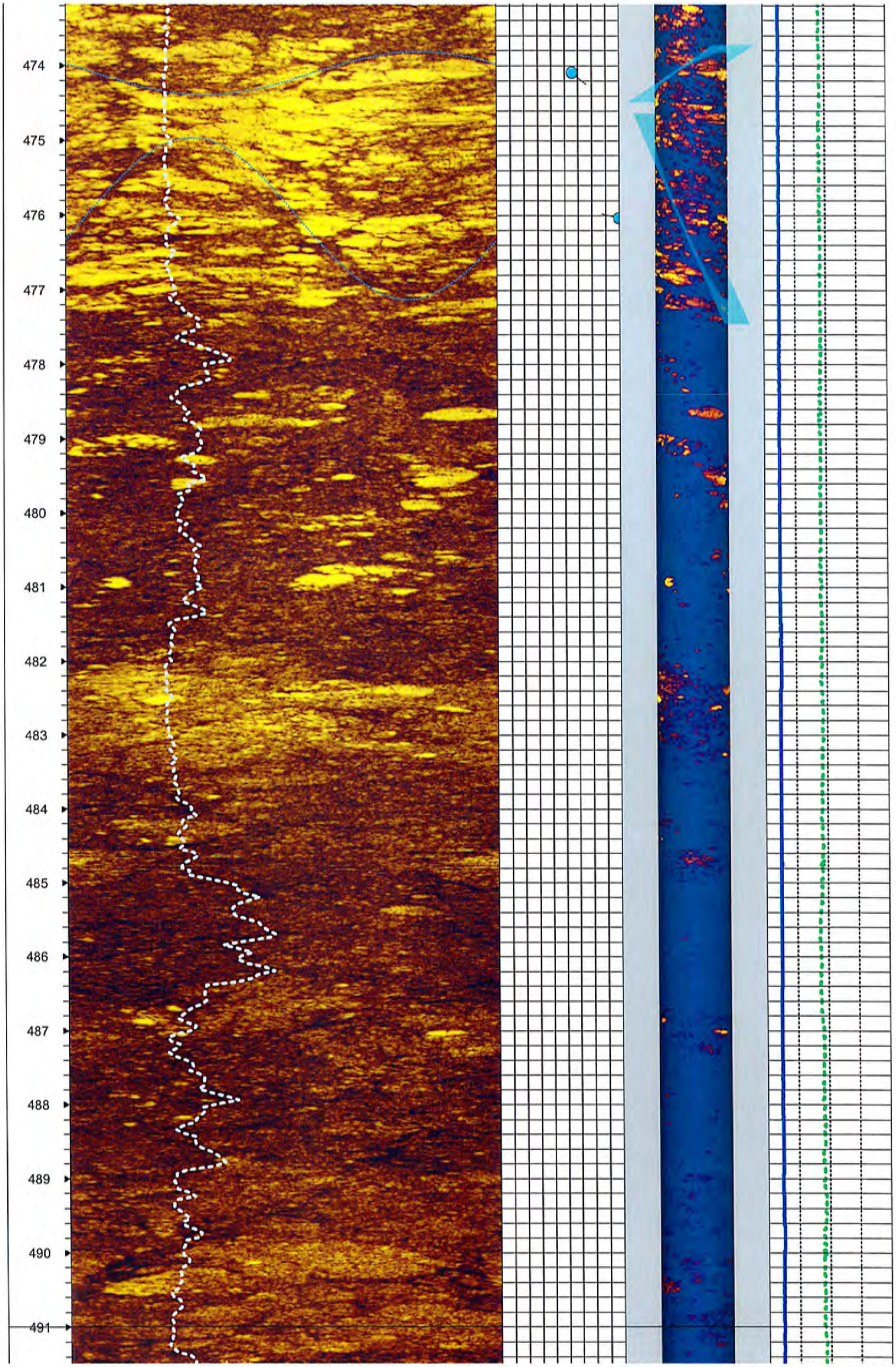

382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399

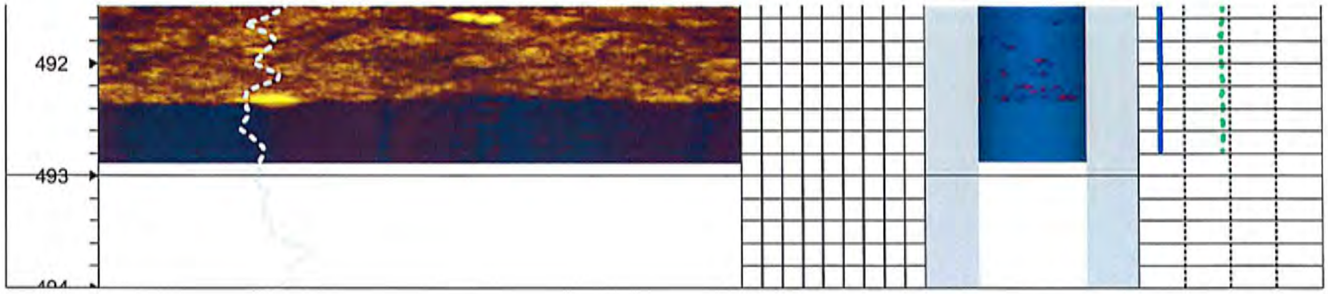

400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418


419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436


437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454


455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473


474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491



492
493
494

NORCAL GEOPHYSICAL CONSULTANTS INC. A Terracon COMPANY

TELEVIEWER ANALYSIS LOWER-SECTION

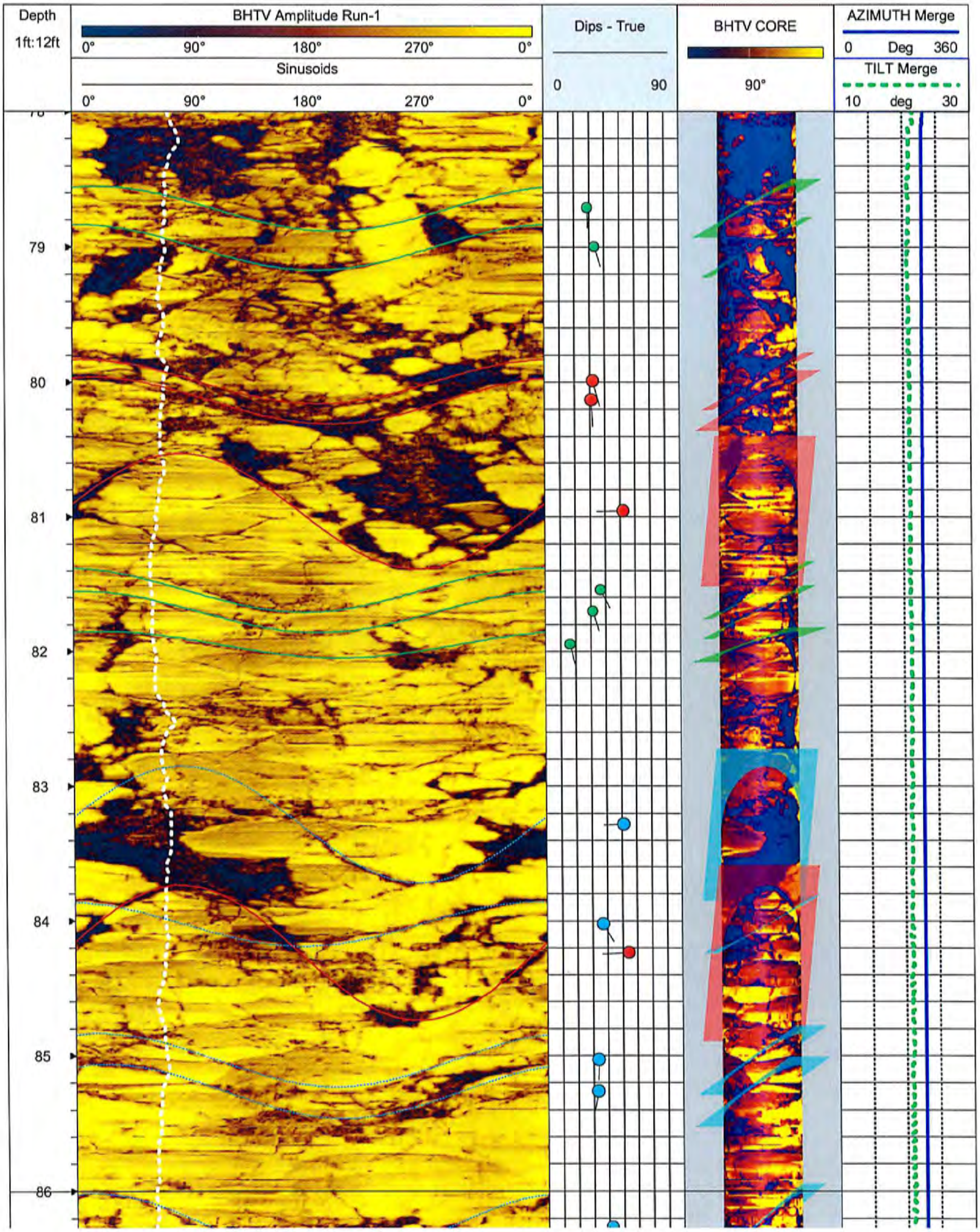
COMPANY: STANTEC
WELL ID: GT-1-2018-2
FIELD: LEHIGH QUARRY
COUNTY: SANTA CLARA

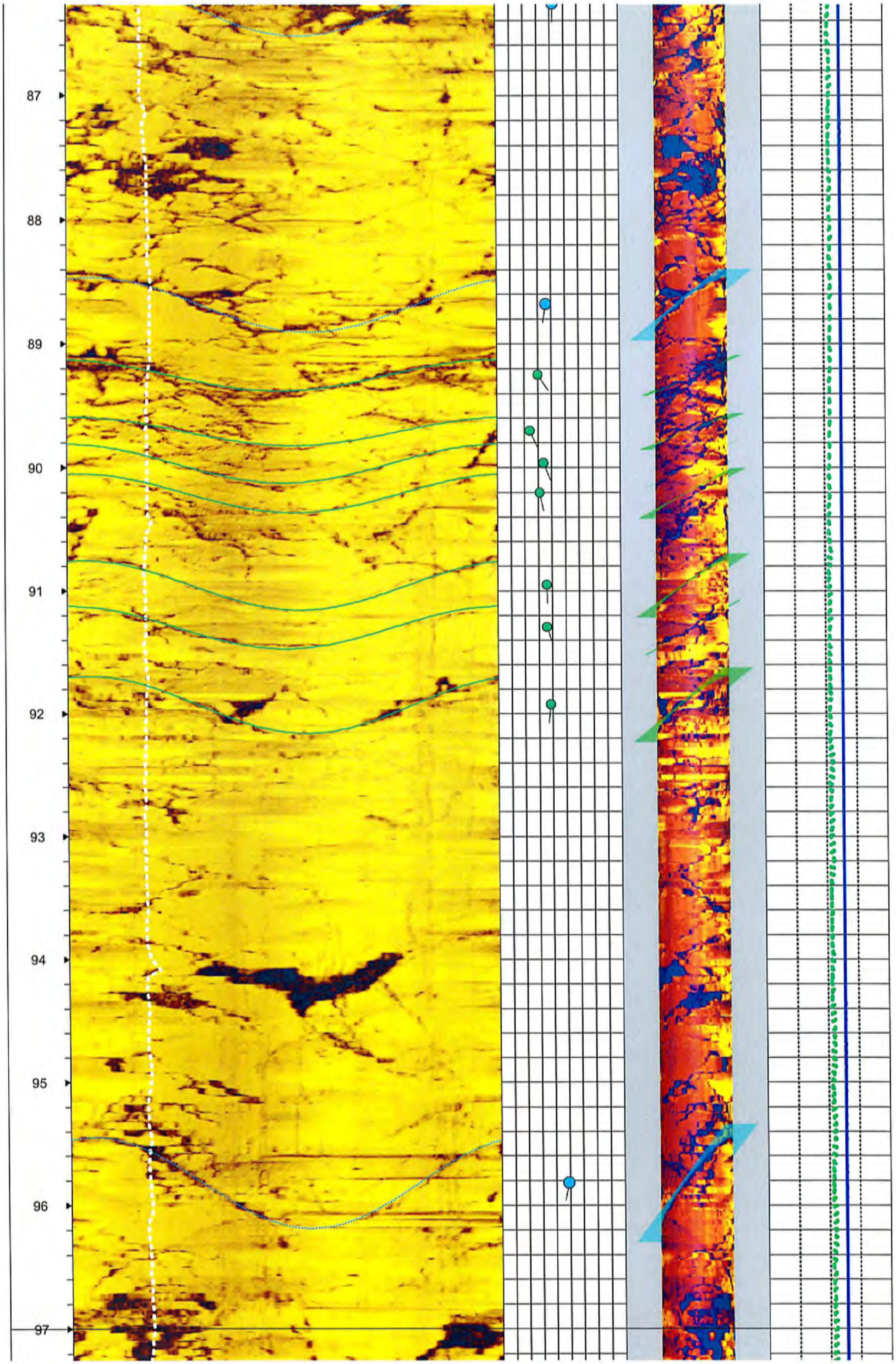
DATE: Oct. 20, 2018
CASING: Hwt to 29.6'ft bgs
JOB NO. NS185080
STATE: CA

NOTES:

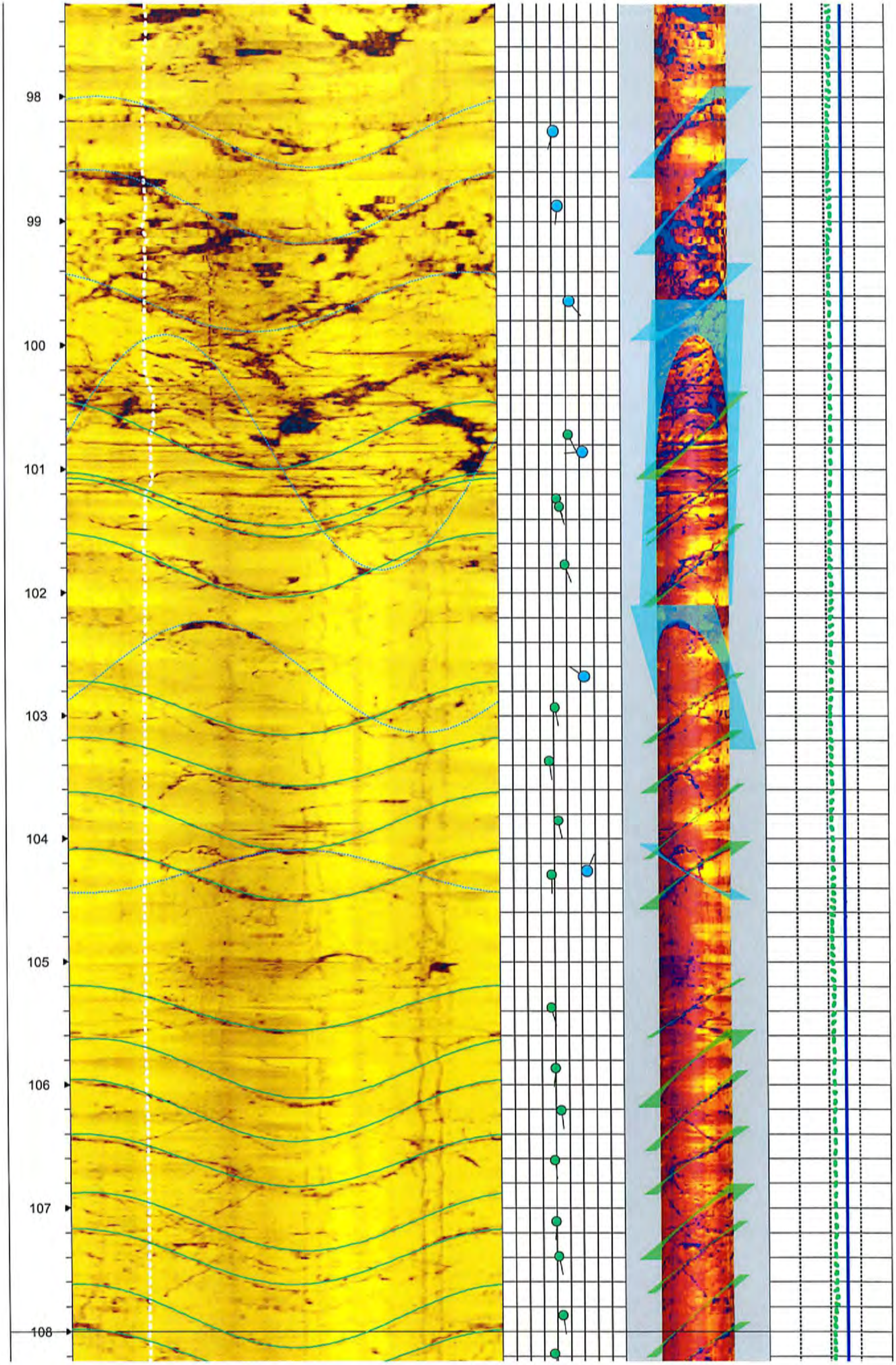
DISCONTINUITY LEGEND

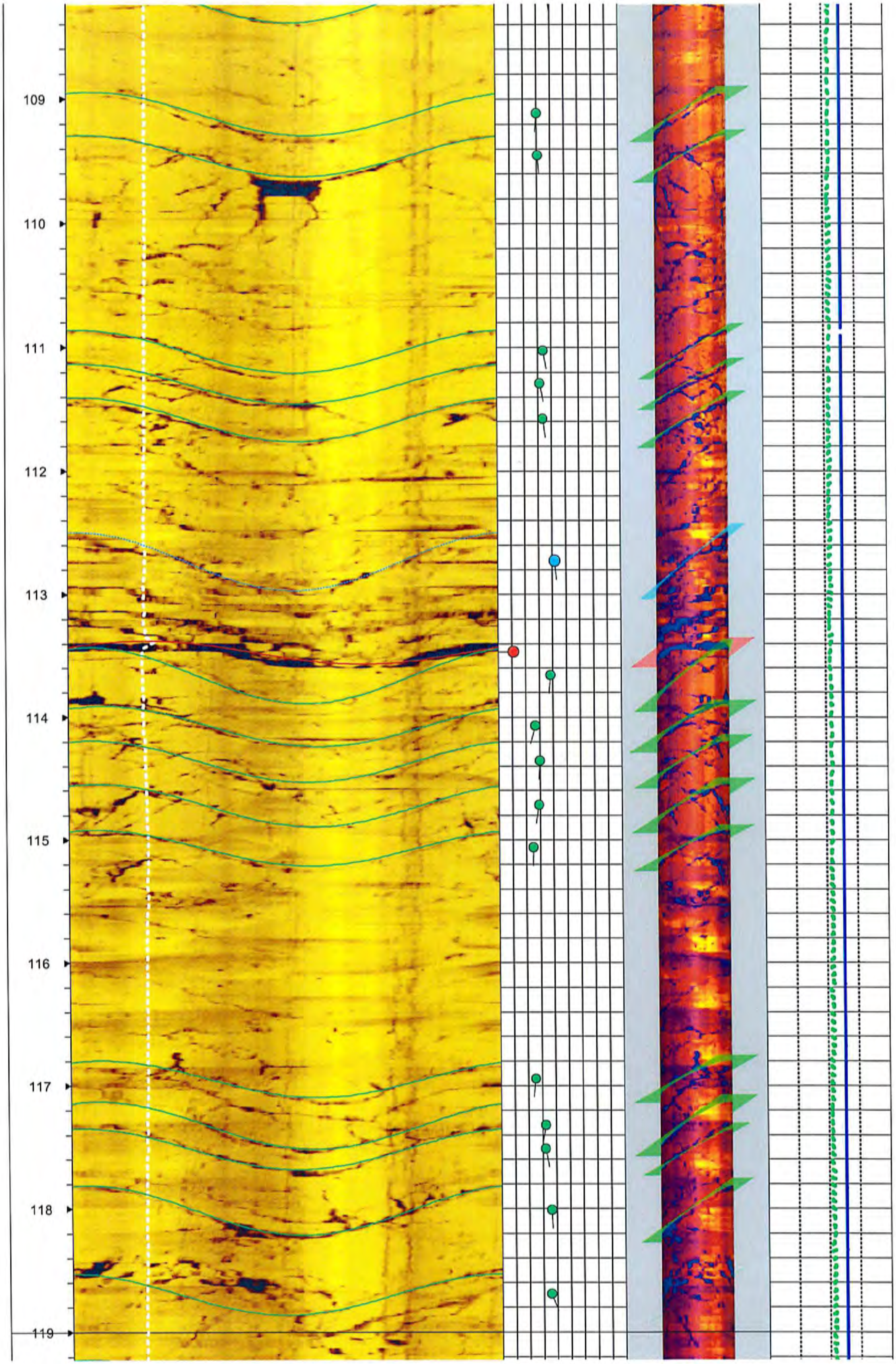
Code	Tadpole	Sine Wave	Name
1			Fracture open to partially open, continuous
2			Fracture "hairline" and/or discontinuous/irregular
3			Foliation or Bedding

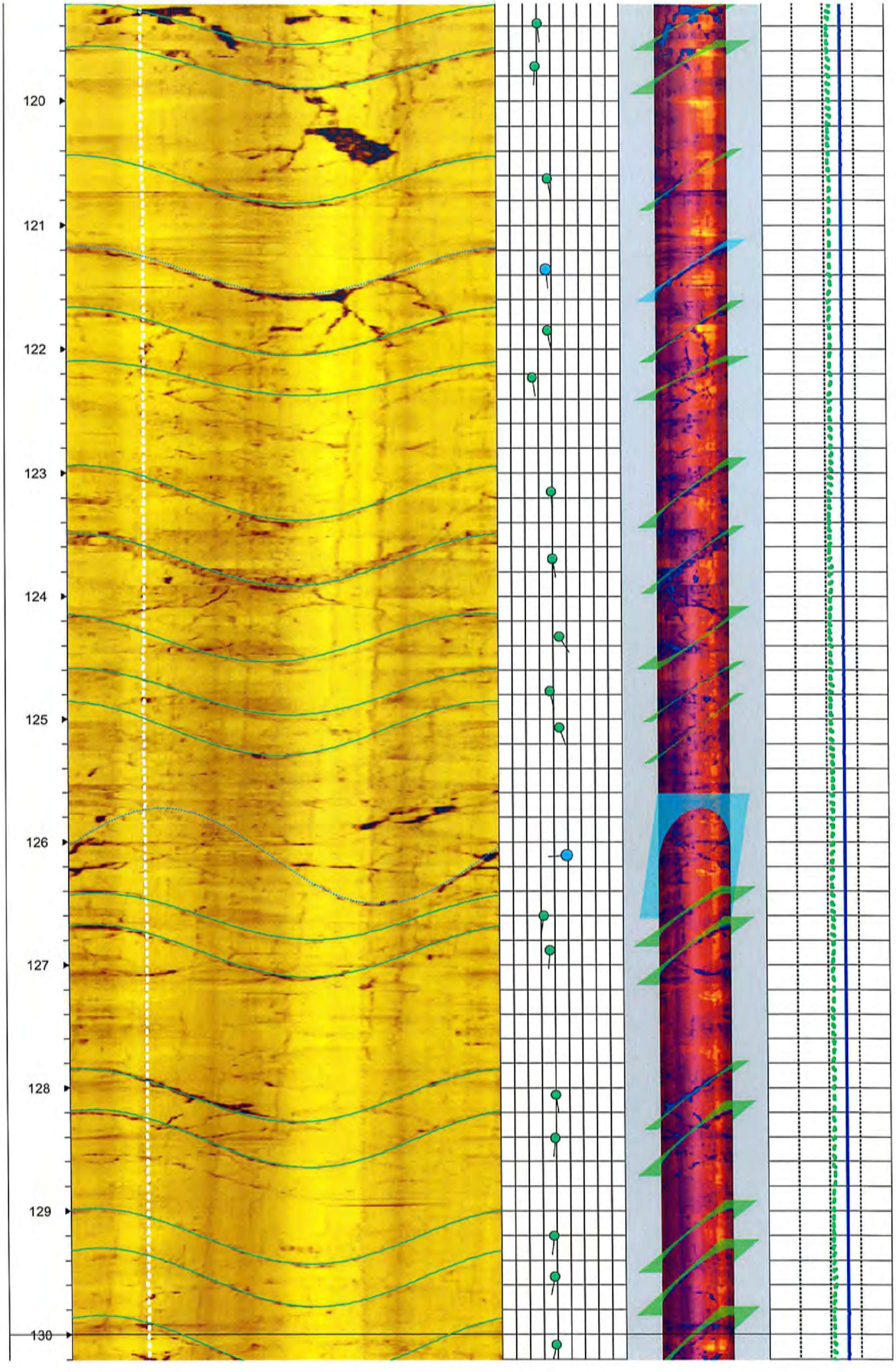




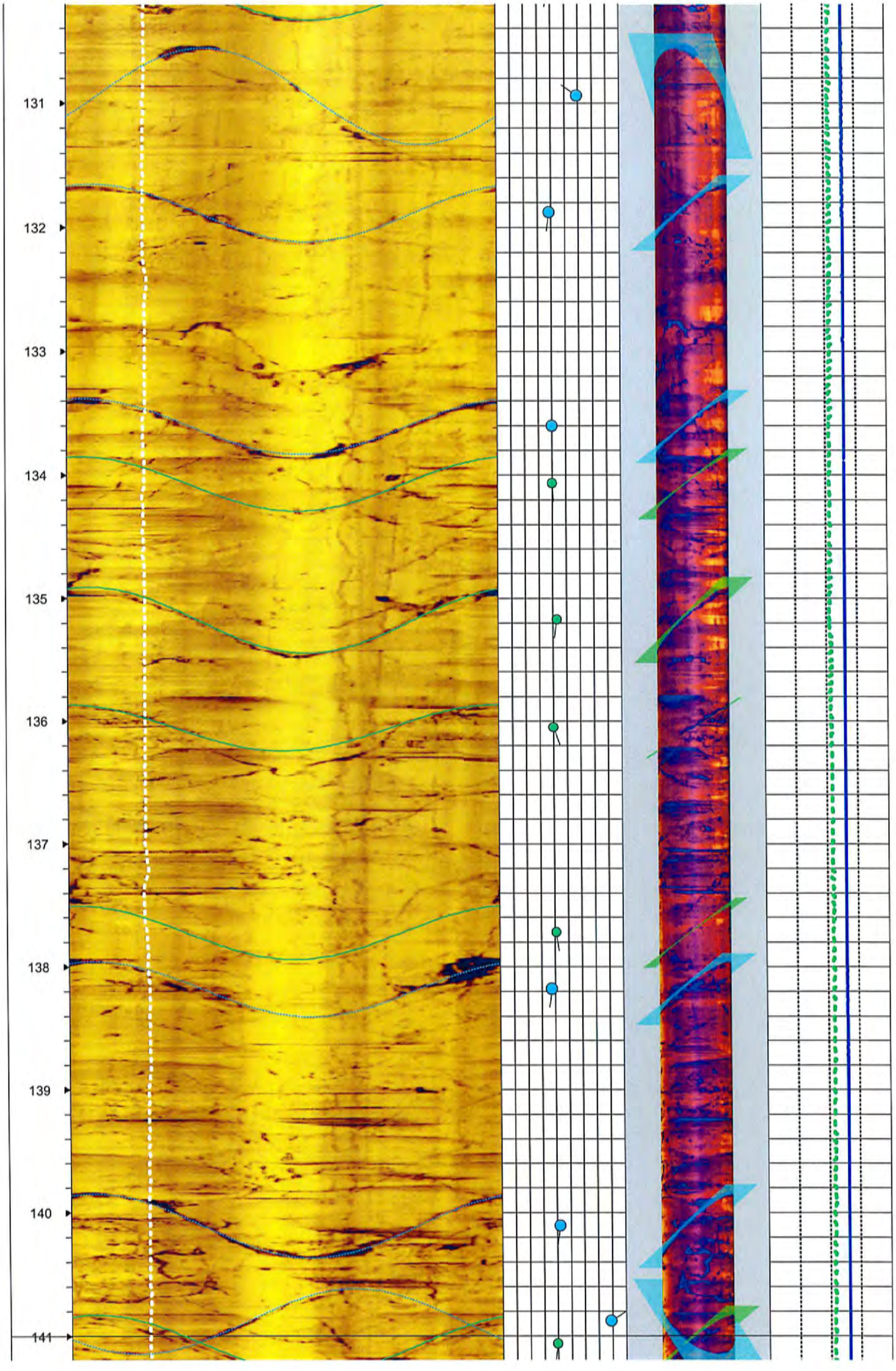
87
88
89
90
91
92
93
94
95
96
97


98
99
100
101
102
103
104
105
106
107
108

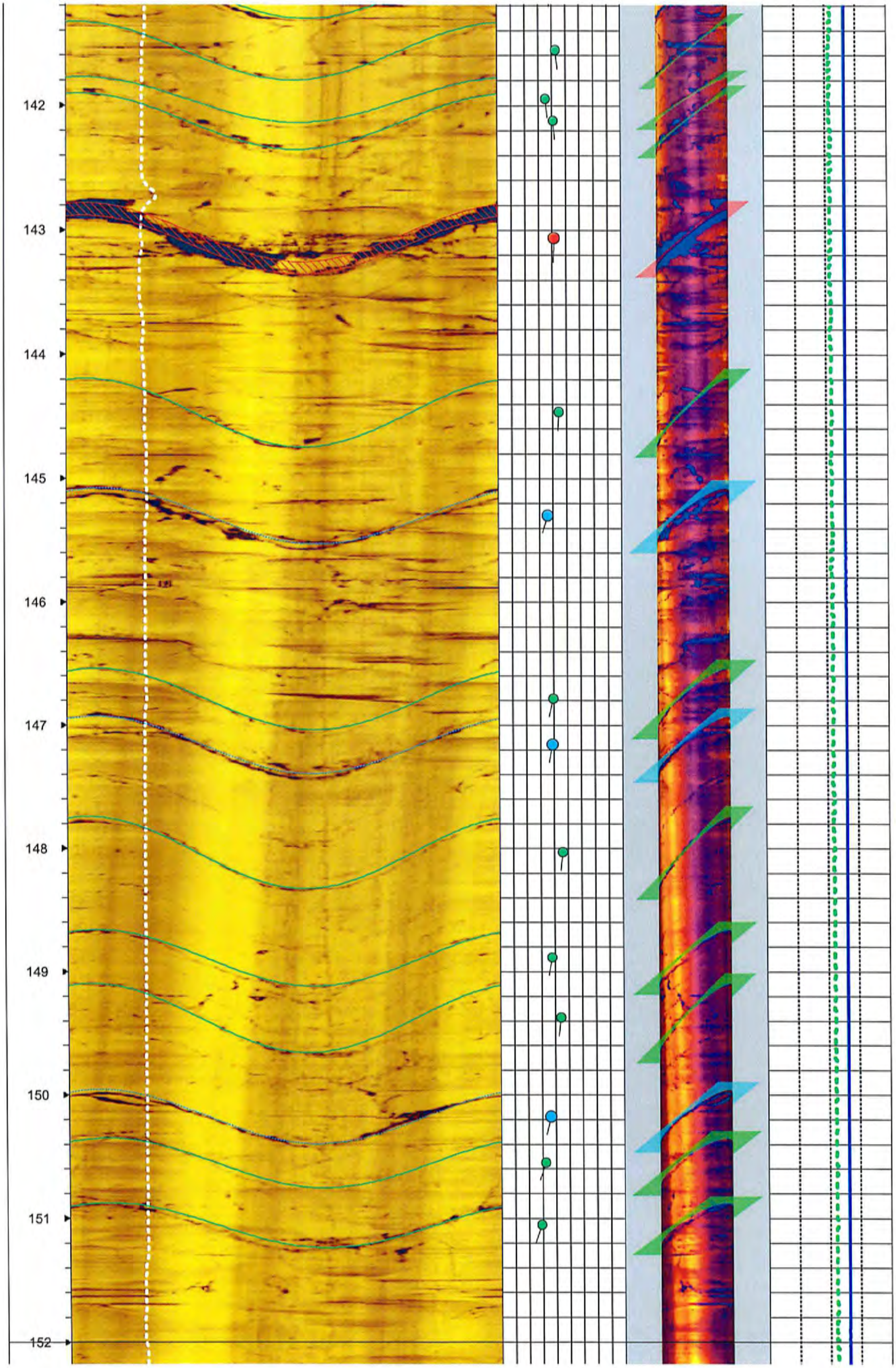

109
110
111
112
113
114
115
116
117
118
119

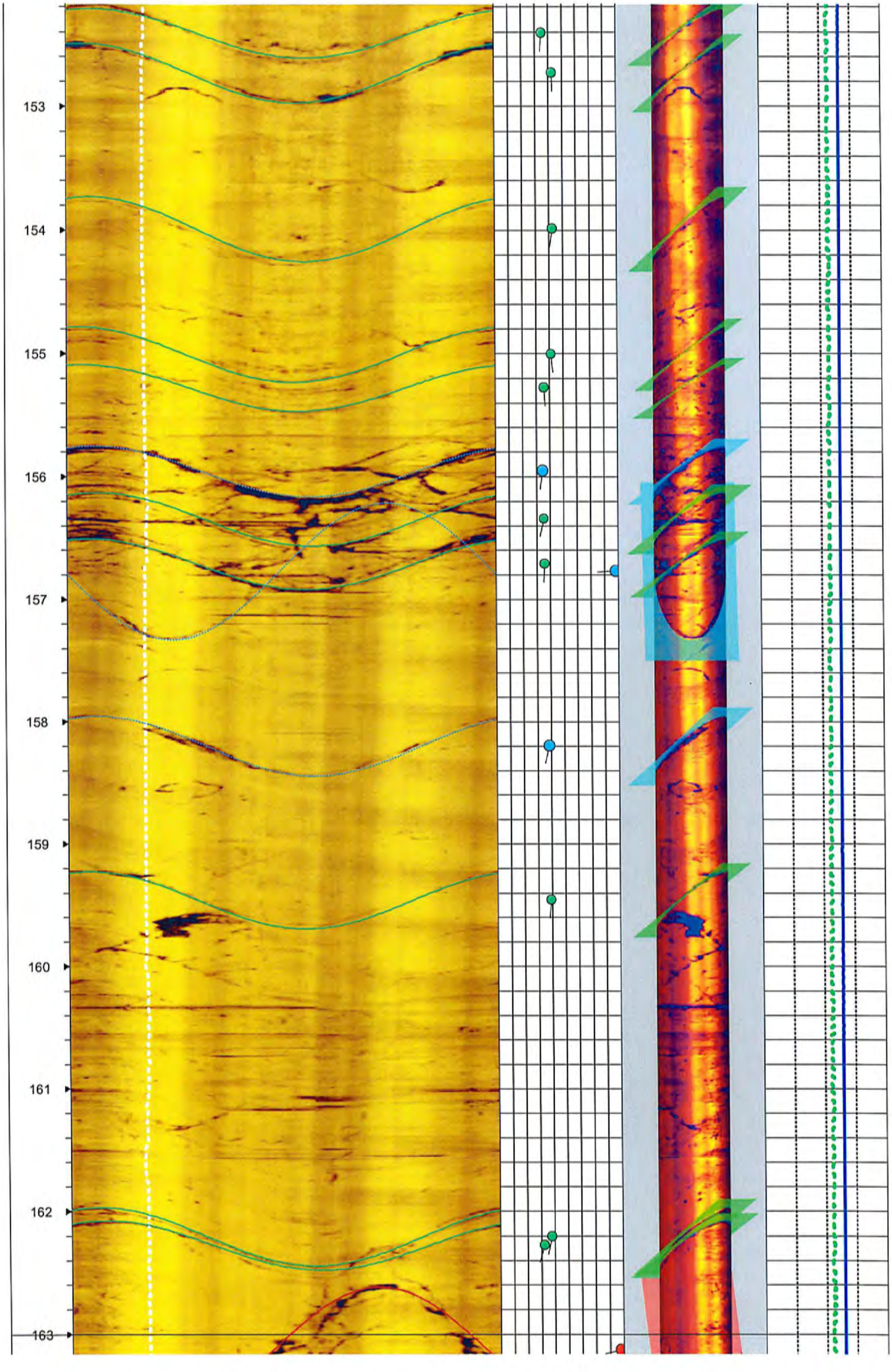


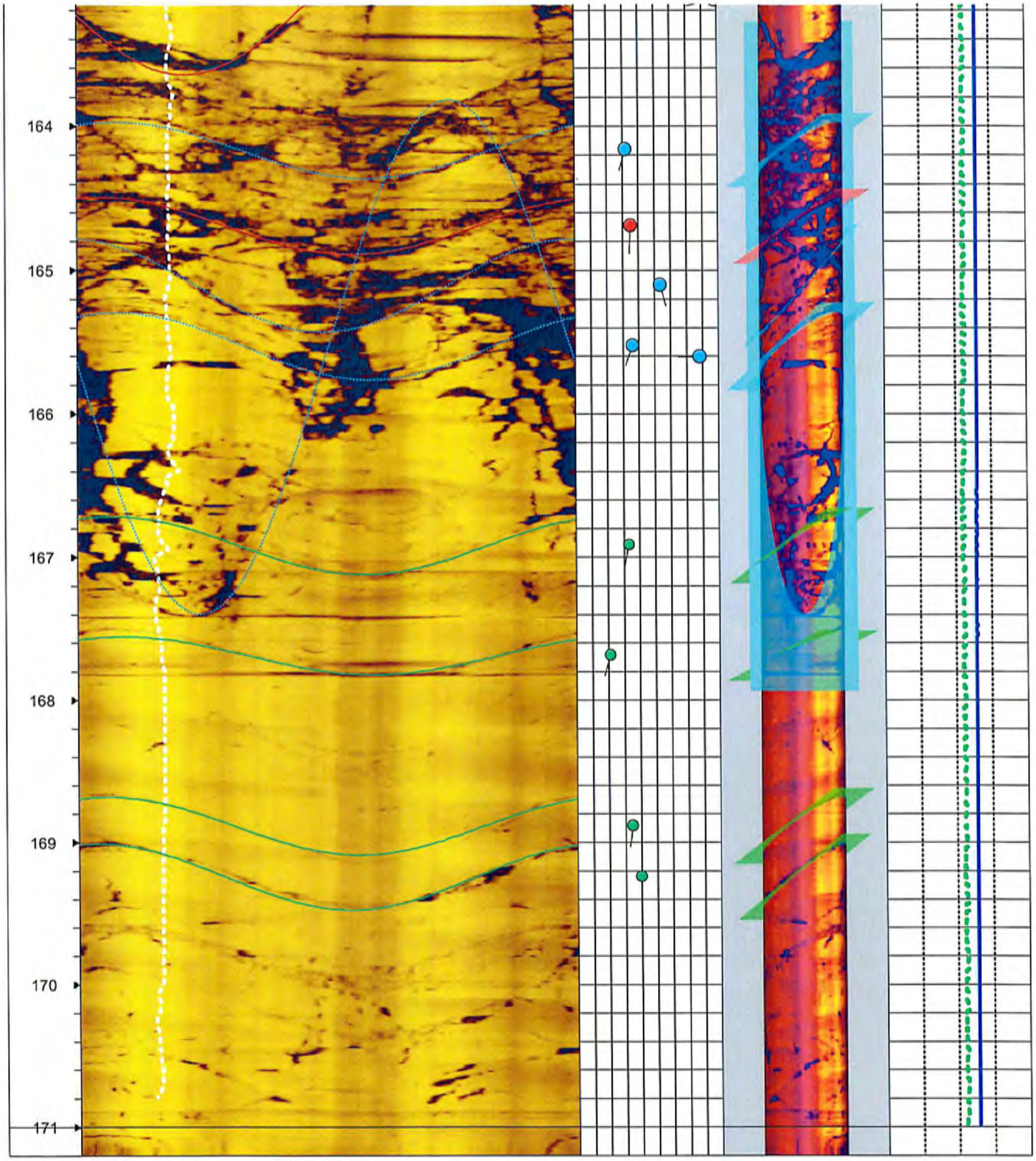
120
121
122
123
124
125
126
127
128
129
130



131
132
133
134
135
136
137
138
139
140
141


142
143
144
145
146
147
148
149
150
151
152


153
154
155
156
157
158
159
160
161
162
163


164
165
166
167
168
169
170
171

NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

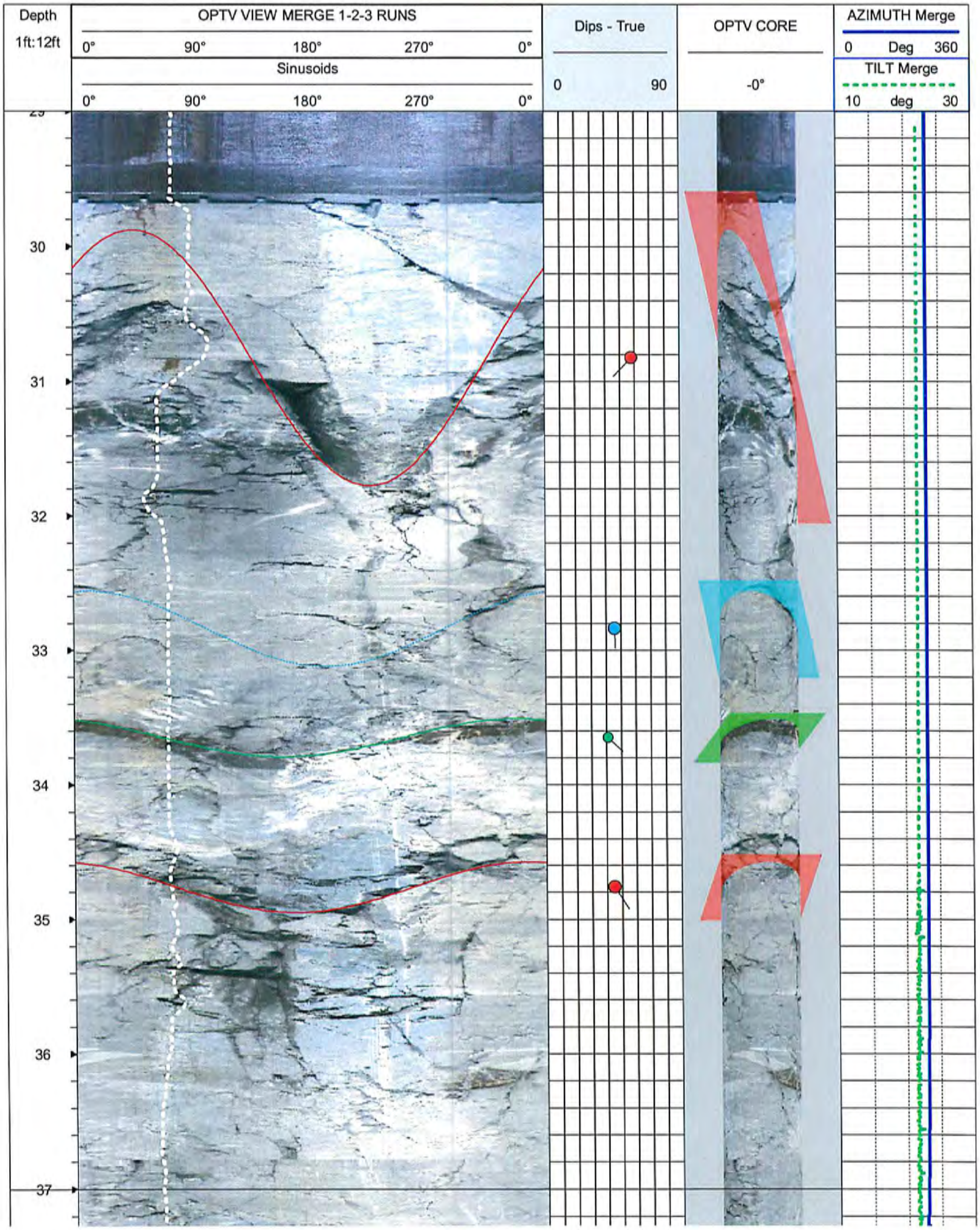
TELEVIEWER ANALYSIS UPPER SECTION

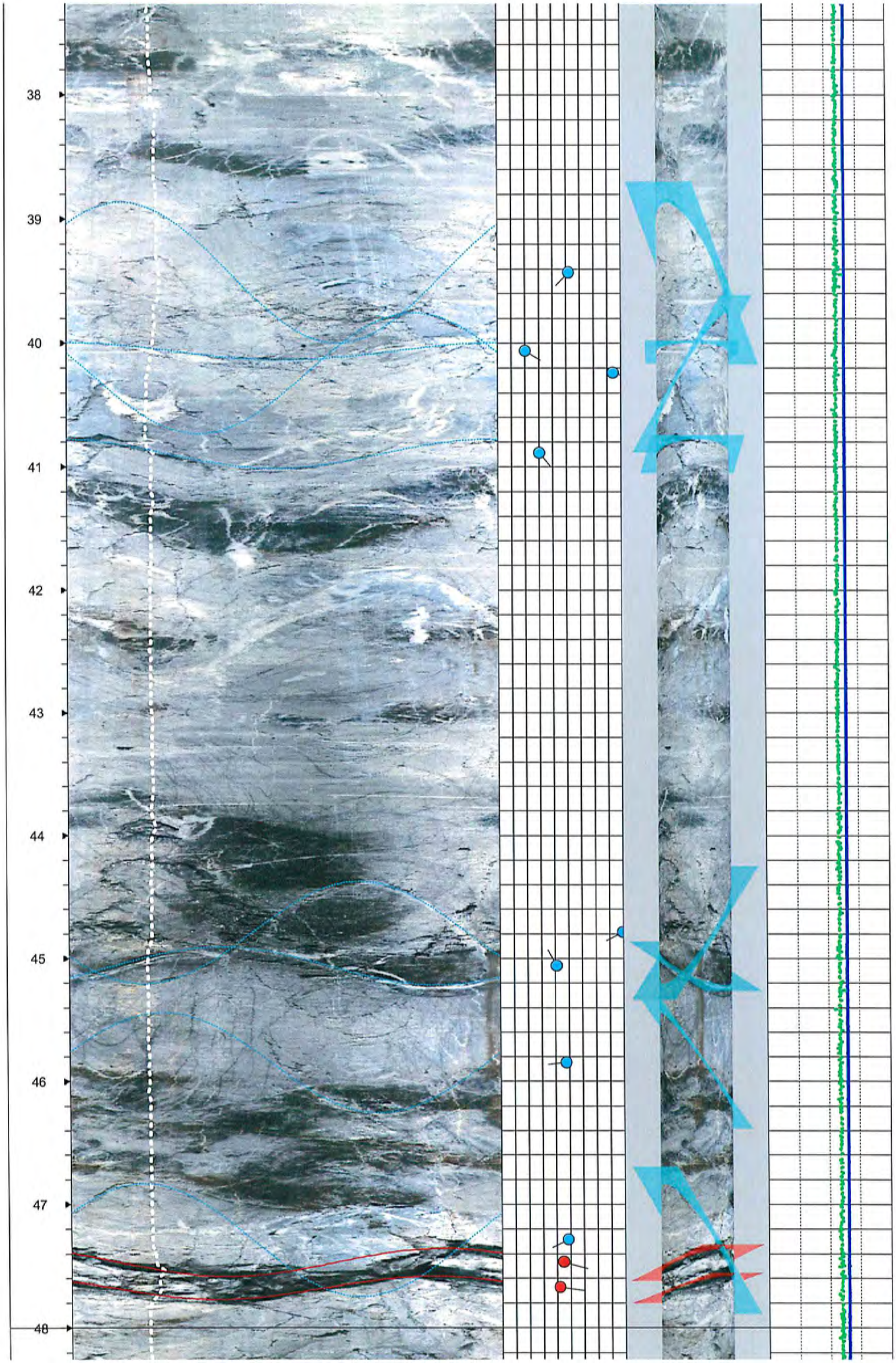
COMPANY:	STANTEC	DATE:	Oct. 20, 2018
WELL ID:	GT-1-2018-2	CASING:	Hwt to 29.6'ft bgs
FIELD:	LEHIGH QUARRY	JOB NO.	NS185080
COUNTY:	SANTA CLARA	STATE:	CA

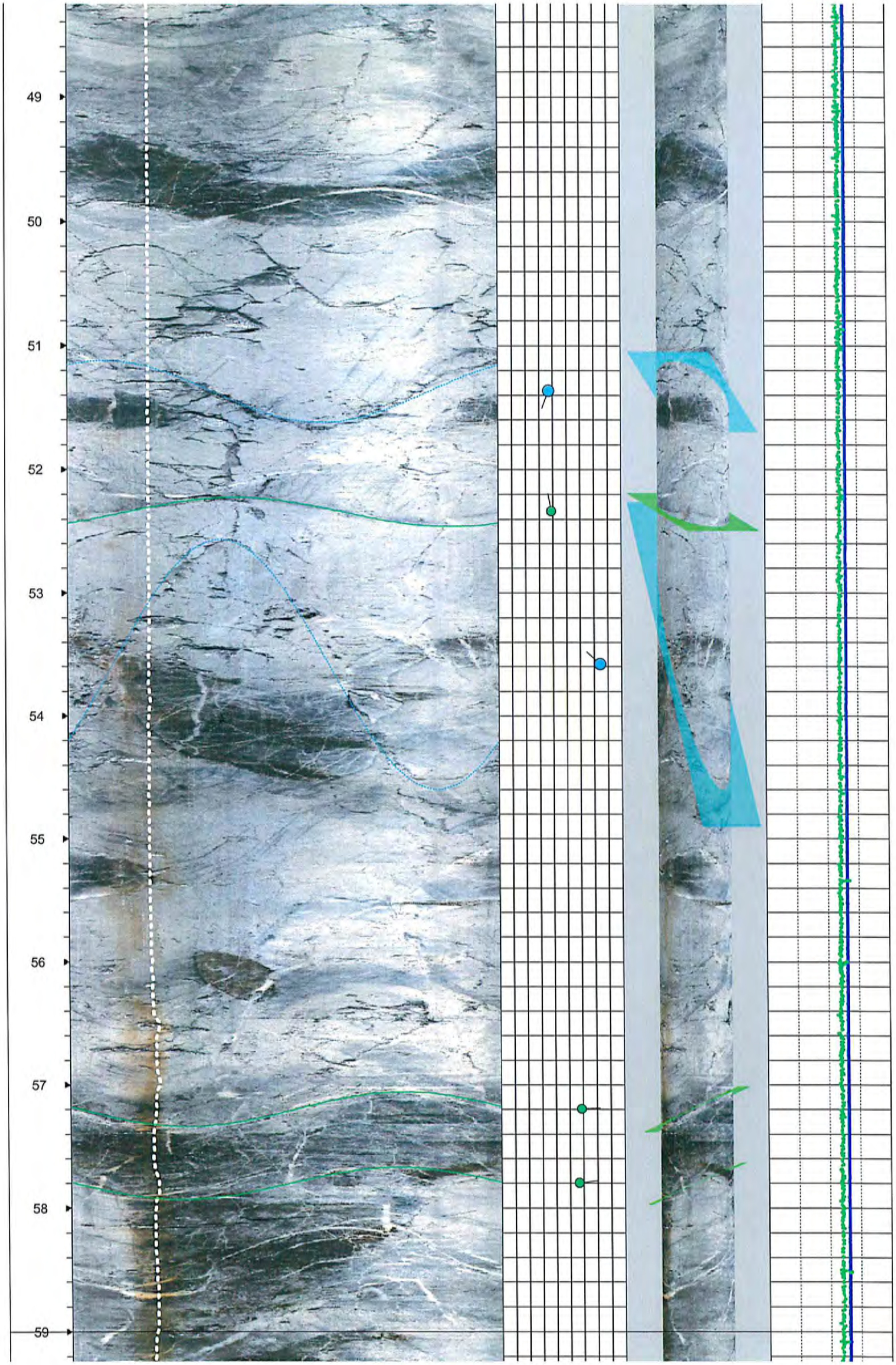
NOTES:

DISCONTINUITY LEGEND

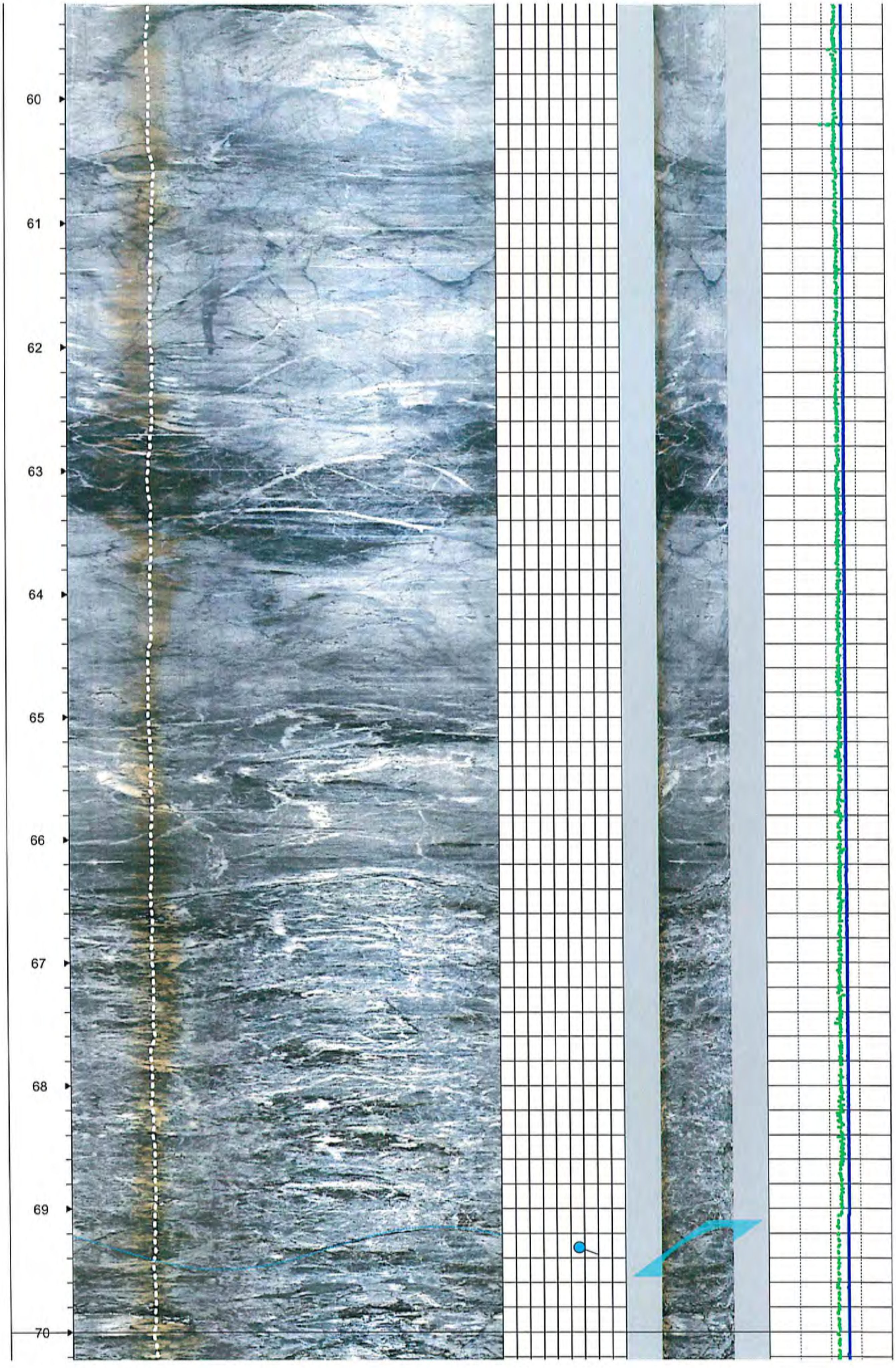
Code	Tadpole	Sine Wave	Name
1			Fracture open to partially open, continuous
2			Fracture "hairline" and/or discontinuous/irregular
3			Foliation or Bedding

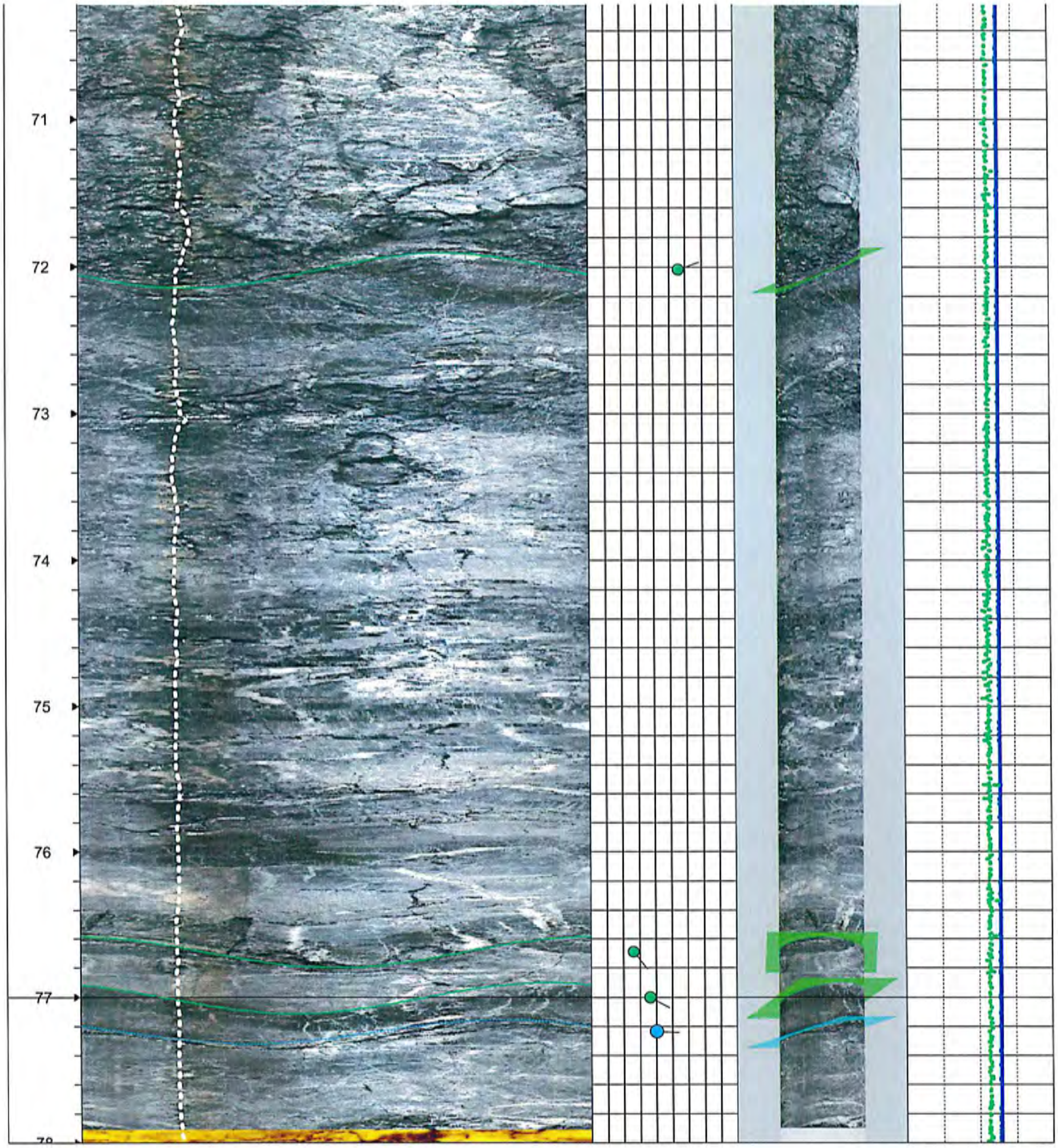



38
39
40
41
42
43
44
45
46
47
48



49
50
51
52
53
54
55
56
57
58
59


60
61
62
63
64
65
66
67
68
69
70



71
72
73
74
75
76
77

NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

TELEVIEWER ANALYSIS

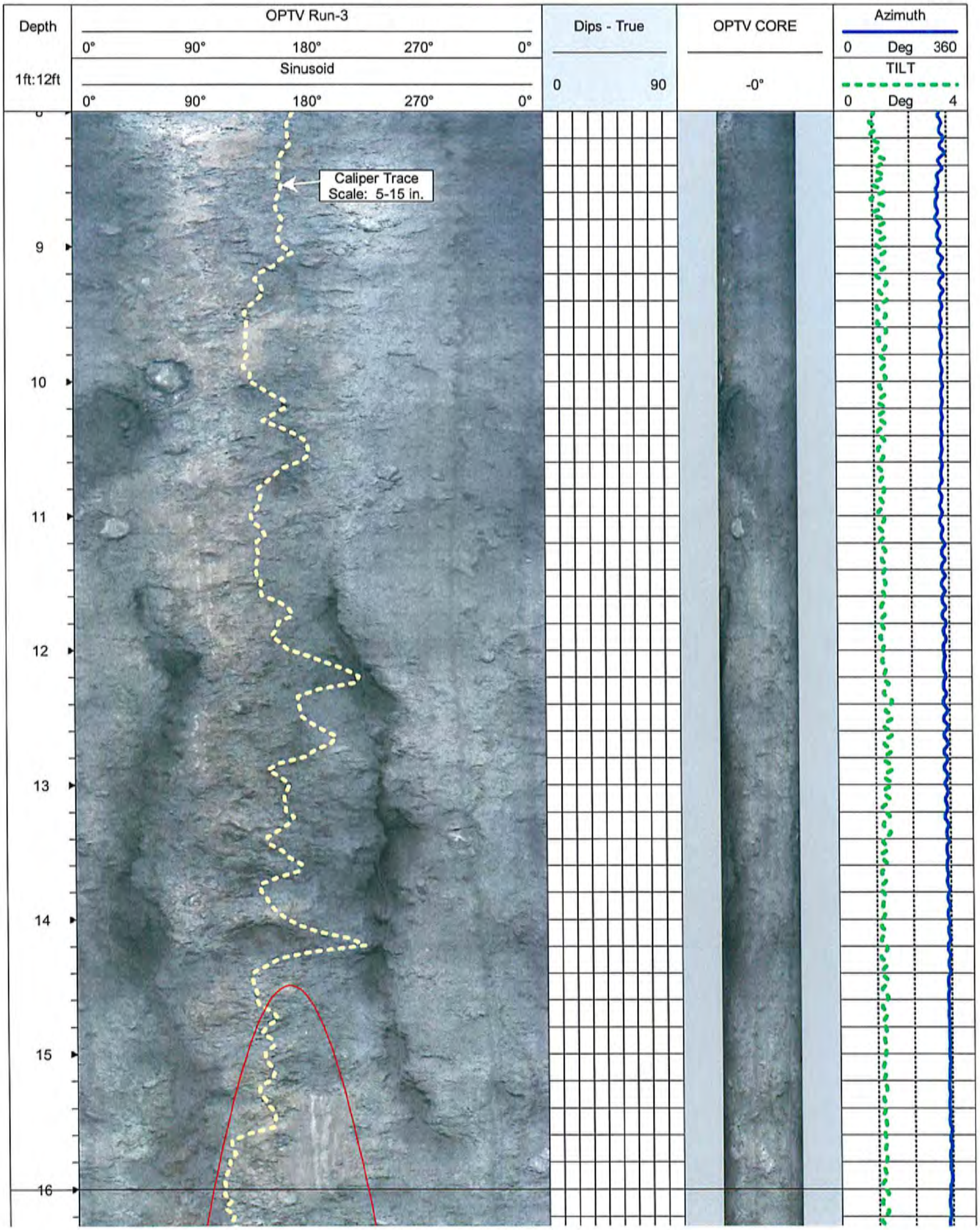
COMPANY: STANTEC
WELL ID: S-1-2018-2
FIELD: LEHIGH QUARRY
COUNTY: Santa Clara

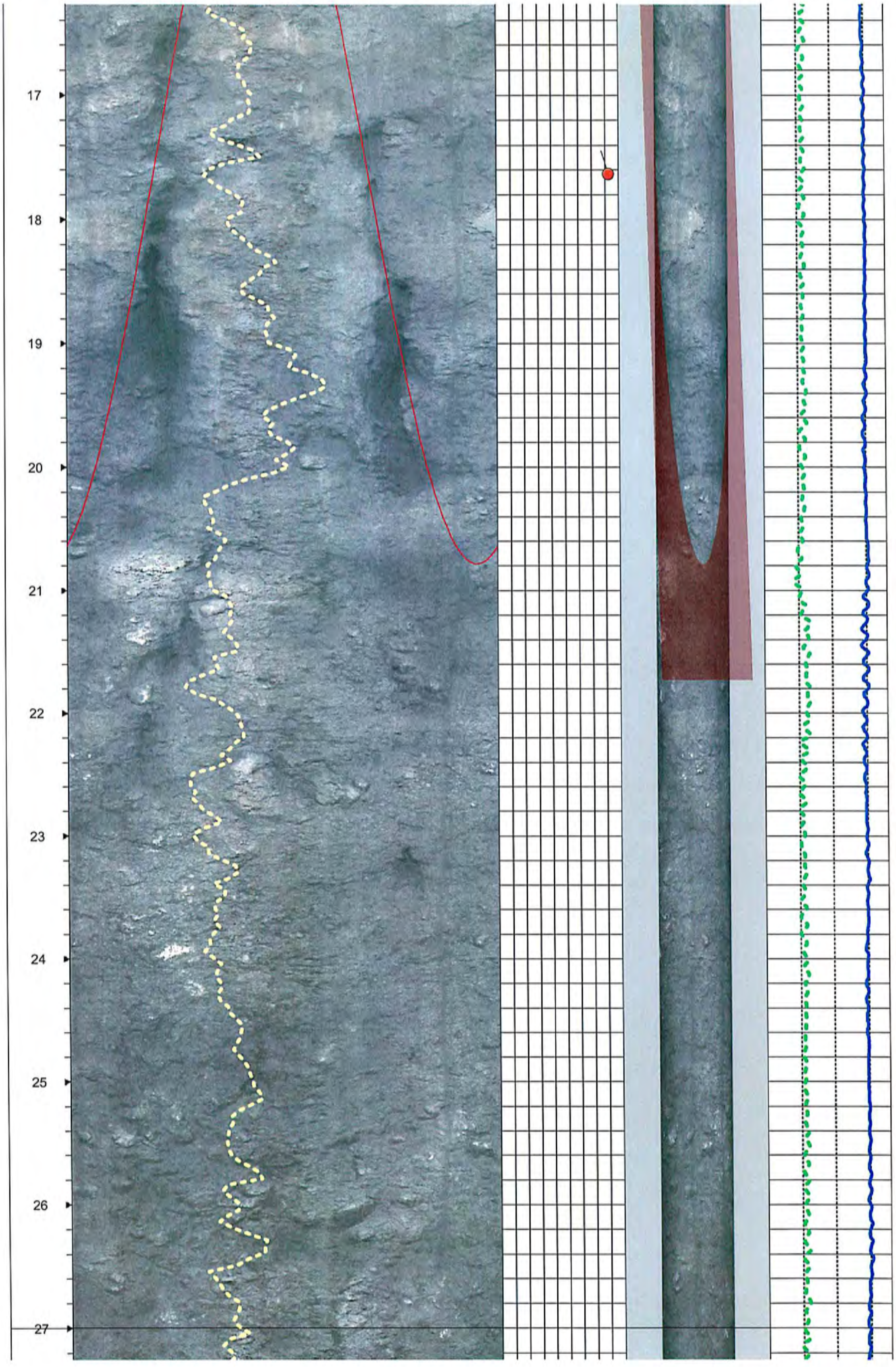
DATE: October 6, 2018
CASING: None
JOB NO. NS185080
STATE: CA

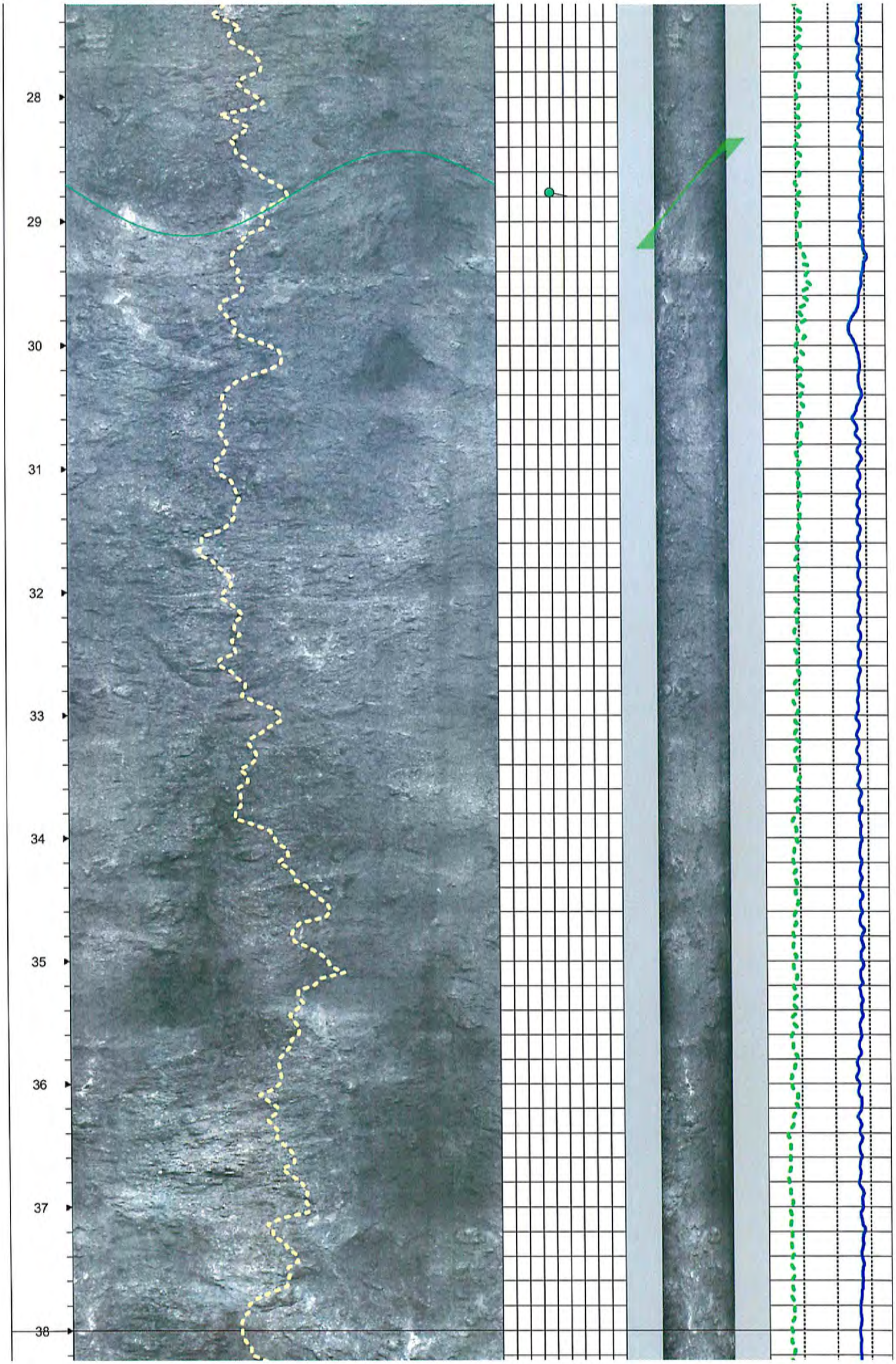
NOTES:

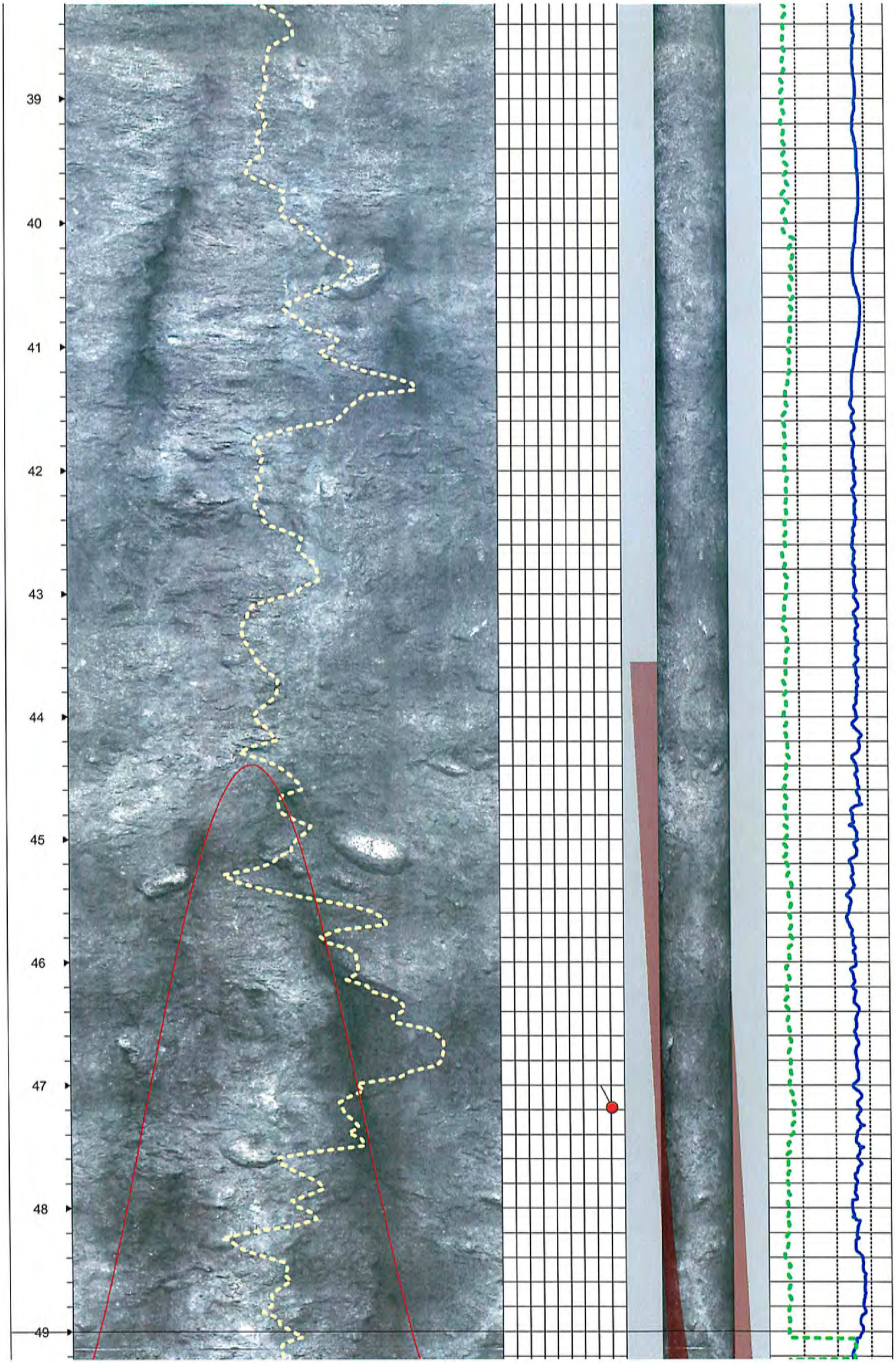
DISCONTINUITY LEGEND

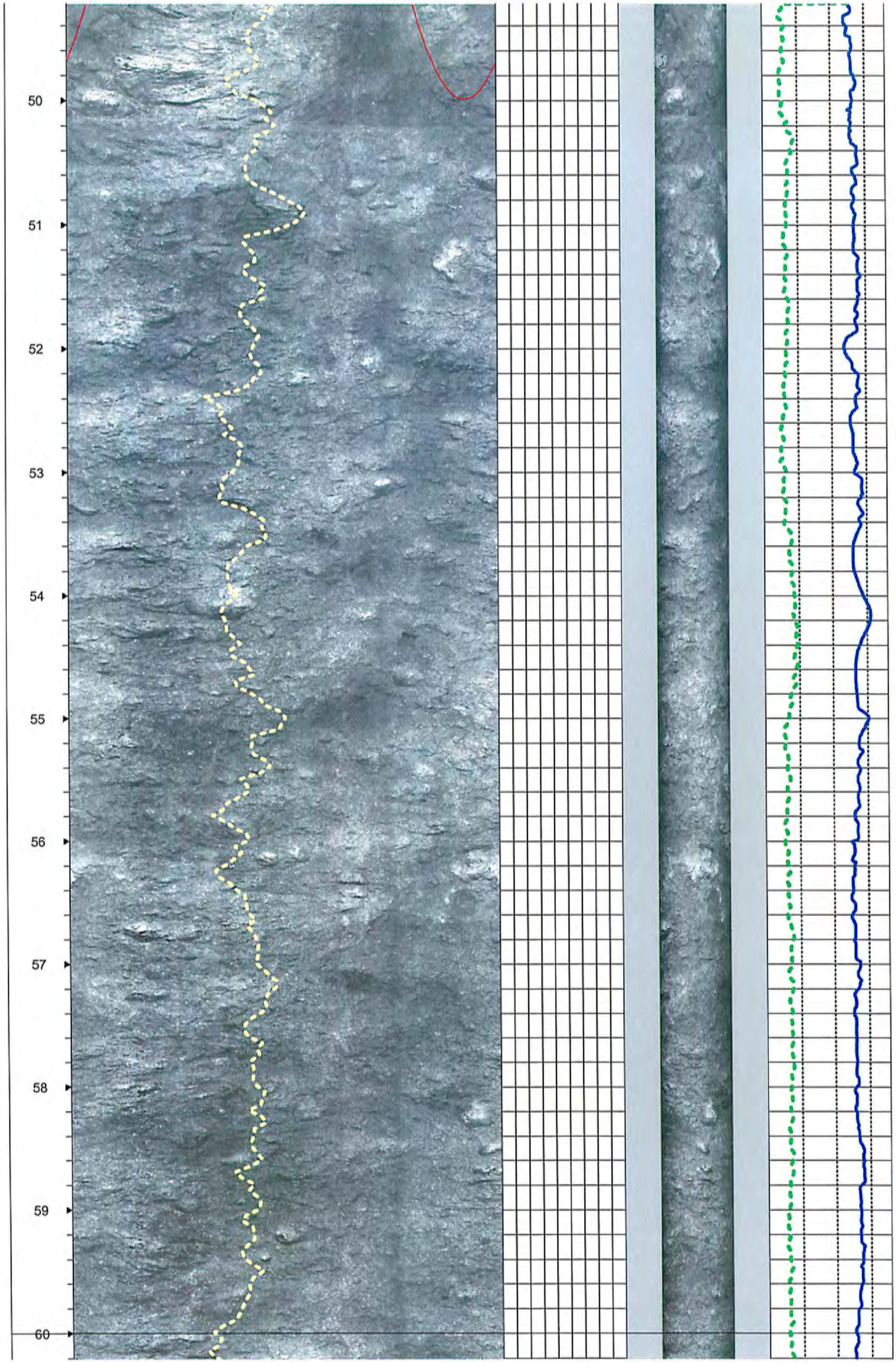
Code	Tadpole	Sine Wave	Name
1			Fracture open to partially open, continuous
2			Fracture "hairline" and/or discontinuous/irregular
3			Foliation or Bedding

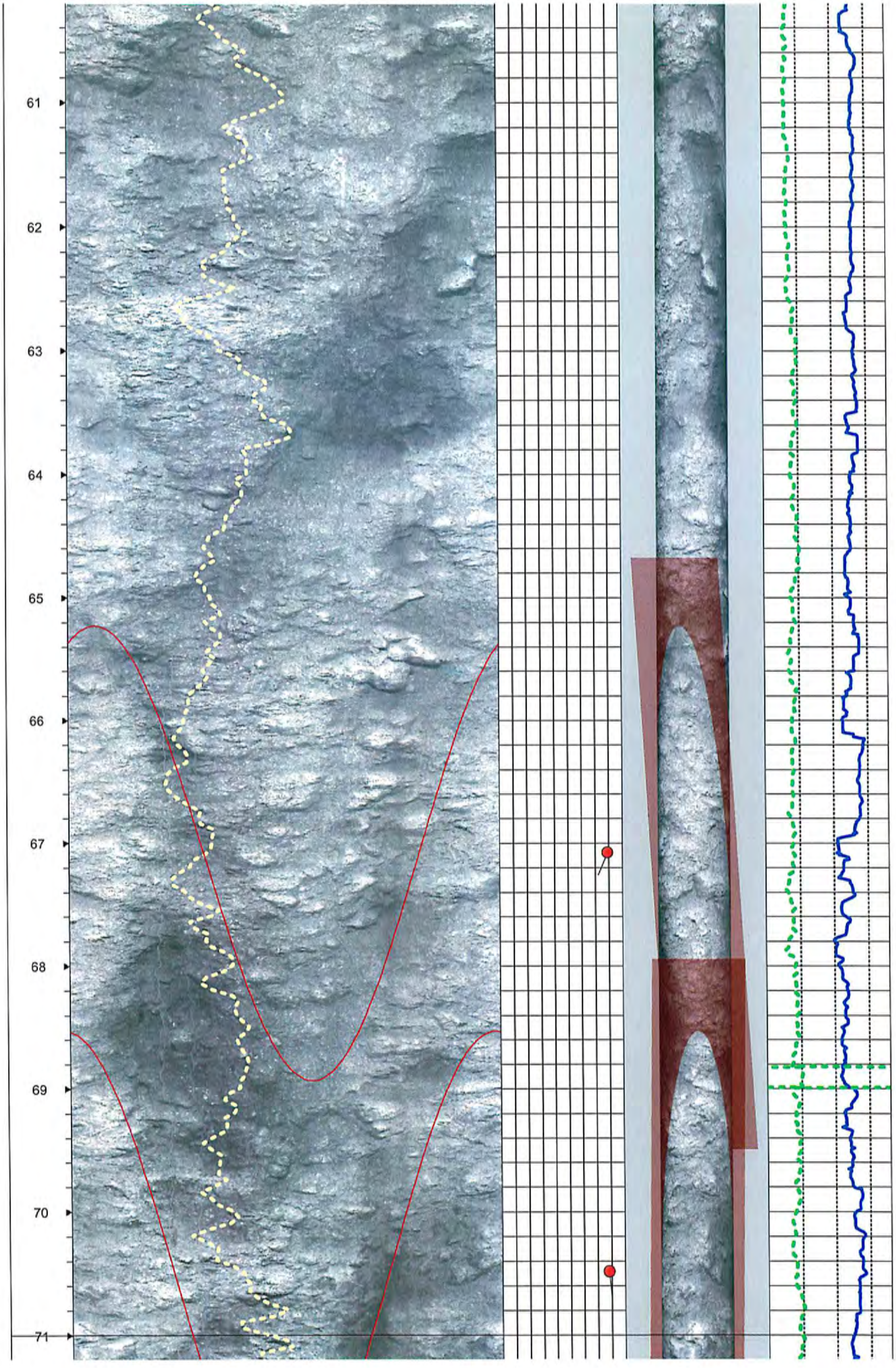




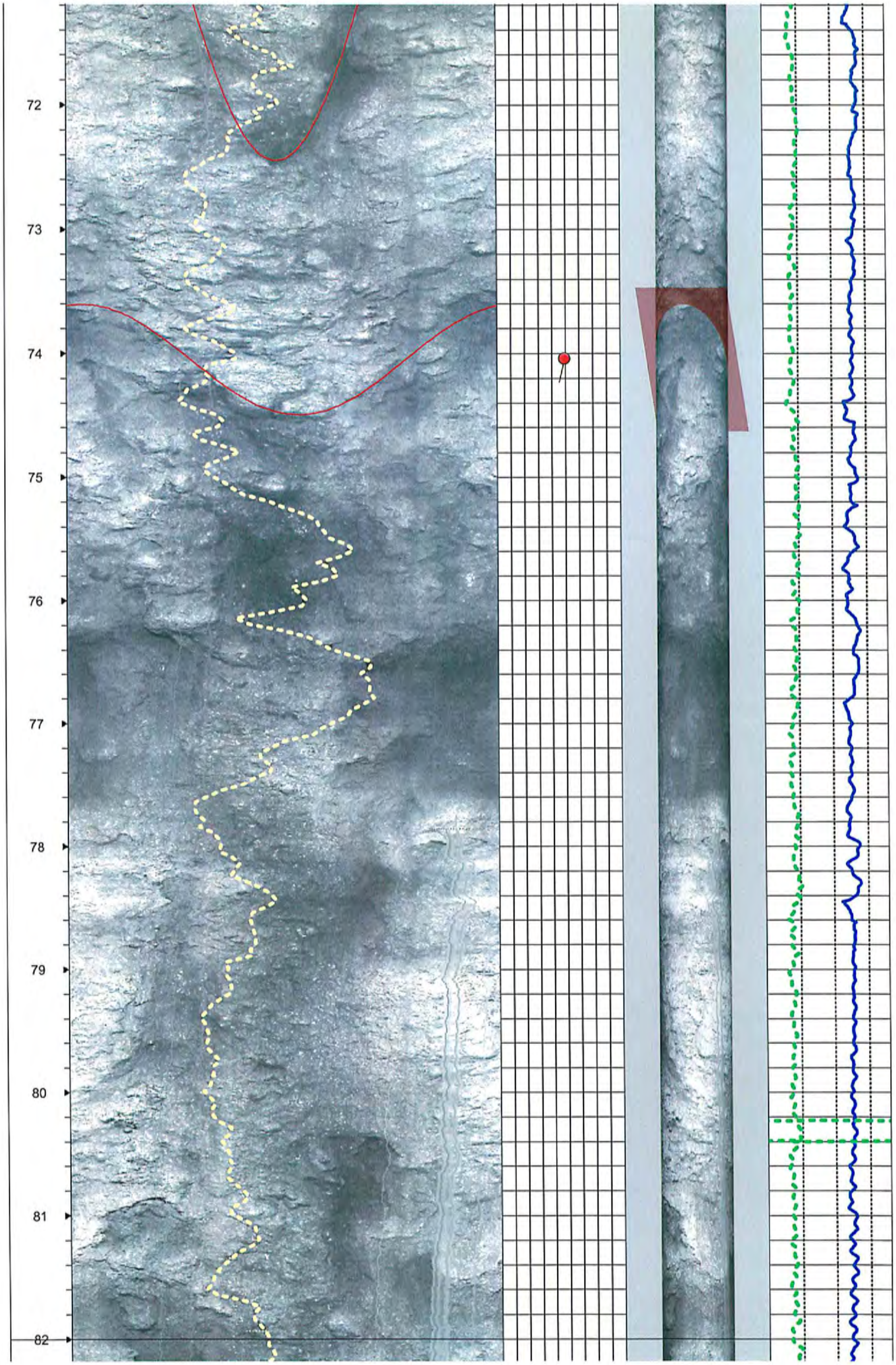

28
29
30
31
32
33
34
35
36
37
38

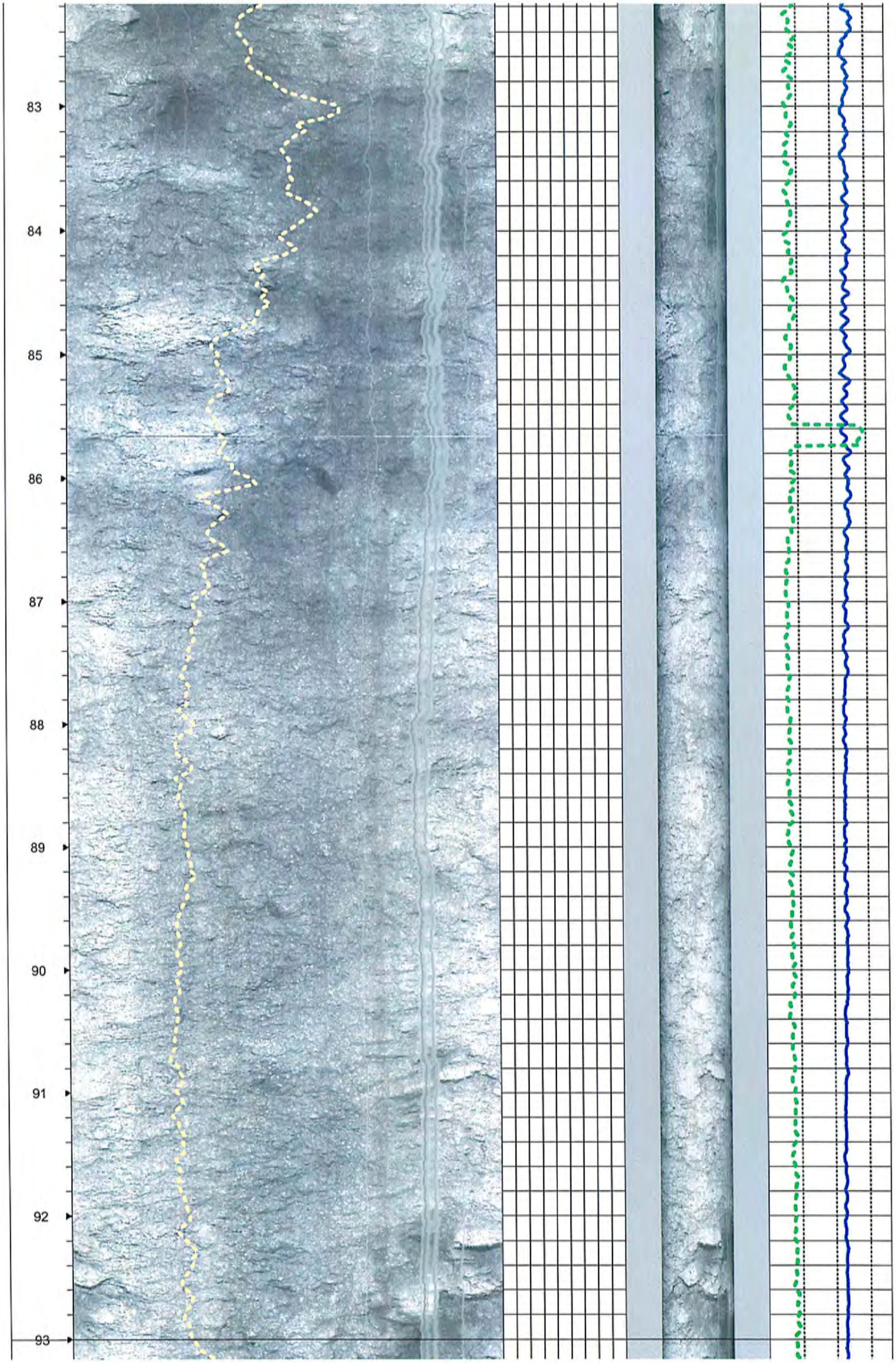

39
40
41
42
43
44
45
46
47
48
49

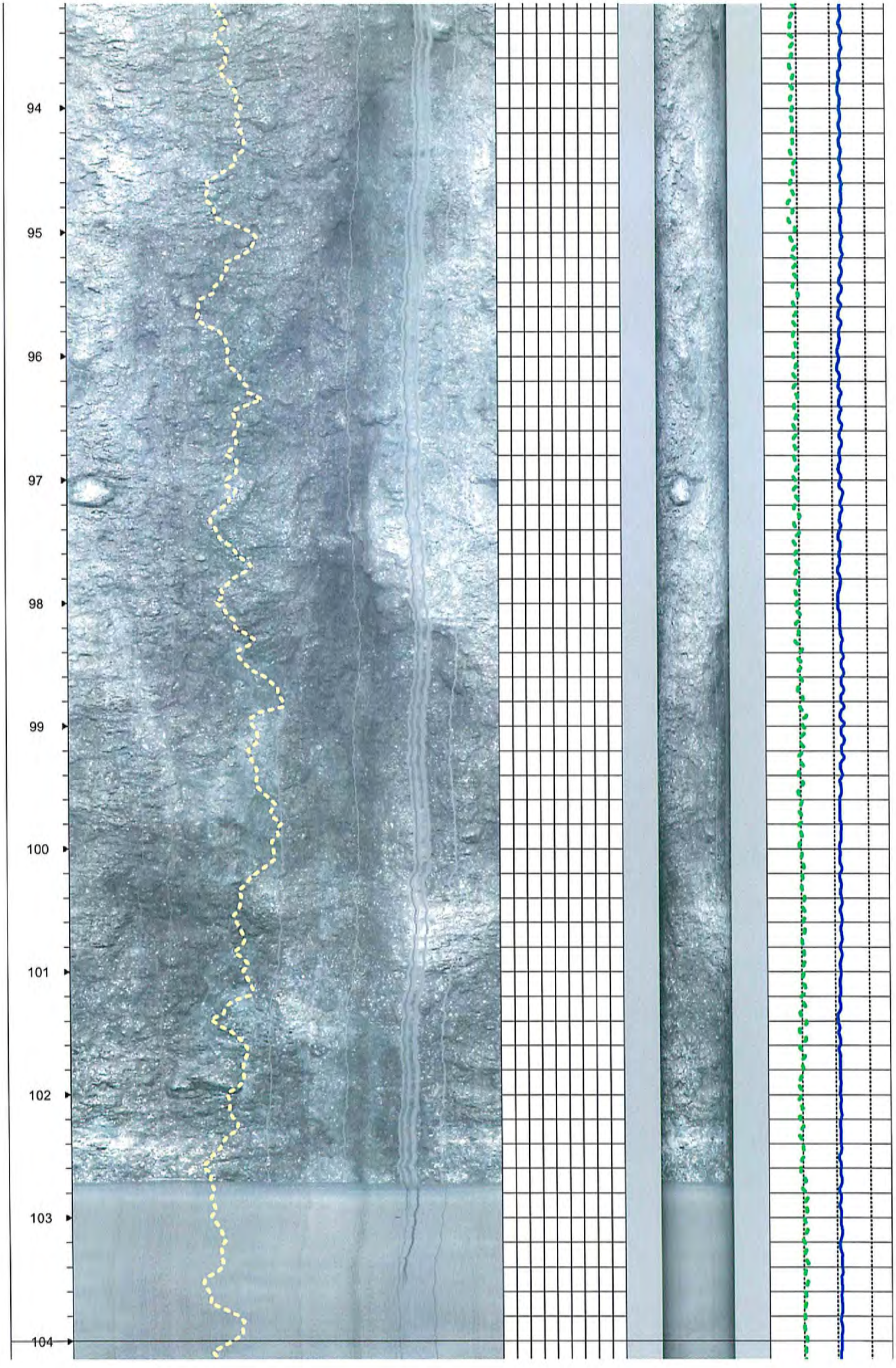

50
51
52
53
54
55
56
57
58
59
60

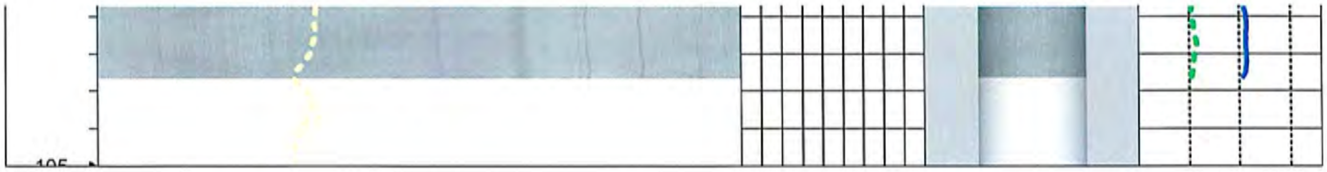


61
62
63
64
65
66
67
68
69
70
71


72
73
74
75
76
77
78
79
80
81
82


83
84
85
86
87
88
89
90
91
92
93


94
95
96
97
98
99
100
101
102
103
104



NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

Appendix D:

Discontinuity Tables

Boreholes GT-1-2018-1, GT-1-2018-2, S-1-2018-2

LEHIGH QUARRY
BOREHOLE DISCONTINUITY TABLE FROM TELEVIEWER ANALYSIS
FOR BOREHOLE GT-1-2018-1 FIELD WORK CONDUCTED OCTOBER, 2018
Cupertino , CA
NORCAL JOB NO. NS185080

DISCONTINUITY LEGEND

Code	Tadpole	Sine Wave	Name
1			Fracture open to partially open, continuous
2			Fracture "hairline" and/or discontinuous/irregular
3			Foliation or Bedding

GT-1-2018-1 Discontinuity Table				
Depth	Dip Azimuth	Dip Angle	Aperture or Thickness	Discontinuity Classification
ft	deg	deg	1/10 inches	(see Code under Legend)
60.08	53.91	33.62	nd	2
60.31	35.27	30.74	nd	3
60.78	36.42	28.05	nd	3
61.12	22.59	24.36	nd	3
61.73	17.86	27.47	nd	3
63.75	61.34	30.61	nd	3
64.12	46.63	31.25	nd	3
64.96	75.32	41.69	nd	3
91.29	288.63	28.23	nd	3
93.45	39.04	43.36	nd	2
95.85	5.81	79.86	nd	2
97.2	348.81	70.38	nd	2
98.33	207.16	76.33	nd	2
102.93	358.77	59.72	nd	2
121.62	143.8	55.7	nd	2
131.74	138.35	53.57	nd	2
155.55	97.48	49.27	nd	2
155.61	289.62	79.3	nd	2
159.91	148.27	63.68	nd	2
160.57	136.55	52.31	nd	2
174.92	96.61	65.5	nd	2
176.87	65.69	46.91	nd	2
178.34	42.06	32.79	nd	3
179.51	127.94	46	nd	3
181.27	69.7	30.66	nd	3
181.99	153.42	27.24	nd	2
182.25	170.56	52.28	nd	2
183.51	119.73	75.92	nd	2
183.7	235.2	71.22	nd	2

184.51	157.38	56.17	nd	2
185.33	190.35	60.68	nd	2
187.06	133.18	46.1	nd	2
187.43	124.91	51.69	nd	2
189.39	183.72	45.37	nd	2
190.92	181.36	66.49	nd	2
191.22	167.91	65.16	nd	2
192.62	168.23	59.88	nd	2
192.95	165.16	59.73	nd	2
194.72	19.47	85.4	nd	2
195.09	102.58	44.77	nd	2
195.36	101.57	46.76	nd	2
195.53	85.05	43.3	nd	2
221.99	134.2	65.99	nd	2
225.41	29.7	74.41	nd	2
225.74	346.21	35.3	nd	2
242.09	184.68	63.74	nd	2
244.56	353.51	50.58	nd	2
245.31	353.19	54.97	nd	2
250.71	285.74	72.67	nd	2
265.15	293.24	38.62	nd	2
265.73	279.59	43.5	nd	2
266.69	238.15	75.65	nd	2
270.17	306.56	56.87	nd	3
272.74	278.7	39.5	nd	2
274.95	250.16	58.3	nd	2
275.57	285.81	48.92	nd	2
278.16	95.33	20.45	nd	2
280.28	199.45	88.98	nd	2
281.23	41.36	48.9	nd	2
305.94	359.2	57.42	nd	2
309.42	131.49	19.31	nd	2
311.02	254.45	73.07	nd	2
312.44	54.57	37.11	nd	2
325.48	62.1	44.16	nd	2
326.11	64.02	42.08	nd	2
326.85	83.5	36.31	nd	2
328.26	59.26	57.87	nd	2
331.05	45.43	89.64	nd	2
332.86	257.74	88.75	nd	2
333.34	259.3	78.02	nd	2
335.85	59.27	81.25	nd	2
349.7	247.76	73.51	nd	2
353.51	265.02	82.78	nd	2
361.71	226.14	50	nd	2
362.58	15.17	41.8	nd	2
363.22	20.99	36.96	nd	2

363.45	109.29	29.07	nd	2
363.51	197.27	58.61	nd	2
365	165.31	74.91	nd	2
365.67	10.09	82.77	nd	2
365.68	206.18	43.34	nd	2
367.7	7.46	38.22	nd	2
368.29	198.54	66.03	nd	2
375.22	16.59	85.19	nd	2
377.86	187.66	64.09	nd	2
378.95	200.18	49.82	nd	2
381.99	309.41	67.5	nd	3
383.08	229.44	62.34	nd	2
385.47	11.38	55.1	nd	2
391.95	22.06	56	nd	2
393.02	45.14	61.79	nd	2
395.24	157	56.72	nd	3
396.23	104.54	46.86	nd	3
396.91	51.97	39.48	nd	3
397.53	67.94	38.9	nd	3
399.84	320.88	72.15	nd	2
401.87	148.98	69.1	nd	2
403.48	303.97	62.83	nd	2
404.06	246.08	80.75	nd	2
404.68	240.83	83.34	nd	2
404.69	306.94	48.52	nd	2
405.75	57.16	87.3	nd	2
406.51	283.32	13.3	nd	2
406.8	253.15	14.49	nd	2
407.21	305.56	33.61	nd	2
408.11	270.39	73.69	nd	2
408.32	236.15	85.13	nd	3
408.98	243.05	70.17	nd	2
409.44	255.04	68.9	nd	2
411.38	319.65	52.87	nd	2
413.52	286.51	35.58	nd	3
415.37	269.53	70.64	nd	3
415.85	241.48	71.14	nd	3
416.12	246.16	70.06	nd	3
416.8	269.42	71.67	nd	3
417.34	131.55	37.3	nd	3
426.07	247.22	64.91	nd	3
428.08	217.52	76.66	nd	3
428.55	253.76	57.59	nd	3
436.71	239.16	85.38	nd	3
436.99	277.17	78.01	nd	2
437.05	213.39	86.16	nd	2
437.2	271.89	72.3	nd	2

439.01	146.2	63.58	nd	3
449.83	63.98	30.98	nd	3
452.85	286.77	60.56	nd	3
455.75	199.1	58.82	nd	3
456.6	174.55	65.88	nd	2
457.07	188.39	48.71	nd	3
458.22	154.91	58.35	nd	2
470.92	188.89	49.01	nd	3
474.1	127.9	55.51	nd	2
476.04	283.68	89.84	nd	2

Note: 'nd" = discontinuity aperture thickness not determined

LEHIGH QUARRY
BOREHOLE DISCONTINUITY TABLE FROM TELEVIEWER ANALYSIS
FOR BOREHOLE GT-1-2018-2 FIELD WORK CONDUCTED OCTOBER, 2018
Cupertino , CA
NORCAL JOB NO. NS185080

DISCONTINUITY LEGEND

Code	Tadpole	Sine Wave	Name
1			Fracture open to partially open, continuous
2			Fracture "hairline" and/or discontinuous/irregular
3			Foliation or Bedding

GT-1-2018-2 Discontinuity Table				
Depth	Dip Azimuth	Dip Angle	Aperture or Thickness	Discontinuity Classification
ft	deg	deg	1/10 inches	(see Code under Legend)
30.82	223.57	57.82	nd	1
32.84	177.93	45.82	nd	2
33.65	132.85	41.19	nd	3
34.76	146.69	44.9	nd	1
39.43	223.54	52.23	nd	2
40.06	122.64	20.16	nd	2
40.24	105.97	84.47	nd	2
40.89	139.98	30.55	nd	2
44.79	241.9	89.62	nd	2
45.06	331.48	41.04	nd	2
45.85	263.41	48.01	nd	2
47.29	242.84	48.41	nd	2
47.47	106.26	44.88	nd	1
47.67	97.61	42.18	nd	1
51.37	200.89	37.17	nd	2
52.34	349.09	39.1	nd	3
53.58	312.48	74.45	nd	2
57.2	86.43	58.71	nd	3
57.8	82.19	56.69	nd	3
69.32	109.58	56.22	nd	2
72.02	69.43	56.04	nd	3
76.69	141.76	26.06	nd	3
77	118.64	36.4	nd	3
77.24	92.28	40.28	nd	2
78.71	178.68	29.2	nd	3
79	163.93	33.73	nd	3
79.99	164.56	32.38	nd	1
80.13	176.8	31.14	nd	1
80.96	269.31	52.24	nd	1

81.54	153.6	36.95	nd	3
81.7	163.6	31.59	nd	3
81.95	166.3	16.21	nd	3
83.28	268.8	51.47	nd	2
84.02	150.21	37.34	nd	2
84.24	266.63	54.06	nd	1
85.03	181.87	33.74	nd	2
85.26	190.24	33.26	nd	2
86.27	180.68	42.2	nd	2
88.68	188.46	36.03	nd	2
89.25	146.46	29.96	nd	3
89.7	154.5	24.03	nd	3
89.96	156.85	33.96	nd	3
90.2	167.19	31.01	nd	3
90.95	177.79	36.08	nd	3
91.3	160.82	36	nd	3
91.93	186	38.54	nd	3
95.82	192.44	49.08	nd	2
98.28	196.15	41.98	nd	2
98.87	186.02	44.75	nd	2
99.64	141.4	52.91	nd	2
100.72	152.94	51.82	nd	3
100.86	265.89	62.43	nd	2
101.24	159.39	42.88	nd	3
101.3	162.87	45.06	nd	3
101.77	159.77	48.85	nd	3
102.68	304.14	62.61	nd	2
102.93	170.02	41.1	nd	3
103.37	172.56	36.99	nd	3
103.85	169.88	43.12	nd	3
104.26	21.16	64.27	nd	2
104.3	178.59	37.75	nd	3
105.37	165.01	37.21	nd	3
105.87	185.56	40.12	nd	3
106.21	173.58	43.85	nd	3
106.61	172.38	39.1	nd	3
107.11	182.71	39.65	nd	3
107.39	169.87	41.3	nd	3
107.87	172.98	44.28	nd	3
108.18	169.32	38.08	nd	3
109.11	184.3	30.25	nd	3
109.45	175.4	30.74	nd	3
111.03	168.88	33.86	nd	3
111.29	168.89	31.68	nd	3
111.58	172.13	33.68	nd	3
112.73	174.62	41.82	nd	2
113.47	270.45	11.37	nd	1

113.66	185.2	38.43	nd	3
114.07	194.71	27.08	nd	3
114.36	182.28	29.99	nd	3
114.72	189.22	29.26	nd	3
115.06	180.85	25.29	nd	3
116.94	188.17	25.34	nd	3
117.32	190.28	32.77	nd	3
117.52	169.47	32.41	nd	3
118.01	177.25	36.54	nd	3
118.69	158.81	35.7	nd	3
119.38	174.1	30.72	nd	3
119.72	184.81	29.2	nd	3
120.63	168.91	37.41	nd	3
121.36	173.99	35.99	nd	2
121.85	169.8	37.15	nd	3
122.23	171.5	26	nd	3
123.15	176.91	39.46	nd	3
123.7	171.14	39.91	nd	3
124.33	148.45	44.67	nd	3
124.77	167.32	37.43	nd	3
125.07	159.79	44.44	nd	3
126.11	265.25	49.34	nd	2
126.6	189.08	32.21	nd	3
126.88	184.71	36.35	nd	3
128.06	172.61	40.18	nd	3
128.41	186.77	39.23	nd	3
129.2	186.41	37.84	nd	3
129.54	192.3	38.19	nd	3
130.09	193.26	39	nd	3
130.94	304.48	59.04	nd	2
131.88	187.96	38.76	nd	2
133.6	179.45	40.02	nd	2
134.07	176.21	40.15	nd	3
135.17	187.98	42.99	nd	3
136.05	159.74	40.15	nd	3
137.72	171.5	41.06	nd	3
138.18	188.1	37.61	nd	2
140.11	187.84	42.06	nd	2
140.88	56.13	78.95	nd	2
141.06	187.92	39.67	nd	3
141.56	173.95	42.82	nd	3
141.95	173.68	35.31	nd	3
142.12	176.13	41.1	nd	3
143.06	181	41.36	6.8	1
144.46	184.65	44.49	nd	3
145.3	197.14	36.32	nd	2
146.78	193.99	39.8	nd	3

147.16	190.14	38.9	nd	2
148.03	186.13	45.93	nd	3
148.89	191.25	38.03	nd	3
149.37	187.8	44.29	nd	3
150.18	193.25	36.54	nd	2
150.55	199.48	32.73	nd	3
151.06	200.2	29.53	nd	3
152.41	184.05	35.1	nd	3
152.73	177.9	42.37	nd	3
153.99	187.21	42.42	nd	3
155	174.05	41.09	nd	3
155.28	174.88	35.63	nd	3
155.95	188.24	34.74	nd	2
156.34	192.25	35.57	nd	3
156.71	183.53	35.65	nd	3
156.77	266.42	88.1	nd	2
158.2	194.28	38.63	nd	2
159.46	184.05	39.37	nd	3
162.2	192.1	38.03	nd	3
162.28	196.88	32.53	nd	3
163.13	256.95	88.27	nd	1
164.16	194.79	31.93	nd	2
164.69	182.11	34.95	nd	1
165.1	164.79	53.33	nd	2
165.52	200.21	36.26	nd	2
165.6	269.39	78.19	nd	2
166.91	192.36	33.43	nd	3
167.69	194.73	21.11	nd	3
168.88	188.06	34.75	nd	3
169.24	182.19	39.94	nd	3

Note: 'nd" = discontinuity aperture thickness not determined

LEHIGH QUARRY
BOREHOLE DISCONTINUITY TABLE FROM TELEVIEWER ANALYSIS
FOR BOREHOLE S-1-2018-2 FIELD WORK CONDUCTED OCTOBER, 2018
Cupertino , CA
NORCAL JOB NO. NS185080

DISCONTINUITY LEGEND

Code	Tadpole	Sine Wave	Name
1			Fracture open to partially open, continuous
2			Fracture "hairline" and/or discontinuous/irregular
3			Foliation or Bedding

S-1-2018-2 Discontinuity Table				
Depth	Dip Azimuth	Dip Angle	Aperture or Thickness	Discontinuity Classification
ft	deg	deg	1/10 inches	(see Code under Legend)
17.63	342.76	82.56	nd	1
28.77	101.23	39.7	nd	3
47.19	333	80.73	nd	1
67.08	202.35	78.94	nd	1
70.48	175.13	78.43	nd	1
74.04	192.78	49.25	nd	1

Note: 'nd" = discontinuity aperture thickness not determined

NORCAL GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

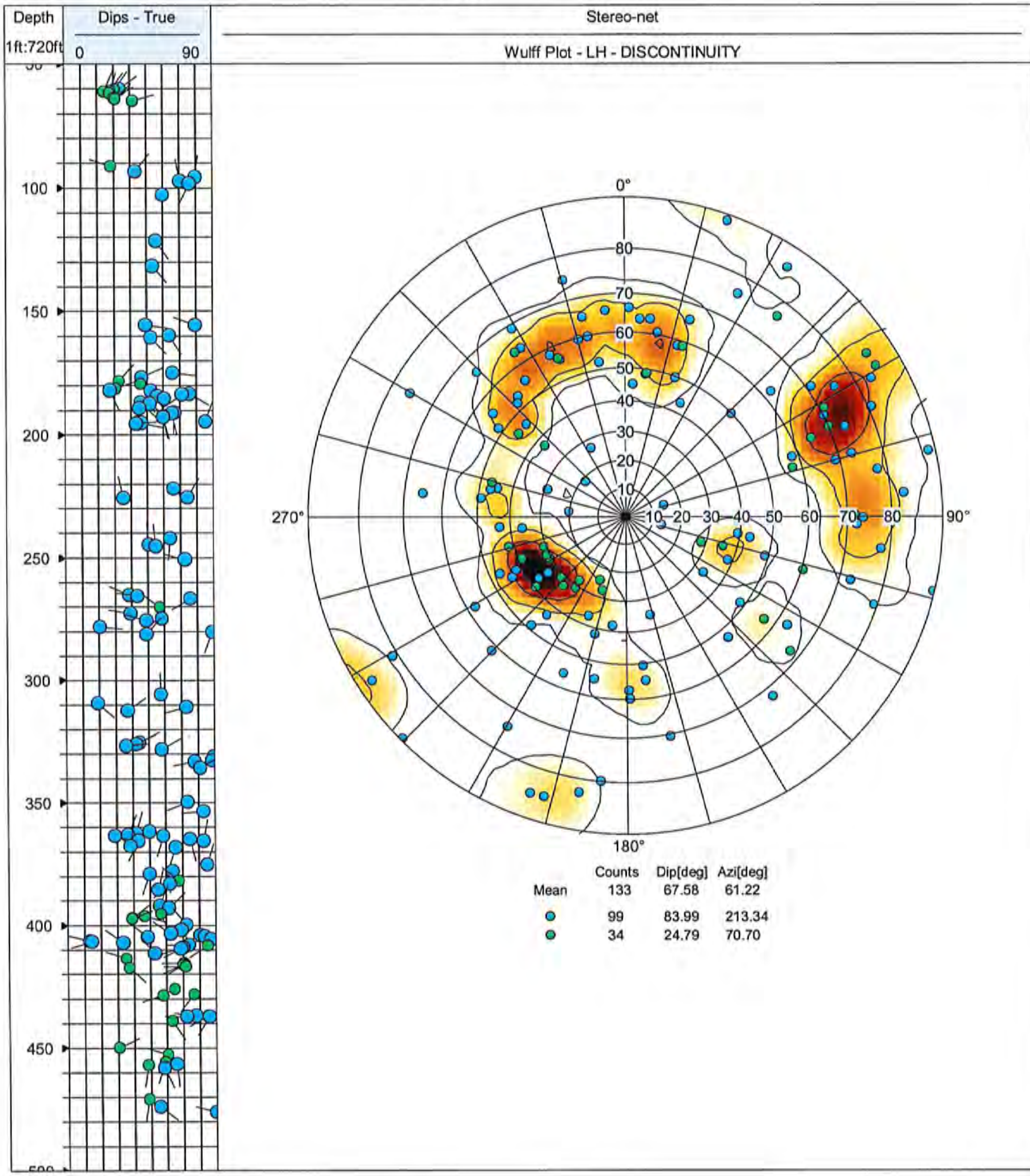
Appendix E:

Polar Projections

Boreholes GT-1-2018-1 and GT-1-2018-2

NORCAL NORCAL GEOPHYSICAL CONSULTANTS, INC.	POLE PROJECTION PLOT	COMPANY: STAANTEC WELL ID: GT-1-2018-1 FIELD: LEHIGH QUARRY COUNTY: SANT CLARA	DATE: OCT. 8, 2018 CASING: STEEL TO 50-3 FT BGS JOB NO. NS185080 STATE: CA

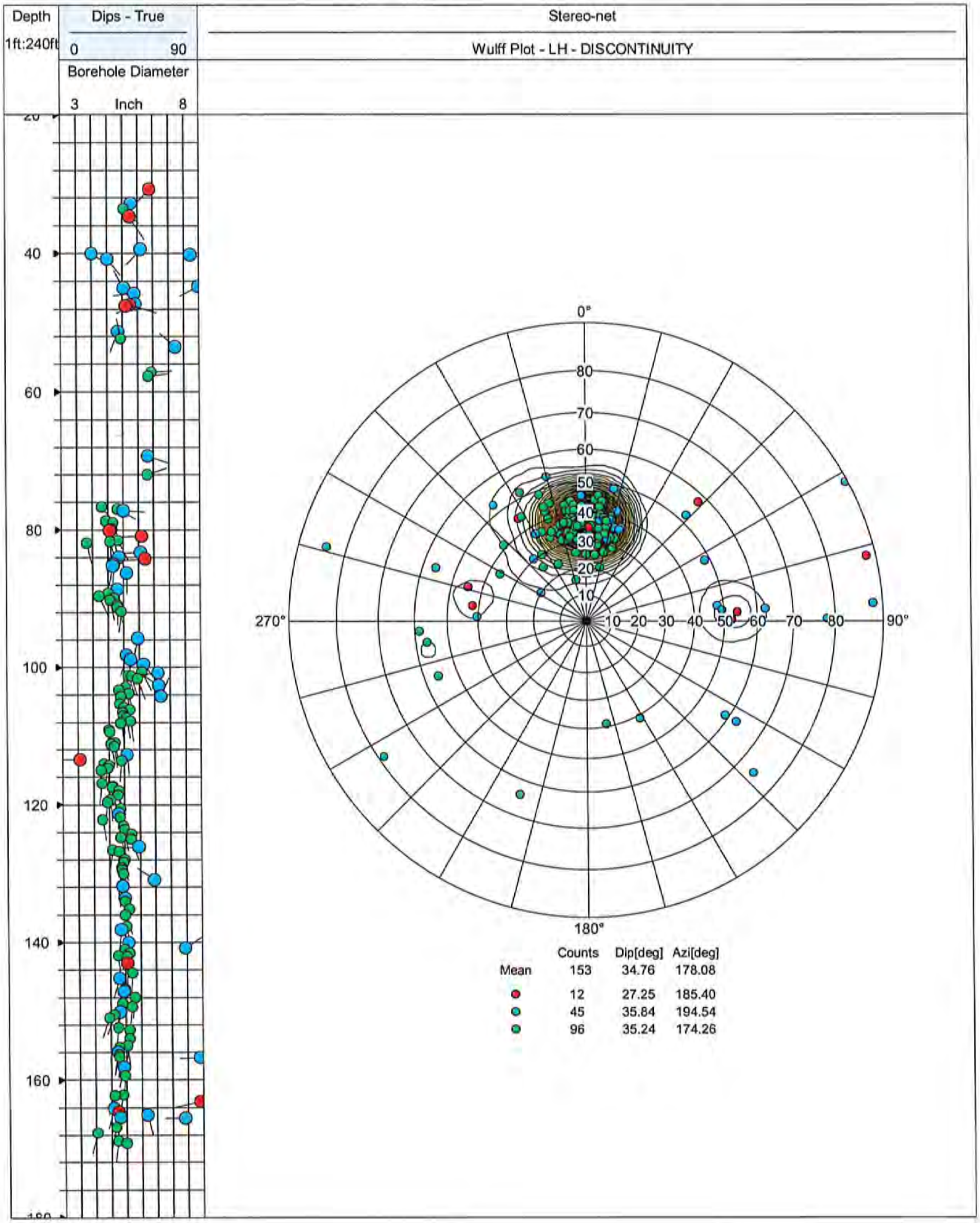
NOTES:



	Counts	Dip[deg]	Azi[deg]
Mean	133	67.58	61.22
● (blue)	99	83.99	213.34
● (green)	34	24.79	70.70

NORCAL GEOPHYSICAL CONSULTANTS, INC.	POLE PROJECTION PLOT	COMPANY: STAANTEC WELL ID: GT-1-2018-2 FIELD: LEHIGH QUARRY COUNTY: SANT CLARA	DATE: OCT. 8, 2018 CASING: STEEL TO 20FT BGS JOB NO. NS185080 STATE: CA

NOTES:



	Counts	Dip[deg]	Azi[deg]
Mean	153	34.76	178.08
● (red)	12	27.25	185.40
● (blue)	45	35.84	194.54
● (green)	96	35.24	174.26

Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

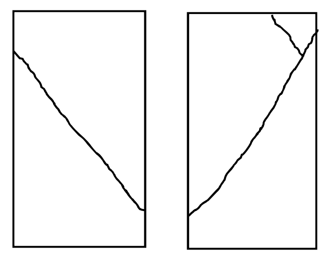
Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone, gray/green, moderately hard	Lab ID	UCR-1
Hole Number	GT-1-2018-1 Depth (ft) 385.1'-385.5'	Date Received	11/01/2018

Temperature (^{o}C)	22	Moisture Condition	As Prepared, Moist	Date Tested	11/08/2018
Side Planeness	N/A	Height (in)	4.891	Wet Unit Weight (pcf)	161.1
Perpendicularity	N/A	Diameter (in)	2.390	Dry Unit Weight (pcf)	N/A
End Planeness	N/A	Area (in^2)	4.485	Moisture Content (%)	N/A
Parallelism	N/A				

Dimensions were not confirmed.

Loading Rate (lbf/sec)	7
Peak Load (lbf)	150
Failure Type	Shear
Compressive Strength (psi)	33
Compressive Strength (psf)	4752
Compressive Strength (tsf)	2

Failure Sketches



Comments: Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone.
Dimensional tolerances were not confirmed.
Primary failure occurred along pre-existing healed fault.

Reviewed By JW

Template: tmp_ucr_input.xlsm
Version: 20170215
Approved By: RJ

Stantec Consulting Services Inc.
Lexington, Kentucky

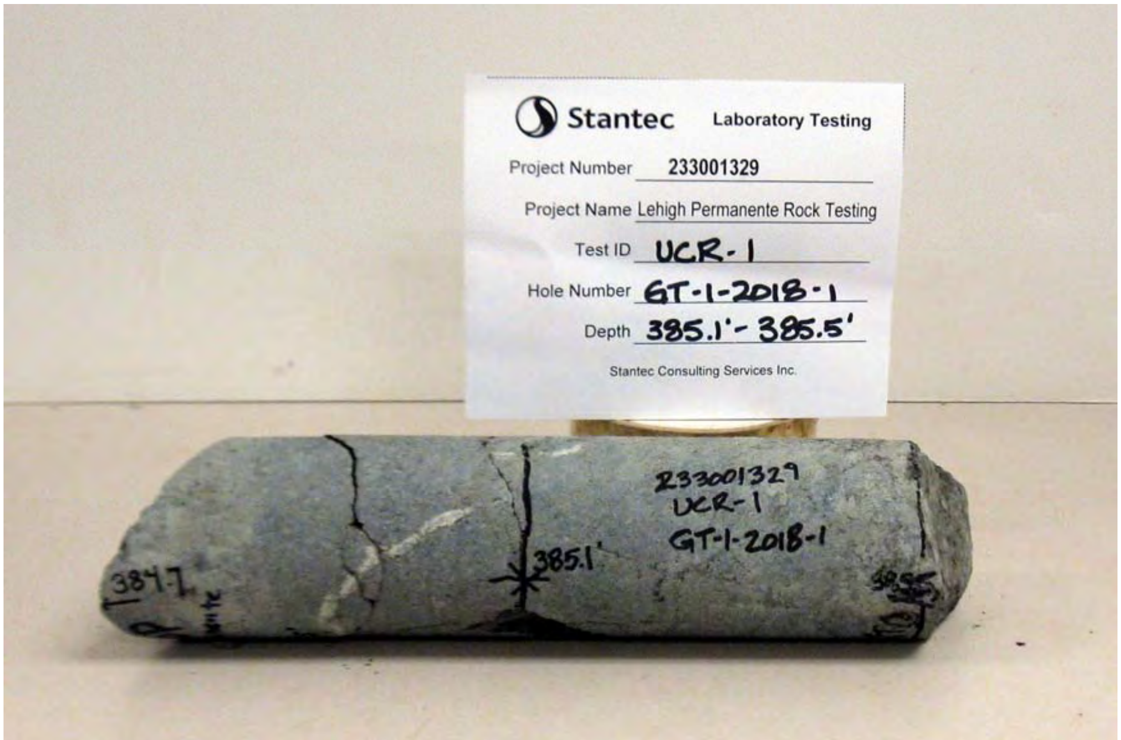
Reported By: JW
Report Date: 11/13/2018

Stantec

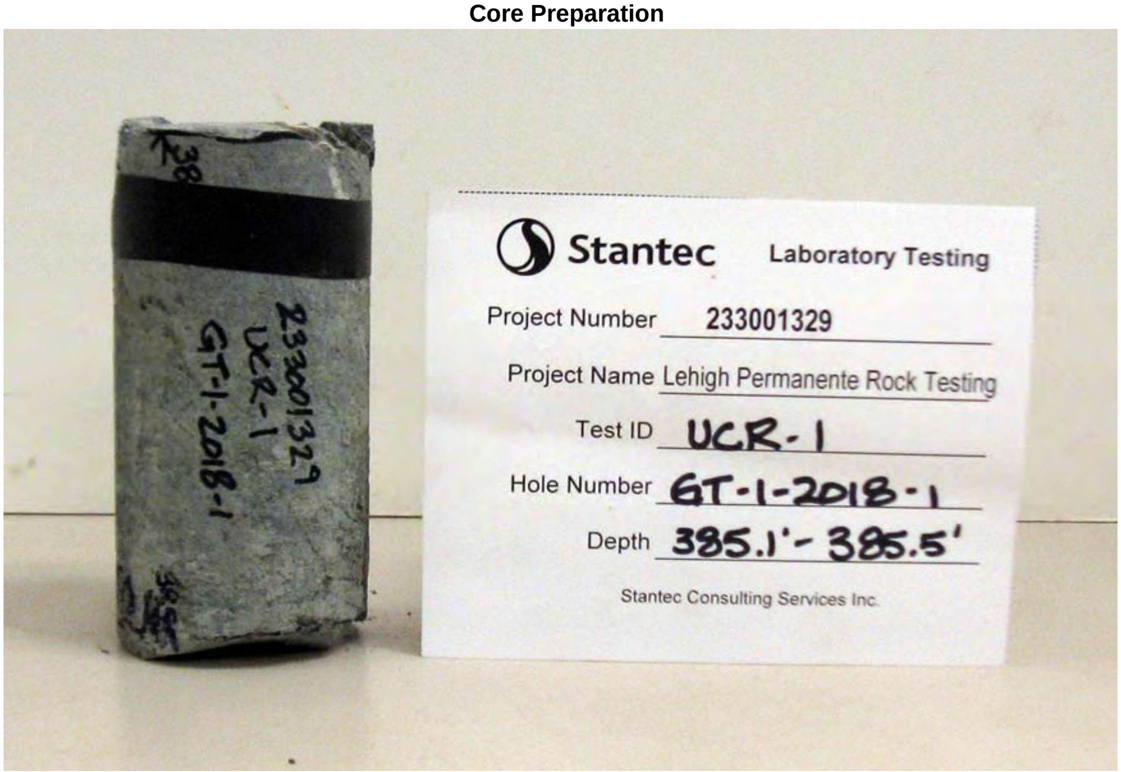
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone, gray/green, moderately hard	Lab ID	UCR-1
Hole Number	GT-1-2018-1 Depth (ft) 385.1'-385.5'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



Core Preparation

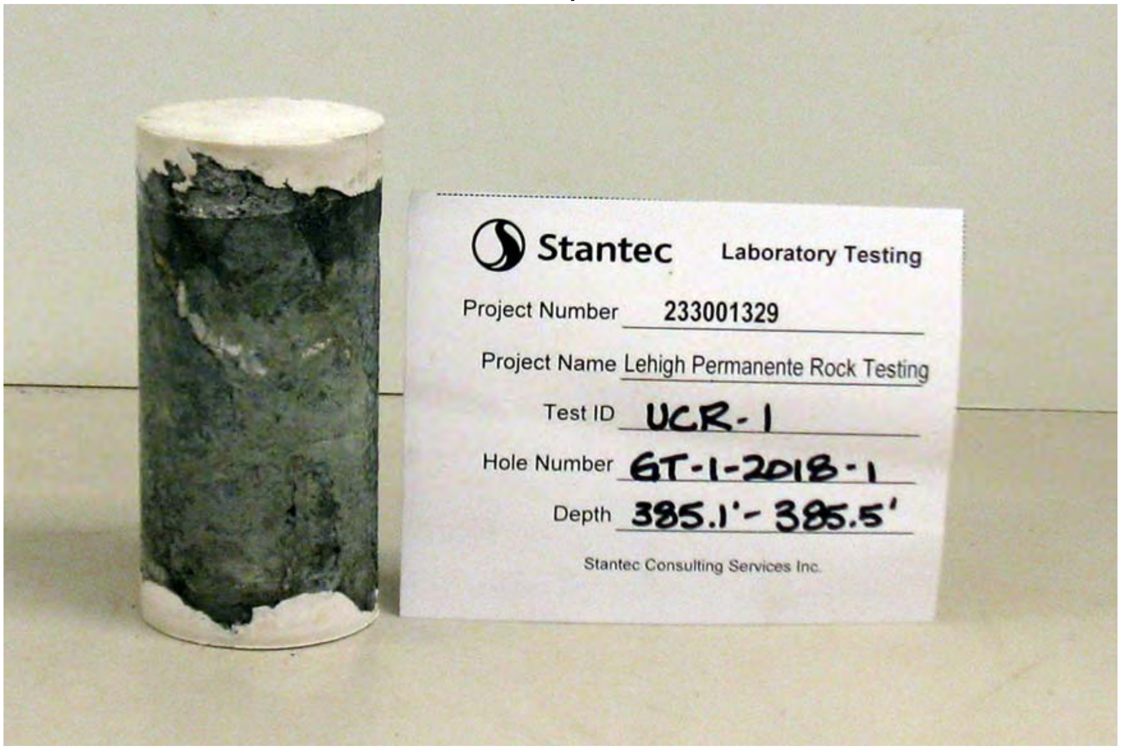


Stantec

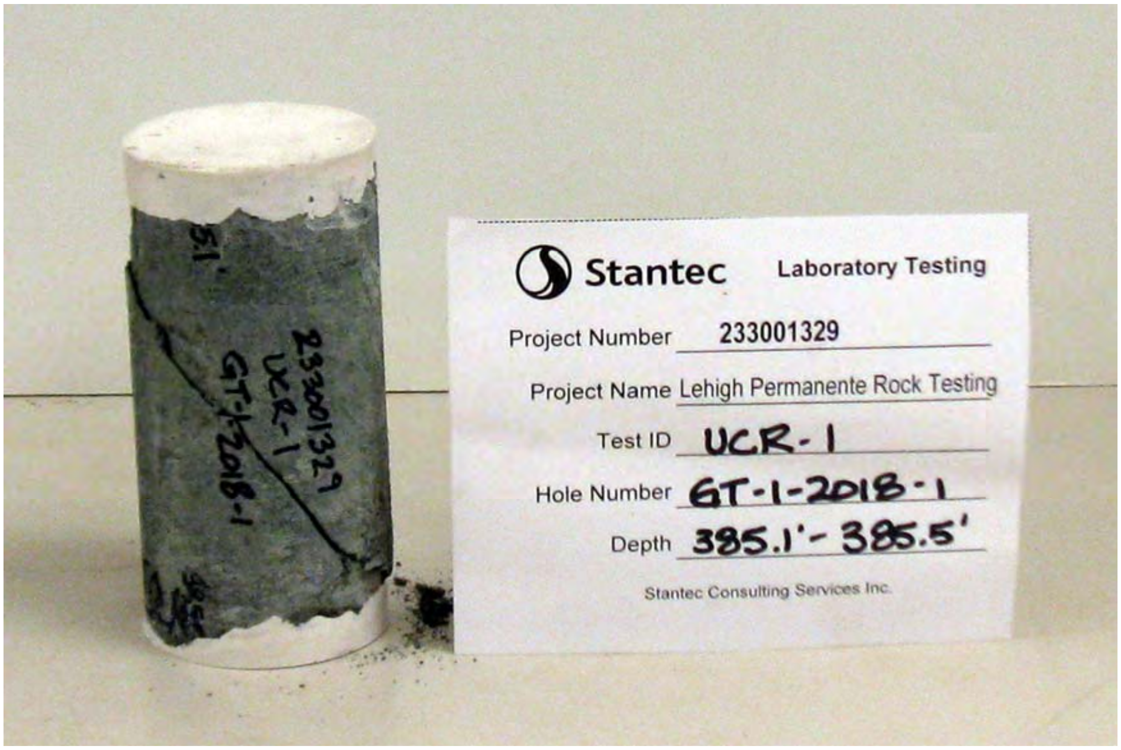
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone, gray/green, moderately hard	Lab ID	UCR-1
Hole Number	GT-1-2018-1 Depth (ft) 385.1'-385.5'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



Post Test

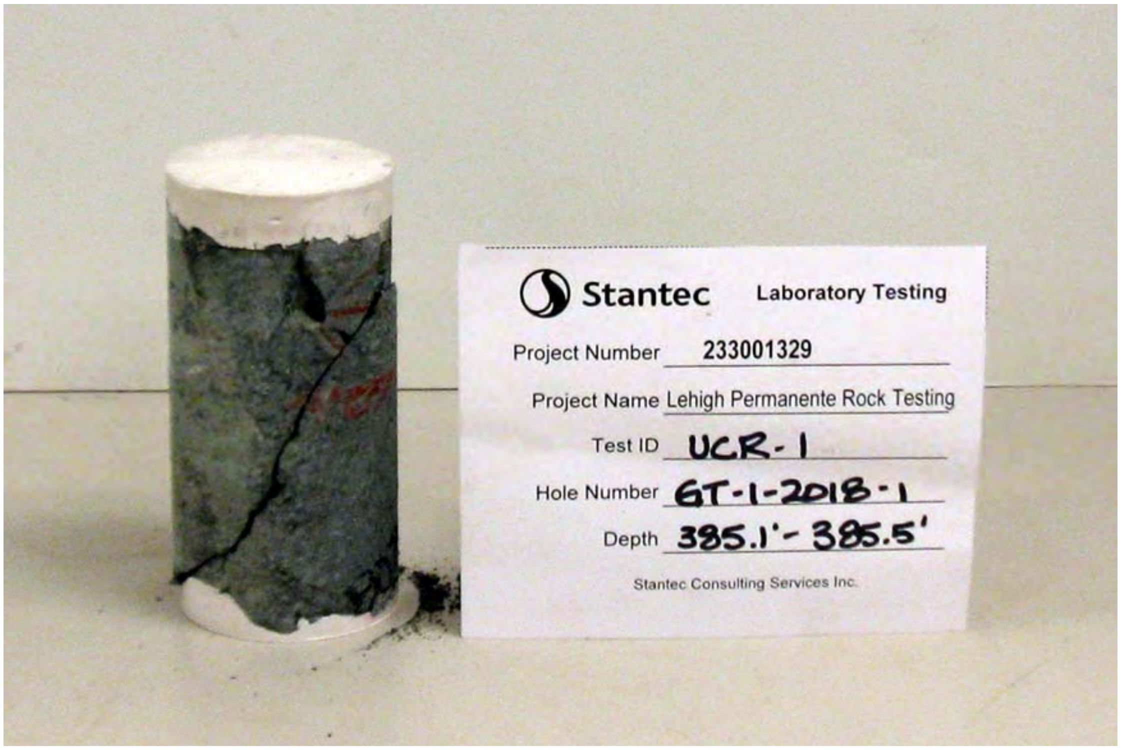


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone, gray/green, moderately hard	Lab ID	UCR-1
Hole Number	GT-1-2018-1 Depth (ft) 385.1'-385.5'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test



Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name: Lehigh Permanente Rock Testing
Project Number: 233001329
Lithology: Greenstone Breccia, green/gray, moderately hard
Lab ID: UCR-2
Hole Number: GT-1-2018-1
Depth (ft): 284.2'-284.7'
Date Received: 11/01/2018

Temperature (^{o}C): 22
Moisture Condition: As Prepared, Moist
Date Tested: 11/13/2018

Side Planeness: N/A
Perpendicularity: N/A
End Planeness: N/A
Parallelism: N/A
Dimensions were not confirmed.

Height (in): 5.946
Diameter (in): 2.373
Area (in^2): 4.424

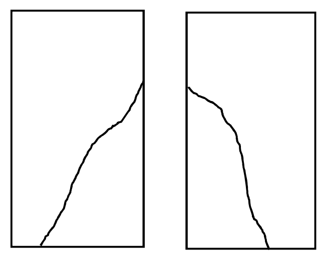
Wet Unit Weight (pcf): 161.2
Dry Unit Weight (pcf): N/A
Moisture Content (%): N/A

Loading Rate (lbf/sec): 7
Peak Load (lbf): 1241

Failure Type: Shear

Compressive Strength (psi): 281
Compressive Strength (psf): 40464
Compressive Strength (tsf): 20

Failure Sketches



Comments: Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone.
Dimensional tolerances were not confirmed.
Primary failure occurred along pre-existing healed fault.

Reviewed By: JW

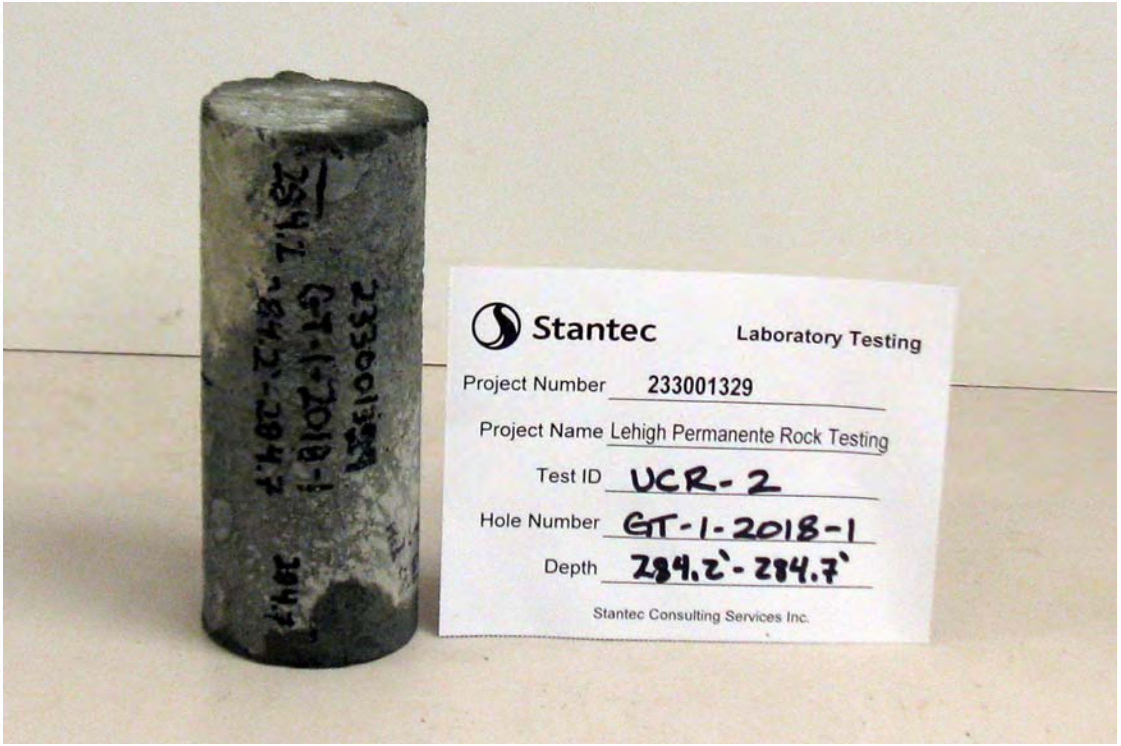
Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, moderately hard	Lab ID	UCR-2
Hole Number	GT-1-2018-1 Depth (ft) 284.2'-284.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received

Core Preparation

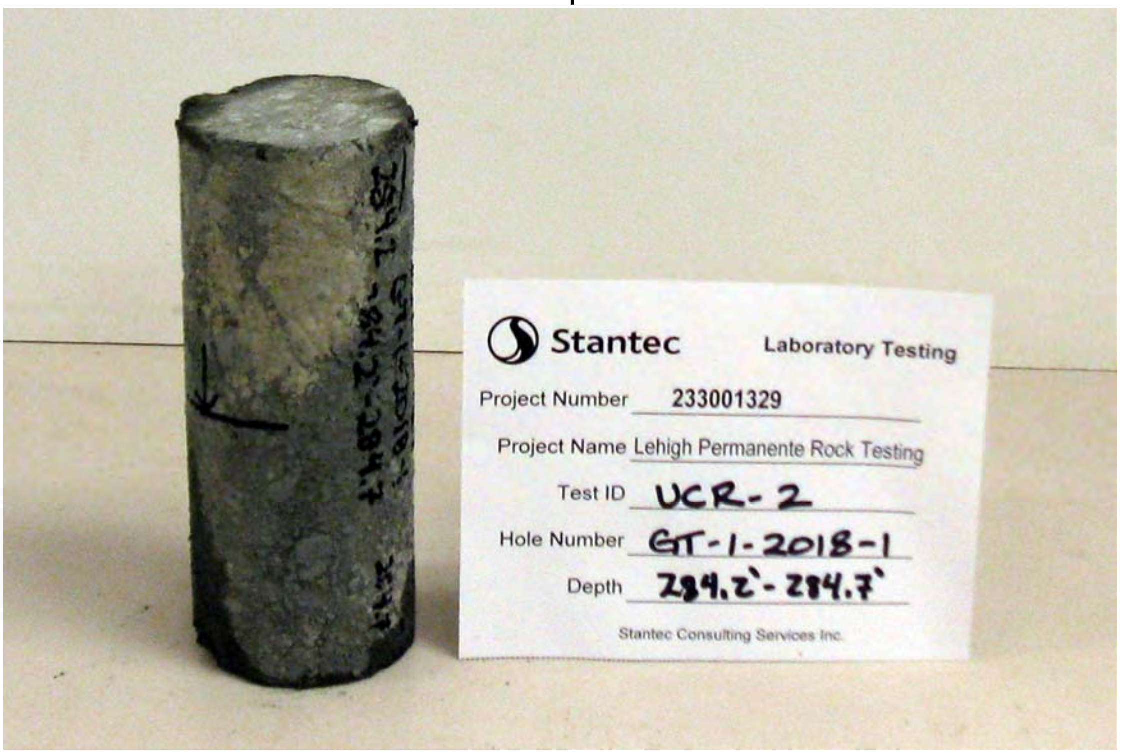


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, moderately hard	Lab ID	UCR-2
Hole Number	GT-1-2018-1 Depth (ft) 284.2'-284.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



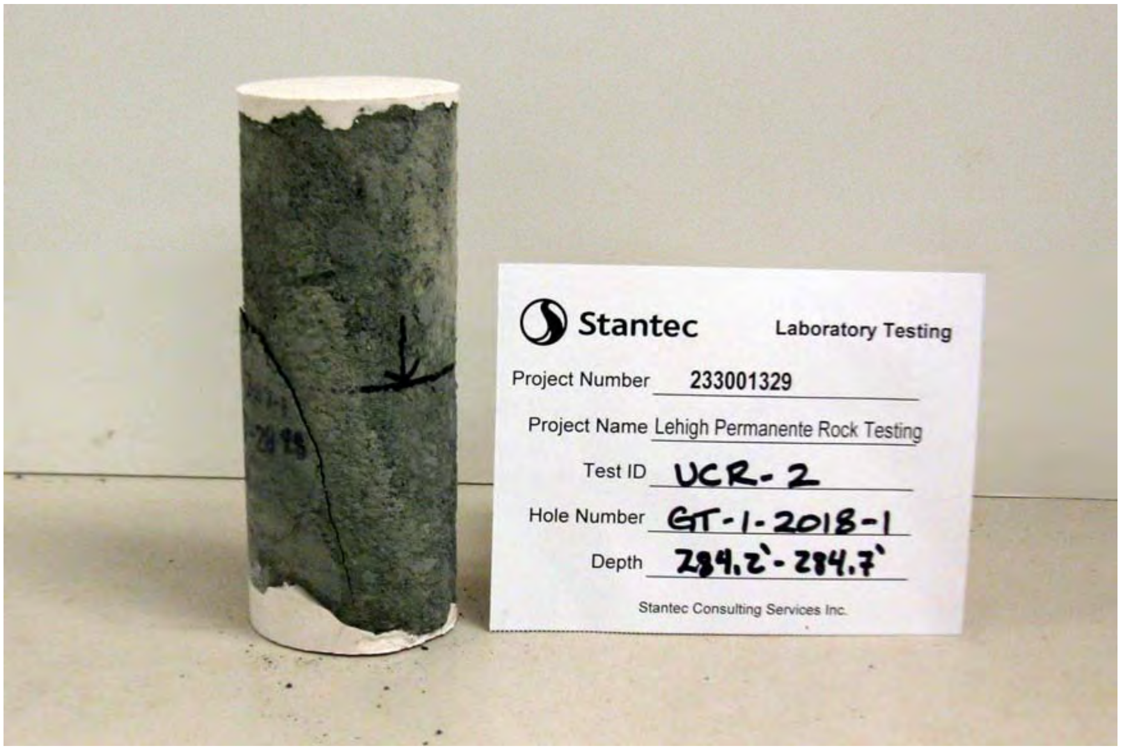
Post Test

Stantec

Photo Report

Project Name Lehigh Permanente Rock Testing
Project Number 233001329
Lithology Greenstone Breccia, green/gray, moderately hard
Lab ID UCR-2
Hole Number GT-1-2018-1 Depth (ft) 284.2'-284.7'
Test Type Uniaxial Compressive Strength of Intact Rock Core

Post Test



Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name: Lehigh Permanente Rock Testing
Project Number: 233001329
Lithology: Greenstone Breccia, green/gray, moderately hard
Lab ID: UCR-4
Hole Number: GT-1-2018-1
Depth (ft): 470.1'-470.6'
Date Received: 11/01/2018

Temperature (^oC): 22
Moisture Condition: As Prepared, Moist
Date Tested: 11/13/2018

Side Planeness: N/A
Perpendicularity: N/A
End Planeness: N/A
Parallelism: N/A
Dimensions were not confirmed.

Height (in): 5.866
Diameter (in): 2.393
Area (in^2): 4.496

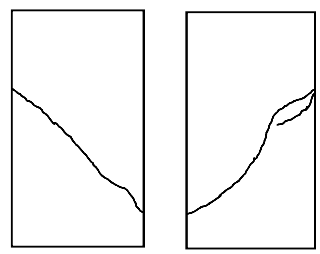
Wet Unit Weight (pcf): 171.0
Dry Unit Weight (pcf): N/A
Moisture Content (%): N/A

Loading Rate (lbf/sec): 20
Peak Load (lbf): 4936

Failure Type: Shear

Compressive Strength (psi): 1098
Compressive Strength (psf): 158112
Compressive Strength (tsf): 79

Failure Sketches



Comments: Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone. Dimensional tolerances were not confirmed.

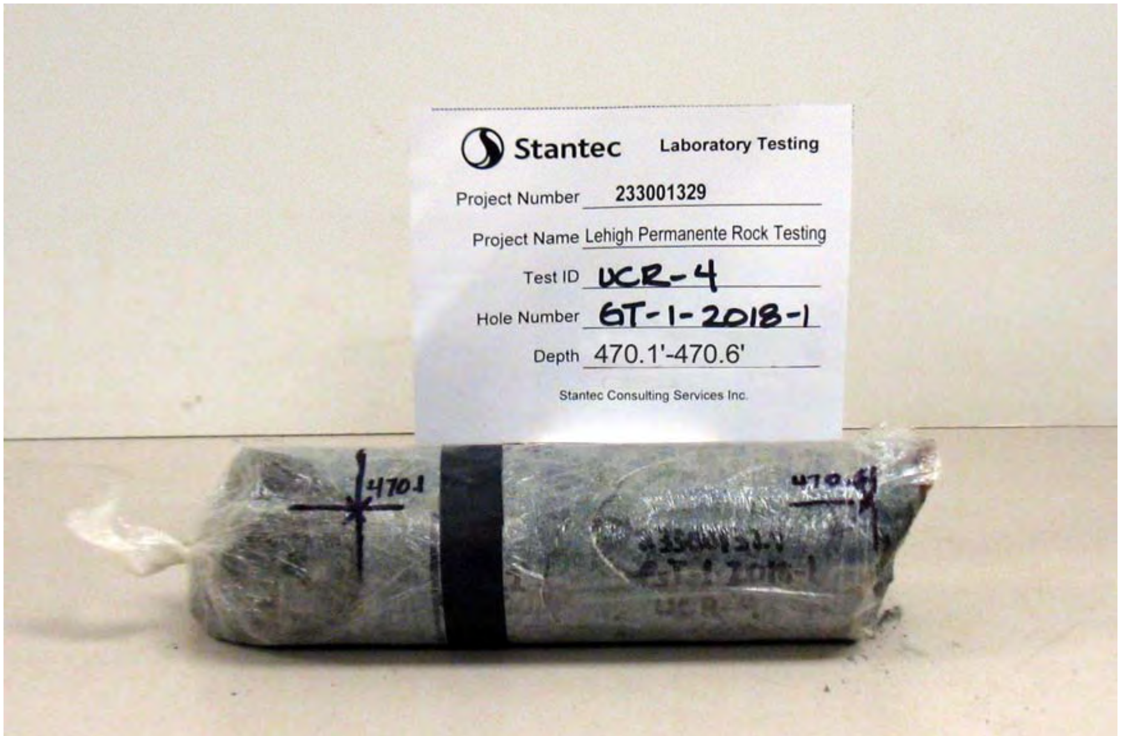
Reviewed By: JW

Stantec

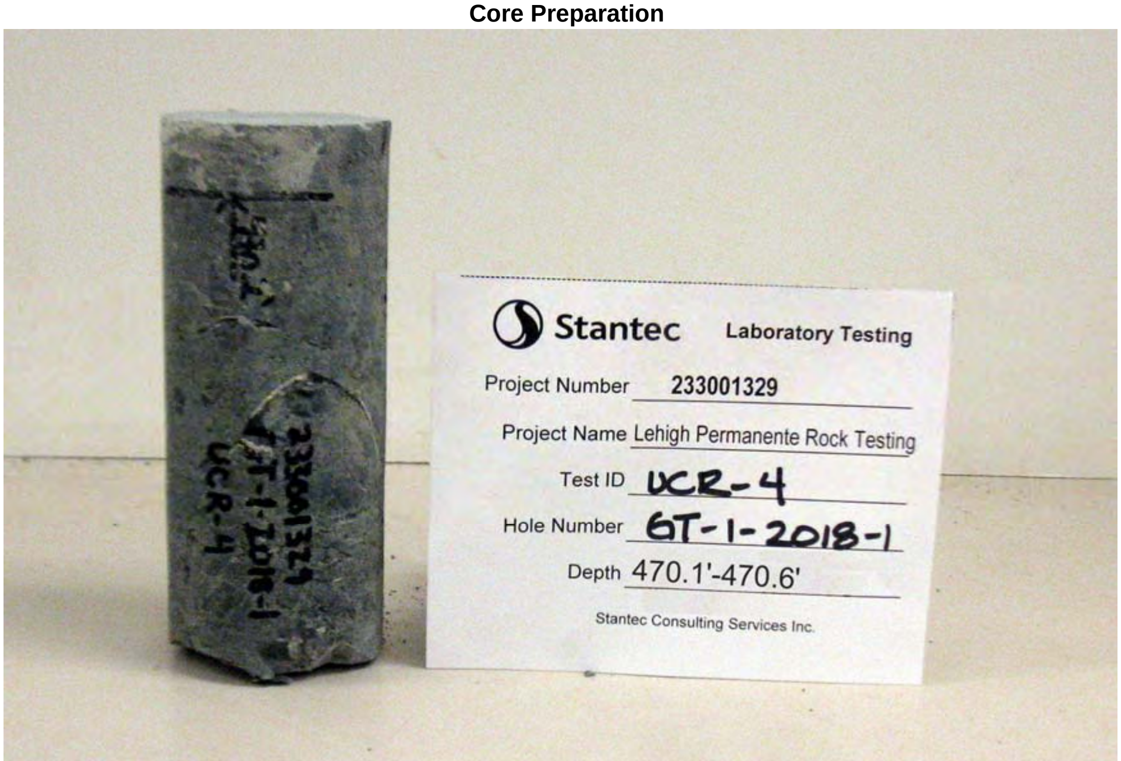
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, moderately hard	Lab ID	UCR-4
Hole Number	GT-1-2018-1 Depth (ft) 470.1'-470.6'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



Core Preparation



Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, moderately hard	Lab ID	UCR-4
Hole Number	GT-1-2018-1 Depth (ft) 470.1'-470.6'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation

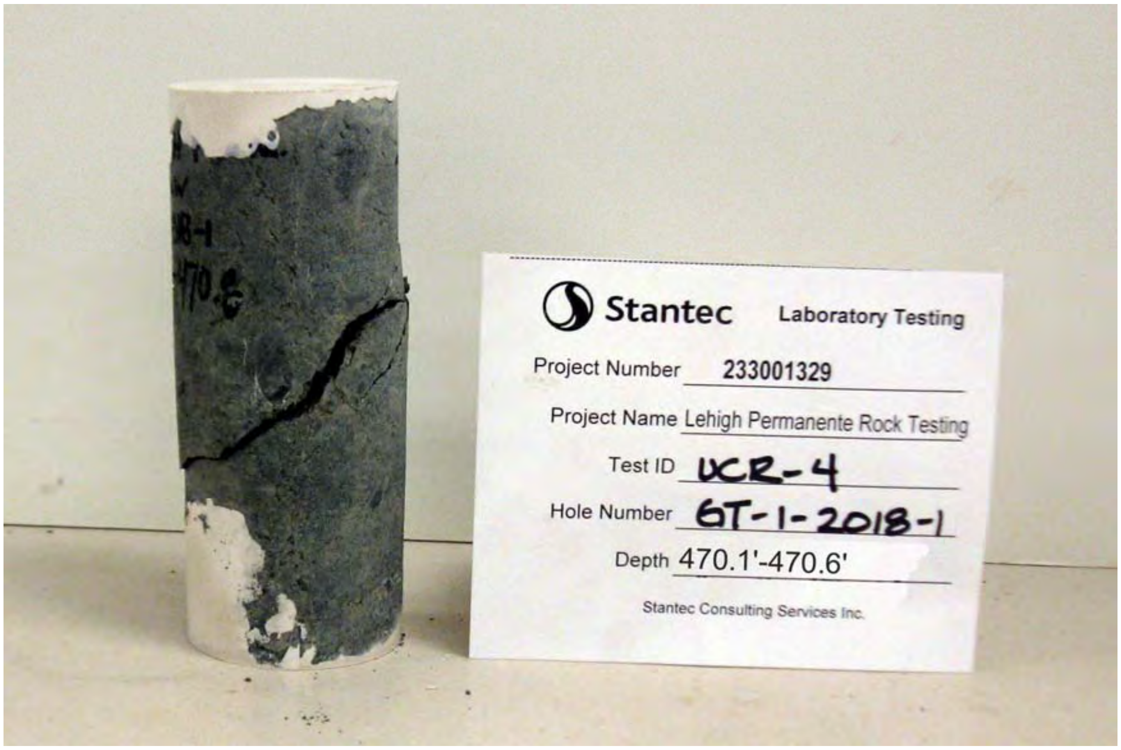
Post Test

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, moderately hard	Lab ID	UCR-4
Hole Number	GT-1-2018-1 Depth (ft) 470.1'-470.6'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test



Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, hard	Lab ID	UCR-5
Hole Number	GT-1-2018-1 Depth (ft) 406.2'-406.7'	Date Received	11/01/2018

Temperature (^{o}C) 22 Moisture Condition As Prepared, Moist Date Tested 11/13/2018

Side Planeness	Pass	Height (in)	5.861	Wet Unit Weight (pcf)	178.6
Perpendicularity	Pass	Diameter (in)	2.383	Dry Unit Weight (pcf)	N/A
End Planeness	Pass	Area (in^2)	4.461	Moisture Content (%)	N/A
Parallelism	Pass				

Loading Rate (lbf/sec) 89

Peak Load (lbf) 69746

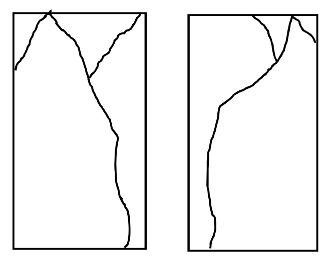
Failure Type Shear

Compressive Strength (psi) 15630

Compressive Strength (psf) 2250720

Compressive Strength (tsf) 1126

Failure Sketches



Comments

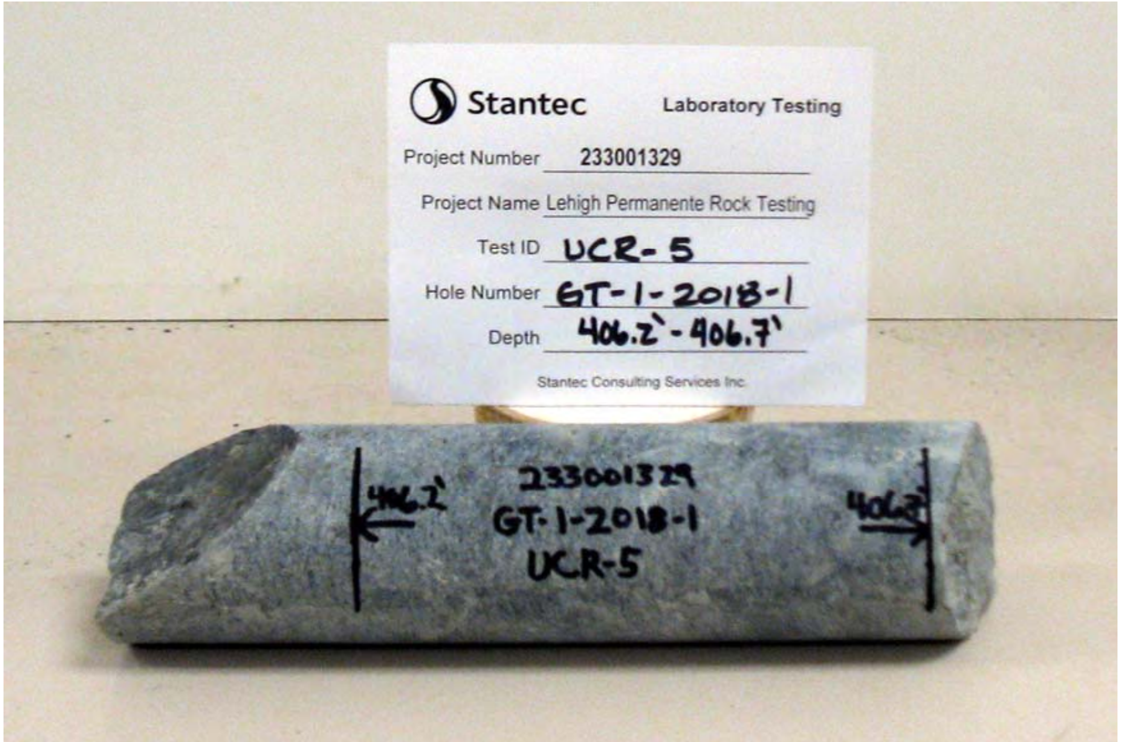
Reviewed By

Stantec

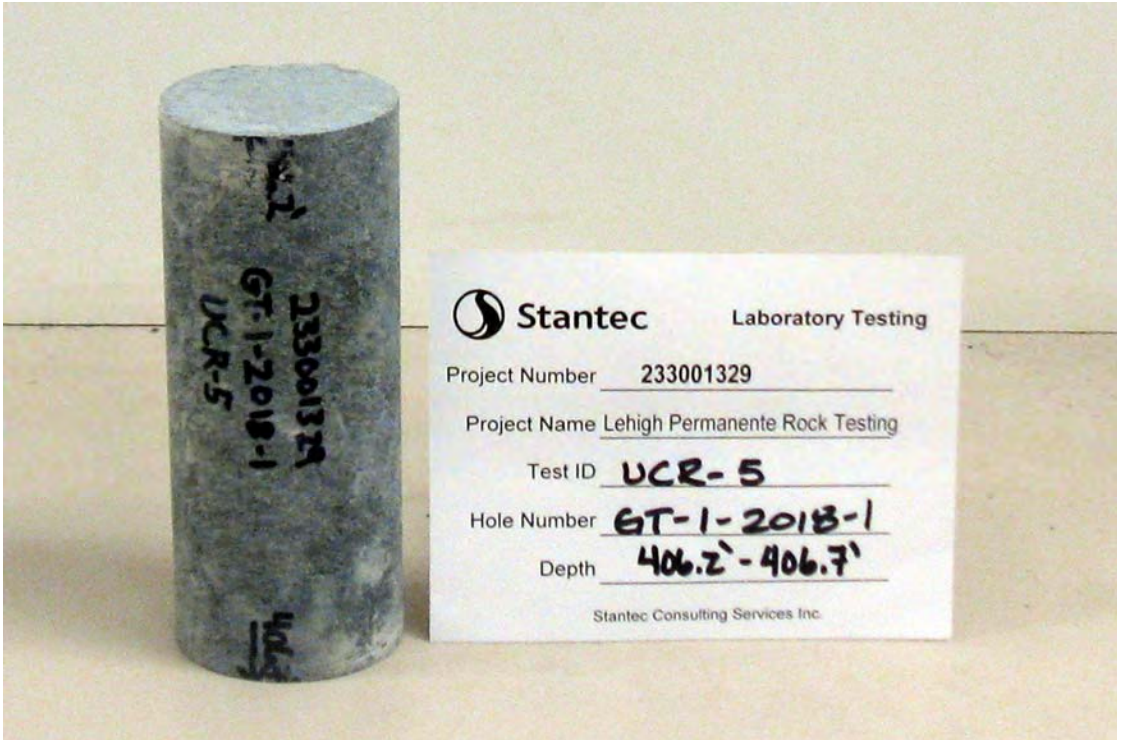
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, hard	Lab ID	UCR-5
Hole Number	GT-1-2018-1 Depth (ft) 406.2'-406.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



Core Preparation

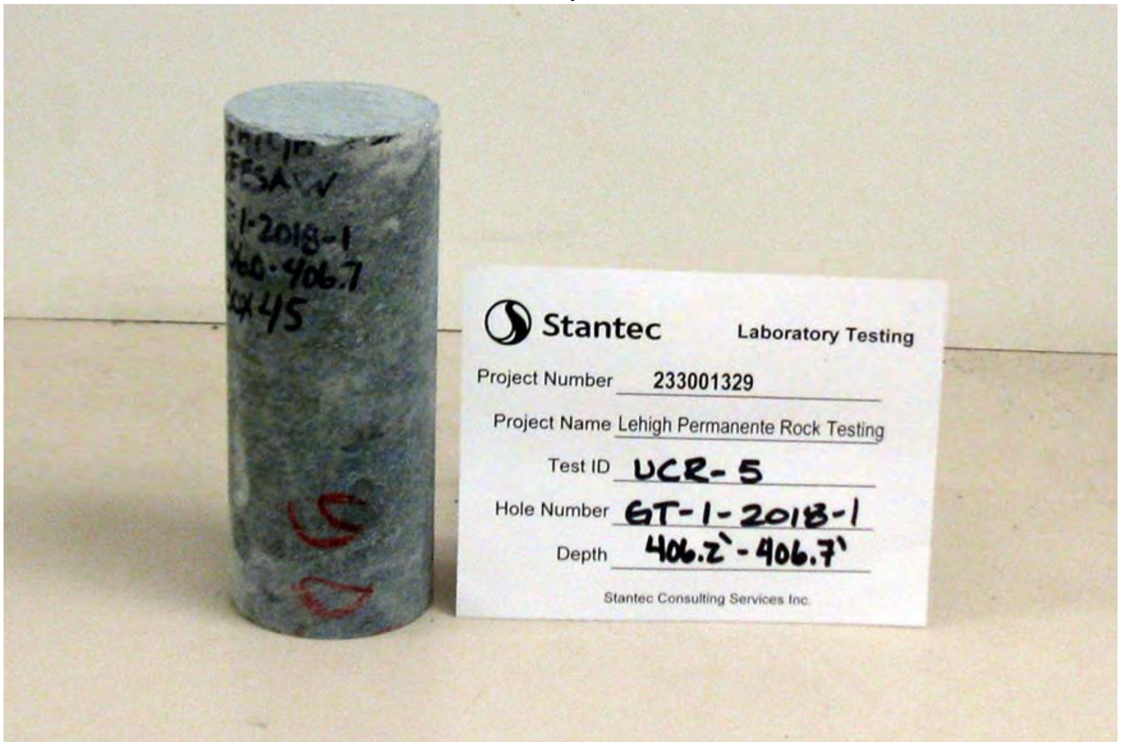


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, hard	Lab ID	UCR-5
Hole Number	GT-1-2018-1 Depth (ft) 406.2'-406.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



Post Test

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, hard	Lab ID	UCR-5
Hole Number	GT-1-2018-1 Depth (ft) 406.2'-406.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test

Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name: Lehigh Permanente Rock Testing
Project Number: 233001329
Lithology: Greenstone Breccia, green/gray, moderately hard
Lab ID: UCR-6
Hole Number: GT-1-2018-1
Depth (ft): 285.2'-285.7'
Date Received: 11/01/2018

Temperature (^{o}C): 22
Moisture Condition: As Prepared, Moist
Date Tested: 11/13/2018

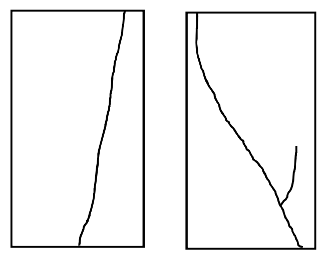
Side Planeness: N/A
Height (in): 5.827
Wet Unit Weight (pcf): 164.8
Perpendicularity: N/A
Diameter (in): 2.377
Dry Unit Weight (pcf): N/A
End Planeness: N/A
Area (in^2): 4.436
Moisture Content (%): N/A
Parallelism: N/A
Dimensions were not confirmed.

Loading Rate (lbf/sec): 7
Peak Load (lbf): 1325

Failure Type: Shear

Compressive Strength (psi): 299
Compressive Strength (psf): 43056
Compressive Strength (tsf): 22

Failure Sketches



Comments: Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone. Dimensional tolerances were not confirmed.

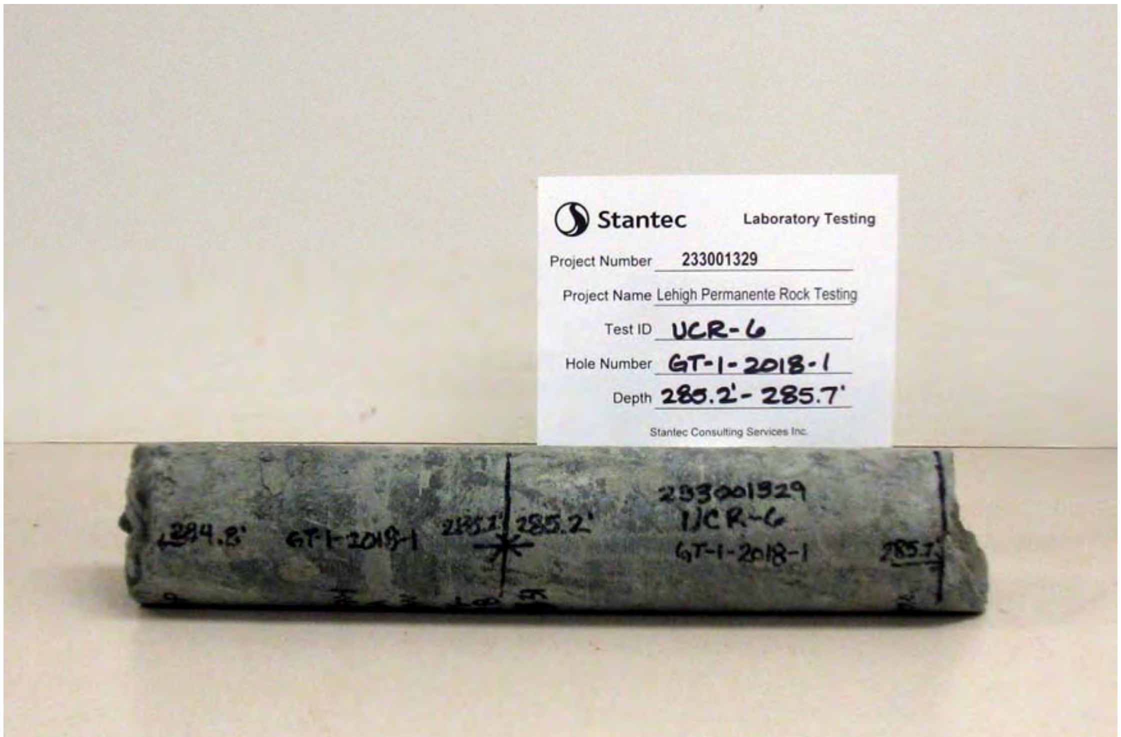
Reviewed By: JW

Stantec

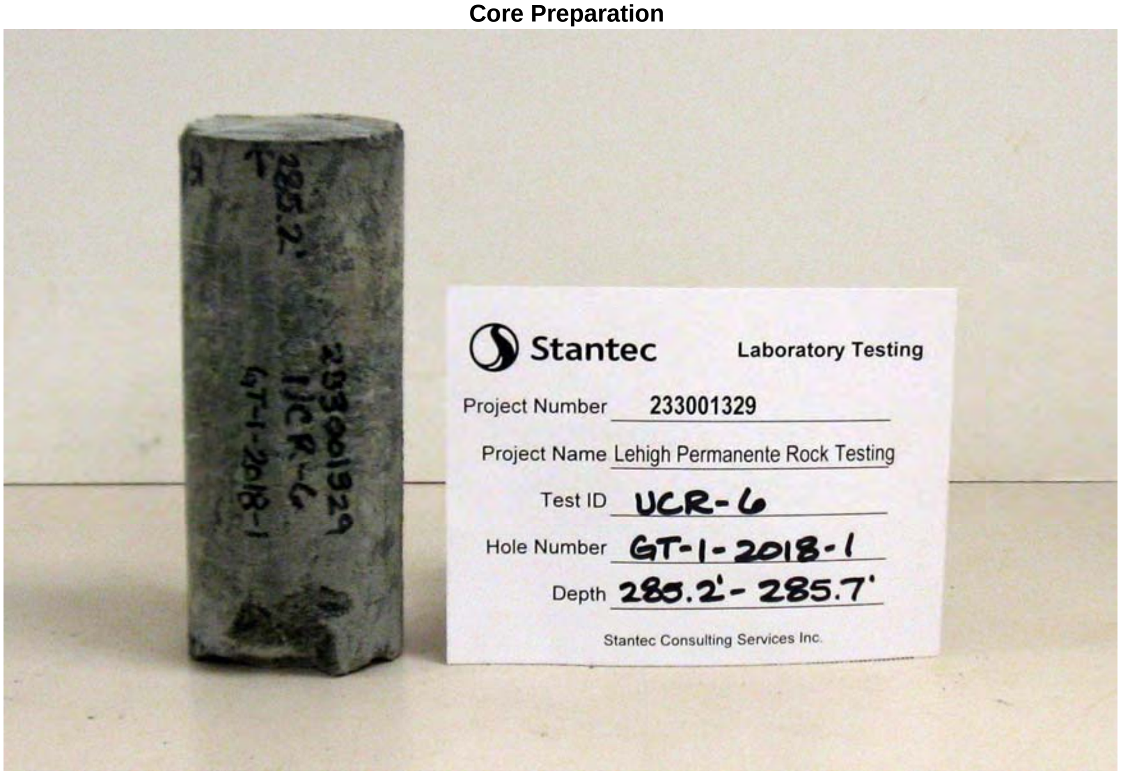
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, moderately hard	Lab ID	UCR-6
Hole Number	GT-1-2018-1 Depth (ft) 285.2'-285.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



Core Preparation

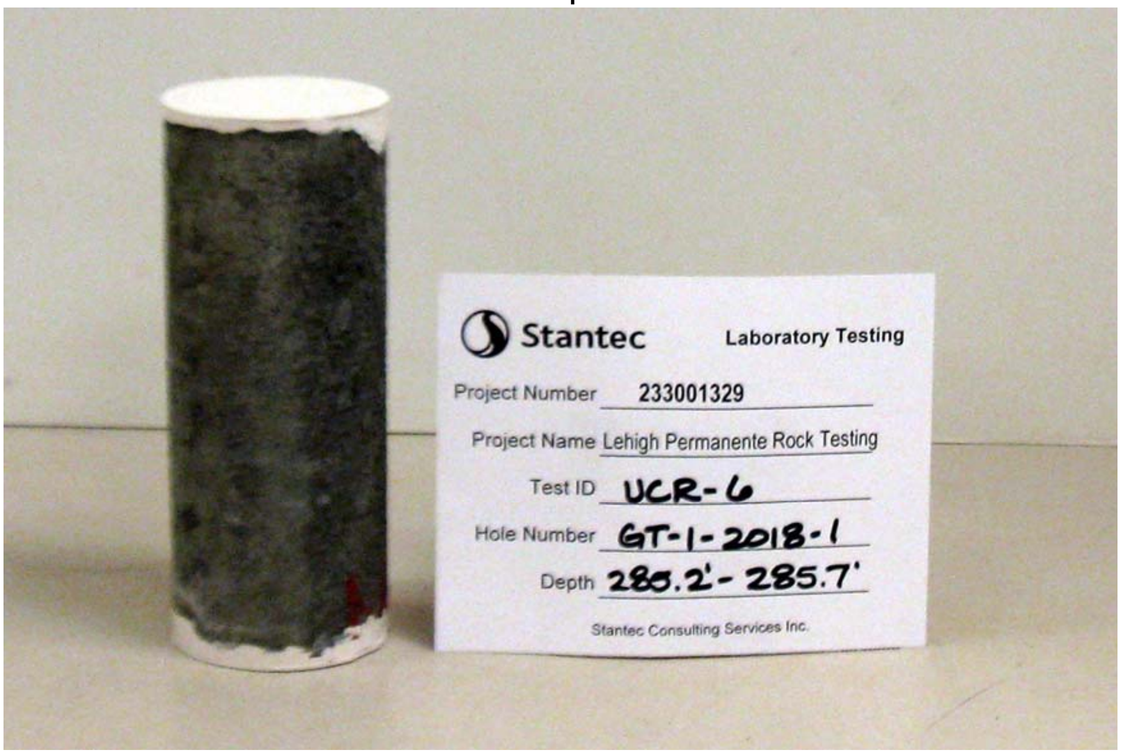


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, moderately hard	Lab ID	UCR-6
Hole Number	GT-1-2018-1 Depth (ft) 285.2'-285.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



Post Test

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, green/gray, moderately hard	Lab ID	UCR-6
Hole Number	GT-1-2018-1 Depth (ft) 285.2'-285.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test

Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens
ASTM D 7012, Method C

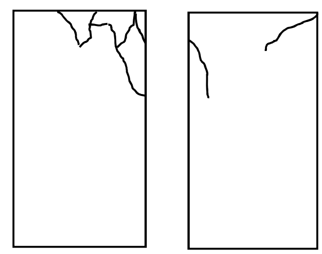
Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, gray, moderately hard	Lab ID	UCR-7
Hole Number	GT-1-2018-1 Depth (ft) 444.4'-444.9'	Date Received	11/01/2018

Temperature (^oC)	22	Moisture Condition	As Prepared, Moist	Date Tested	11/15/2018
Side Planeness	N/A	Height (in)	5.935	Wet Unit Weight (pcf)	170.9
Perpendicularity	N/A	Diameter (in)	2.388	Dry Unit Weight (pcf)	N/A
End Planeness	N/A	Area (in^2)	4.478	Moisture Content (%)	N/A
Parallelism	N/A				

Dimensions were not confirmed.

Loading Rate (lbf/sec)	7
Peak Load (lbf)	1209
Failure Type	Undetermined
Compressive Strength (psi)	270
Compressive Strength (psf)	38880
Compressive Strength (tsf)	19

Failure Sketches



Comments: Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone. Dimensional tolerances were not confirmed.

Reviewed By JW

Template: tmp_ucr_input.xlsm
Version: 20170215
Approved By: RJ

Stantec Consulting Services Inc.
Lexington, Kentucky

Reported By: JW
Report Date: 11/15/2018

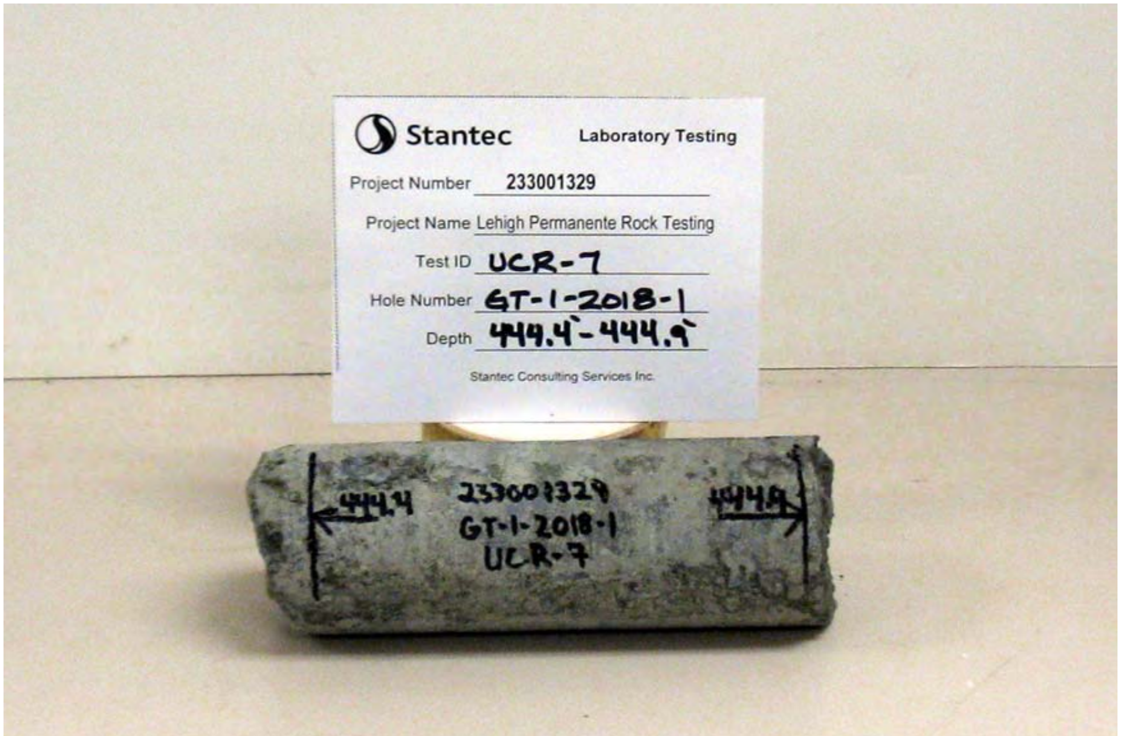
Stantec

Photo Report

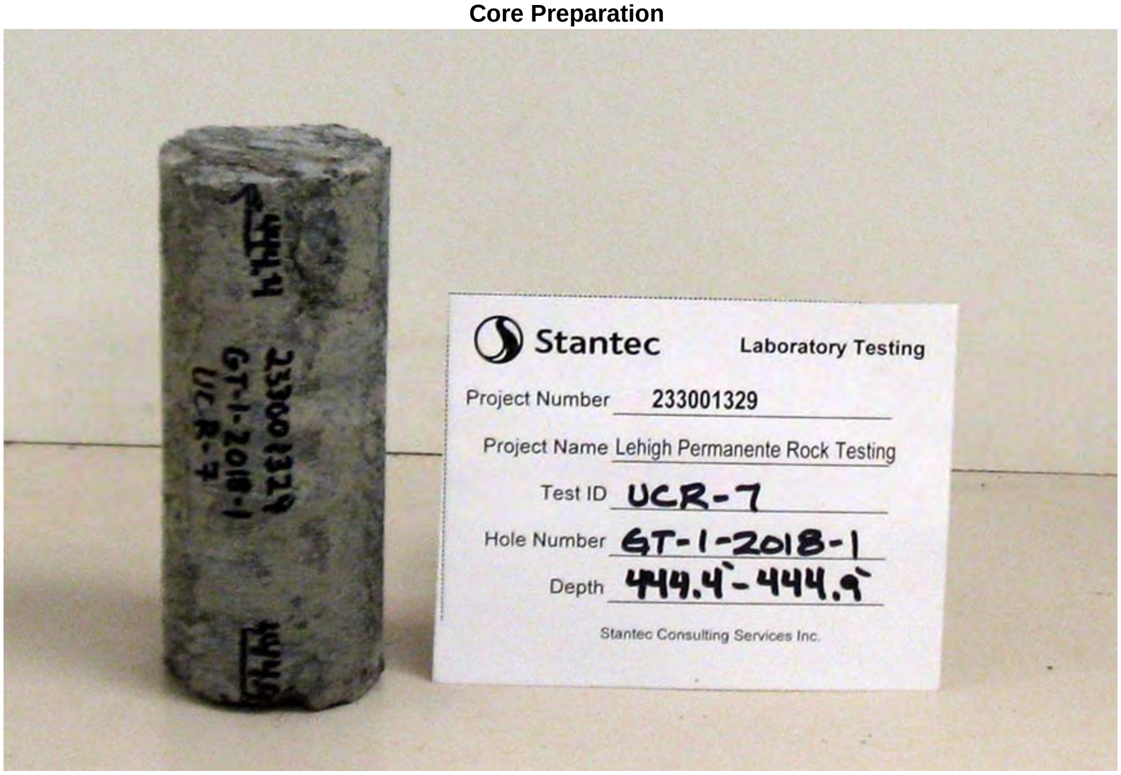
Project Name Lehigh Permanente Rock Testing
Lithology Greenstone Breccia, gray, moderately hard
Hole Number GT-1-2018-1 Depth (ft) 444.4'-444.9'
Test Type Uniaxial Compressive Strength of Intact Rock Core

Project Number 233001329
Lab ID UCR-7

As Received



Core Preparation



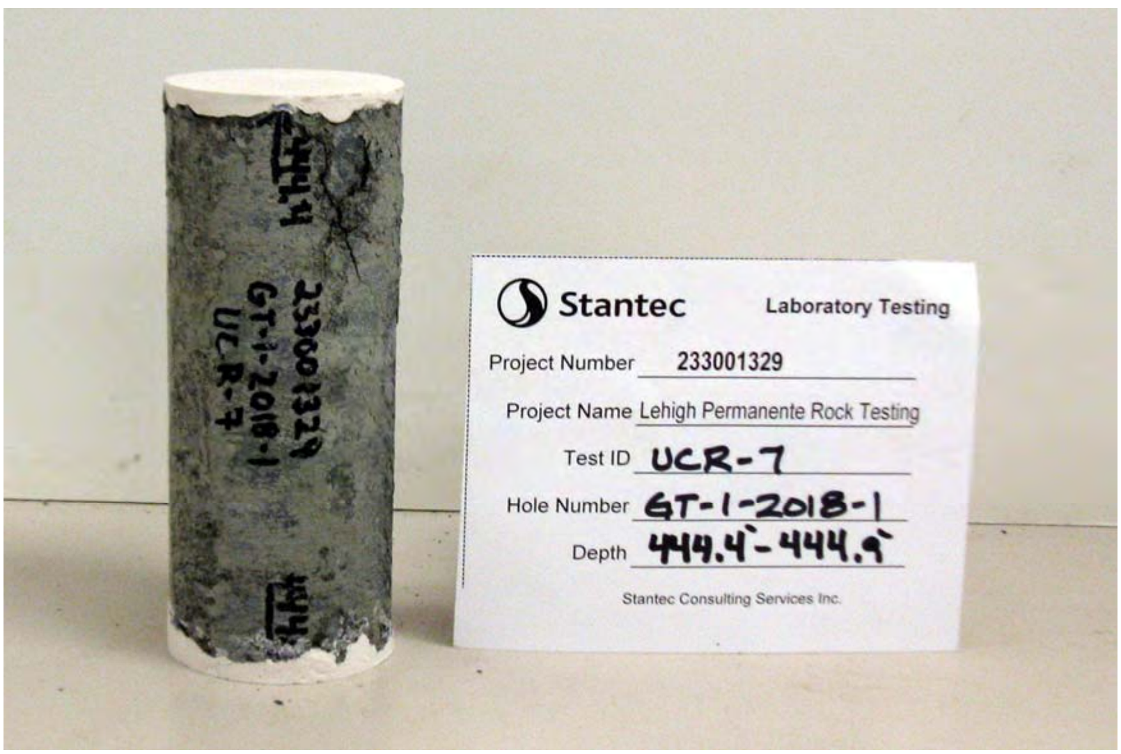
Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, gray, moderately hard	Lab ID	UCR-7
Hole Number	GT-1-2018-1 Depth (ft) 444.4'-444.9'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation

Post Test

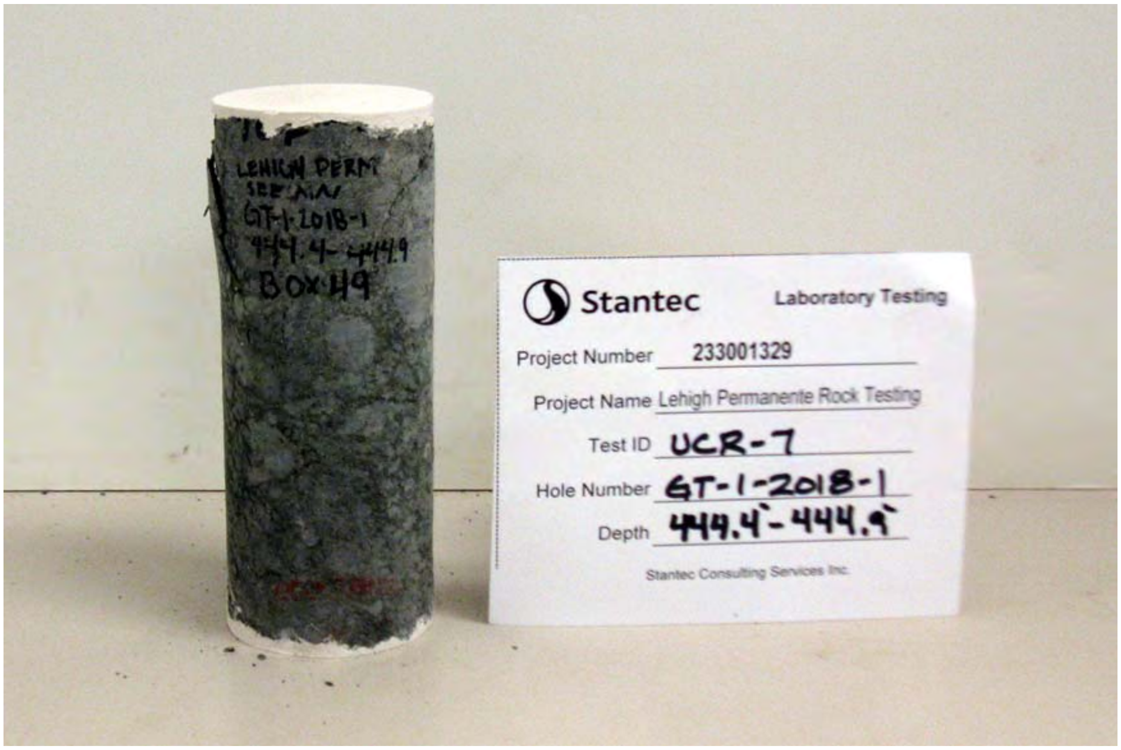


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, gray, moderately hard	Lab ID	UCR-7
Hole Number	GT-1-2018-1 Depth (ft) 444.4'-444.9'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test



Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens
ASTM D 7012, Method C

Project Name: Lehigh Permanente Rock Testing
Project Number: 233001329
Lithology: Breccia, dark gray, moderately hard
Lab ID: UCR-8
Hole Number: GT-1-2018-1
Depth (ft): 68.8'-69.2'
Date Received: 11/01/2018

Temperature (^oC): 22
Moisture Condition: As Prepared, Moist
Date Tested: 11/15/2018

Side Planeness: N/A
Perpendicularity: N/A
End Planeness: N/A
Parallelism: N/A
Dimensions were not confirmed.

Height (in): 3.715
Diameter (in): 2.419
Area (in^2): 4.596

Wet Unit Weight (pcf): 147.1
Dry Unit Weight (pcf): N/A
Moisture Content (%): N/A

Loading Rate (lbf/sec): 5
Peak Load (lbf): 835

Failure Type: Shear

Compressive Strength (psi): 182
Compressive Strength (psf): 26208
Compressive Strength (tsf): 13

Failure Sketches


Comments: Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone.
Dimensional tolerances were not confirmed.
Specimen doesn't meet 2:1 height to diameter ratio requirement, tested upon client's request.

Reviewed By: JW

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, dark gray, moderately hard	Lab ID	UCR-8
Hole Number	GT-1-2018-1 Depth (ft) 68.8'-69.2'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received

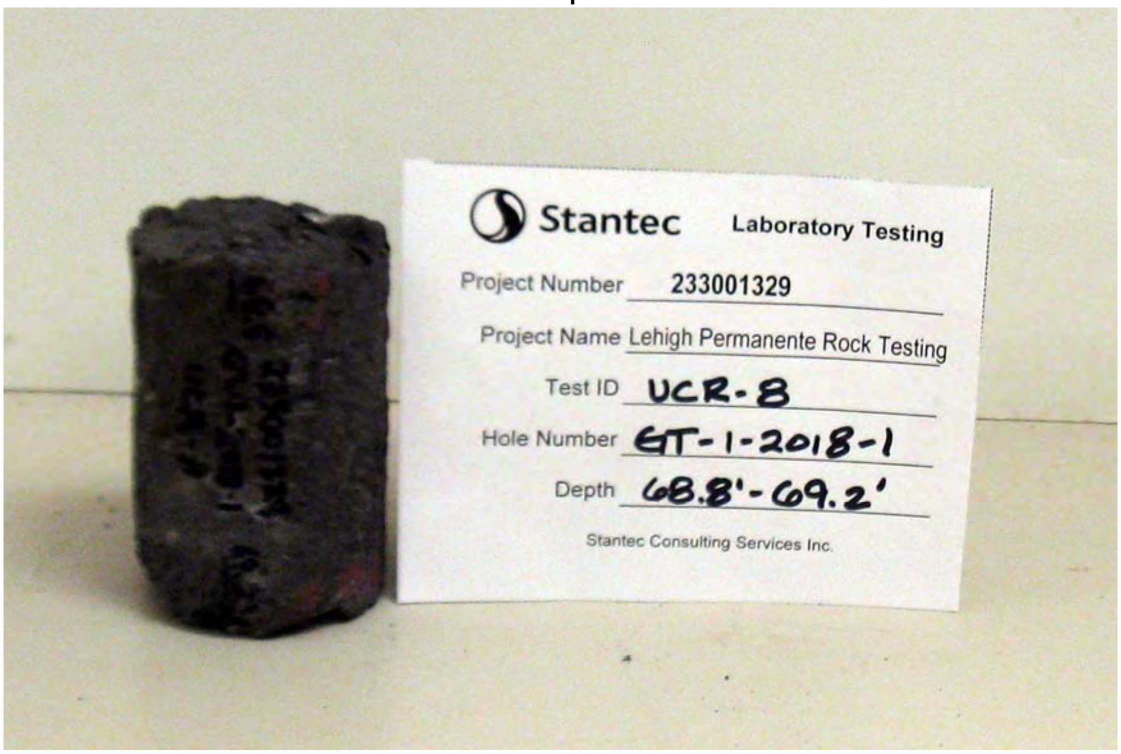
Core Preparation

Stantec

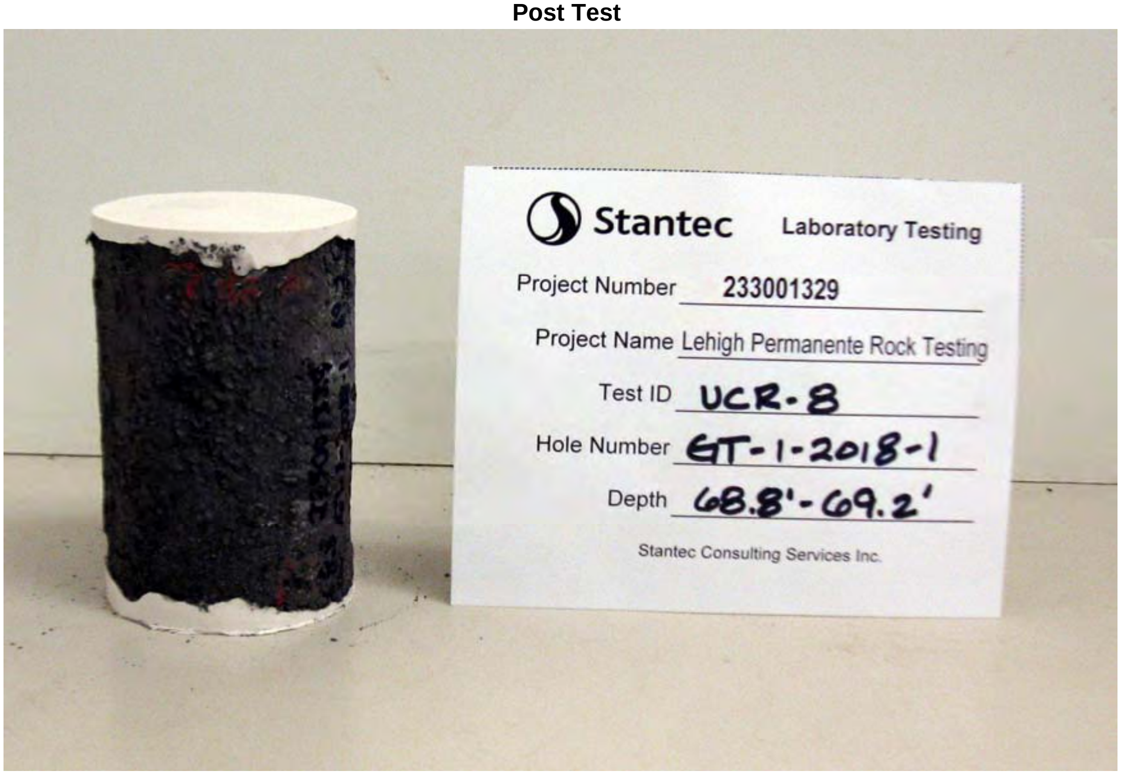
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, dark gray, moderately hard	Lab ID	UCR-8
Hole Number	GT-1-2018-1 Depth (ft) 68.8'-69.2'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



Post Test

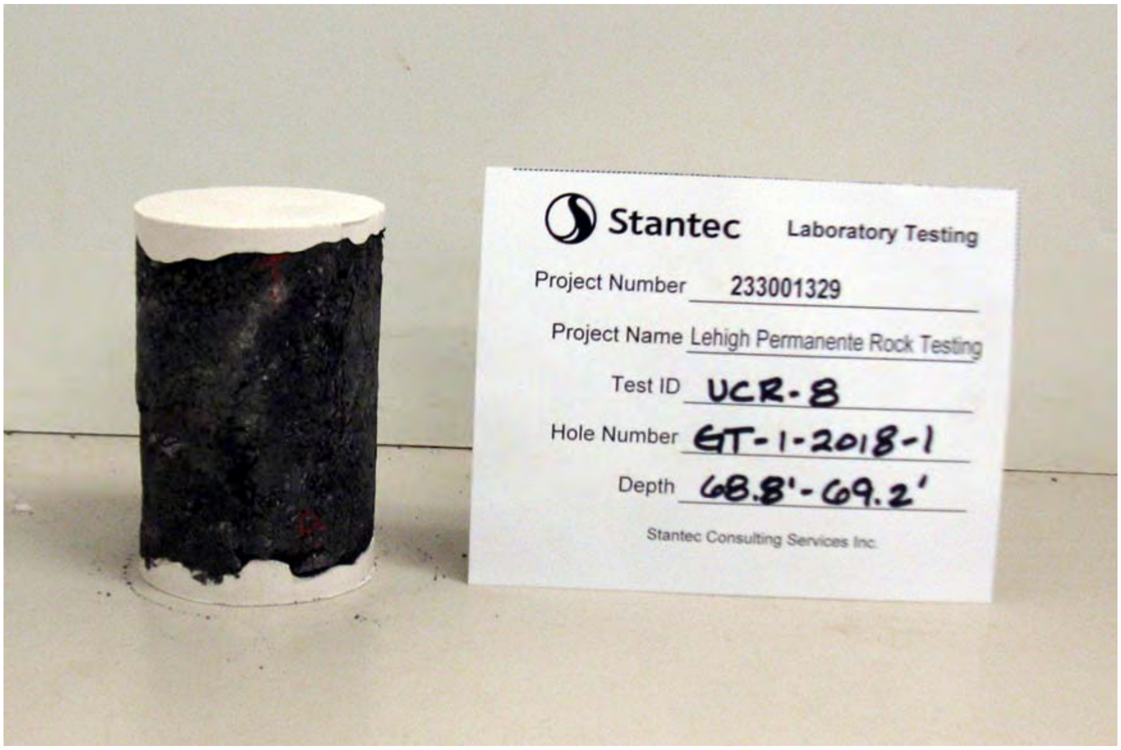


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, dark gray, moderately hard	Lab ID	UCR-8
Hole Number	GT-1-2018-1 Depth (ft) 68.8'-69.2'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test



Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, gray, moderately hard	Lab ID	UCR-9
Hole Number	GT-1-2018-1 Depth (ft) 4.2'-4.7'	Date Received	11/01/2018

Temperature (^oC)	22	Moisture Condition	As Prepared, Moist	Date Tested	11/15/2018

Side Planeness	N/A	Height (in)	5.881	Wet Unit Weight (pcf)	157.4
Perpendicularity	N/A	Diameter (in)	2.383	Dry Unit Weight (pcf)	N/A
End Planeness	N/A	Area (in^2)	4.458	Moisture Content (%)	N/A
Parallelism	N/A				

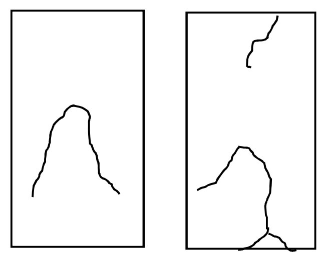
Dimensions were not confirmed.

Loading Rate (lbf/sec)	14
Peak Load (lbf)	5732

Failure Type Undetermined

Compressive Strength (psi)	1286
Compressive Strength (psf)	185184
Compressive Strength (tsf)	93

Failure Sketches



Comments Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone.
Dimensional tolerances were not confirmed.

Reviewed By JW

Template: tmp_ucr_input.xlsm
Version: 20170215
Approved By: RJ

Stantec Consulting Services Inc.
Lexington, Kentucky

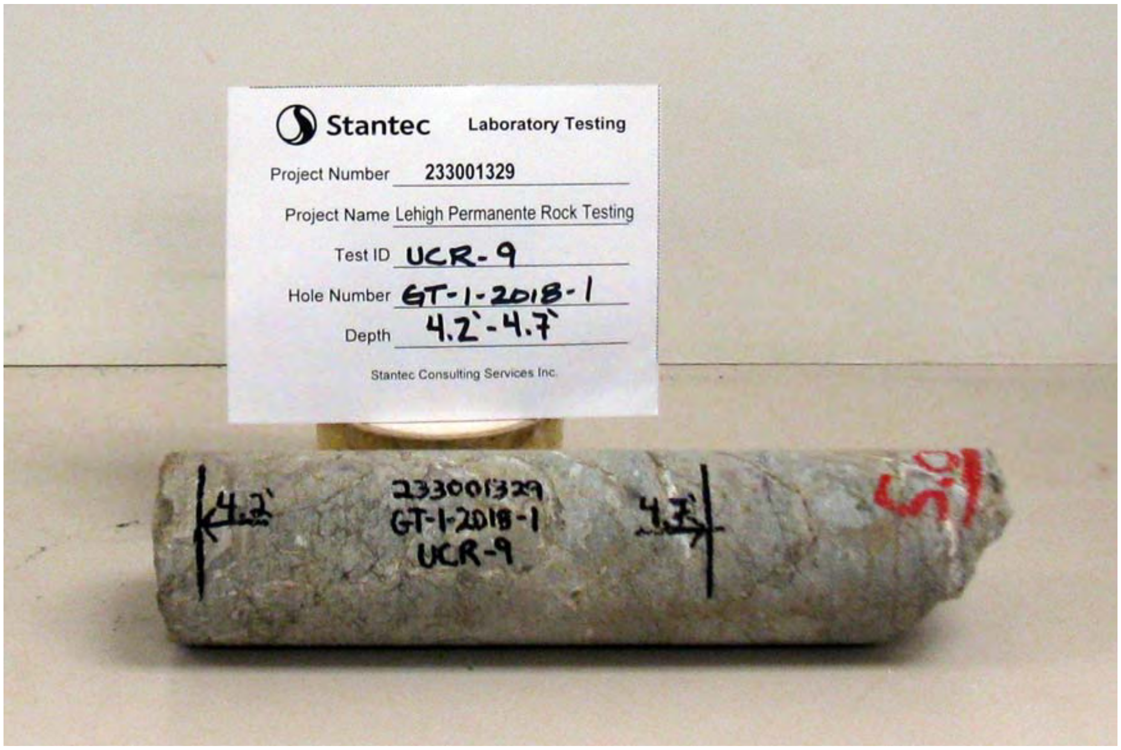
Reported By: JW
Report Date: 11/15/2018

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, gray, moderately hard	Lab ID	UCR-9
Hole Number	GT-1-2018-1 Depth (ft) 4.2'-4.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



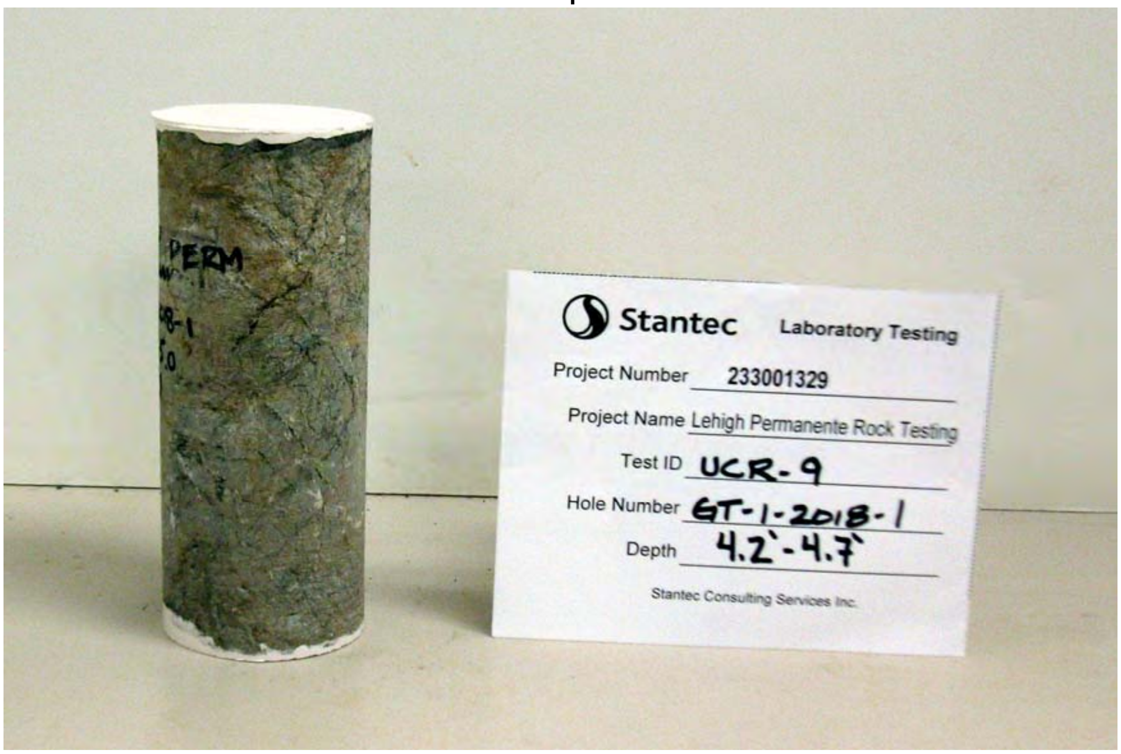
Core Preparation

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, gray, moderately hard	Lab ID	UCR-9
Hole Number	GT-1-2018-1 Depth (ft) 4.2'-4.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



Post Test

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, gray, moderately hard	Lab ID	UCR-9
Hole Number	GT-1-2018-1 Depth (ft) 4.2'-4.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test

Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name: Lehigh Permanente Rock Testing
Project Number: 233001329
Lithology: Breccia, gray, moderately hard
Lab ID: UCR-10
Hole Number: GT-1-2018-1
Depth (ft): 128.2'-128.7'
Date Received: 11/01/2018

Temperature (°C): 22
Moisture Condition: As Prepared, Moist
Date Tested: 11/15/2018

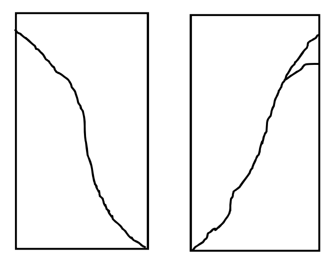
Side Planeness: N/A
Height (in): 5.460
Wet Unit Weight (pcf): 158.5
Perpendicularity: N/A
Diameter (in): 2.405
Dry Unit Weight (pcf): N/A
End Planeness: N/A
Area (in^2): 4.543
Moisture Content (%): N/A
Parallelism: N/A
Dimensions were not confirmed.

Loading Rate (lbf/sec): 18
Peak Load (lbf): 721

Failure Type: Shear

Compressive Strength (psi): 159
Compressive Strength (psf): 22896
Compressive Strength (tsf): 11

Failure Sketches



Comments: Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone. Dimensional tolerances were not confirmed.

Reviewed By: JW

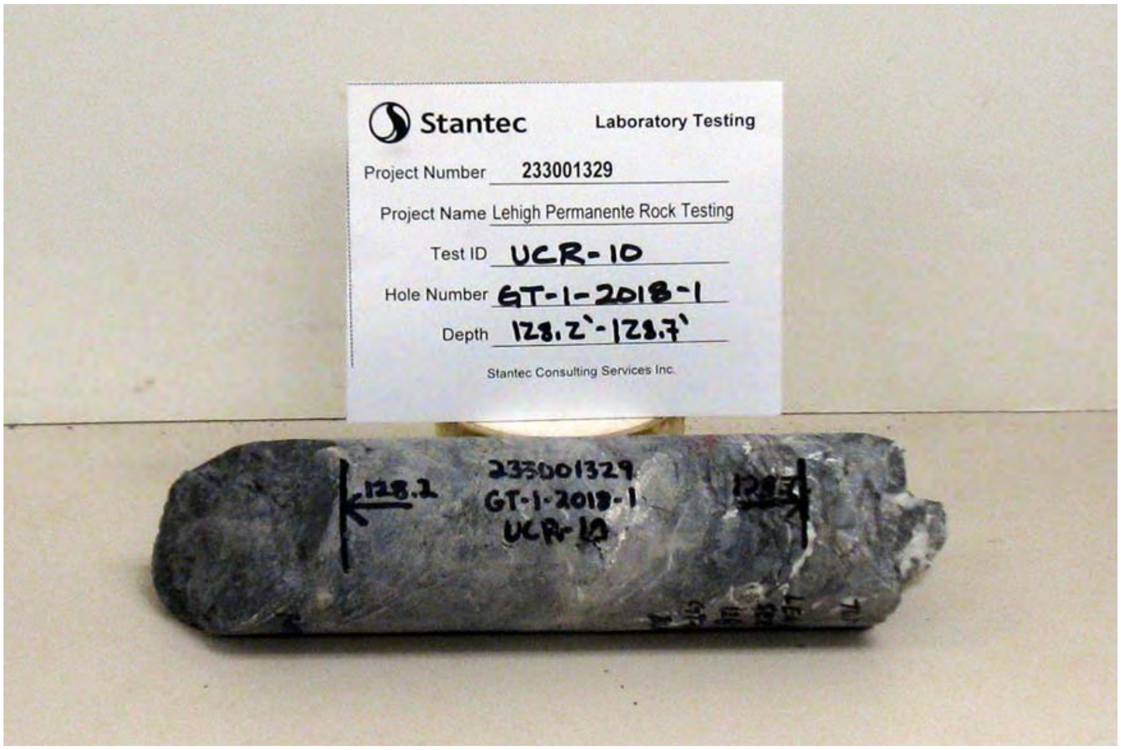
Stantec

Photo Report

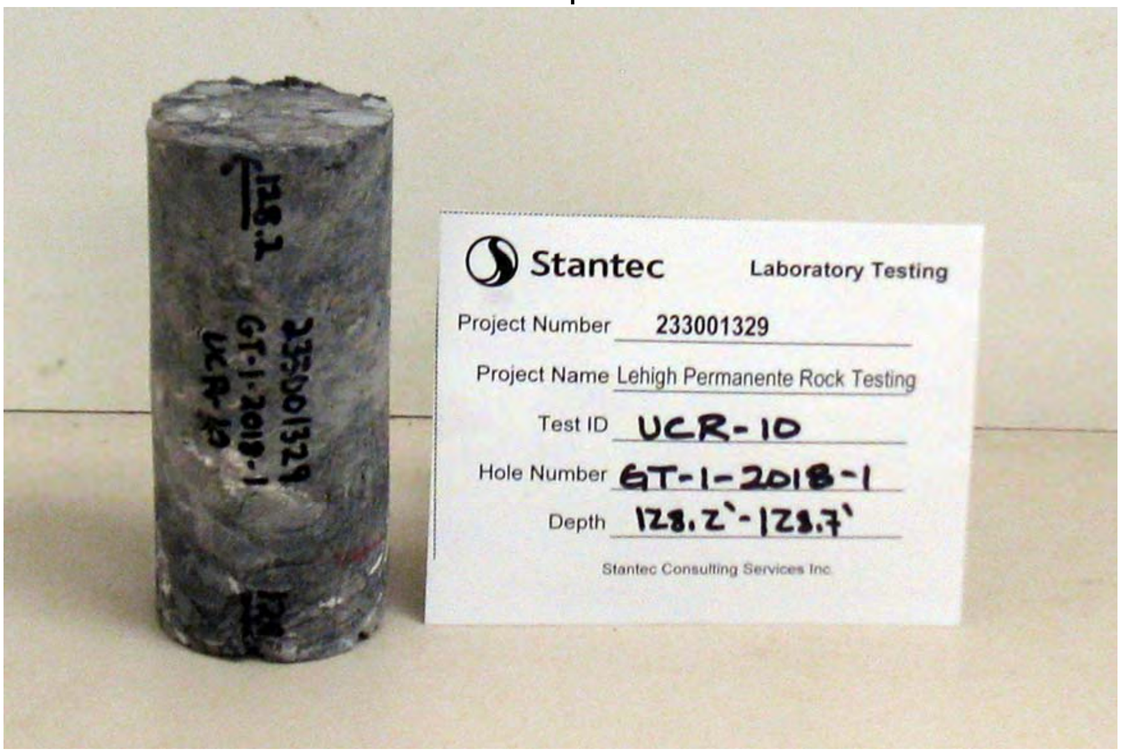
Project Name Lehigh Permanente Rock Testing
Lithology Breccia, gray, moderately hard
Hole Number GT-1-2018-1 Depth (ft) 128.2'-128.7'
Test Type Uniaxial Compressive Strength of Intact Rock Core

Project Number 233001329
Lab ID UCR-10

As Received



Core Preparation

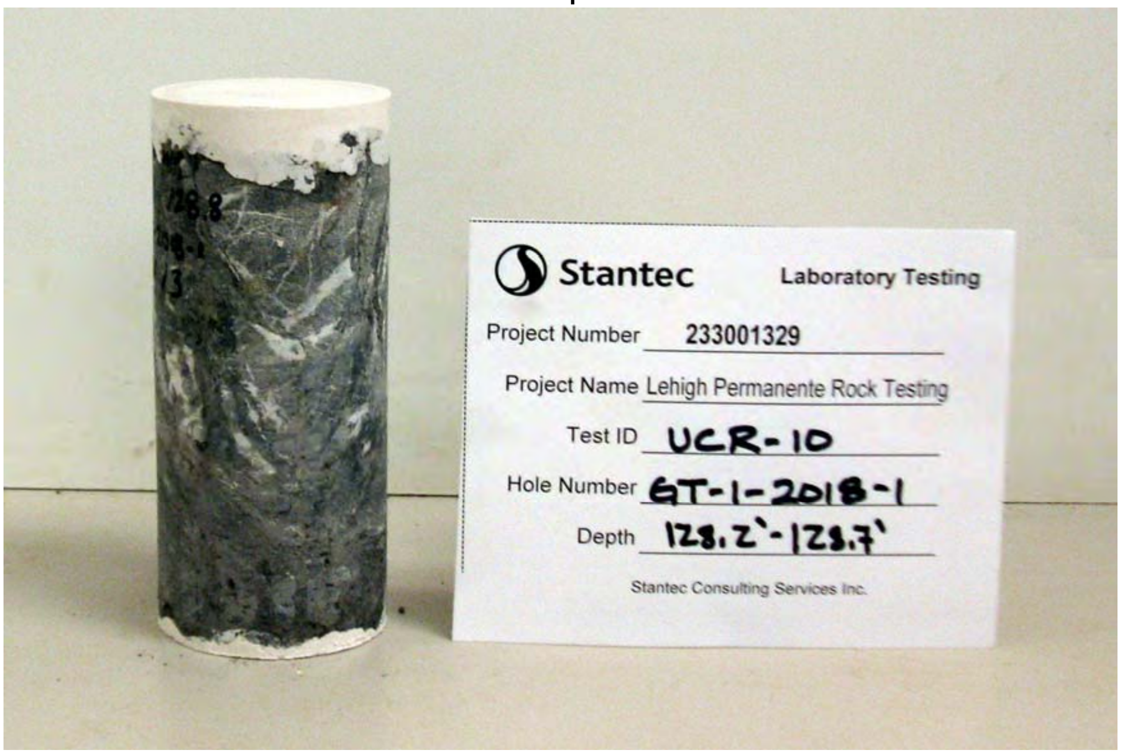


Stantec

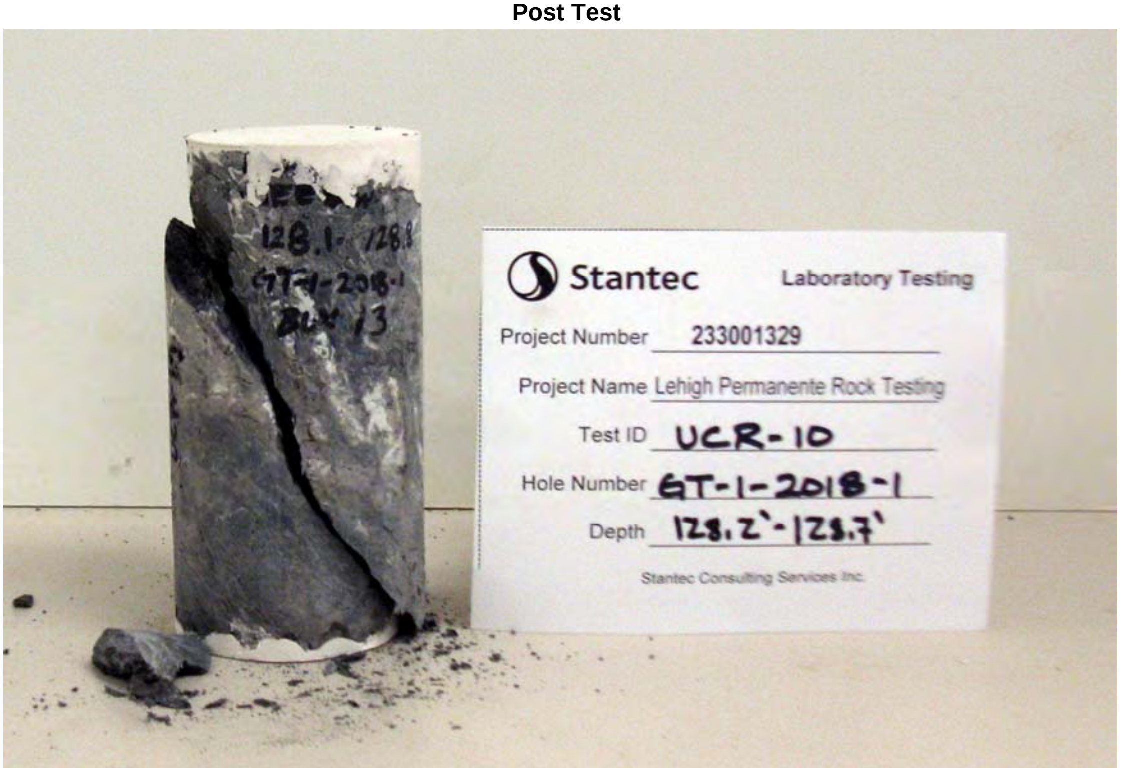
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, gray, moderately hard	Lab ID	UCR-10
Hole Number	GT-1-2018-1 Depth (ft) 128.2'-128.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



Post Test



Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Breccia, gray, moderately hard	Lab ID	UCR-10
Hole Number	GT-1-2018-1 Depth (ft) 128.2'-128.7'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test

Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens
ASTM D 7012, Method C

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, gray, moderately hard	Lab ID	UCR-11
Hole Number	GT-1-2018-1 Depth (ft) 136.3'-137.0'	Date Received	11/01/2018

Temperature (^oC) 22 Moisture Condition As Prepared, Moist Date Tested 11/13/2018

Side Planeness	N/A	Height (in)	5.372	Wet Unit Weight (pcf)	156.5
Perpendicularity	N/A	Diameter (in)	2.402	Dry Unit Weight (pcf)	N/A
End Planeness	N/A	Area (in^2)	4.532	Moisture Content (%)	N/A
Parallelism	N/A				

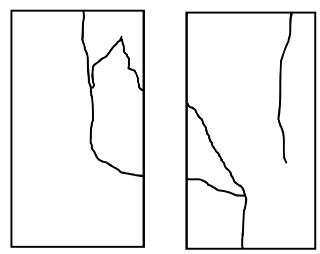
Dimensions were not confirmed.

Loading Rate (lbf/sec) 10
Peak Load (lbf) 1778

Failure Type Undetermined

Compressive Strength (psi) 392
Compressive Strength (psf) 56448
Compressive Strength (tsf) 28

Failure Sketches



Comments Fragile nature of specimen inhibited preparation, required capping of ends with Hydro-Stone. Dimensional tolerances were not confirmed.

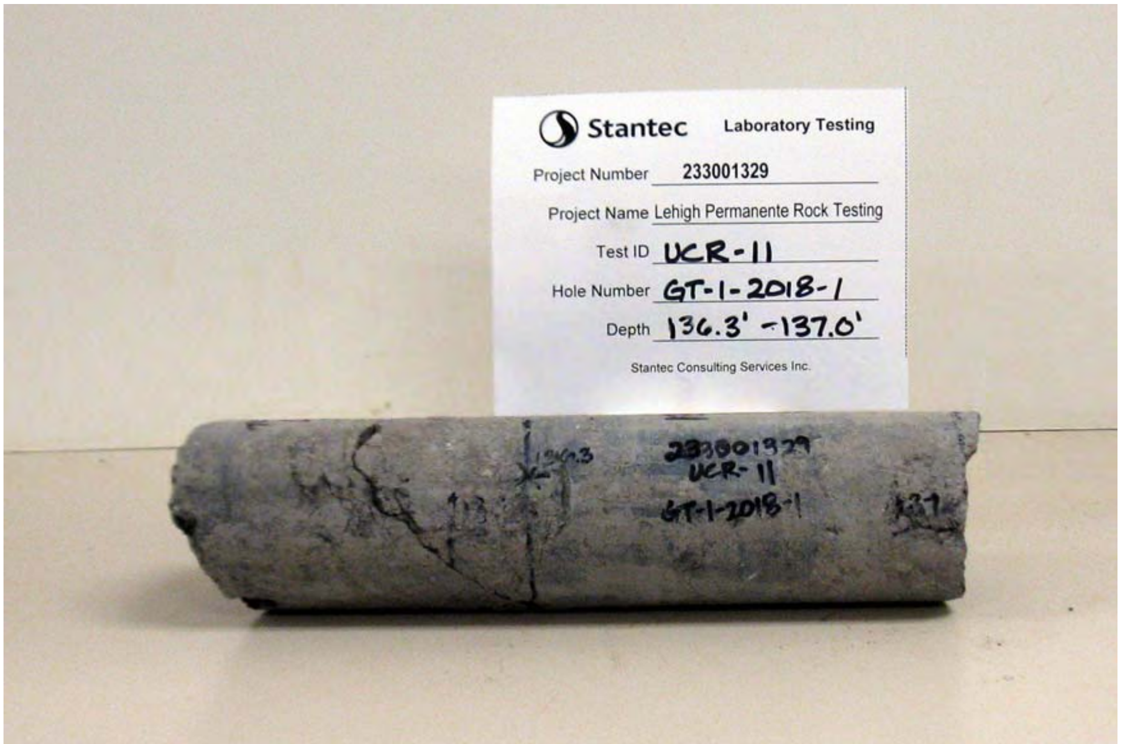
Reviewed By JW

Stantec

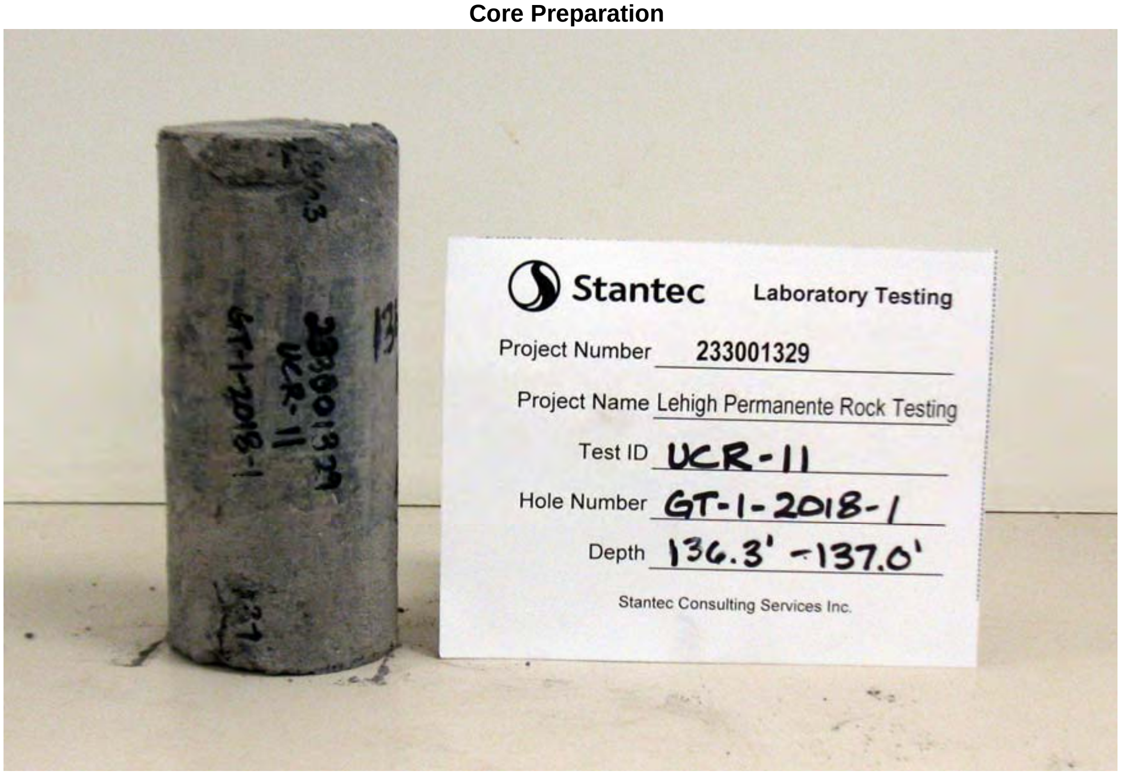
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, gray, moderately hard	Lab ID	UCR-11
Hole Number	GT-1-2018-1 Depth (ft) 136.3'-137.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



Core Preparation

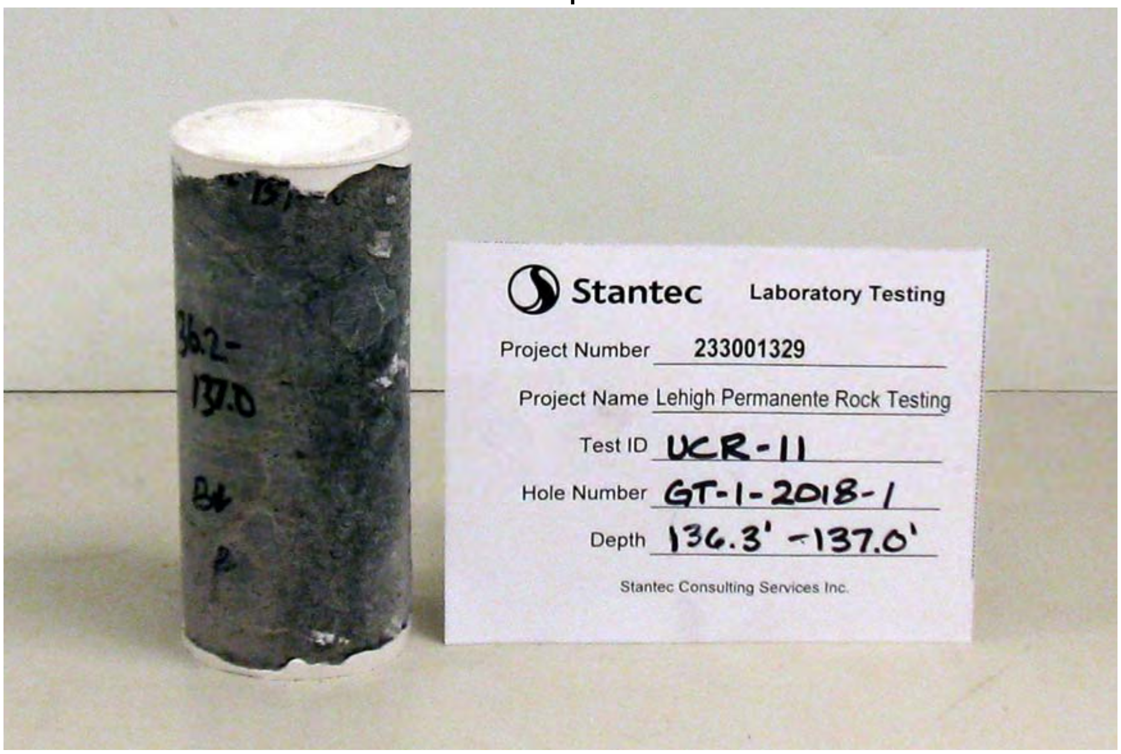


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, gray, moderately hard	Lab ID	UCR-11
Hole Number	GT-1-2018-1 Depth (ft) 136.3'-137.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



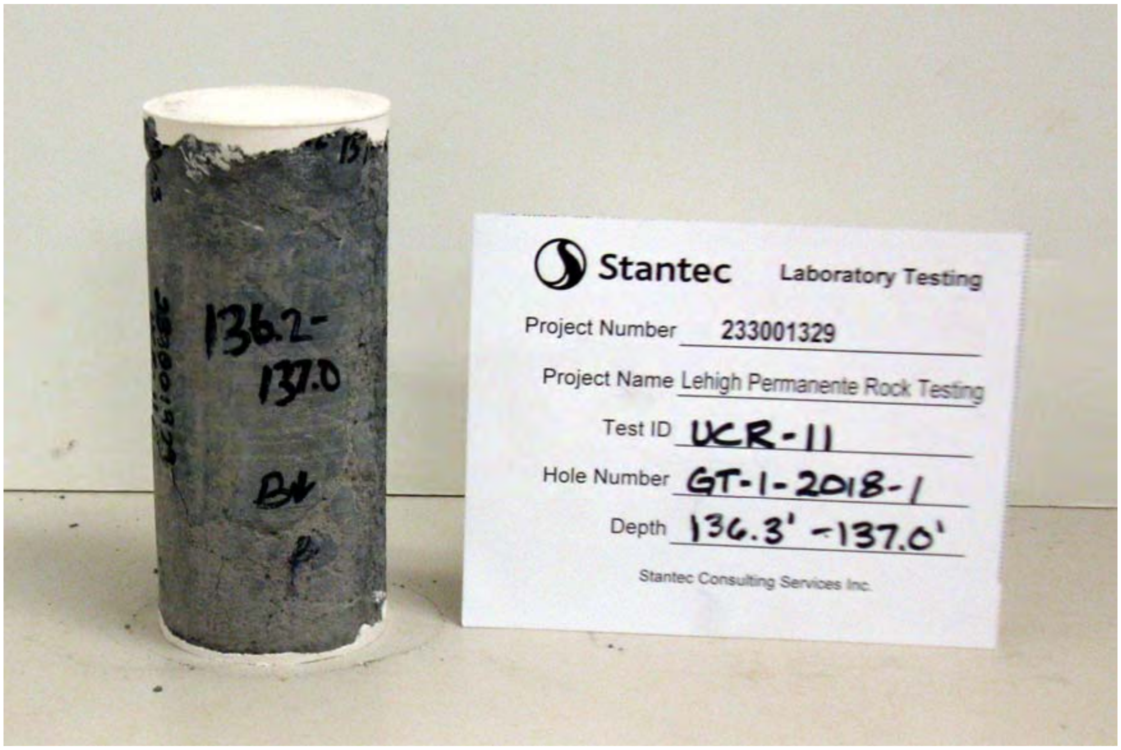
Post Test

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Greenstone Breccia, gray, moderately hard	Lab ID	UCR-11
Hole Number	GT-1-2018-1 Depth (ft) 136.3'-137.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test



Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name: Lehigh Permanente Rock Testing
Project Number: 233001329
Lithology: Limestone, gray, hard, bedded
Lab ID: UCR-12
Hole Number: GT-1-2018-1
Depth (ft): 156.1'-156.6'
Date Received: 11/01/2018

Temperature (^oC): 22
Moisture Condition: As Prepared, Moist
Date Tested: 11/13/2018

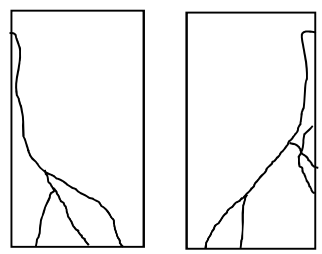
Side Planeness	Pass	Height (in)	5.805	Wet Unit Weight (pcf)	165.6
Perpendicularity	Pass	Diameter (in)	2.399	Dry Unit Weight (pcf)	N/A
End Planeness	Pass	Area (in^2)	4.518	Moisture Content (%)	N/A
Parallelism	Pass				

Loading Rate (lbf/sec): 202
Peak Load (lbf): 33525

Failure Type: Shear

Compressive Strength (psi): 7420
Compressive Strength (psf): 1068480
Compressive Strength (tsf): 534

Failure Sketches



Comments:

Reviewed By: JW

Stantec

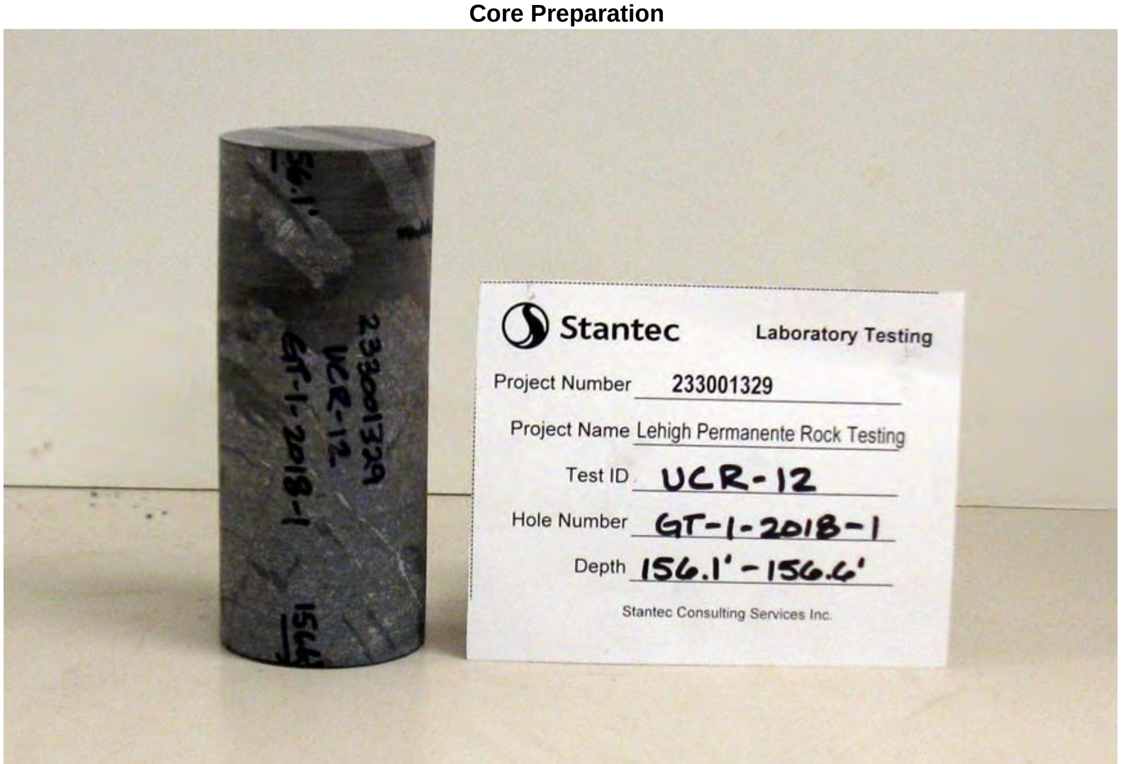
Photo Report

Project Name Lehigh Permanente Rock Testing
Lithology Limestone, gray, hard, bedded
Hole Number GT-1-2018-1 Depth (ft) 156.1'-156.6'
Test Type Uniaxial Compressive Strength of Intact Rock Core

Project Number 233001329
Lab ID UCR-12

As Received

Core Preparation



Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard, bedded	Lab ID	UCR-12
Hole Number	GT-1-2018-1	Depth (ft)	156.1'-156.6'
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation

Post Test

Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard, bedded	Lab ID	UCR-12
Hole Number	GT-1-2018-1 Depth (ft) 156.1'-156.6'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test

Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name	Lehigh Permanente Rock Testing
Project Number	233001329
Lithology	Limestone, gray, hard
Lab ID	UCR-13
Hole Number	GT-1-2018-1
Depth (ft)	119.5'-120.0'
Date Received	11/01/2018
Temperature (^{o}C)	22
Moisture Condition	As Prepared, Moist
Date Tested	11/15/2018

Side Planeness	Pass
Perpendicularity	Pass
End Planeness	Pass
Parallelism	Pass
Height (in)	5.891
Diameter (in)	2.394
Area (in^2)	4.499
Wet Unit Weight (pcf)	166.9
Dry Unit Weight (pcf)	N/A
Moisture Content (%)	N/A

Loading Rate (lbf/sec)	103
Peak Load (lbf)	54224
Failure Type	Undetermined
Compressive Strength (psi)	12050
Compressive Strength (psf)	1735200
Compressive Strength (tsf)	868

Failure Sketches

N/A

Comments: Testing load indicated compressive failure of specimen, no external visual sign of failure was observed.

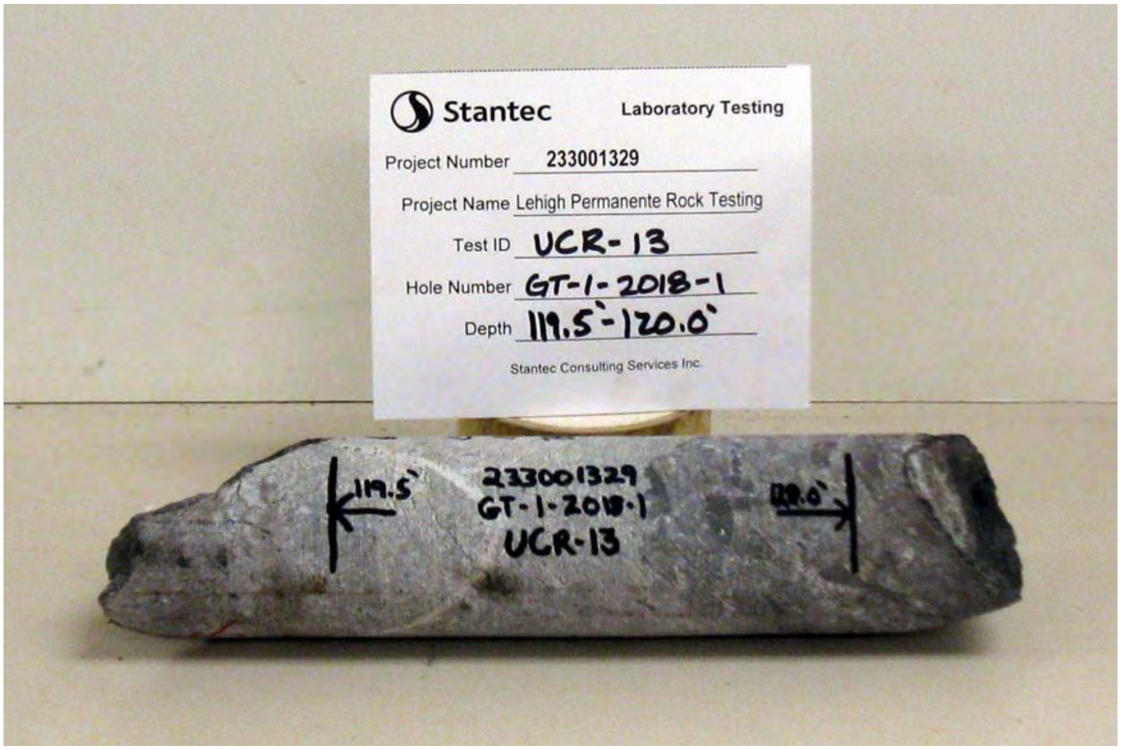
Reviewed By JW

Stantec

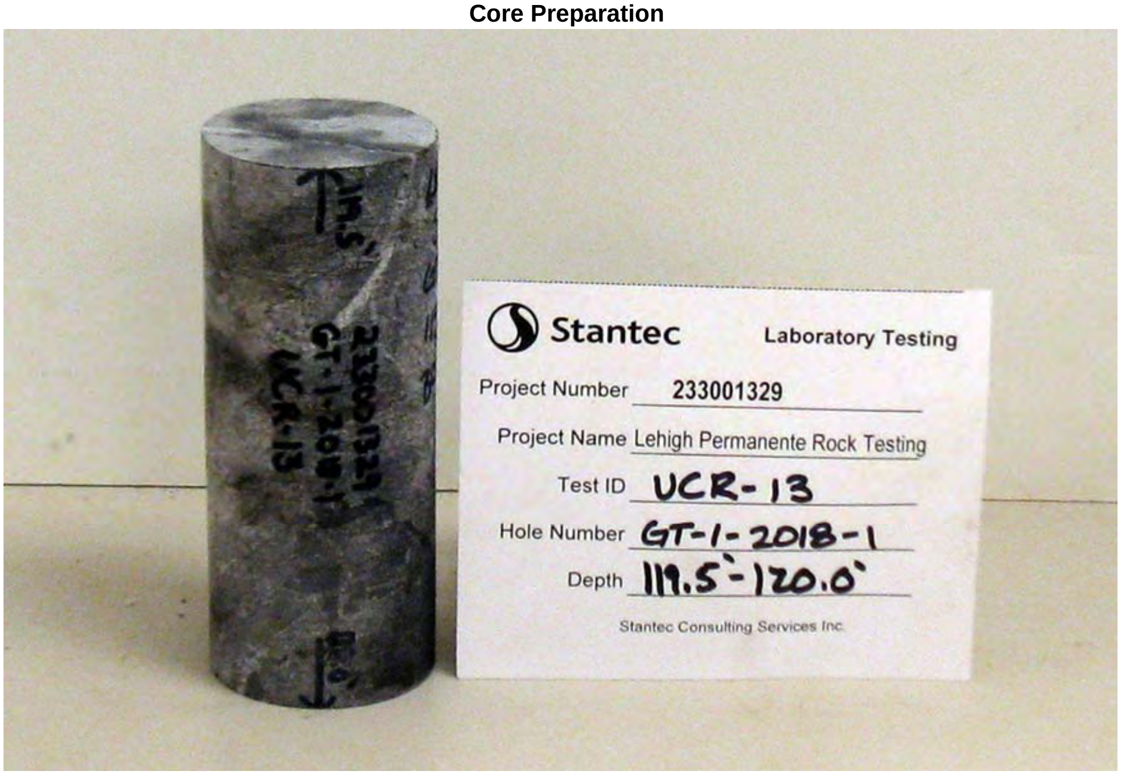
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-13
Hole Number	GT-1-2018-1 Depth (ft) 119.5'-120.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



Core Preparation

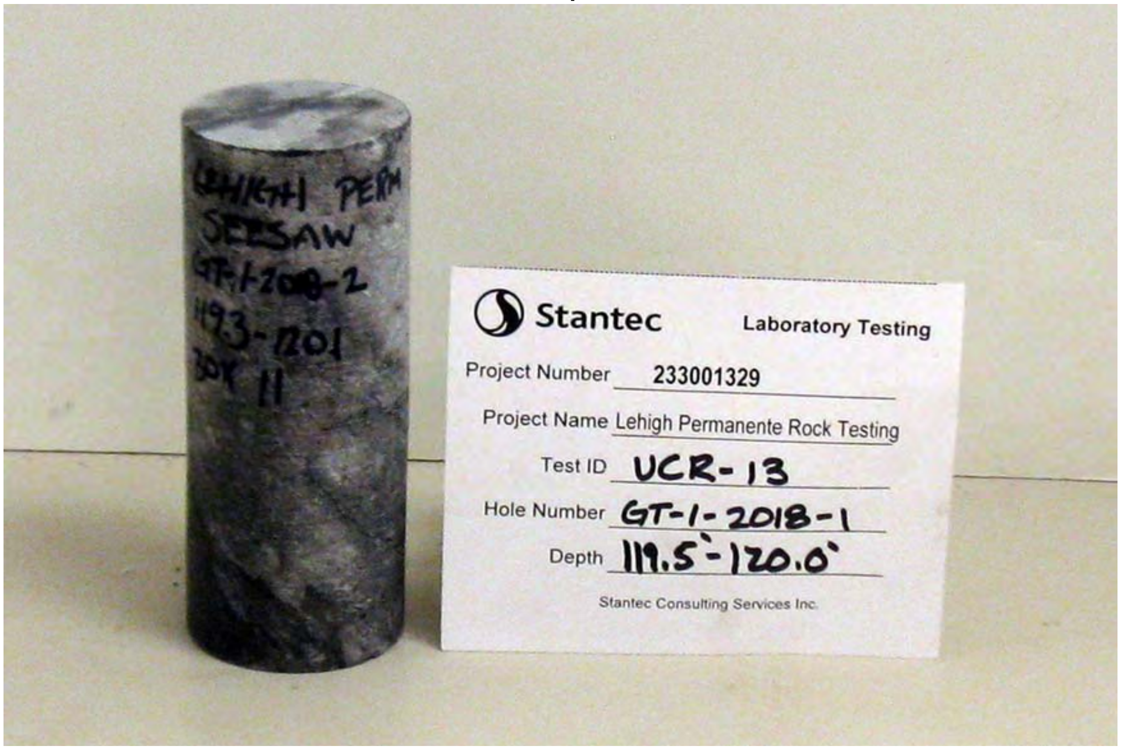


Stantec

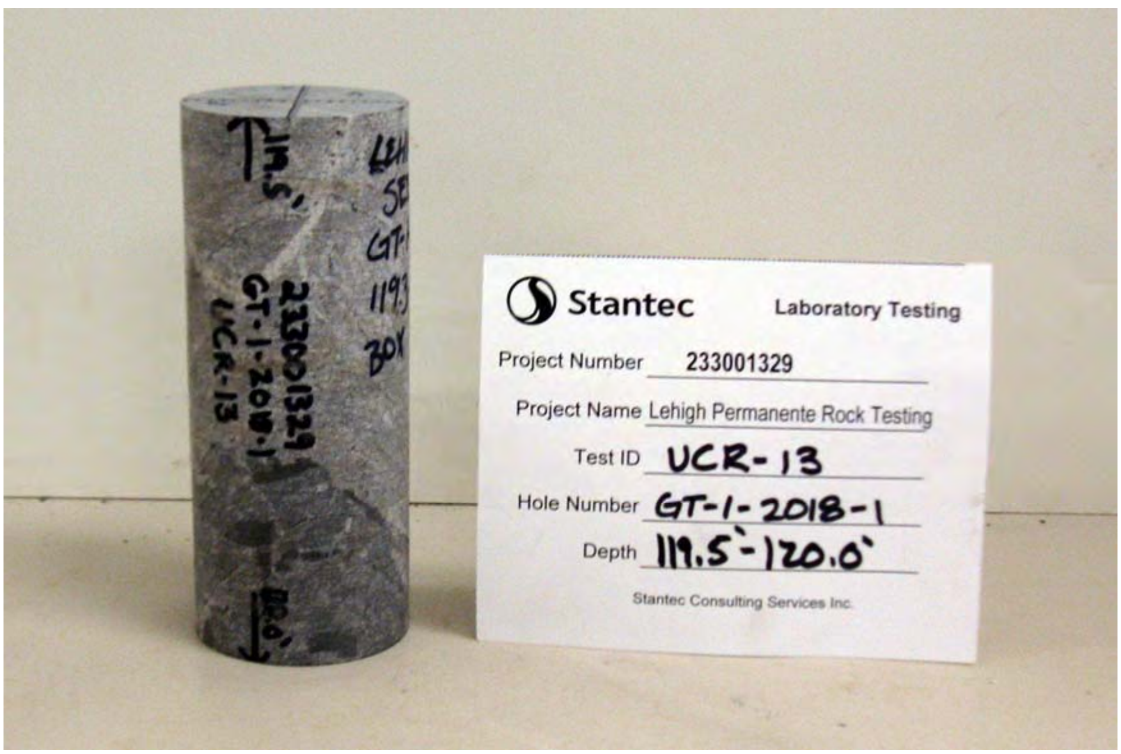
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-13
Hole Number	GT-1-2018-1 Depth (ft) 119.5'-120.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



Post Test

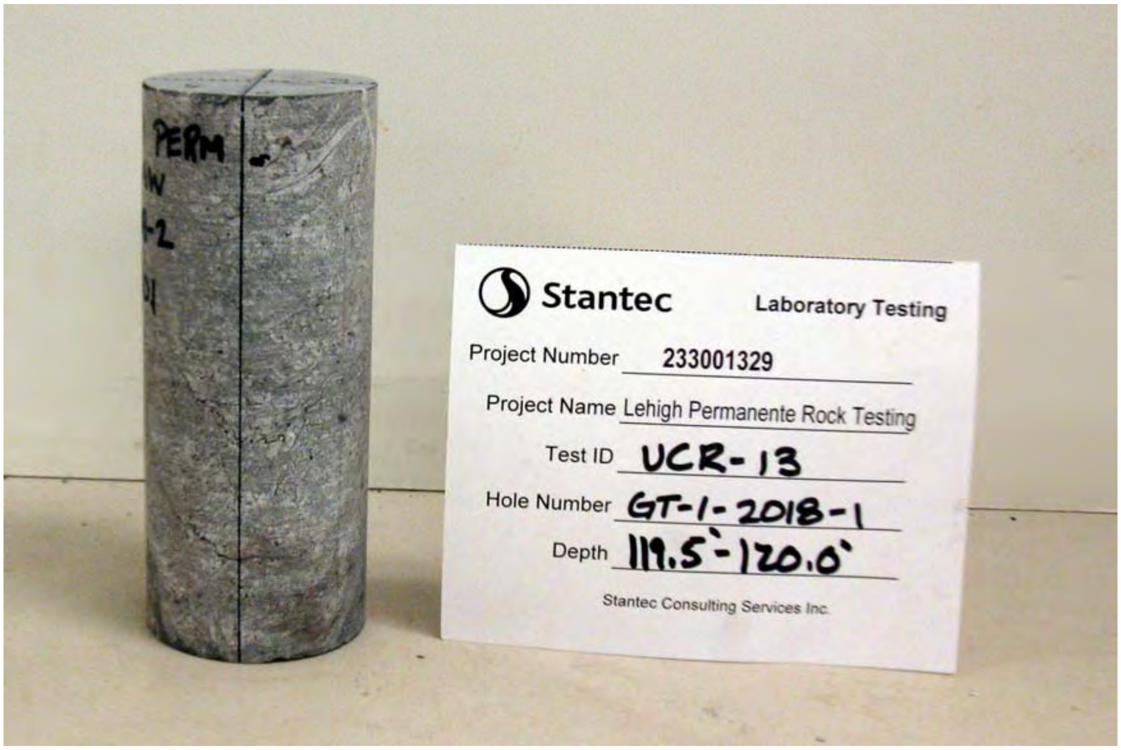


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-13
Hole Number	GT-1-2018-1 Depth (ft) 119.5'-120.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test



Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

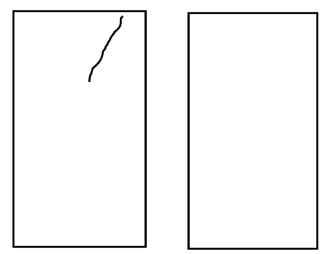
ASTM D 7012, Method C

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-14
Hole Number	GT-1-2018-1 Depth (ft) 105.6'-106.0'	Date Received	11/01/2018

Temperature (^{o}C)	22	Moisture Condition	As Prepared, Moist	Date Tested	11/15/2018
Side Planeness	Pass	Height (in)	4.796	Wet Unit Weight (pcf)	166.1
Perpendicularity	Pass	Diameter (in)	2.391	Dry Unit Weight (pcf)	N/A
End Planeness	Pass	Area (in^2)	4.491	Moisture Content (%)	N/A
Parallelism	Pass				

Loading Rate (lbf/sec)	147
Peak Load (lbf)	35285
Failure Type	Undetermined
Compressive Strength (psi)	7860
Compressive Strength (psf)	1131840
Compressive Strength (tsf)	566

Failure Sketches



Comments

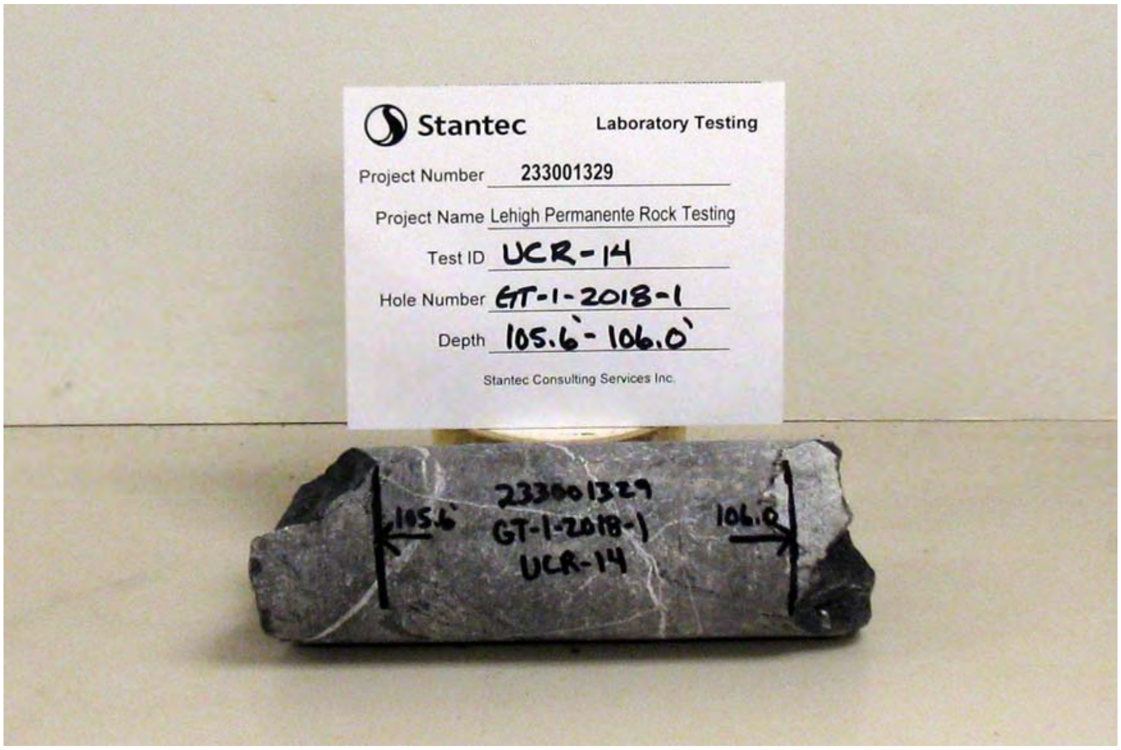
Reviewed By

Stantec

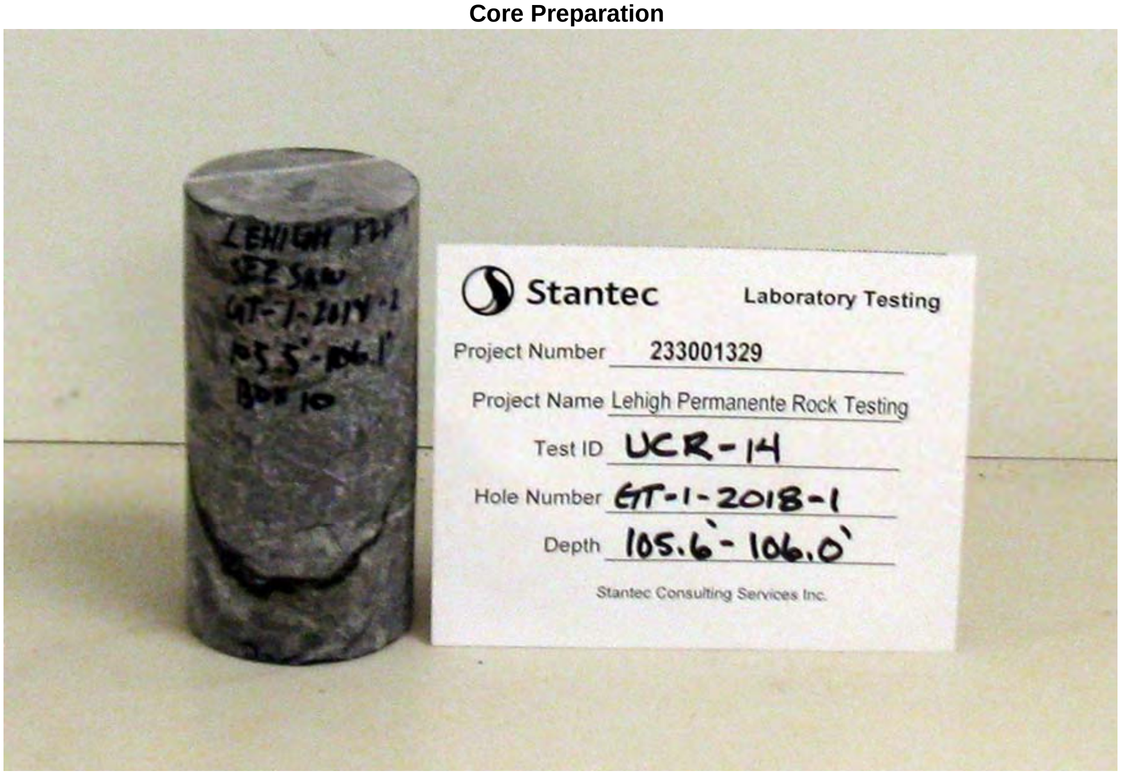
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-14
Hole Number	GT-1-2018-1 Depth (ft) 105.6'-106.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



Core Preparation

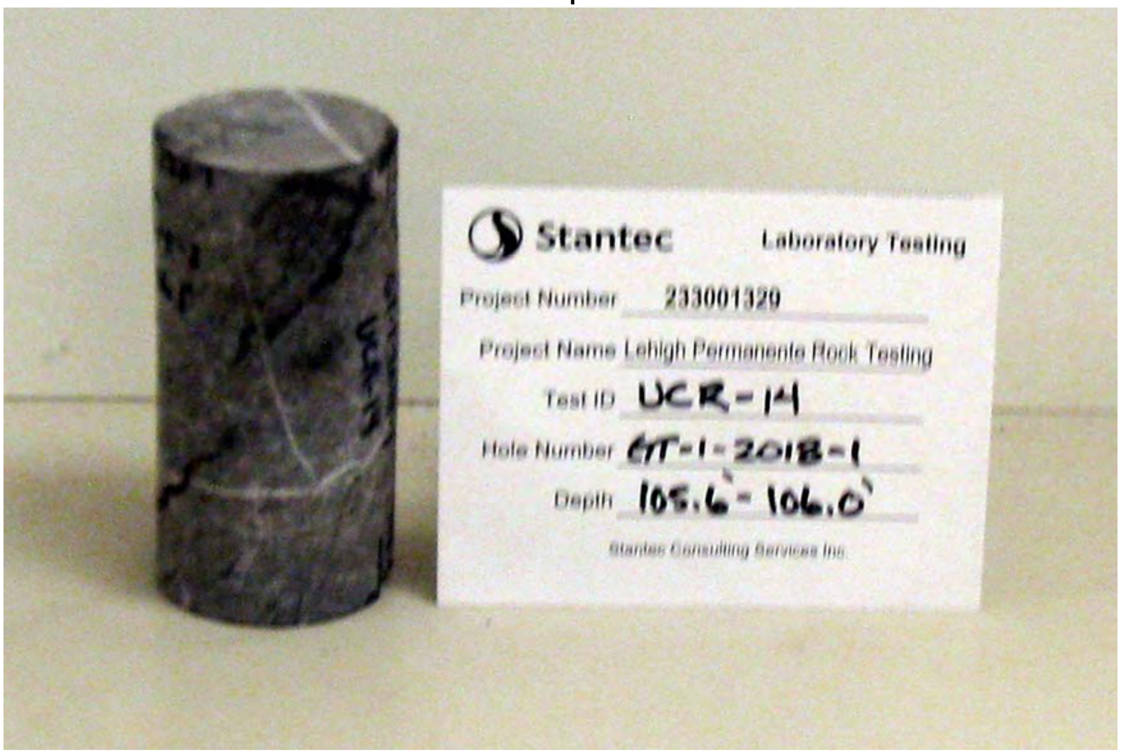


Stantec

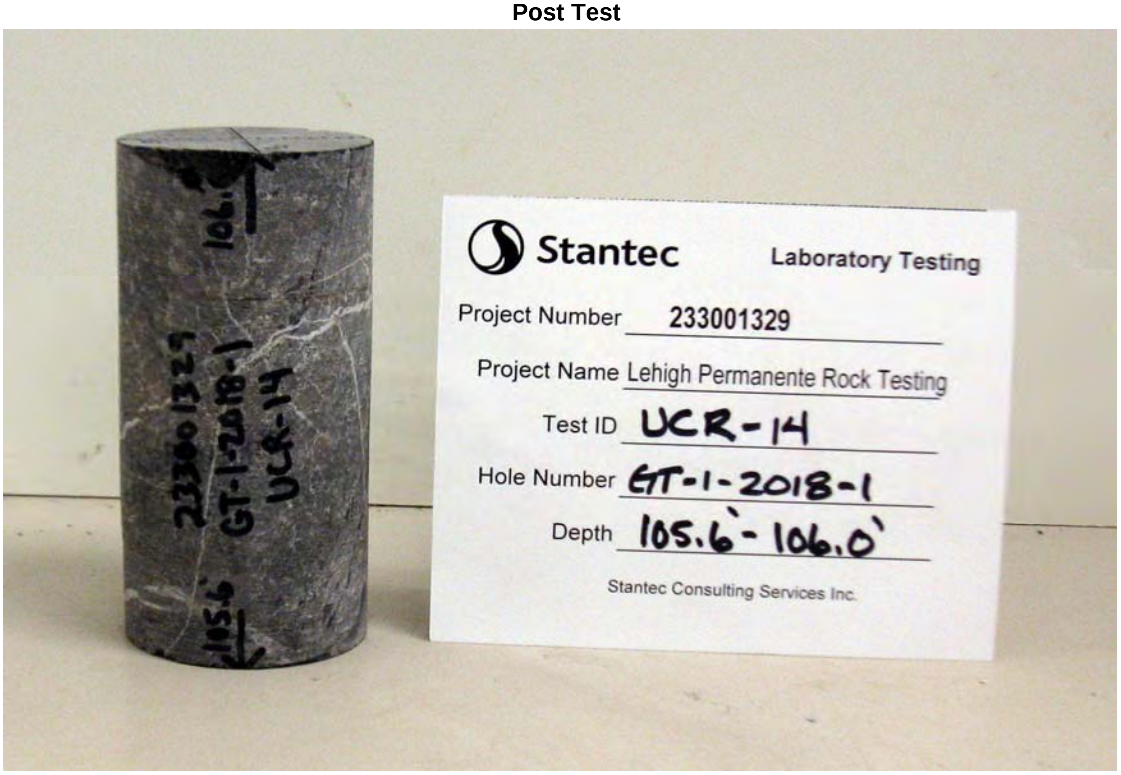
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-14
Hole Number	GT-1-2018-1 Depth (ft) 105.6'-106.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Core Preparation



Post Test

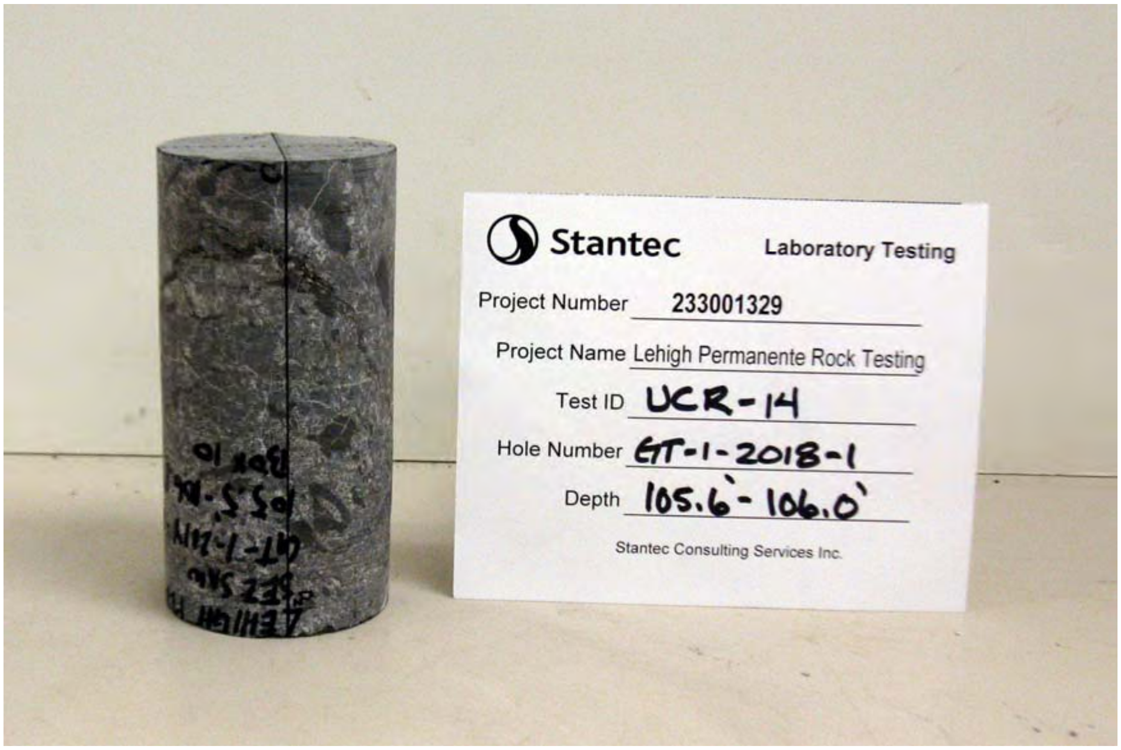


Stantec

Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-14
Hole Number	GT-1-2018-1 Depth (ft) 105.6'-106.0'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

Post Test



Stantec

Uniaxial Compressive Strength of Intact Rock Core Specimens

ASTM D 7012, Method C

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-15
Hole Number	GT-1-2018-1 Depth (ft) 151.3'-151.8'	Date Received	11/01/2018

Temperature (^{o}C)	22	Moisture Condition	As Prepared, Moist	Date Tested	11/13/2018
Side Planeness	Pass	Height (in)	4.964	Wet Unit Weight (pcf)	165.9
Perpendicularity	Pass	Diameter (in)	2.393	Dry Unit Weight (pcf)	N/A
End Planeness	Pass	Area (in^2)	4.497	Moisture Content (%)	N/A
Parallelism	Pass				

Loading Rate (lbf/sec) 109

Peak Load (lbf) 30534

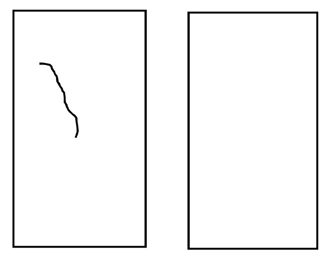
Failure Type Undetermined

Compressive Strength (psi) 6790

Compressive Strength (psf) 977760

Compressive Strength (tsf) 489

Failure Sketches



Comments

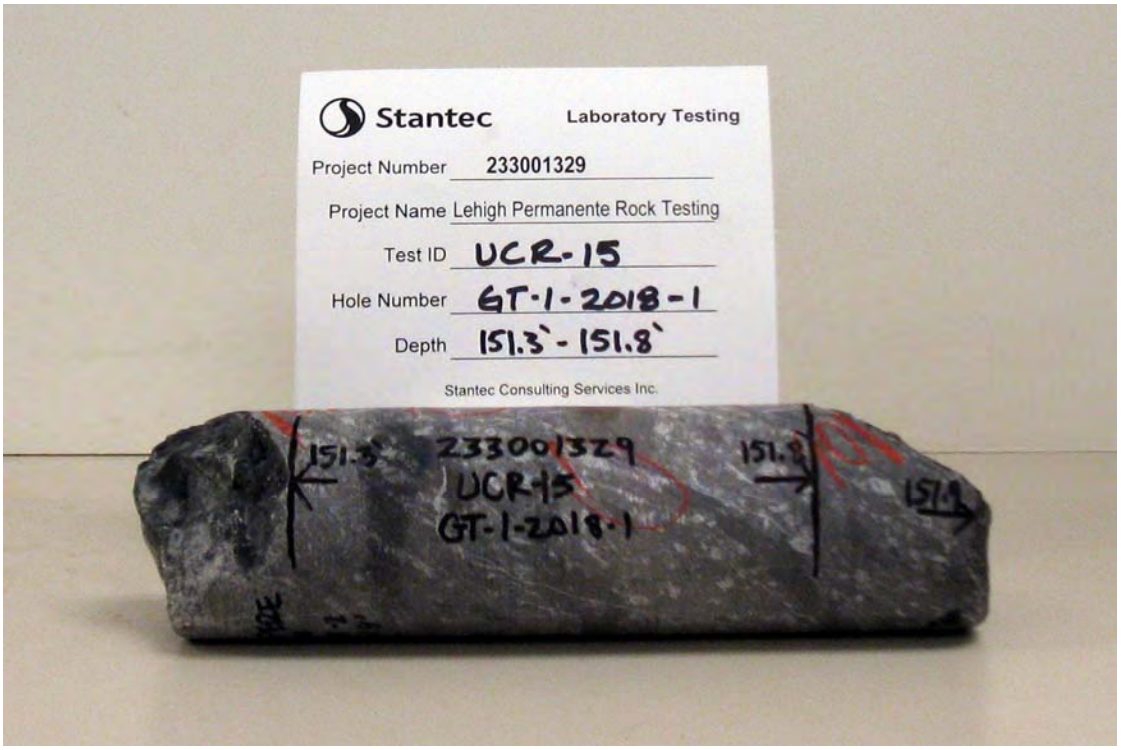
Reviewed By

Stantec

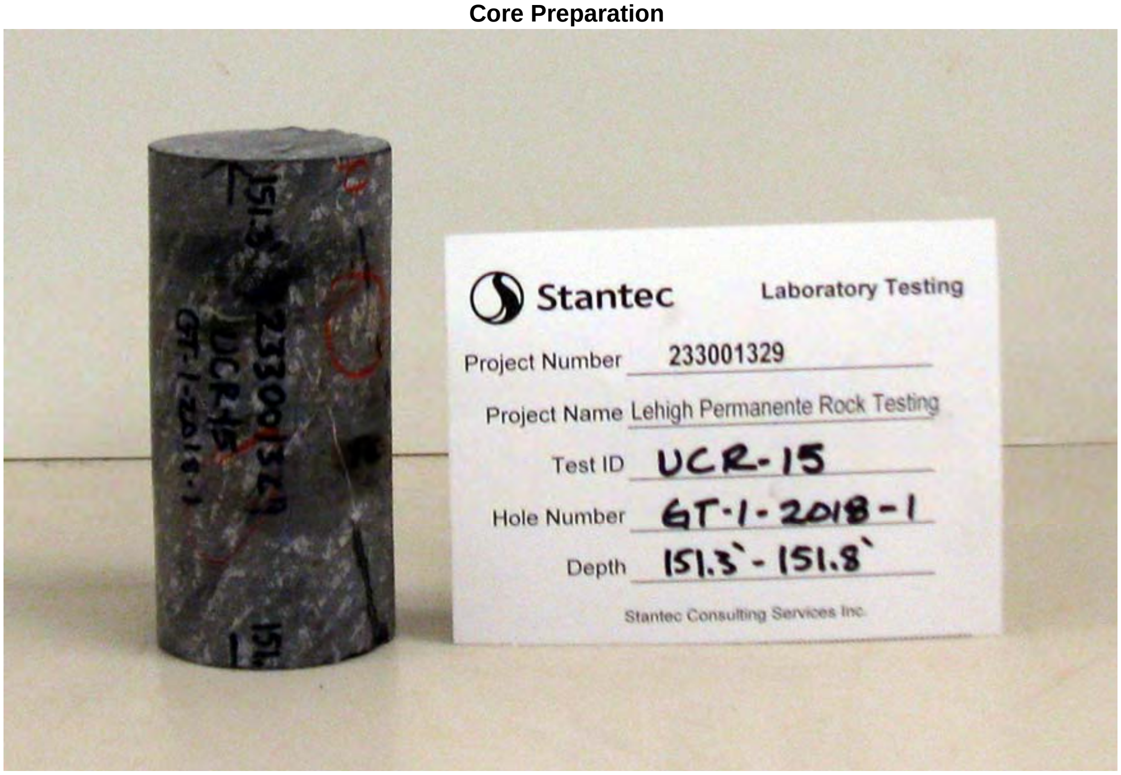
Photo Report

Project Name	Lehigh Permanente Rock Testing	Project Number	233001329
Lithology	Limestone, gray, hard	Lab ID	UCR-15
Hole Number	GT-1-2018-1 Depth (ft) 151.3'-151.8'		
Test Type	Uniaxial Compressive Strength of Intact Rock Core		

As Received



Core Preparation

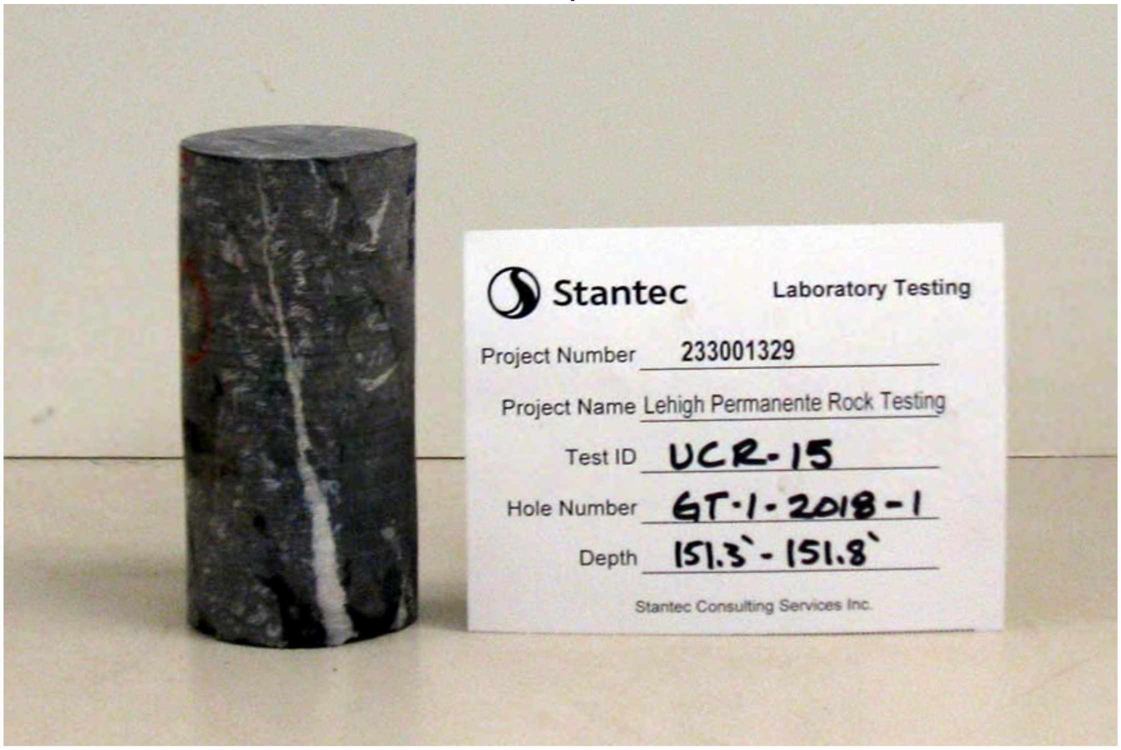


Stantec

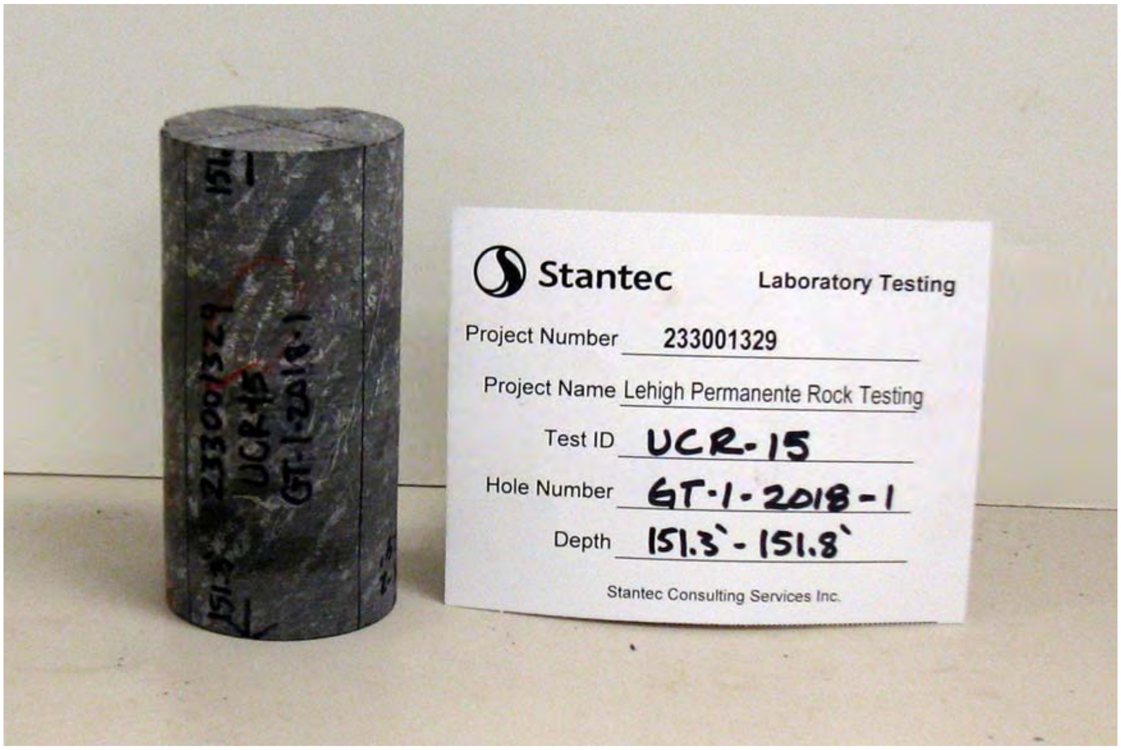
Photo Report

Project Name Lehigh Permanente Rock Testing
Project Number 233001329
Lithology Limestone, gray, hard
Lab ID UCR-15
Hole Number GT-1-2018-1 Depth (ft) 151.3'-151.8'
Test Type Uniaxial Compressive Strength of Intact Rock Core

Core Preparation



Post Test



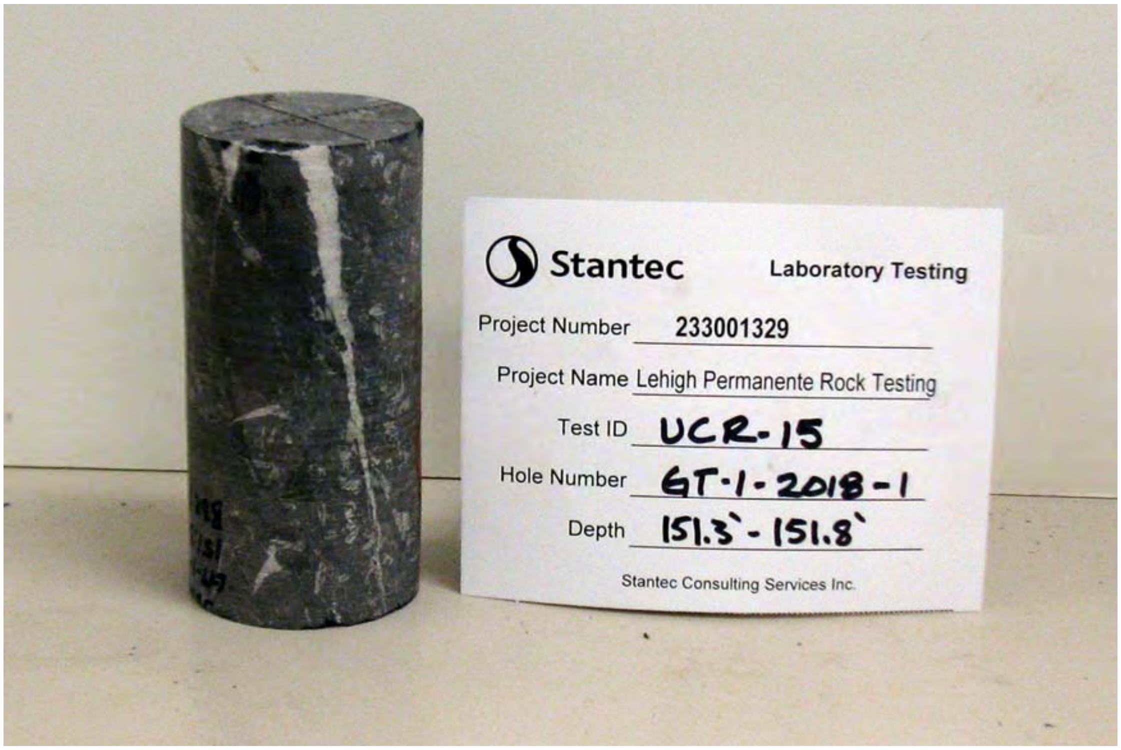
Stantec

Photo Report

Project Name Lehigh Permanente Rock Testing
Lithology Limestone, gray, hard
Hole Number GT-1-2018-1 Depth (ft) 151.3'-151.8'
Test Type Uniaxial Compressive Strength of Intact Rock Core

Project Number 233001329
Lab ID UCR-15

Post Test

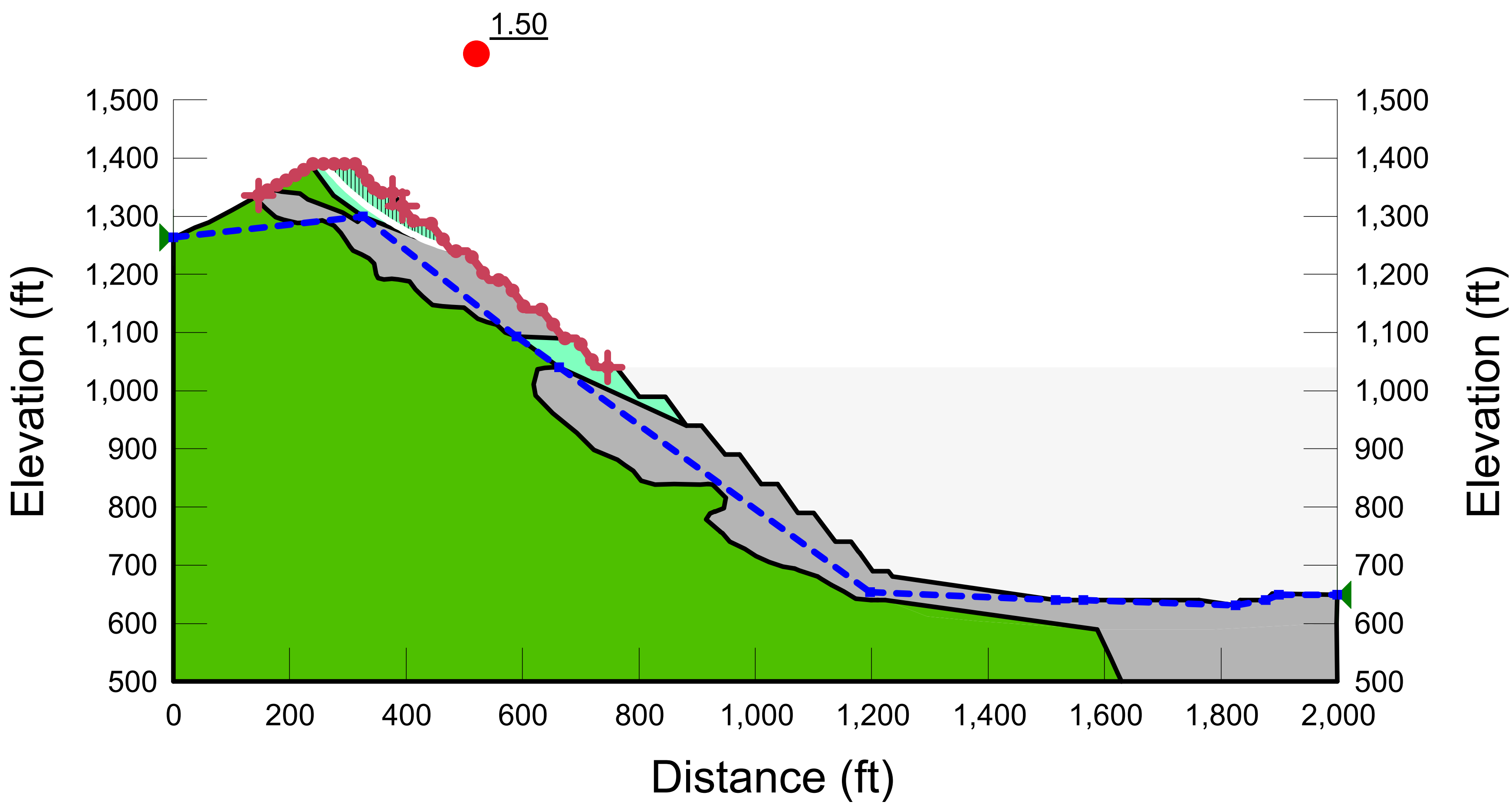


APPENDIX B

Slope Stability Analyses

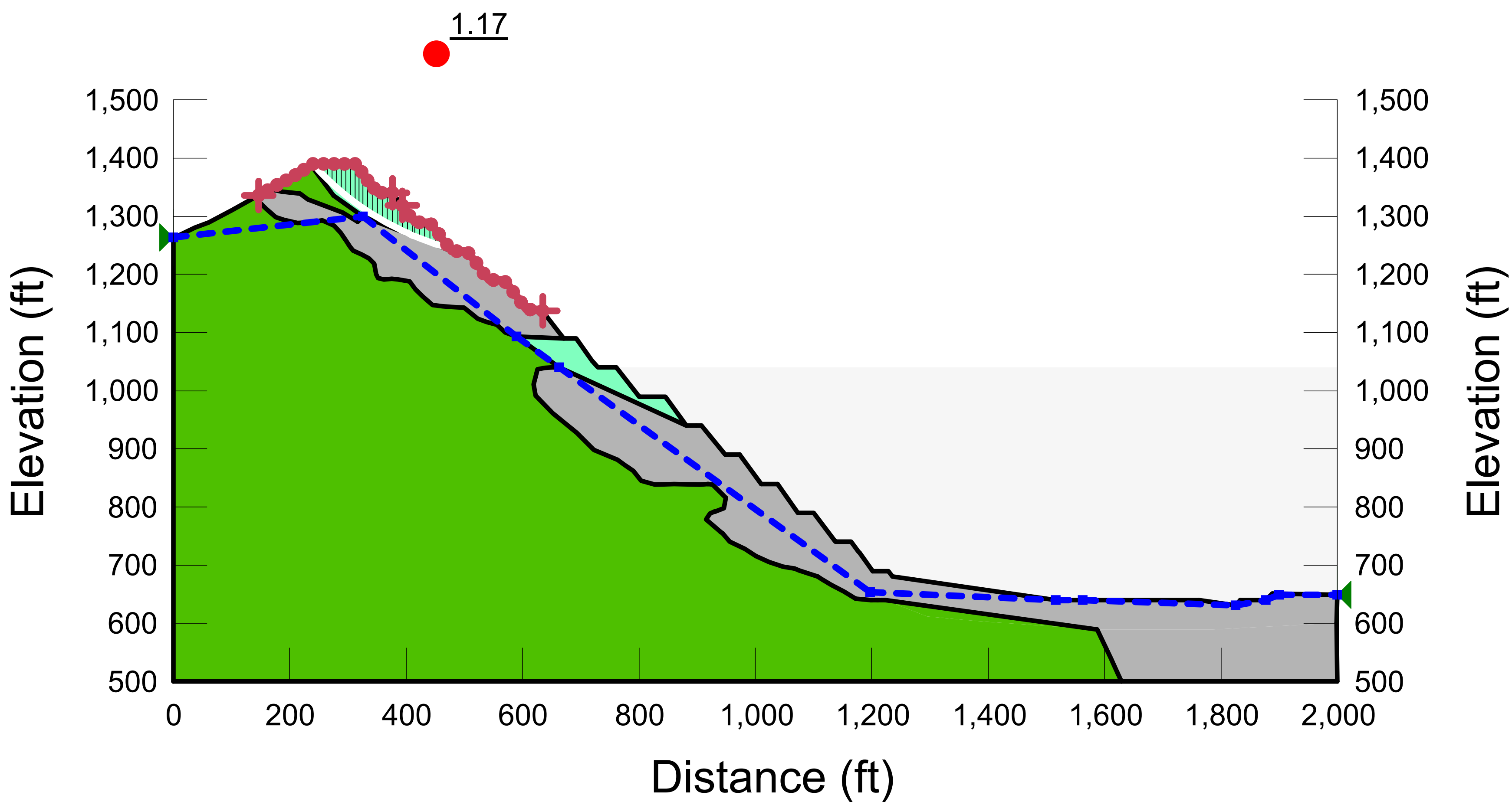
Title: Seesaw - Section A
Parent: 03. Mine Plan (Static with Drawdown)
Name: 03a. Upper Slope
Method: Spencer
Factor of Safety: 1.50
Horz Seismic Coef.:

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1



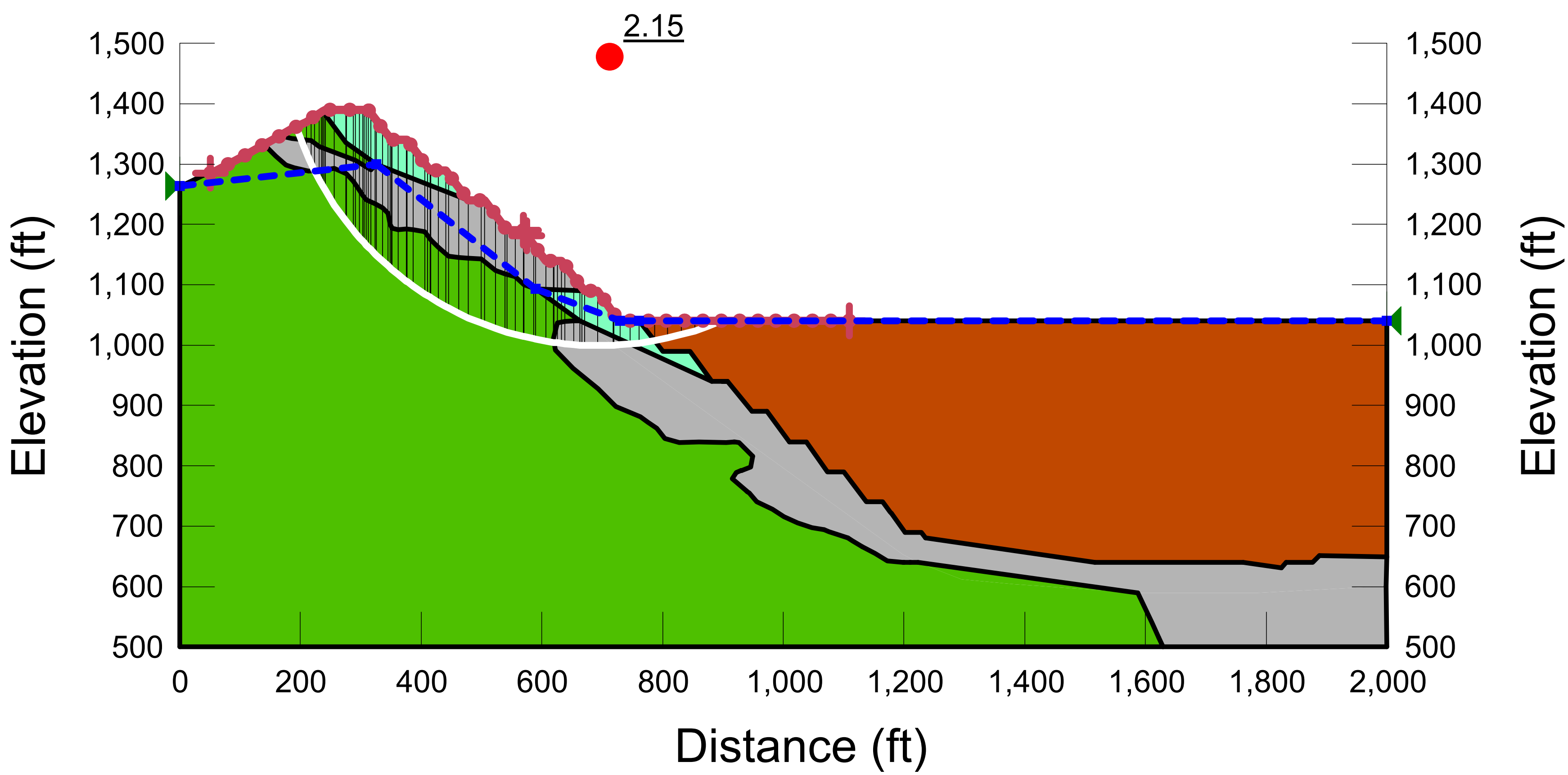
Title: Seesaw - Section A
Parent: 04. Mine Plan (Pseudostatic with Drawdown)
Name: 04a. Upper Slope
Method: Spencer
Factor of Safety: 1.17
Horz Seismic Coef.: 0.15

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1



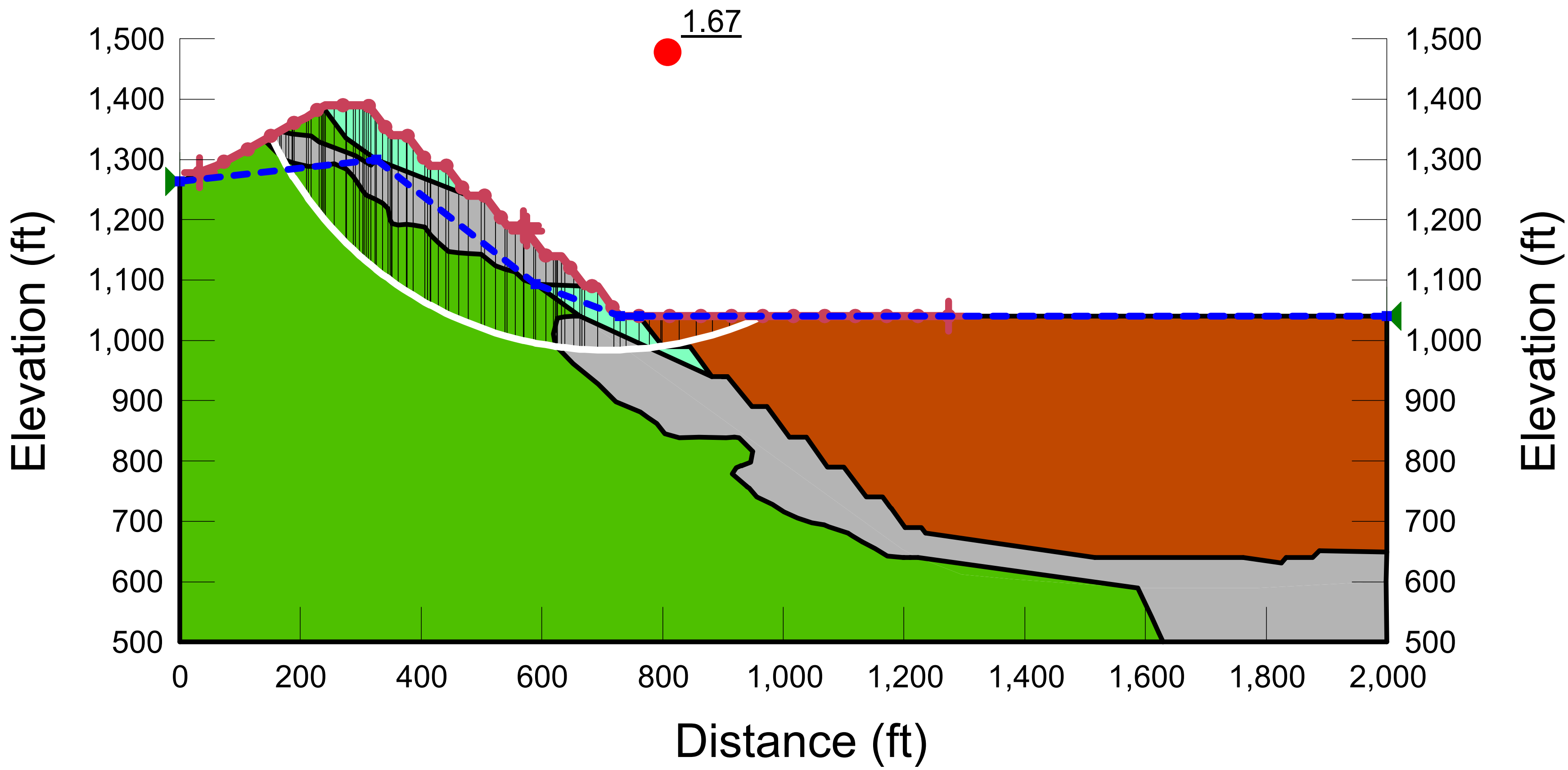
Title: Seesaw - Section A
Parent:
Name: 05. Reclaimed Surface (Static with Drawdown)
Method: Spencer
Factor of Safety: 2.15
Horz Seismic Coef.:

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	1



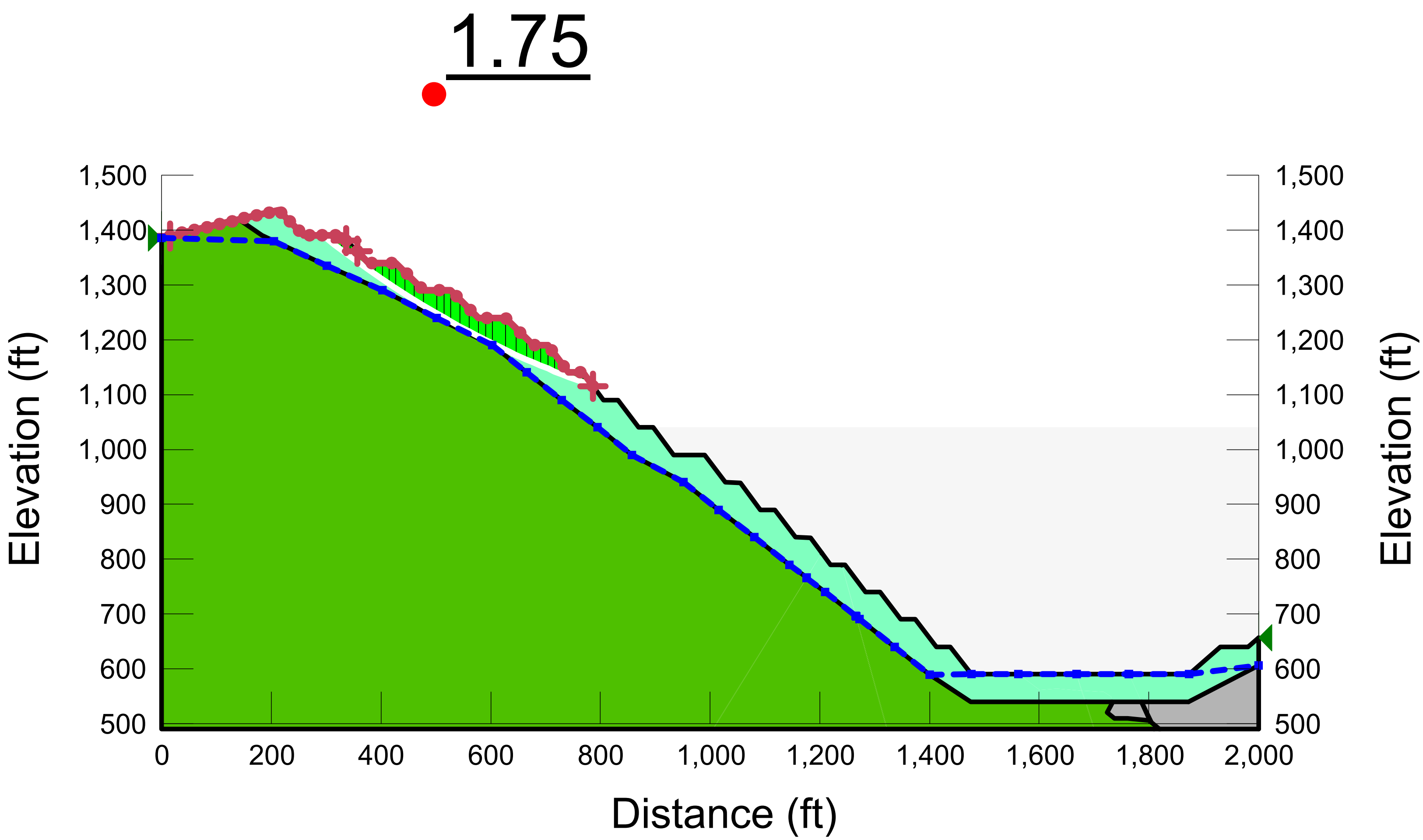
Title: Seesaw - Section A
Parent:
Name: 06. Reclaimed Surface (Pseudostatic with Drawdown)
Method: Spencer
Factor of Safety: 1.67
Horz Seismic Coef.: 0.15

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	1



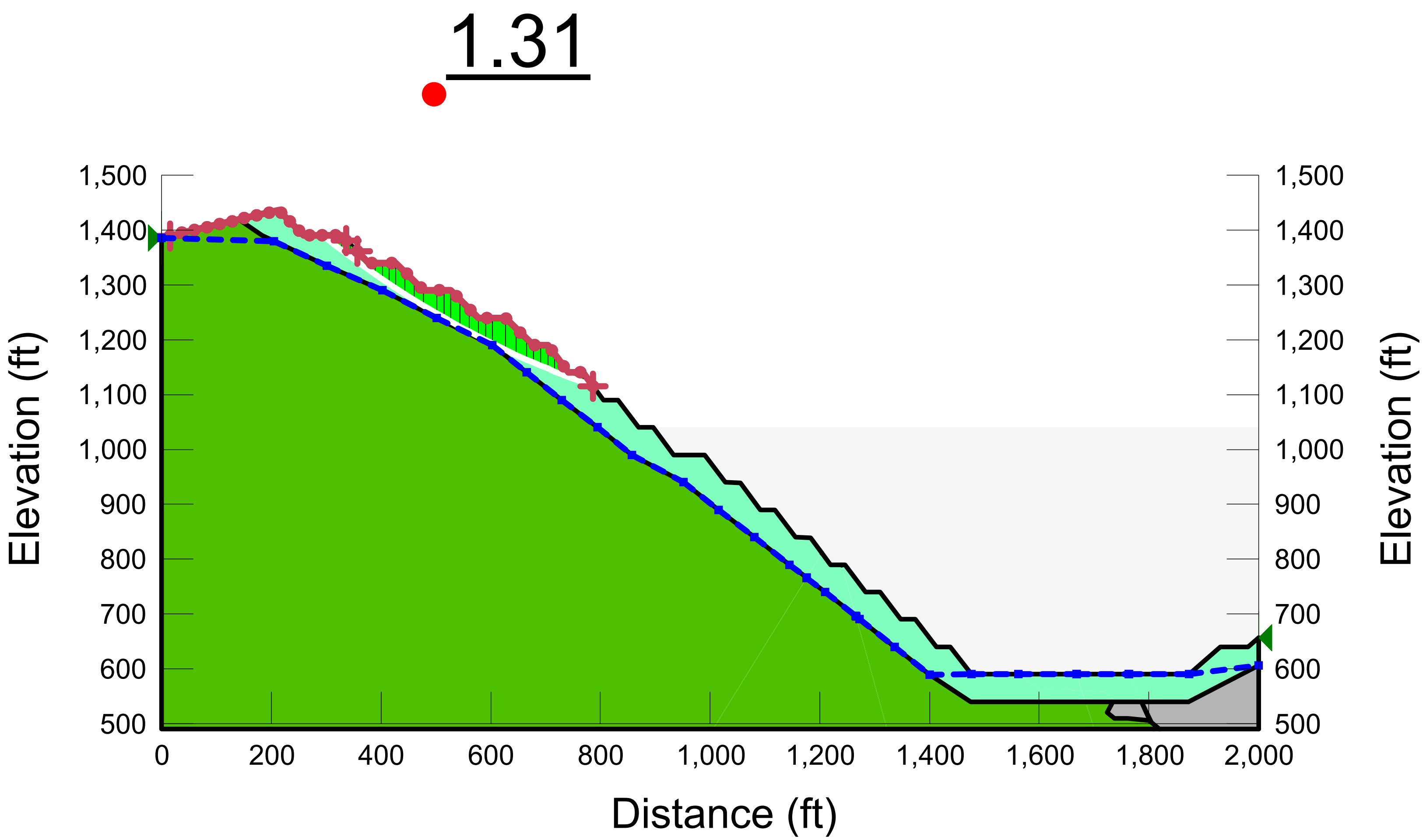
Title: Seesaw - Section B
Name: 03a. Upper Slope
Method: Spencer
Factor of Safety: 1.75

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1



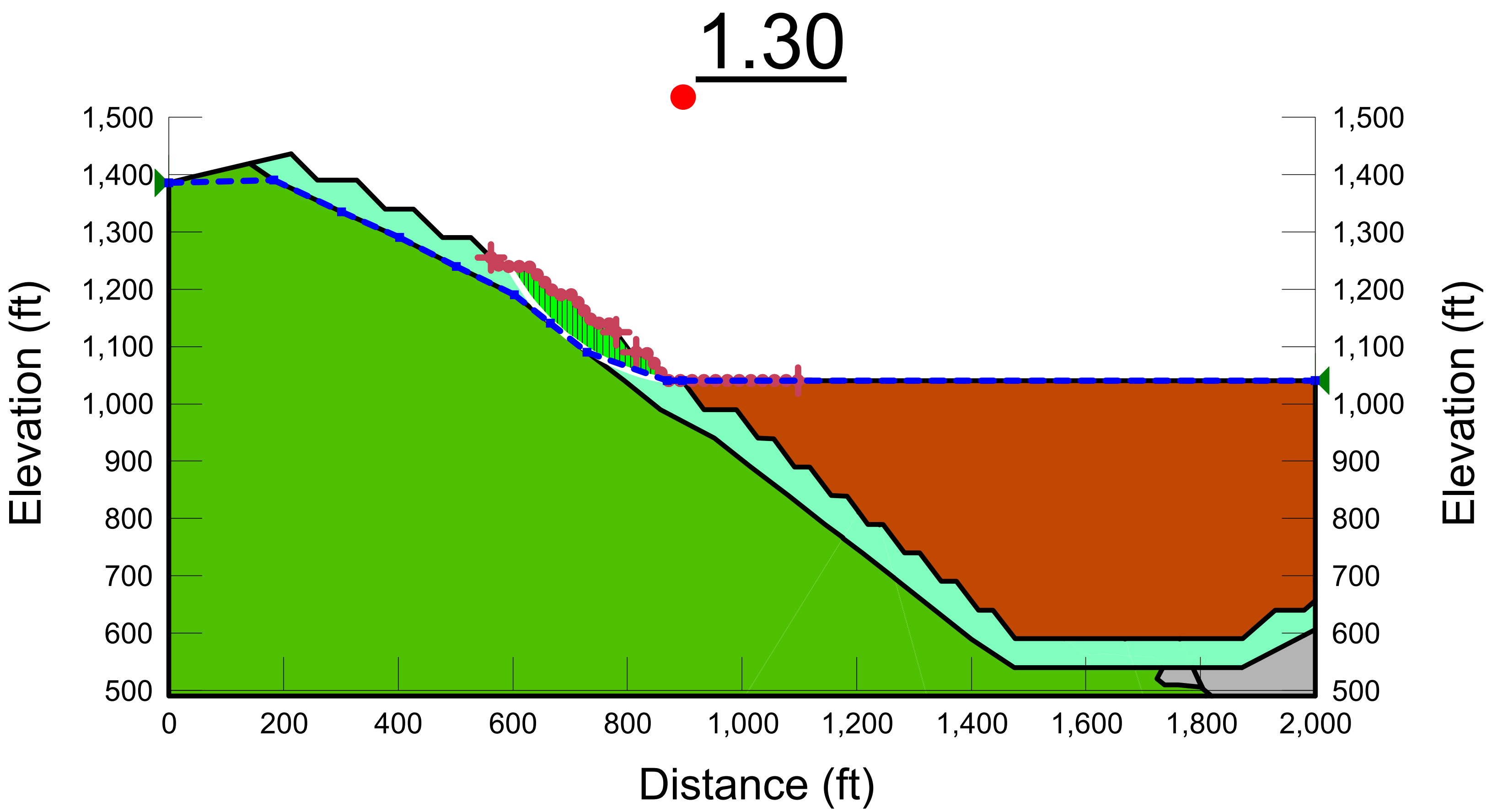
Title: Seesaw - Section B
Name: 04a. Upper Slope
Method: Spencer
Factor of Safety: 1.31

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1



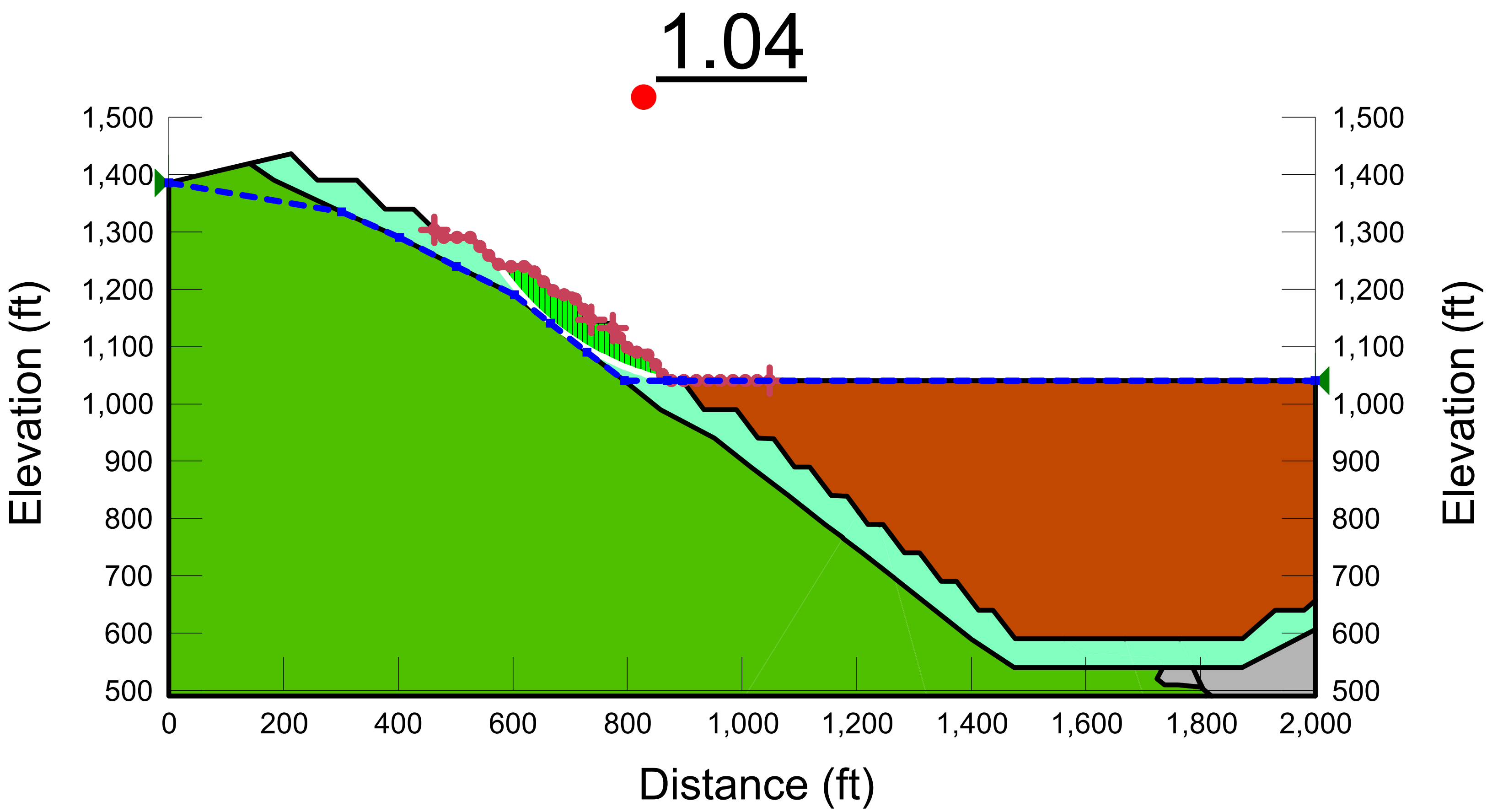
Title: Seesaw - Section B
Name: 05. Reclaimed Surface (Static with Drawdown)
Method: Spencer
Factor of Safety: 1.30

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	1



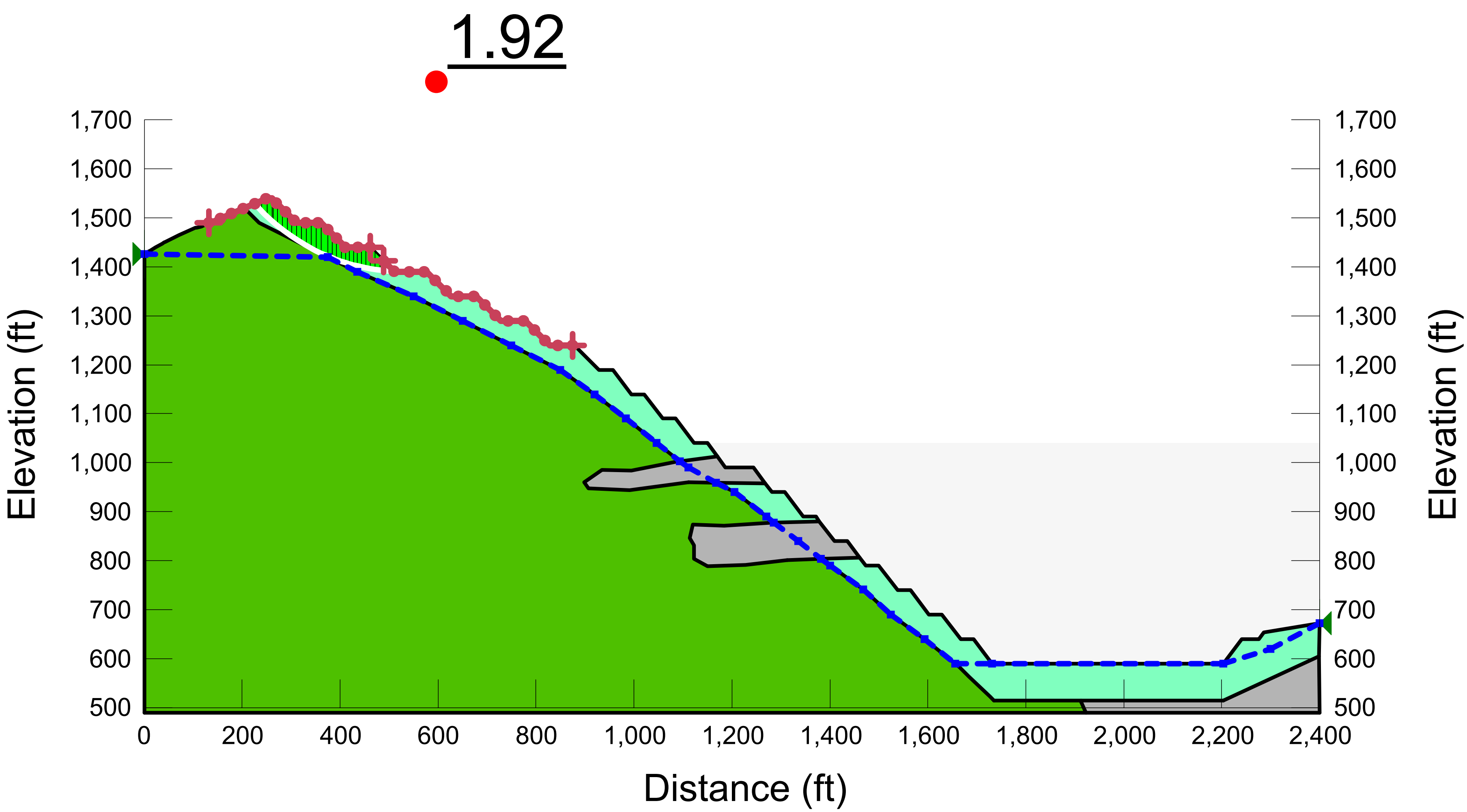
Title: Seesaw - Section B
Name: 06. Reclaimed Surface (Pseudostatic with Drawdown)
Method: Spencer
Factor of Safety: 1.04

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	1



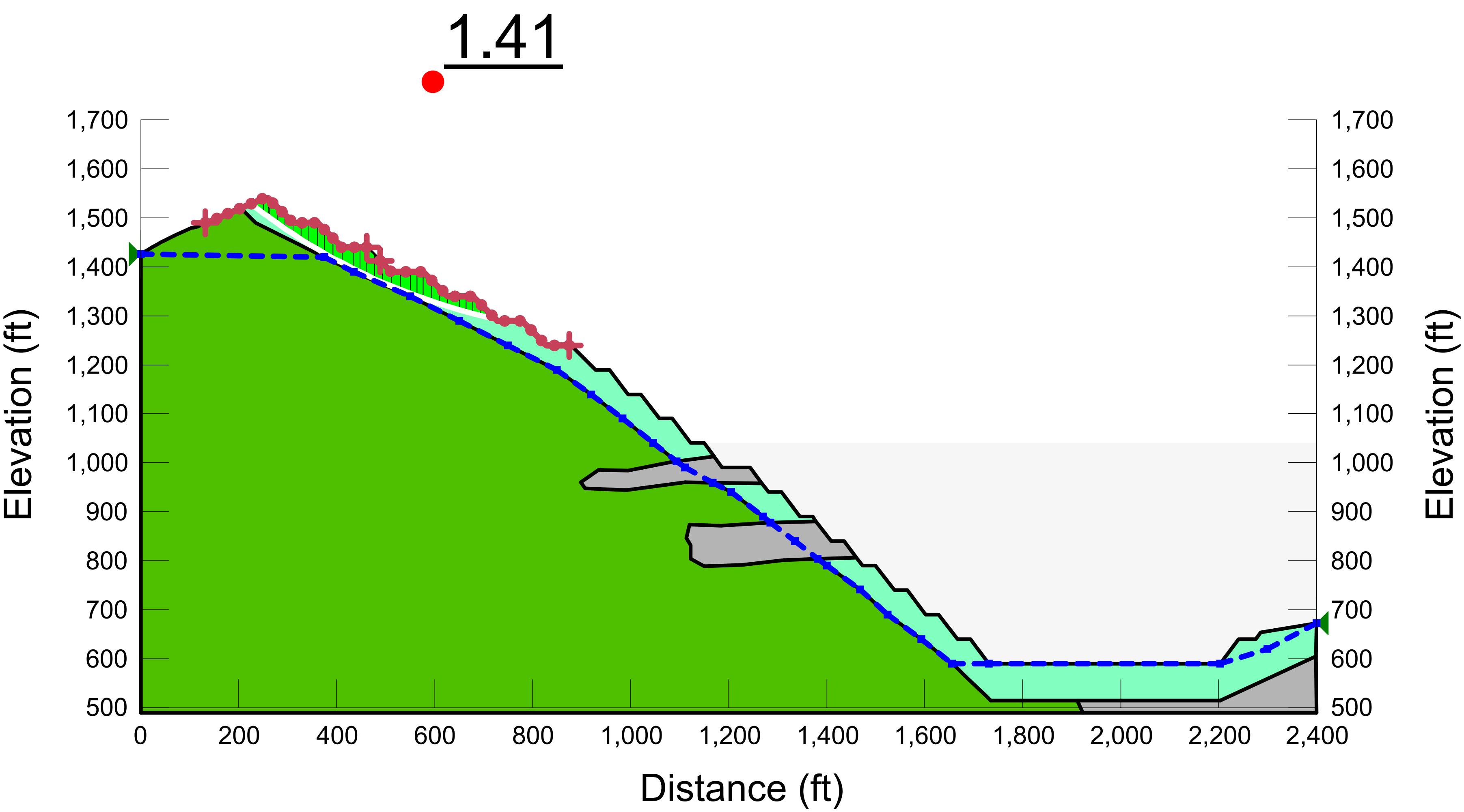
Title: Seesaw - Section C
Parent: 03. Mine Plan (Static with Drawdown)
Name: 03a. Upper Slope
Method: Spencer
Factor of Safety: 1.92
Horz Seismic Coef.:

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1



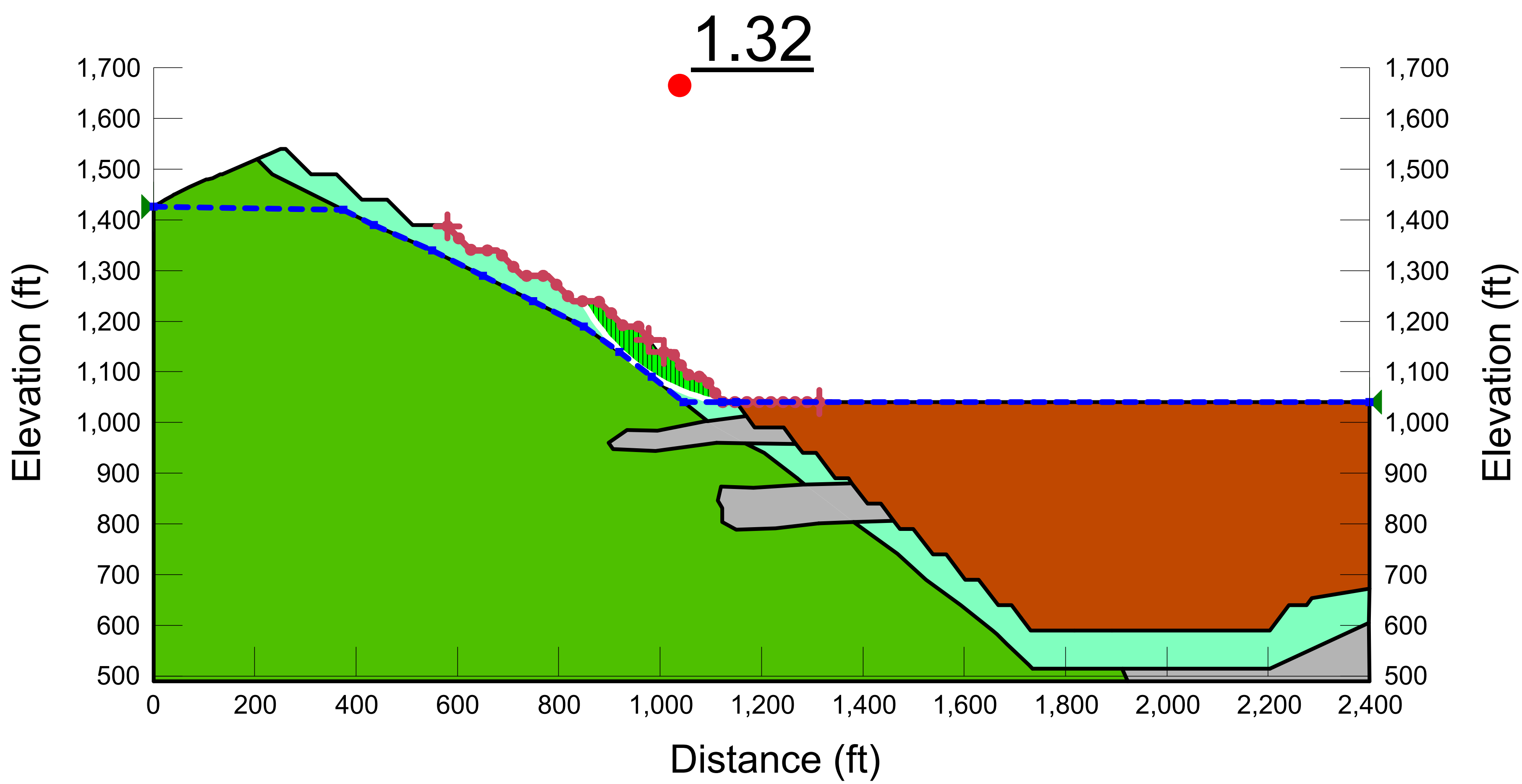
Title: Seesaw - Section C
Parent: 04. Mine Plan (Pseudostatic with Drawdown)
Name: 04a. Upper Slope
Method: Spencer
Factor of Safety: 1.41
Horz Seismic Coef.: 0.15

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1



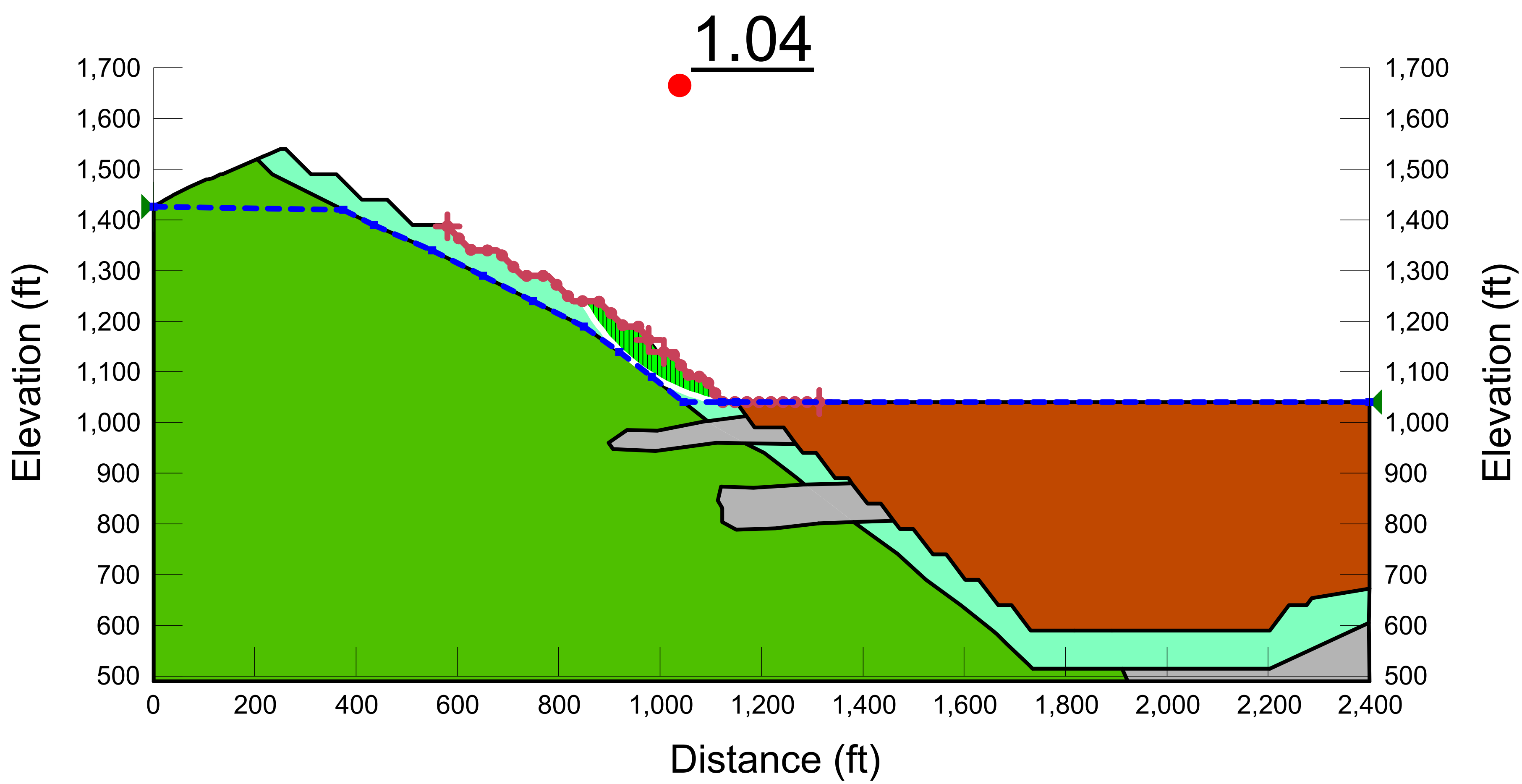
Title: Seesaw - Section C
Parent:
Name: 05. Reclaimed Surface (Static with Drawdown)
Method: Spencer
Factor of Safety: 1.32
Horz Seismic Coef.:

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	1



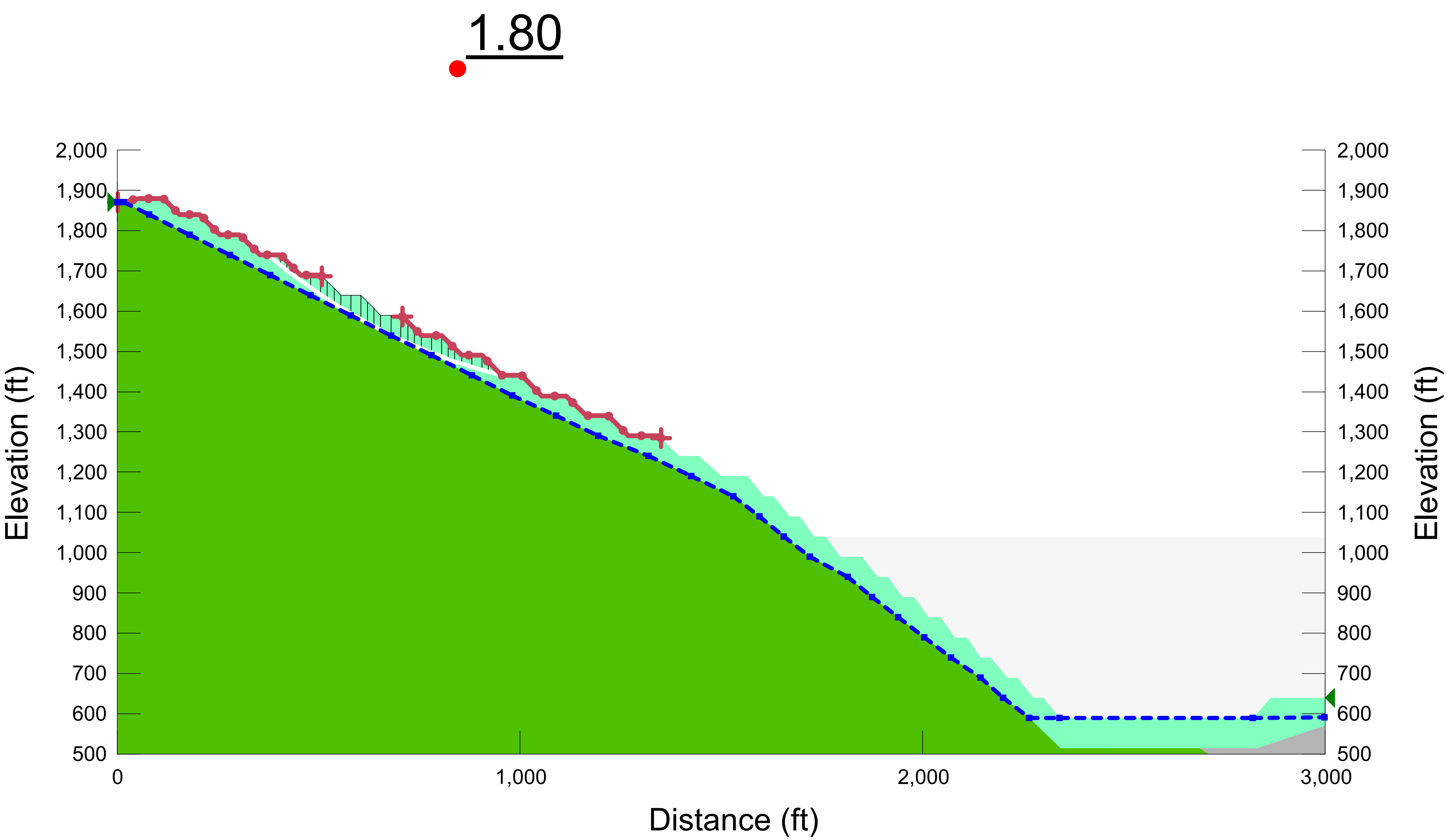
Title: Seesaw - Section C
Parent:
Name: 06. Reclaimed Surface (Pseudotatic with Drawdown)
Method: Spencer
Factor of Safety: 1.04
Horz Seismic Coef.: 0.15

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	1



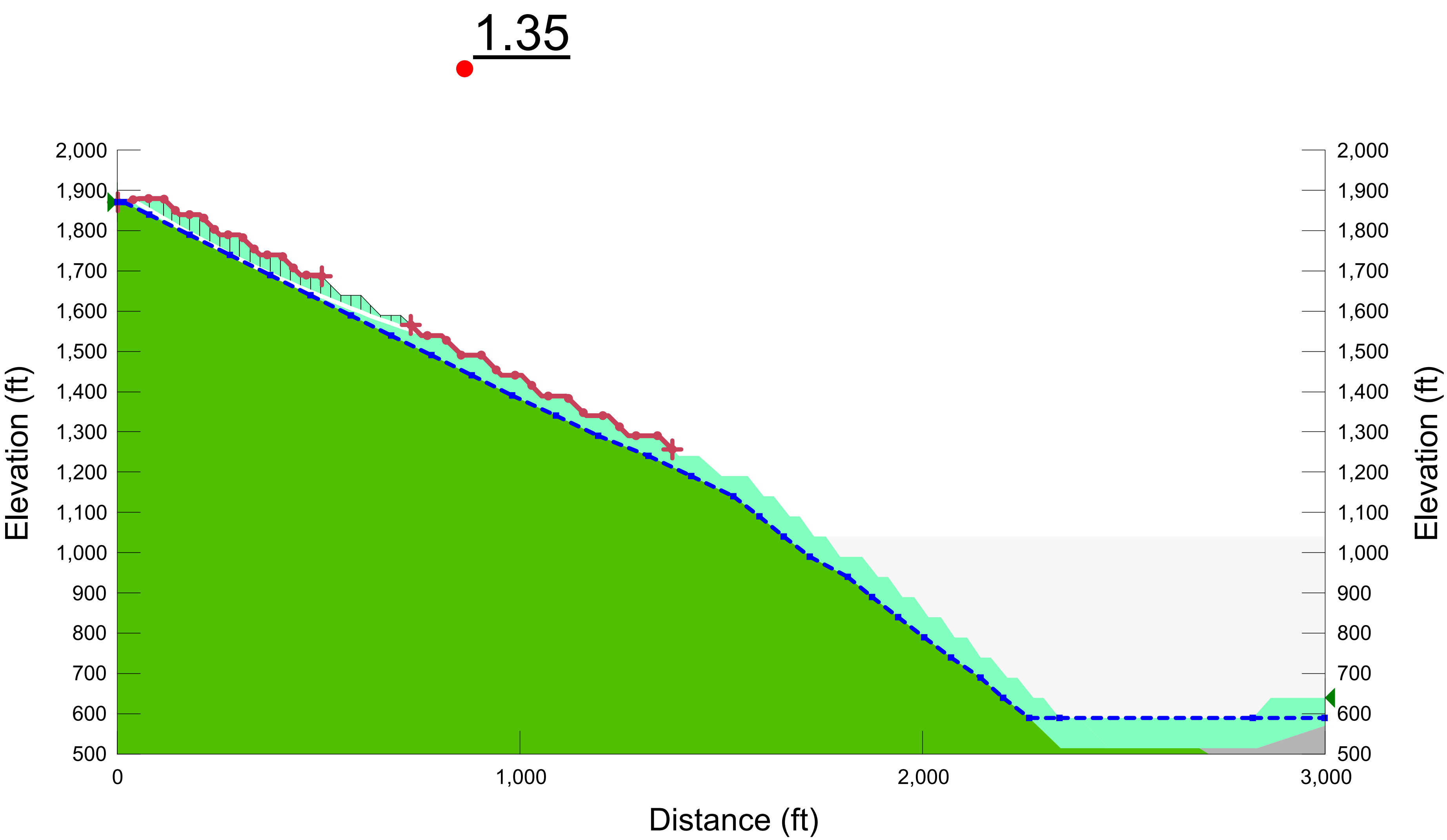
Title: Seesaw - Section D
Parent: 03. Mine Plan (Static with Drawdown)
Name: 03a. Upper Slope
Method: Spencer
Factor of Safety: 1.80
Horz Seismic Coef.:

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	0	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	0	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	0	1



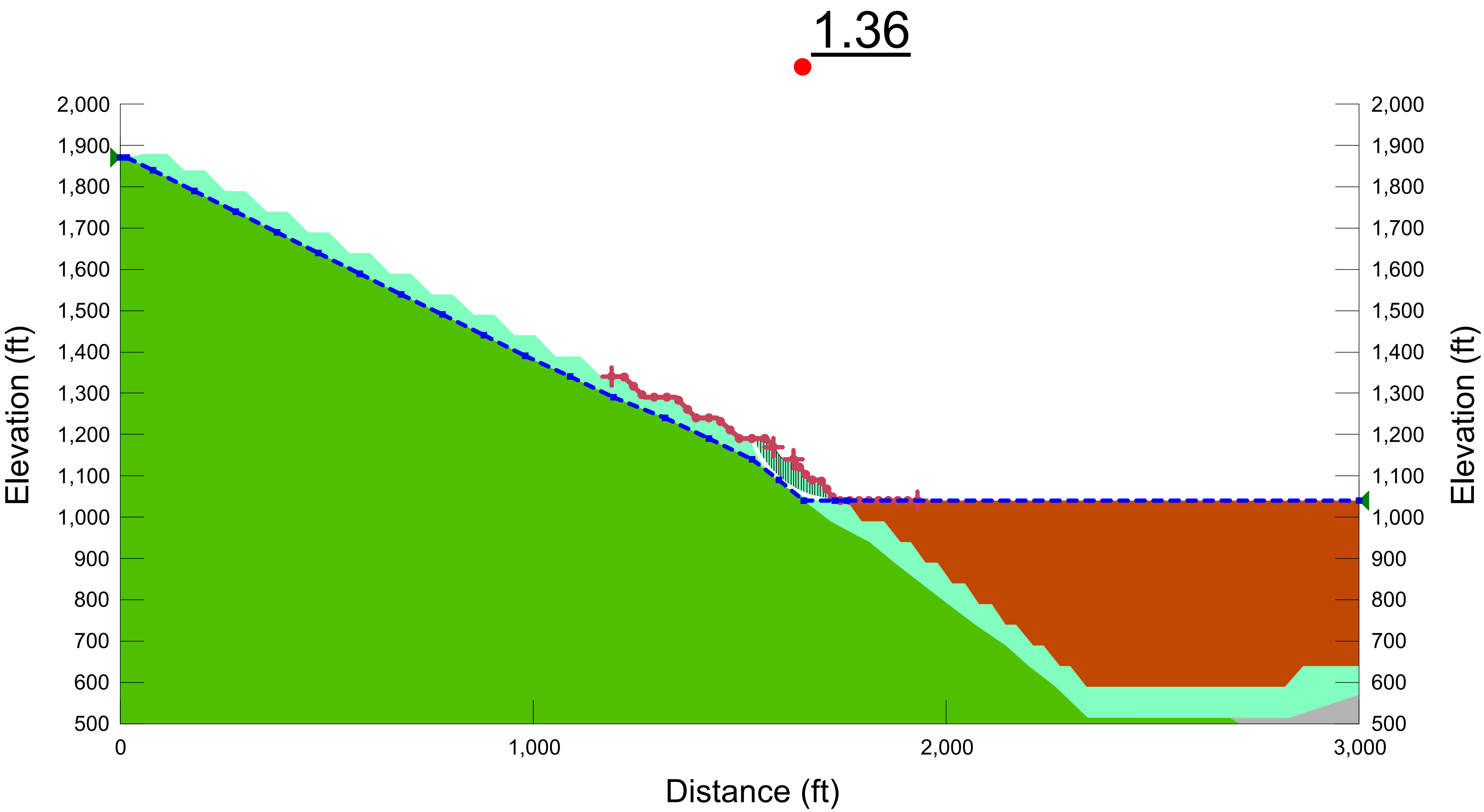
Title: Seesaw - Section D
Parent: 04. Mine Plan (Pseudostatic with Drawdown)
Name: 04a. Upper Slope
Method: Spencer
Factor of Safety: 1.35
Horz Seismic Coef.: 0.15

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	0	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	0	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	0	1



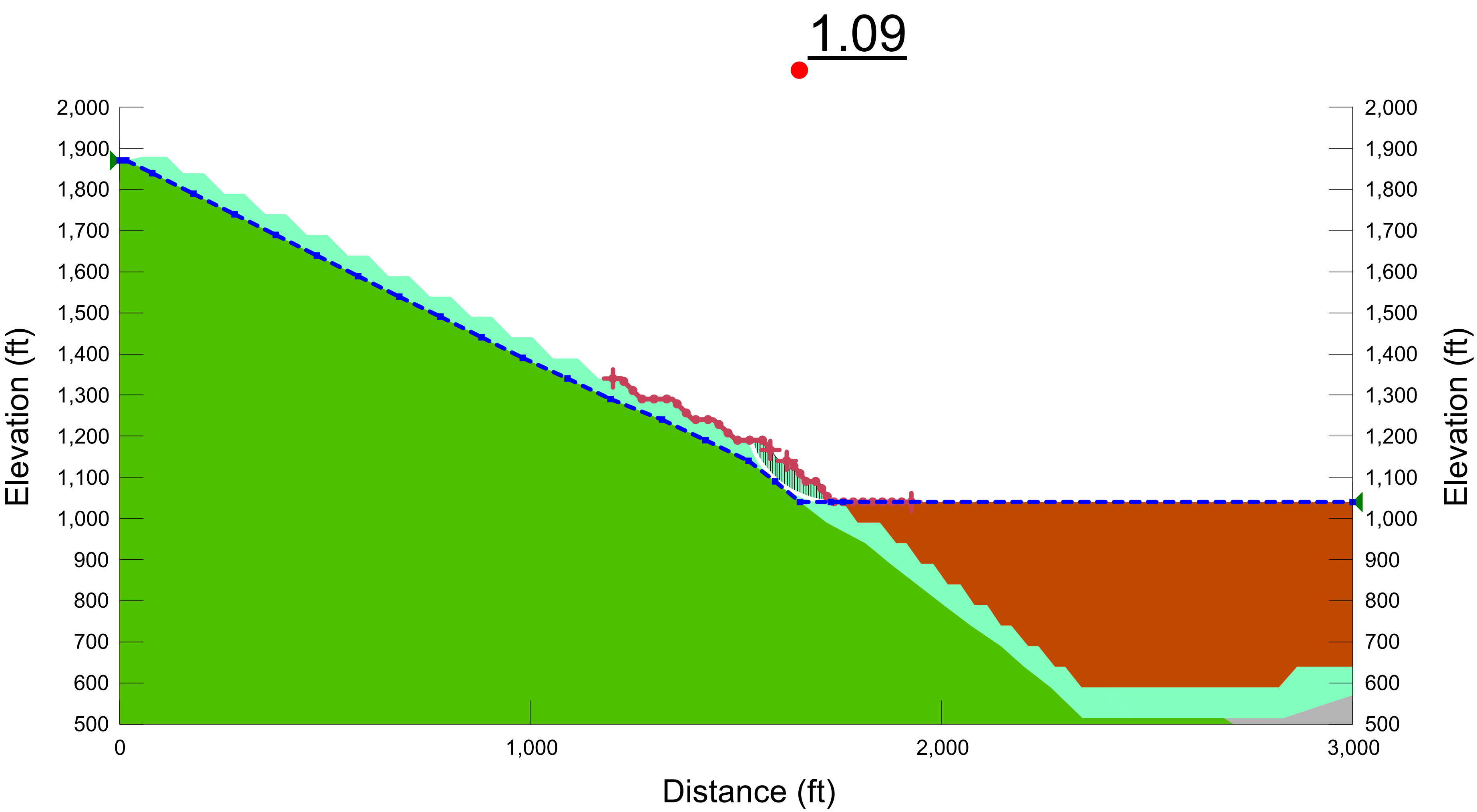
Title: Seesaw - Section D
Parent:
Name: 05. Reclaimed Surface (Static with Drawdown)
Method: Spencer
Factor of Safety: 1.36
Horz Seismic Coef.:

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	0	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	0	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	0	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	0	1



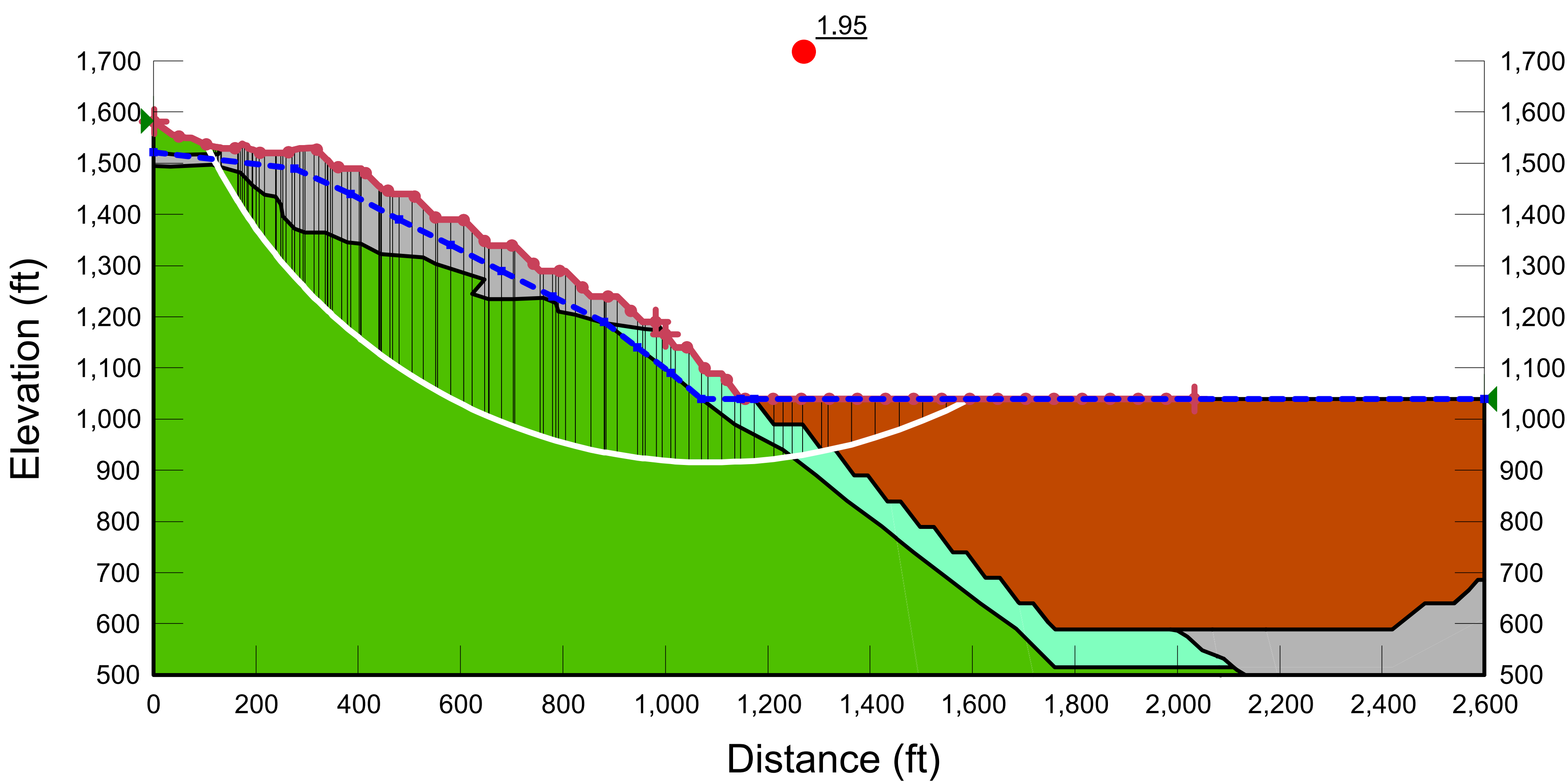
Title: Seesaw - Section D
Parent:
Name: 06. Reclaimed Surface (Pseudostatic with Drawdown)
Method: Spencer
Factor of Safety: 1.09
Horz Seismic Coef.: 0.15

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	0	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	0	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	0	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	0	1



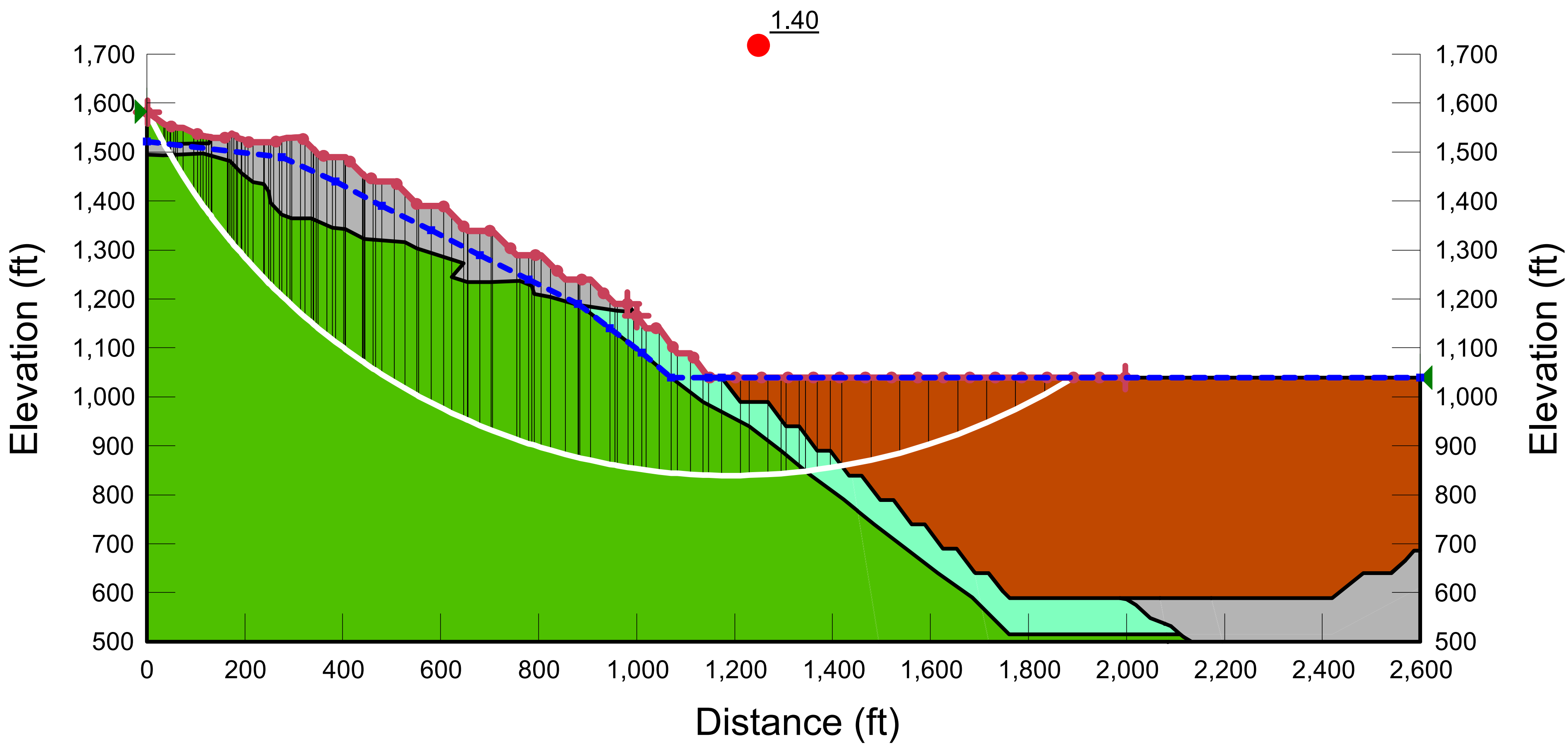
Title: Seesaw - Section E
Parent:
Name: 05. Reclaimed Surface (Static with Drawdown)
Method: Spencer
Factor of Safety: 1.95
Horz Seismic Coef.:

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	1



Title: Seesaw - Section E
Parent:
Name: 06. Reclaimed Surface (Pseudostatic with Drawdown)
Method: Spencer
Factor of Safety: 1.40
Horz Seismic Coef.: 0.15

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	1
	Limestone Bedrock	Mohr-Coulomb	165	12,500	30	1
	Suitable Surplus Soil	Mohr-Coulomb	120	200	30	1



APPENDIX C

Seismic Displacement Analyses

North Highwall Reserve Seismic Displacement Analysis

Section		Yield Acceleration ky (g)	Average Failure Surface Height (ft)	Seismic Displacement (in) (Bray and Travasarou		
				Median	16% exceedence	84% exceedence
Section A	Upper Slope	na	na	na	na	na
	Reclaimed	na	na	na	na	na
Section B	Upper Slope	na	na	na	na	na
	Reclaimed	0.18	49	2	5	1
Section C	Upper Slope	na	na	na	na	na
	Reclaimed	0.185	40	2	4	1
Section D	Upper Slope	na	na	na	na	na
	Reclaimed	0.205	48	2	3	1
Section E	Reclaimed	na	na	na	na	na

Based on: Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, ASCE, V. 133(4), pp. 381-392, April 2007

MODEL INPUTS:	Value	Reference
Moment Magnitude Mw	7.1	Golder
PGA	0.6g	Golder
Non-ZeroStandard Deviation	0.66	Bray & Travasarou paper
Ts Coefficient	1.5	Bray & Travasarou paper

APPENDIX G-3

NORTH QUARRY BACKFILL

GEOTECHNICAL EVALUATION

North Quarry Backfill Geotechnical Evaluation

Permanente Quarry

April 5, 2019

Prepared for:

Lehigh Southwest Cement Company,
Division of Lehigh Cement Company LLC
Heidelberg Cement Group

Prepared by:

Stantec Consulting Services Inc.
American Plaza II
57 W. 200 So., Suite 500
Salt Lake City, UT 84101

Revision	Description	Author		Quality Check		Independent Review	
3	Client Comments	Michael Davis	4/5/19	Paul Kos	4/5/19	Greg Gold	4/5/19
2	Client Review	Michael Davis	2/1/19	Paul Kos	2/1/19	Greg Gold	2/1/19
1	For Comment	Michael Davis	MD	Paul Kos	PK	Greg Gold	GG
0	For Comment	Michael Davis	11/28/18	Paul Kos	11/28/18	Greg Gold	11/28/18
B	Internal Review	Michael Davis	11/16/18	Jennifer Van Pelt	JVP	Greg Gold	GG
A	Initial Draft	Michael Davis	11/15/18	Toni Jack	11/15/18	Paul Kos	11/15/18

Sign-off Sheet

This document entitled North Quarry Backfill Geotechnical Evaluation was prepared by Stantec Consulting Services Inc. (Stantec) for the account of Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party because of decisions made or actions taken based on this document.

Prepared by ____

(signature)

Michael Davis

Reviewed by ____

(signature)

Nelson Kawamura

Approved by ____

(signature)

Greg Gold

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

This North Quarry Backfill Geotechnical Evaluation has been prepared to assist Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc., with the upcoming Reclamation Plan amendment submission, under California's Surface Mining and Reclamation Act (SMARA). This report provides specifications to guide Lehigh in backfilling the North Quarry and documents the results of stability analyses. Stability analyses associated with mining and reclaiming the highwalls are provided in a separate report.

Lehigh will reclaim the North Quarry by backfilling the quarry to an elevation of approximately 990 feet (ft) above mean sea level (AMSL). This elevation corresponds to the lowest depression in the surrounding natural topography and will prevent the accumulation of standing water on the reclaimed surface.

A total volume of 34.5 million cubic yards (M yd^3) is required to fill the North Quarry to its final design surface. This volume includes up to 14.1M yd^3 of space available for on-site generated materials, and at a minimum 20.4M yd^3 of space available for suitable surplus soil from off-site sources.

Backfill of the quarry will be completed in two phases.

- Phase 1 of the quarry backfill will occur from quarry bottom (approximate elevation 440 feet AMSL) to approximately 850 feet AMSL (the lower quarry). Backfill material consisting of greenstone overburden generated onsite and imported suitable surplus soil fill will be used to backfill the lower quarry. The final elevation of Phase 1 will depend on the amount of material available during mining operations.
- Phase 2 of the quarry backfill will occur from approximately 850 feet AMSL to 990 feet AMSL (the upper quarry). Suitable surplus soil, imported from offsite sources, will be used to backfill the upper quarry so that positive drainage from the quarry area is established and no water is impounded.

Geotechnical stability analyses were completed on one cross-section through the North Quarry. The minimum acceptable factors of safety for the analyses are 1.3 for static conditions and 1.0 for pseudo-static conditions based on mining industry standards. All configurations modeled as part of these analyses meet or exceed the minimum acceptable factor of safety.

Backfill of the quarry will occur from the bottom of the quarry upward. Material will be placed in lifts according to the predominant material type within the lift (either greenstone overburden or suitable surplus soil). Adequate compaction will be achieved by truck and dozer traffic, as the lifts are advanced. Phase 1 of the Plan will be completed prior to starting Phase 2. The final surface of Phase 1 will be at an elevation of approximately 850 feet AMSL.

The final backfilled quarry surface will slope at 2 percent (%) toward the east end of the south highwall, which is the lowest area of the surrounding topography. The backfilled quarry will be reclaimed following the details and specifications of the included revegetation plan.

Abbreviations

%	percent
AMSL	Above mean sea level
bgs	Below ground surface
yd^3	cubic yards
FoS	factor of safety
ft	feet
g	Gravitational force
Golder	Golder Associates Inc.
in	inches
ky	Yield acceleration
Lehigh	Lehigh Southwest Cement Company
M	Million
M yd^3	million cubic yards
pcf	Pounds per cubic foot
psf	Pounds per square foot
RPA	Reclamation Plan Amendment
SMARA	[California's] Surface Mining and Reclamation Act
Stantec	Stantec Consulting Services, Inc.
WDR	Waste discharge requirements
yd^3	Cubic yard

Glossary

Cohesion	The force which holds molecules or like particles together in a rock or soil.
Factor of safety	The ratio of resisting force to driving force in a slope stability problem. A factor of safety of one represents the minimum factor of safety for which the slope is stable.
Greenstone	Common term applied to metabasalts within the Franciscan Complex, due to unweathered, dark green color (Foruria 2004).
Greenstone overburden	Material unsuitable for use as aggregate material. Typically, it is weathered greenstone, but it may include other rock types such as low-grade limestone, graywacke, and chert.
North Highwall Reserve	Limestone and aggregate resources in the north highwall of the North Quarry.
Phi’, ф’	The frictional shear resistance of soil or rock.
Pseudo-static slope stability analysis	A pseudo-static analysis is a limit equilibrium method of analysis which represents the effects of earthquake shaking by accelerations that create inertial forces. This is the simplest way to analyze the dynamic effects of earthquake loading of a soil or slope. The output is a single factor of safety.
Rock Plant Reserve	Limestone and aggregate resources at the southern extent of the Permanente Property.
Seismic deformation analysis	An empirical calculation which estimates the extent of lateral displacement during the design earthquake. The output is the median displacement.
Soil	Native, unconsolidated material present at the surface before mining operations began.
Suitable surplus soil	Soil imported from offsite locations that is free of rubbish, trash, and other deleterious materials
Static slope stability analysis	A limit equilibrium method of analysis which satisfies moment and force equilibrium to solve a slope stability problem. The output is a single factor of safety.

1.0 INTRODUCTION

1.1 PURPOSE

Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc., engaged Stantec Consulting Services Inc. (Stantec) to provide professional engineering services related to the development of a reclamation plan for the backfilled North Quarry at the Permanente Quarry. The Reclamation Plan involves backfilling the North Quarry to the minimum elevation of the surrounding natural topography. This elevation corresponds to the lowest depression in the surrounding natural topography and will prevent the accumulation of standing water on the reclaimed surface. To support the Reclamation Plan, static and pseudo-static slope stability analyses of the backfill have been completed to support this backfill plan.

The North Quarry Backfill Geotechnical Evaluation was prepared to assist Lehigh with the upcoming Reclamation Plan amendment submissions, under California's Surface Mining and Reclamation Act (SMARA). This report presents the Reclamation Plan, documents the results of stability analyses, and provides specifications to guide Lehigh in backfilling the North Quarry. Stability analyses associated with mining and reclaiming the highwalls are provided in the North Highwall Reserve Geotechnical Evaluation report.

1.2 PROJECT BACKGROUND

The Permanente Quarry (Quarry) is a limestone and aggregate mining operation, active since the late 1930's, in the unincorporated foothills of western Santa Clara County, approximately two miles west of the city of Cupertino, California. The Quarry occupies a portion of a 3,510-acre property (Permanente Property) owned by Hanson Permanente Cement, Inc. and operated by Lehigh.

The Permanente Property is situated in the rugged foothills along the eastern side of the Santa Cruz Mountains segment of the California Coast Ranges. This area of the Coast Ranges is characterized by moderately to steeply sloping hillsides ranging from approximately 500 to 2,000 feet (ft) above mean sea level (AMSL). The eastern side of the range is incised with eastern flowing drainages, including the Permanente Creek Drainage Basin, which flows through the central part of the Permanente Property, and drains into the southern part of the San Francisco Bay, near Palo Alto and Mountain View, California. The regional location map is included as Figure 1.1.

Operational areas at the Quarry comprise surface mining excavations, overburden stockpiling, crushing and processing facilities, access roads, administrative offices, and equipment storage facilities. Other predominantly undisturbed areas are held in reserve for future mining or to buffer operational areas from adjacent land uses. The North Quarry is where mineral extraction currently occurs and has historically taken place. The North Quarry features a large mining area, with elevations that currently range from approximately 525 feet to 1,750 feet AMSL. Limestone and aggregate mined from the North Quarry are crushed and either stockpiled for aggregate production at Lehigh's on-site rock (aggregate) plant or are used for cement manufacture at Lehigh's adjacent cement plant. Figure 1.2 shows a plan view of the site.

Mining operations take place subject to SMARA, which mandates that surface mining operations have an approved reclamation plan that describes how mined lands will be prepared for alternative post-mining uses, and how residual hazards will be addressed. Mining operations are required to comply with the Porter-Cologne Water Quality Control Act and mining regulations adopted pursuant thereto. Waste Discharge Requirements (WDRs) were issued in 2018 that require Lehigh to address how the facility will perform reclamation activities while also protecting associated ground and surface waters. Golder Associates Inc. (Golder) completed geotechnical investigations and slope stability evaluations in 2011 to support an amended Reclamation Plan for the operational areas disturbed by mining activities. The current Reclamation Plan was approved in 2012. Changes to the current approved Reclamation Plan are being considered, which necessitate an update of the Reclamation Plan for the Permanente Quarry under SMARA. The activities described in the amended Reclamation Plan will then be utilized in preliminary and/or final closure plans required by the WDRs.

This report provides specifications and guidelines to support the amended Reclamation Plan with respect to backfilling the North Quarry and is accompanied by three other similar reports (Rock Plant Reserve Geotechnical Evaluation, North Highwall Reserve Geotechnical Evaluation, and West Materials Storage Area Geotechnical Evaluation), which provide specifications and guidelines related to the proposed amendments to the Reclamation Plan for other areas in the Quarry.

1.3 SCOPE OF WORK

Lehigh retained Stantec to prepare this report to support the amended Reclamation Plan in connection with backfilling the North Quarry. Stantec's scope of work included:

- Review previous geologic and geotechnical studies.
- Analyze current and historical aerial photographs.
- Evaluate historic and new data to determine material strength parameters for stability analyses.
- Design North Quarry backfill.
- Design a stable reclamation slope.
- Evaluate geotechnical stability of North Quarry backfill under static and seismic conditions.

2.0 NORTH QUARRY

2.1 NORTH QUARRY MINE PLAN

The North Quarry is located on the hillside to the west of the cement plant. The topography surrounding the North Quarry ranges in elevation from approximately 990 feet AMSL near the east end of the south highwall to approximately 1,750 feet AMSL at the top of the scarp in the northwest corner of the highwall. Mining operations are ongoing in the North Quarry, with plans to mine the southern portion of the quarry to an elevation of 440 feet AMSL. These plans are included in the North Highwall Reserve Geotechnical Evaluation. The northern portion of the quarry has been developed to an elevation of 525 feet AMSL and has been partially backfilled to an elevation of 700 feet AMSL. Figure 2.1 shows the existing topography in the North Quarry area. Concurrent mining and backfilling in separate areas of the quarry are likely to occur as mining concludes in each area of the quarry; Figure 2.2 shows the final mined surface of the North Quarry before backfilling occurs.

2.2 RECLAMATION PLAN

Lehigh will reclaim the North Quarry by backfilling the quarry to an elevation of approximately 990 feet AMSL. This elevation corresponds to the lowest depression in the surrounding natural topography and will prevent the accumulation of standing water on the reclaimed surface. The final backfilled surface will slope to the southeast at 2%. Stantec completed static and pseudo-static slope stability analyses to evaluate the stability of the regraded (post reclamation) slopes. Topsoil and other amendments will be placed on the backfilled slope and vegetation planted in a manner consistent with the revegetation plan component of the proposed Reclamation Plan amendment.

Backfill of the quarry will be completed in two phases. Phase 1 of the quarry backfill will occur from quarry bottom (440 feet AMSL) to approximately 850 feet AMSL (the lower quarry). Undifferentiated greenstone overburden, generated onsite, and imported offsite fill will be used to backfill the lower quarry. The final elevation of Phase 1 will depend on the amount of material available during mining operations. Up to 14.2 million cubic yards (M yd^3) of material is required to fill the lower quarry.

Phase 2 of the quarry backfill will occur from 850 feet AMSL to 990 feet AMSL (the upper quarry). Suitable surplus soil, imported from off-site sources, will be used to backfill the upper quarry. A minimum 20.3M yd^3 of material is required to fill the upper quarry. Figure 2.3 shows the final surface of Phase 2. Figure 2.4 shows a cross-section through the North Quarry at the end of Phase 2.

2.3 FINAL SURFACE

The final backfilled surface will slope toward the east end of the south highwall, toward the lowest area of the surrounding topography. Figure 2.3 shows the final contoured surface of Phase 2.

3.0 QUARRY BACKFILL SPECIFICATIONS

A total volume of 34.5 M yd^3 is required to fill the North Quarry to its final design surface. The North Quarry will be backfilled with a mixture of greenstone overburden (generated onsite) and suitable surplus soil (imported from off-site) to a minimum elevation of approximately 990 feet AMSL. This elevation corresponds to the lowest natural outlet in the surrounding topography so that the reclaimed surface of the quarry does not impound water.

It is important to note that the exact progression of backfill will depend on other operations and materials available at the Permanente Quarry. While this high-level plan shows the final surfaces and materials contained in each area, interim benches and access will be created to ensure both the adherence to plans and supply and demand of backfill products.

3.1 MATERIAL SPECIFICATION

Table 3.1 summarizes the material specifications of the quarry backfill. The total volume required for the quarry backfill is 34.5M yd^3.

Table 3.1 Material Specifications

Backfill Area	Volume (yd^3)	Material Specification
Lower Quarry	14,200,000	Undifferentiated greenstone overburden generated from on-site sources or suitable surplus soil generated from off-site sources.
Upper Quarry	20,300,000	Suitable surplus soil generated from off-site sources.

3.2 BACKFILL SPECIFICATION

Backfill of the quarry will generally occur from the bottom of the quarry upward. However, this does not mean each lift of material will be fully completed prior to the next level being started. Material will be placed in lifts according to the predominant material type within the lift. Adequate compaction will be achieved by truck and dozer traffic, as the lifts are advanced.

Lifts of greenstone overburden, where rock makes up greater than 50% of the material within the lift, can be advanced across the quarry at a thickness ranging from 30 feet to 60 feet. This specification will apply to the lower quarry, below elevation 850 feet AMSL, where greenstone overburden generated onsite will be used to backfill the quarry.

Lifts of suitable surplus soil, where soils make up greater than 50% of the material within the lift, can be advanced across the quarry, at a thickness ranging from 10 feet to 15 feet. This specification will apply to portions of the lower quarry, where the greenstone overburden generated on-site is predominantly soil sized materials, and to the upper quarry.

Table 3.2 summarizes the lift thicknesses required for the quarry backfill.

Table 3.2 Lift Thickness

Backfill Material	Lift Thickness
Greater than 50% rock (greater than 50% one-inch particles)	30 feet to 60 feet
Greater than 50% soil sized materials (less than 50% one-inch particles)	10 feet to 15 feet

During the quarry backfill, lifts of backfill material will be advanced across the quarry by end dumping material onto the advancing lift and dozing it into place. Lifts will be advanced, at angle of repose, across the quarry (approximately 35° slope faces for greenstone overburden and approximately 30° slope faces for soil).

Benches will be formed from a single lift of rock, or multiple lifts of rock or soil. The maximum height of each interim bench is 60 feet. Where possible, each bench should be advanced across the entire quarry before beginning the next bench; however, this may not always be practical.

When a bench cannot be advanced to completion, a 50-foot catch bench (offset) must be maintained between the crest of the lower bench and the toe of the upper bench, regardless of backfill type. This configuration will result in an overall slope angle of approximately 2H:1V and provides sufficient width for accessing the benches.

Adequate compaction will be achieved by truck and dozer traffic as the lifts are advanced, and no formal compaction specifications are required.

The final surface of Phase 2 will be at a maximum elevation of approximately 1,036 feet AMSL, and it will slope at approximately 2% to the southeast corner of the quarry at a minimum elevation of approximately 990 feet AMSL. Figure 2.3 shows the final topography, and Figure 2.4 shows a cross-section of the quarry backfill.

A high-level summary of the quarry backfill plan is shown in Table 3.3.

Table 3.3 Quarry Backfill Plan Summary

Backfill Phase	Item	Description
Phase 1	Maximum Surface Elevation	Approximately 850 feet
	Backfill Volume	14.1M yd^3 (maximum)
	Backfill Material	Undifferentiated fill, consisting of greenstone overburden generated on-site and suitable surplus soil imported from off site
	Lift Thickness of Greenstone Overburden (>50% rock).	30 feet to 60 feet
	Lift Thickness of Suitable Surplus Soil (>50% soil)	10 feet to 15 feet
	Compaction Effort	2 to 5 passes with truck or dozer
	Maximum Bench Height	60 feet (vertical)
	Catch Bench Width	50 feet (horizontal)
Phase 2	Minimum Final Surface Elevation	990 feet
	Maximum Final Surface Elevation	1,038 feet
	Backfill Volume	20.4M yd^3 (minimum)
	Backfill Material	Suitable surplus soil imported from off-site sources
	Lift Thickness of Suitable Surplus Soil	10 feet to 15 feet
	Compaction Effort	3 to 5 passes with truck or dozer
	Maximum Bench Height	15 feet (vertical)
	Catch Bench Width	50 feet (horizontal)

4.0 GEOTECHNICAL STABILITY

A single cross-section of the quarry backfill was modeled to ensure that an appropriate factor of safety against slope failure is achieved. The section represents worst case conditions, including the greatest fill depths and on the steepest section of the remaining pit wall. Figures 2.1 through 2.3 show the location of the cross-section analyzed, and the cross-section is included as Figure 2.4.

The slope stability analyses were modeled using the software Slope-W® 2018 R2 version 9.1 by GeoStudio, released in 2018. The software used limit equilibrium on slices of potential failure surface to calculate factor of safety (FoS). The models were evaluated under static and pseudo-static conditions, with horizontal ground acceleration, for the closure configurations using the Spencer method. The two types of analysis have been summarized in Table 4.1. The minimum acceptable factors of safety for the analyses are 1.3 for static conditions, and 1.0 for pseudo-static conditions based on mining industry standards. For the pseudo-static model conditions, a horizontal seismic coefficient of 0.15 time the force of gravity (g) was applied to the static condition models to be consistent with previous studies (Golder 2011) and to follow recommendations for earthquakes with magnitudes up to 8-1/4 (Seed 1982). To evaluate the slope stabilities, cross-sections were analyzed for the reclamation surfaces.

Table 4.1 Stability Analyses

Analysis Type	Description	Minimum Acceptable Factor of Safety
Static Analysis	A limit equilibrium method of analysis which satisfies moment and force equilibrium to solve a slope stability problem. The output is a single FoS for the potential failure surface with the lowest FoS.	1.3
Pseudo-static Analysis	A limit equilibrium method of analysis which represents the effects of earthquake shaking by accelerations that create inertial forces. This is the simplest way to analyze the dynamic effects of earthquake loading of a soil or slope. The output is a single FoS for the potential failure surface with the lowest FoS.	1.0

Site specific geotechnical information on the backfill materials included material strength data on greenstone bedrock, greenstone overburden, and native soils. Imported suitable surplus soil is assumed to have similar geotechnical properties as the on-site native soils. Strength parameters for the materials have been established in previous geotechnical analyses of the Permanente Property and are based on laboratory testing, back-calculation, and published values for soil properties (Golder 2011). These strength parameters are listed in Table 4.2.

The strength parameters of the greenstone have been re-evaluated based on the results of the 2018 geotechnical investigation completed by Stantec, and have been divided into two zones as follows:

- Mining influenced zone – areas which have the potential to be influenced from mining operations including blasting and mechanical excavation. A horizontal distance from the highwall of 75 feet is used to define the mining influenced zone. This distance is one and one-half times the bench height following industry design guidelines (Hustrulid 2000).
- Undisturbed zone – greenstone which is greater than 75 feet (horizontal) into the highwall that is not considerably modified by mining operations.

Table 4.2 Geotechnical Strength Parameters

Material	Unit Weight (pcf)	Cohesion (psf)	Phi' (Degrees)
Suitable surplus soil	120	200	30
Greenstone overburden	125	0	35
Greenstone bedrock (mining influenced zone)	165	1,800	27
Greenstone bedrock (undisturbed zone)	165	12,500	30

Stability analyses are focused on the quarry backfill, and do not reflect the stability of the adjacent highwall. The stability of the highwall is analyzed in a separate report, entitled the North Highwall Reserve Geotechnical Evaluation. The final surface of the quarry backfill is relatively flat and; therefore, has very high factors of safety.

These analyses meet or exceed the minimum acceptable factors of safety, as defined in Table 4.1. The shallow slopes have very high factors of safety, and the results from the stability analyses are shown in Table 4.3. These high factors of safety confirm that the geotechnical conclusions reached in this report are not impacted by:

- The relative fill quantities of the greenstone and suitable surplus soil imports.
- The sequence of deposition of the greenstone and suitable surplus soil imports.

Figure 2.4 shows the location of the cross-section which was analyzed for backfill stability. Appendix A contains printouts of the slope stability sections analyzed for the quarry backfill.

Table 4.3 Geotechnical Stability Analyses Results

Description	Analysis Type	Factor of Safety
Final surface	Static	28.5
	Pseudo-static	3.4

Seismic displacements were calculated using an empirical equation developed by Bray and Travasarou (Bray 2007). This method estimates the displacement of a rigid block on a slope and is consistent with previous displacement analyses. The peak ground acceleration (PGA) value of 0.6g was used for the calculations, which is also consistent with previous analyses. This PGA corresponds to an earthquake with a mean return time of 475 years (Petersen 2008). The yield acceleration (ky) was calculated using the Slope/W model by adjusting the seismic coefficient until the model provided a FoS = 1.0, and these values were used for the displacement calculation. Cross-sections with pseudo-static FoS greater than 1.15 will have minimal displacement during a seismic event (Seed 1982), and displacements for these cross-sections are assumed less than two inches. The actual displacements were not calculated for these sections. Literature on seismic slope displacements suggest that median displacements of less than 6 in (15 centimeters [cm]) are “minor” and displacements of greater than 3 feet (1 meter [m]) are “major” (Bray 2007). Displacements for quarry backfill are ”minor” and unlikely to influence the reclaimed slope.

5.0 SUMMARY

Stantec has provided this quarry backfill geotechnical evaluation to Lehigh in support of a Reclamation Plan amendment for the Permanente Quarry located near Cupertino, California, and to assist with the preparation of plans required by the facility WDRs. The geotechnical assessment provided in this report demonstrates that the proposed Reclamation Plan for North Quarry backfill meets or exceeds SMARA requirements for factors of safety under static and seismic conditions.

6.0 CONCLUSION

This report provides the analysis and supporting information needed to demonstrate that Lehigh Southwest Cement Company's backfilling plan for reclamation operations at the North Quarry meets SMARA and associated design and performance requirements. The North Quarry will be backfilled in phases and once completed will establish positive drainage for reclamation operations. The geotechnical assessment provided in this report demonstrates that the proposed Reclamation Plan meets or exceeds SMARA requirements for factors of safety under static and seismic conditions.

This report has been prepared for Lehigh Southwest Cement Company to provide them with geotechnical guidance in support of the development and reclamation of the North Quarry. As mutual protection to Lehigh, the public, and Stantec, this report and its figures are submitted for exclusive use by Lehigh Cement Company. Our report and recommendations should not be reproduced in whole or in part without our express written permission, other than as required in relation to agency review and submittals. The drawings included with the report are for regulatory review and are not intended as detailed construction drawings. All information and design results contained herein have been prepared by the authors who have signed below and attached drawings have been certified by Nelson Kawamura, California PE. A draft of this report was reviewed by personnel from Lehigh Southwest Cement Company.

Stantec Consulting Ltd.

Michael Davis
Senior Geotechnical Consultant, Salt Lake City
Phone: 801-384-0942
mike.davis2@stantec.com

Nelson Kawamura

Nelson Kawamura G.E.
Principal, Civil Engineer, Waterpower & Dams
Phone: 503-220-5424
nelson.kawamura@stantec.com

REGISTERED PROFESSIONAL ENGINEER
NELSON KAWAMURA
GE 2868
EXP. 9/30/2019
GEOTECHNICAL
STATE OF CALIFORNIA

April 5, 2019

7.0 REFERENCES

Bray, J. D., and Travasarou, T., 2007. “Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements”, Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Foruria, J. September 2004. Geology of the Permanente Limestone & Aggregate Quarry, Santa Clara County, California. 2004.

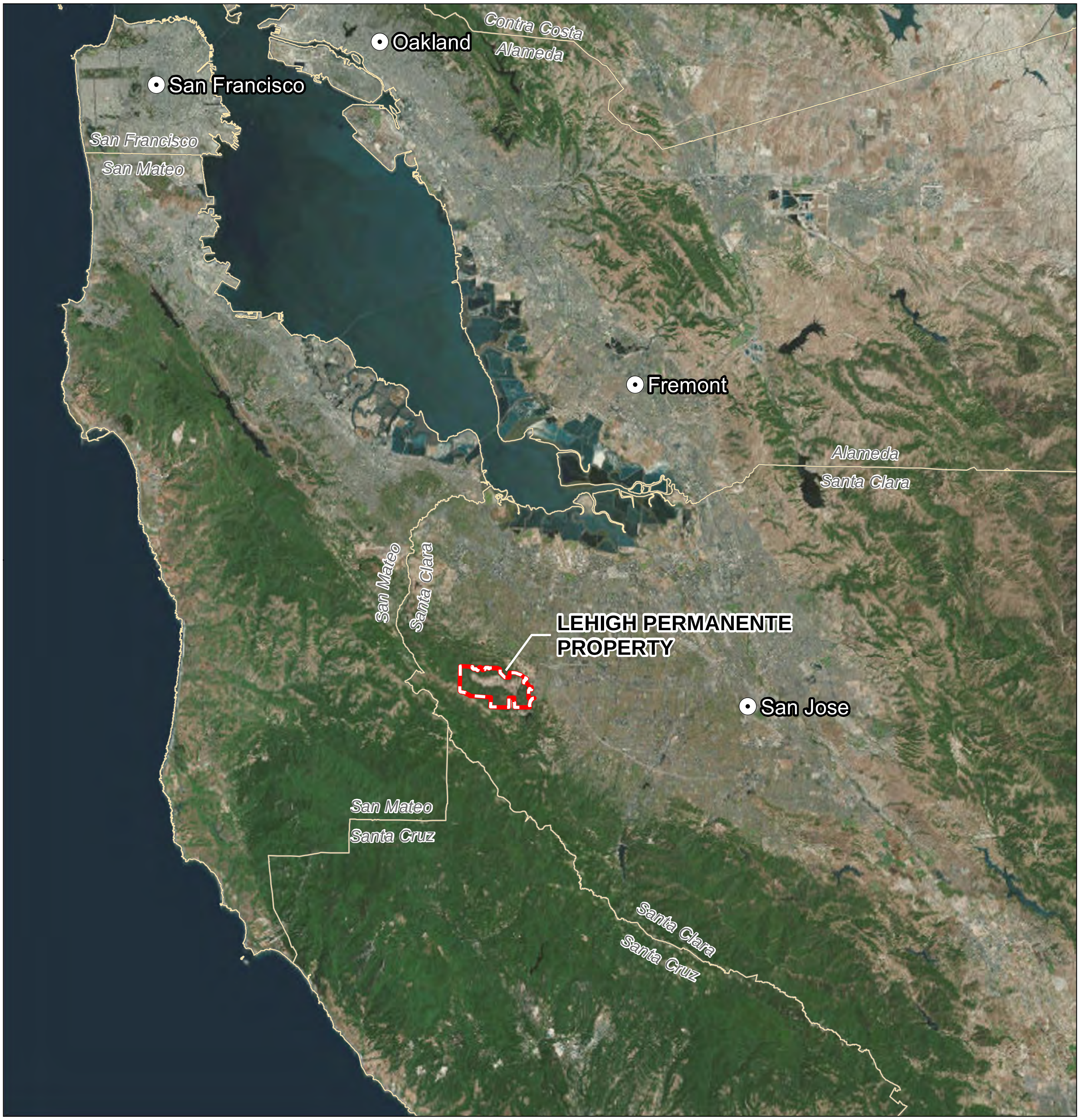
Golder Associates, November 2011. Geotechnical Evaluations and Design Recommendations (Revised). Permanente Quarry Reclamation Plan Update, Santa Clara County, California. 2011.

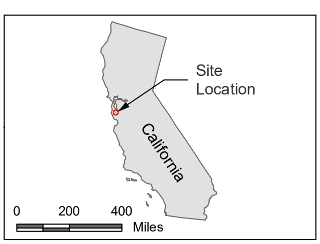
Hustrulid, William A., McCarter, Michael K., Van Zyl, Dirk J.A. 2000. Slope Stability in Surface Mining. Society for Mining, Metallurgy, and Exploration, Inc. (SME), Littleton, Colorado. 2000.

Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth S., 2008. Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008–1128, 61 p.

Seed, H. B., 1979. “Considerations in the Earthquake-Resistant Design of Earth and Rockfill Dams,” Geotechnique, vol. 29, No. 3, pp. 215-263.

FIGURES





City

Lehigh Permanente Property

County

0 4 8 Miles

(At original document size of 8.5x11)
1:500,000

N

Stantec

Project Location
T07N, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-12-20
Technical Review by PK on 2018-12-20
Finalized on 2019-04-05

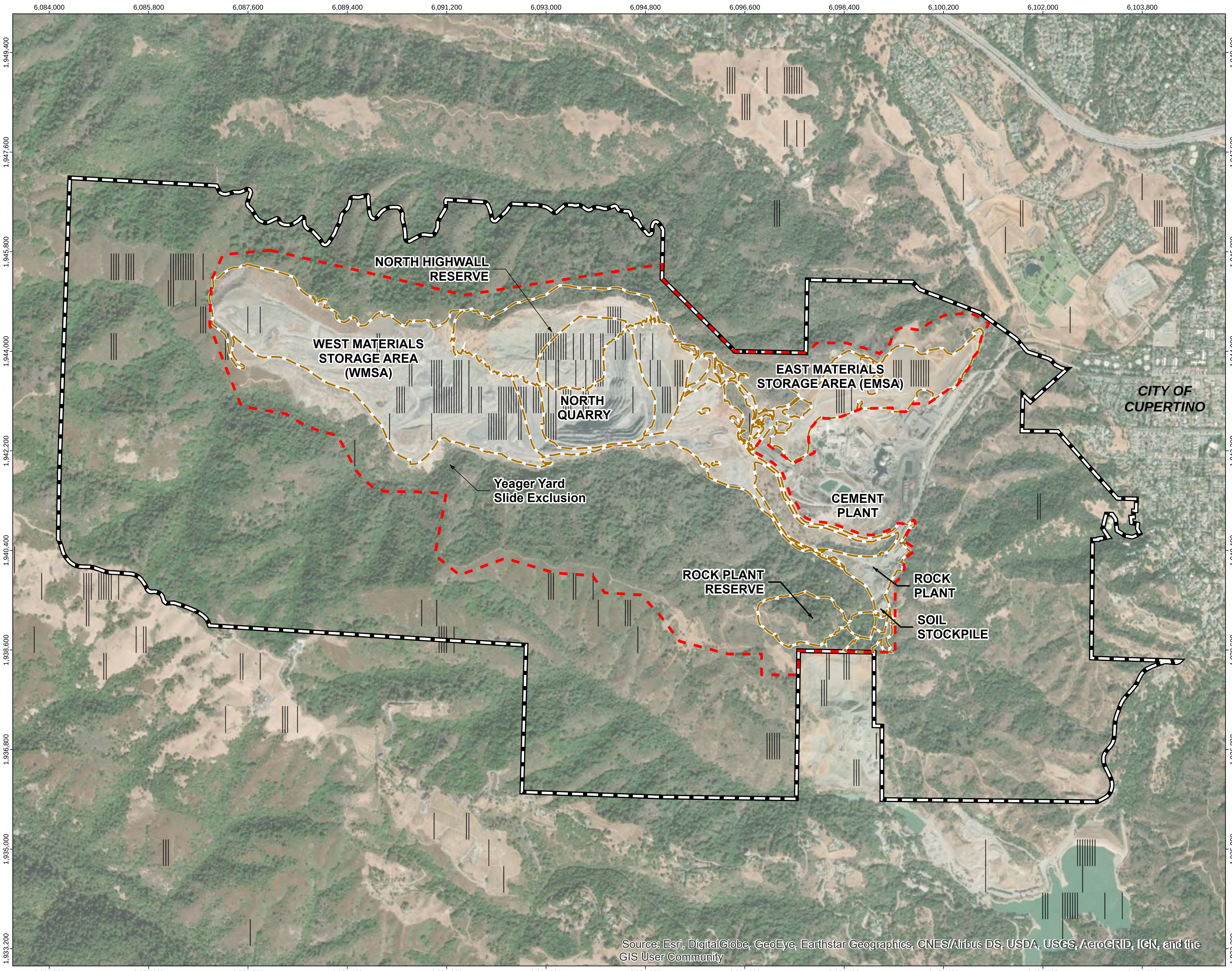
Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
1.1

Title
Regional Location Map

Notes
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

U:\233001289\gis_MXDs\Lehigh_Permanente_Regional_Location_11x17_Landsc_20181220.mxd Revised: 2018-12-20 By: cbolen



Stantec

Project Areas
RPA Boundary
Property Boundary

N

0 1,800 3,600 Feet

1:21,600 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Basemap Image: DigitalGlobe (8/28/2017)

Project Location	Review
T07S, R02W Santa Clara County, CA	Prepared by CBB on 2018-12-18 Technical Review by PK on 2018-12-19 Finalized on 2019-04-05

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

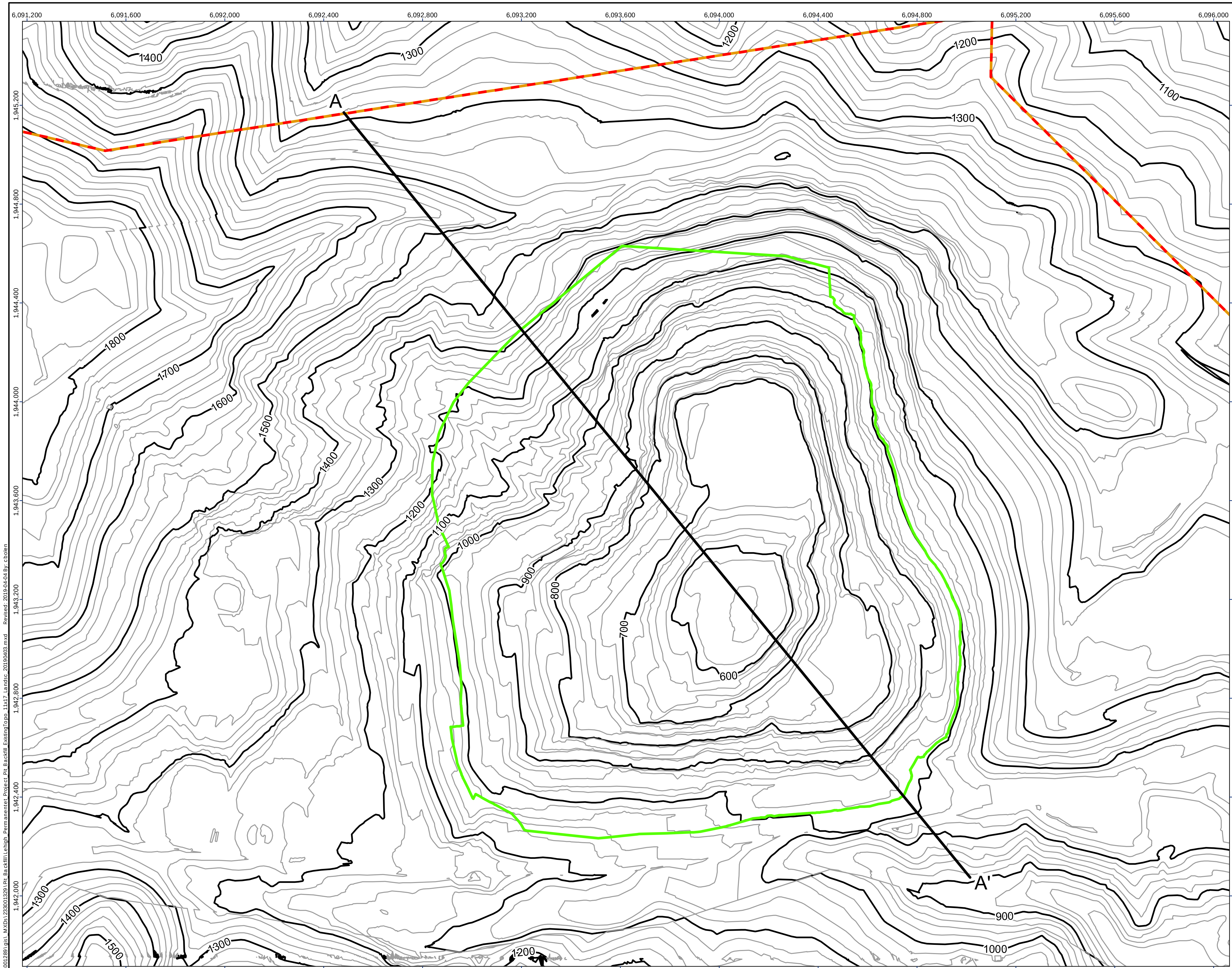
Figure No.

1.2

Title

Project Overview

\\us0349-ppfss01\Shared projects\233001289\gis\ MXDs\233001289\Lehigh Permanente Project Overview 11x17 Landsc 20190405.mxd Revised: 2019-04-09 By: pkos



Stantec

Pit Backfill Boundary

Cross-Section

100 ft Index Contour

20 ft Contour

2012 RPA Boundary

Proposed RPA Boundary

N

0 400 800 Feet

1:4,800 (At original document size of 11x17)

Note

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

Project Location	Review
T07S, R02W	Prepared by CBB on 2018-12-18
Santa Clara County, CA	Technical Review by PK on 2018-12-19
	Finalized on 2019-04-05

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

Figure No.

2.1

Title

North Quarry Backfill
Existing Topography

U:\233001289\gis\ MXDs\233001329\Pit Backfill\Lehigh Permanentet Project Pit Backfill ExistingTopo 11x17 Landsc 20190403.mxd Revised: 2019-04-04 By: cbolen

Stantec

Pit Backfill Boundary

Cross-Section

100 ft Index Contour

20 ft Contour

2012 RPA Boundary

Proposed RPA Boundary

N

0 400 800 Feet

1:4,800 (At original document size of 11x17)

Note

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

Project Location	Review
T07S, R02W Santa Clara County, CA	Prepared by CBB on 2018-12-18 Technical Review by PK on 2018-12-19 Finalized on 2019-04-05

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

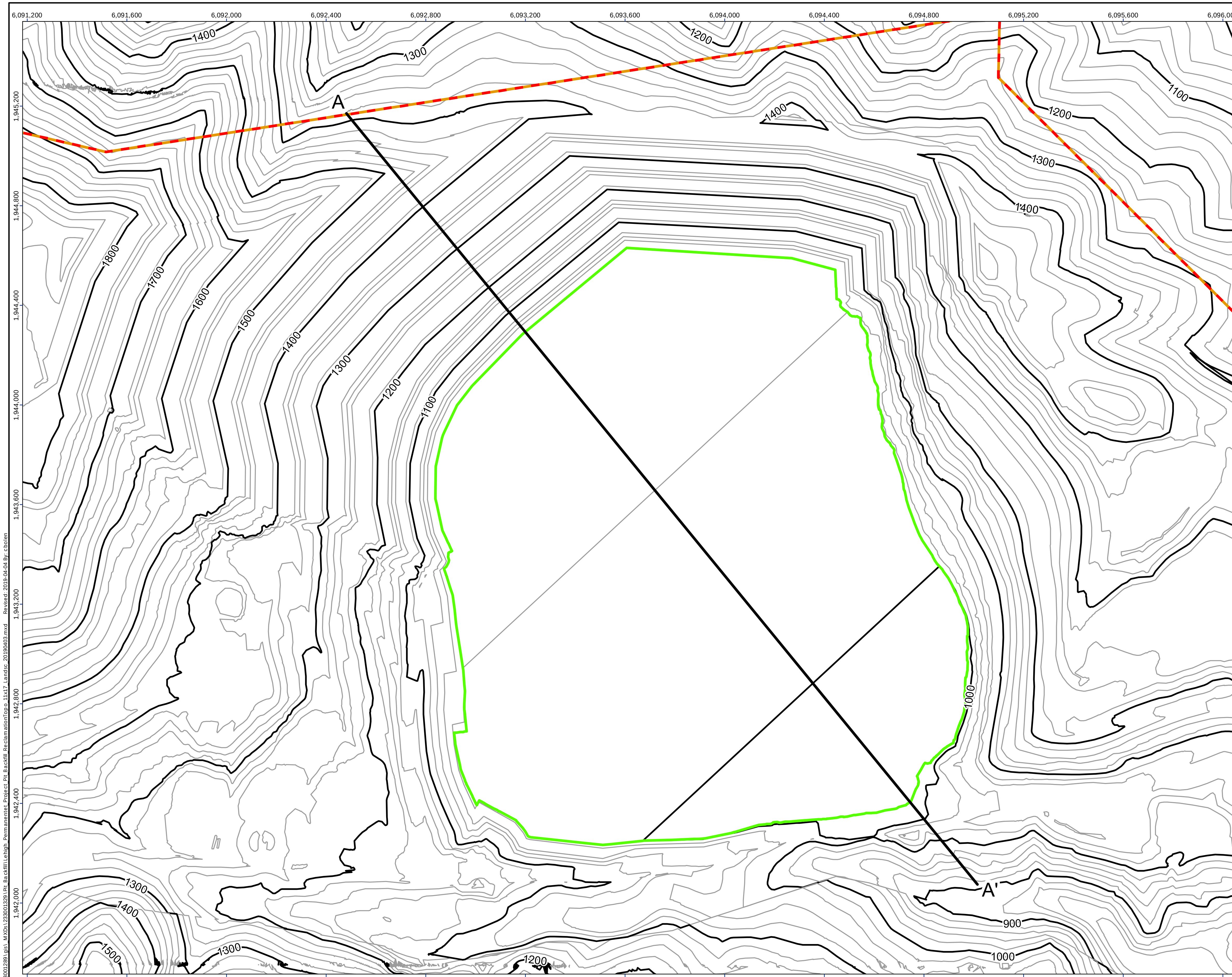
Figure No.

2.2

Title

North Quarry Backfill
Extent of Mining Topography

U:\233001289\gis_MXDs\233001329\Pit_Backfill\Lehigh_Permanentet_Project_Pit_Backfill_MiningTopo_11x17_Landsc_20190403.mxd Revised: 2019-04-04 By: cbolen



Stantec

Pit Backfill Boundary

Cross-Section

100 ft Index Contour

20 ft Contour

2012 RPA Boundary

Proposed RPA Boundary

N

0 400 800 Feet

1:4,800 (At original document size of 11x17)

Note

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

Project Location

T07S, R02W
Santa Clara County, CA

Review

Prepared by CBB on 2018-12-18
Technical Review by PK on 2018-12-19
Finalized on 2019-04-05

Client/Project

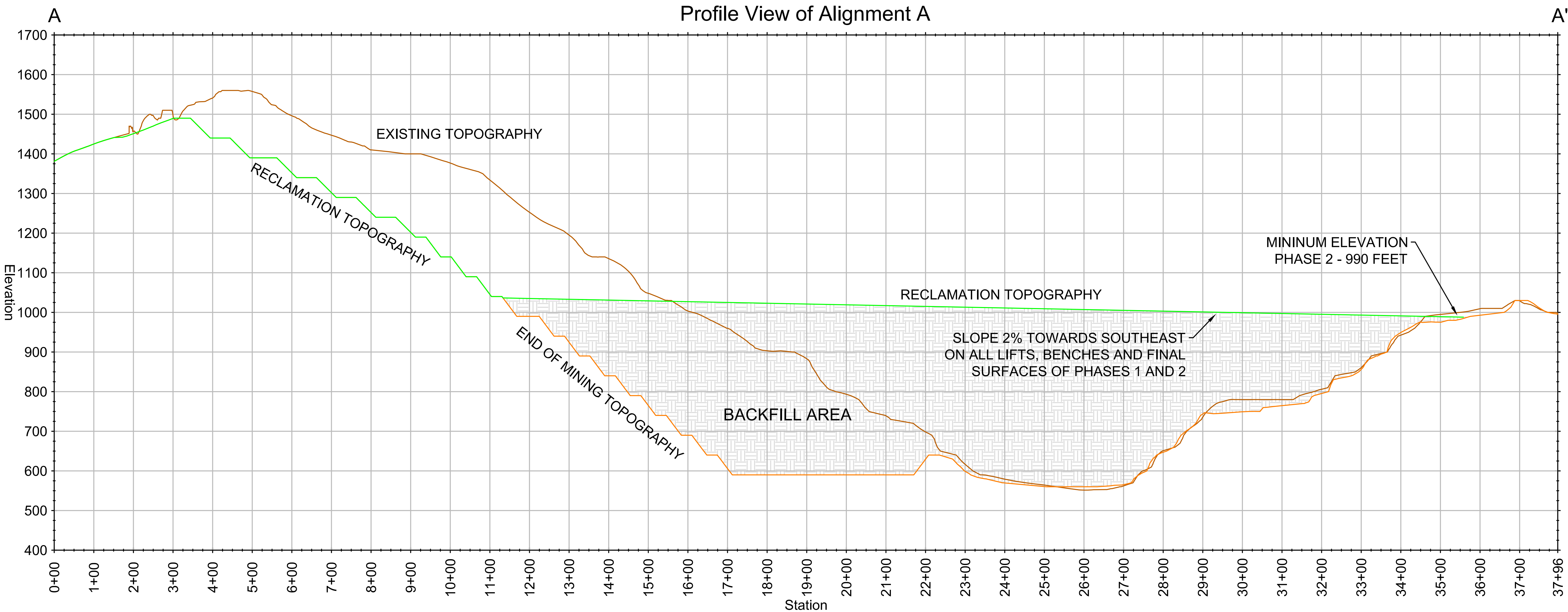
Lehigh Southwest Cement Company
Permanente Quarry

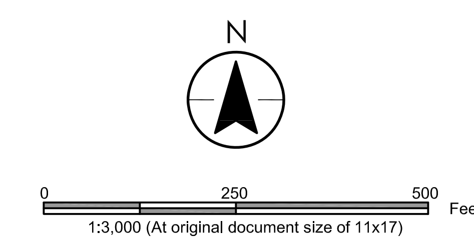
Figure No.

2.3

Title

North Quarry Backfill
Reclamation Topography





Stantec

Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
2.4

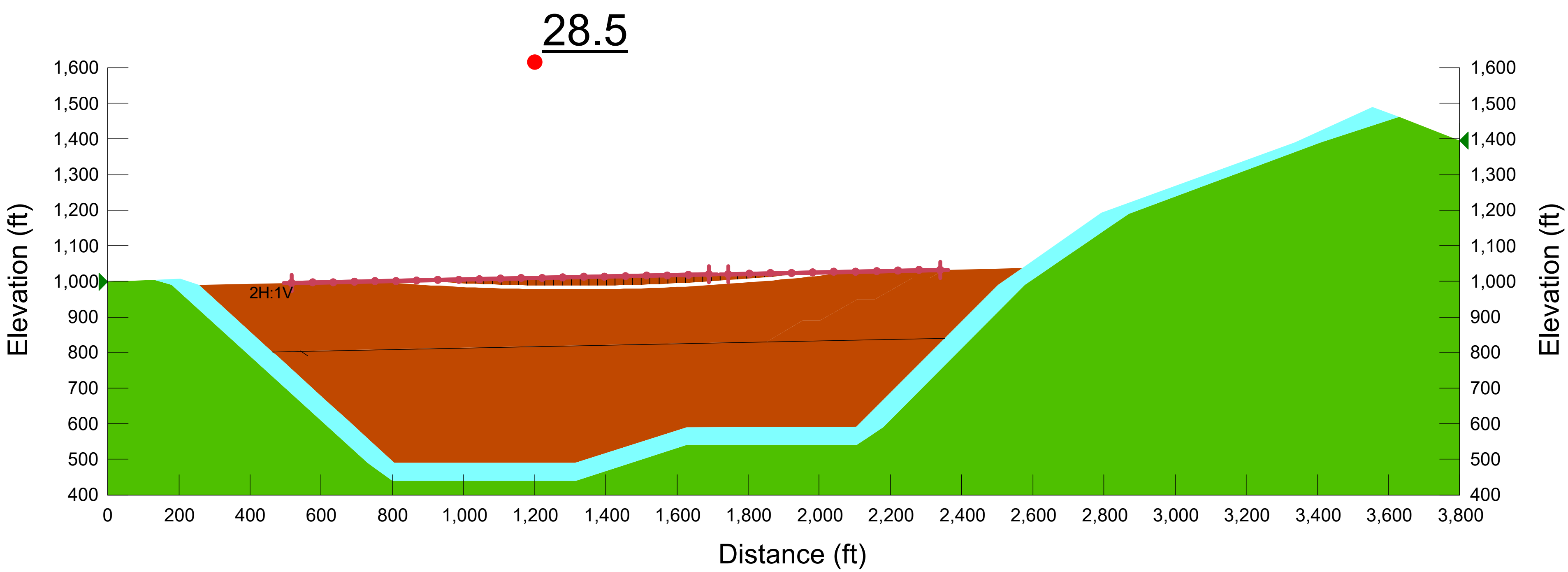
Title
North Quarry Backfill
Cross-Section

APPENDIX A

Quarry Backfill Slope Stability Analyses

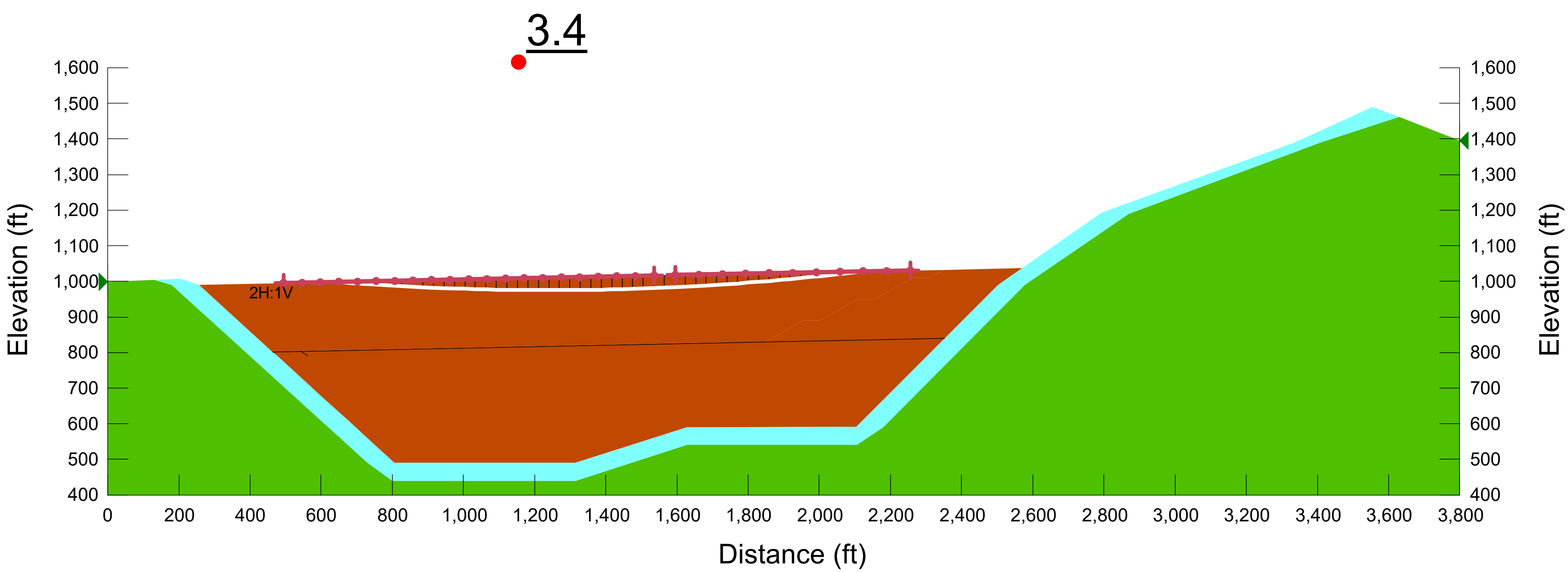
File Name: 233001329 Pit Backfill Stability Phase 2- Rev B.gsz
Name: 03. Static Soil (Final)
Method: Spencer
Factor of Safety: 28.5
Horz Seismic Coef.:

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Greenstone	Mohr-Coulomb	165	12,500	30	0
	Greenstone (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	0
	Soil	Mohr-Coulomb	127	0	30	0



File Name: 233001329 Pit Backfill Stability Phase 2- Rev B.gsz
Name: 04. Pseudostatic Soil (Final)
Method: Spencer
Factor of Safety: 3.4
Horz Seismic Coef.: 0.15

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Greenstone	Mohr-Coulomb	165	12,500	30	0
	Greenstone (Mining Influenced Zone)	Mohr-Coulomb	165	1,800	27	0
	Soil	Mohr-Coulomb	127	0	30	0



APPENDIX G-4

ROCK PLANT RESERVE

GEOTECHNICAL EVALUATION

Rock Plant Reserve Geotechnical Evaluation

Permanente Quarry

April 5, 2019

Prepared for:

Lehigh Southwest Cement
24011 Stevens Creek Blvd.
Cupertino, CA 95014-5659

Prepared by:

Stantec Consulting Services Inc.
2890 E. Cottonwood Parkway, Suite 300
Salt Lake City, UT 84121

Revision	Description	Author		Quality Check		Independent Review	
3	Client Comments	Paul Kos	4-5-19	Toni Jack	4-5-19	Greg Gold	4-5-19
2	Client Review	Paul Kos	2-1-19	Toni Jack	2-1-19	Greg Gold	2-1-19
1	Client Review	Paul Kos	12-12-18	Toni Jack	12-12-18	Greg Gold	12-12-18
0	Client Review	Paul Kos	11-30-18	Helene Wieting	11-30-18	Greg Gold	11-30-18

Sign-off Sheet

This document entitled Rock Plant Reserve Geotechnical Evaluation was prepared by Stantec Consulting Services Inc. (Stantec) for the account of Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party because of decisions made or actions taken based on this document.

Prepared by ____________________

(signature)

Paul Kos

Reviewed by ____________________

(signature)

Nelson Kawamura

Approved by ____________________

(signature)

Greg Gold

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

This Rock Plant Reserve Geotechnical Evaluation has been prepared to assist Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc., with the upcoming Reclamation Plan amendment submission, under California's Surface Mining and Reclamation Act (SMARA). This report presents the proposed mining and reclamation plan, documents previous and recent investigations of the Rock Plant Reserve area and provides results of stability analyses to support Lehigh's proposed operation in the Rock Plant Reserve.

Previous and recent investigations of the Rock Plant Reserve area include drilling programs, geologic mapping, laboratory testing, and visual inspections, and these investigations were used to develop this investigation. This recent investigation included aerial photograph interpretation and field mapping of faults, bedding, and structure for potential impacts to highwall stability. A key finding is that bedding dip slope and direction appear to have a negative impact on slope stability, and highwalls sloped in the dip direction (generally southeast) need to be sloped at less than the dip angle. The investigation also included drilling, geotechnical sampling, and geophysical logging of the boreholes to evaluate rock strengths in the proposed highwall. These data were used to design a stable highwall.

Lehigh will mine the Rock Plant Reserve to recover economic limestone resources. The mining will begin at the 1340-foot AMSL elevation, and the slope will be mined from top to bottom to the 920-foot AMSL elevation. The current practice of 50-foot high slopes between benches will be continued. The inter-bench slope gradients range from 26.5° to 35° depending on rock types, wall orientation, structure, and wall height. Quarry wall heights range from 420 feet in the northwest wall to daylight on the eastern side of the quarry. The quarry floor elevation was established to prevent a lake from being formed.

Geotechnical stability analyses were completed on four cross-sections through the Rock Plant Reserve. These cross-sections represent a variety of slope angles and combinations of lithology. The minimum acceptable factors of safety for the analyses are 1.3 for static conditions and 1.0 for pseudo-static conditions, based on mining industry standards. All configurations modeled as part of these analyses meet or exceed the minimum acceptable factor of safety. Generally, geotechnical stability is governed by the near surface geology, which will have reduced strengths due to mining activities. The geotechnical analyses require that groundwater, where present, be lowered along some of the highwalls so that it does not coincide with this surficial "mining impacted zone". Passive dewatering of the highwall is assumed as part of the ongoing operation during development. Ongoing monitoring of the highwall dewatering during development would be required to determine and/or confirm conditions.

Abbreviations

°	Degree(s)
AMSL	above mean sea level
BFA	Bench Face Angle
cm	centimeter(s)
FoS	factors of safety
ft	feet
g	Gravitational force
GSI	Geological Strength Index
Golder	Golder Associates Inc.
H	hardness
In	inches
IRA	Inter-ramp Angle
ksi	Kips per square inch
ky	Yield acceleration
Lehigh	Lehigh Southwest Cement Company
m	meter(s)
mm	millimeter(s)
psi	Pounds per square inch
pcf	Pounds per cubic foot
PGA	peak ground acceleration
RMR_{89}	Rock Mass Rating system (1989)
RPA	Reclamation Plan Amendment
RQD	rock quality designation
SMARA	Surface Mining and Reclamation Act
Stantec	Stantec Consulting Services Inc.
T	tons
UCS	unconfined compressive strength

Glossary

Cohesion	The force which holds molecules or like particles together in a rock or soil.
Factor of safety	The ratio of resisting force to driving force in a slope stability problem. A factor of safety of one represents the minimum factor of safety under which the slope is stable.
Greenstone	Common term applied to metabasalts within the Franciscan Complex, due to unweathered, dark green color (Foruria 2004).
Greenstone overburden	Material unsuitable for use as aggregate material. Typically, it is weathered greenstone, but it may include other rock types such as low-grade limestone, graywacke, and chert.
North Highwall Reserve	Limestone and aggregate resources in the north highwall of the North Quarry.
Phi' (ф')	The frictional shear resistance of soil or rock.
Pseudo-static slope stability analysis	A limit equilibrium method of analysis which represents the effects of earthquake shaking by accelerations that create inertial forces. This is the simplest way to analyze the dynamic effects of earthquake loading of a soil or slope. The output is a single factor of safety.
Rock Plant Reserve	Limestone and aggregate resources in an approximately 30.5-acre area at the southern extent of the Permanente Property.
Seismic deformation analysis	An empirical calculation which estimates the extent of lateral displacement during the design earthquake. The output is the median displacement.
Soil	Native, unconsolidated material present at the surface before mining operations began.
Static slope stability analysis	A limit equilibrium method of analysis which satisfies moment and force equilibrium to solve a slope stability problem. The output is a single factor of safety.

1.0 INTRODUCTION

1.1 PURPOSE

Lehigh Southwest Cement Company (Lehigh), a subsidiary of Lehigh Hanson, Inc., engaged Stantec Consulting Services Inc. (Stantec) to provide professional engineering and geologic services for the Permanente Quarry and specifically to investigate the limestone and aggregate resources associated with the proposed Rock Plant Reserve, an approximately 30.5-acre extraction area in the south-central portion of the Permanente Property. The mining and reclamation plans are described herein to provide guidance to Lehigh for completing and reclaiming the quarry. In addition, static and pseudo-static slope stability analyses of the reclamation surface have been completed to support these plans.

This Rock Plant Reserve Geotechnical Evaluation was prepared to assist Lehigh with the upcoming Reclamation Plan amendment submissions under California's Surface Mining and Reclamation Act (SMARA). This report presents the reclamation plan for the Rock Plant Reserve, documents the results of stability analyses, and provides specifications to guide Lehigh in reclaiming the Rock Plant Reserve.

1.2 PROJECT BACKGROUND

The Permanente Quarry (Quarry) is a limestone and aggregate mining operation, active since the late 1930's, in the unincorporated foothills of western Santa Clara County, approximately two miles west of the city of Cupertino, California. The Quarry occupies a portion of a 3,510-acre property (Permanente Property) owned by Hanson Permanente Cement, Inc. and operated by Lehigh.

The Permanente Property is situated in the rugged foothills along the eastern side of the Santa Cruz Mountains segment of the California Coast Ranges. This area of the Coast Ranges is characterized by moderately to steeply sloping hillsides ranging from approximately 500 to 2,000 feet (ft) above mean sea level (AMSL). The eastern side of the range is incised with eastern flowing drainages, including the Permanente Creek Drainage Basin, which flows through the central part of the Permanente Property and drains into the southern part of the San Francisco Bay, near Palo Alto and Mountain View, California. The regional location map is included as Figure 1.1.

Operational areas at the Quarry comprise surface mining excavations, overburden stockpiling, crushing and processing facilities, access roads, administrative offices, and equipment storage facilities. The Rock Plant Reserve area is at the southern end of the Permanente Property. Other predominantly undisturbed areas are held in reserve for future mining or to buffer operational areas from adjacent land uses. Mined limestone and greenstone will be sold directly, crushed and processed into aggregate products at Lehigh's on-site rock (aggregate) plant, or used for cement manufacture at Lehigh's adjacent cement plant. Figure 1.2 shows a plan view of the site.

Mining operations take place subject to SMARA, which mandates that surface mining operations have an approved Reclamation Plan that describes how mined lands will be prepared for alternative post-mining uses, and how residual hazards will be addressed. Golder Associates Inc. (Golder) completed geotechnical investigations and slope stability evaluations in 2011 to support an amended Reclamation Plan for the operational areas disturbed by mining activities.

The current Reclamation Plan was approved in 2012. Changes to the current approved Reclamation Plan are being considered, which necessitate an update of the Reclamation Plan for the Permanente Quarry under SMARA.

This report summarizes the recent investigations and provides specifications and guidelines to support the amended Reclamation Plan with respect to the Rock Plant Reserve and is accompanied by three other similar reports (North Highwall Reserve Geotechnical Evaluation, West Materials Storage Area Geotechnical Evaluation, and North Quarry Backfill Geotechnical Evaluation), which provide specifications and guidelines related to the proposed amendments to the Reclamation Plan for other areas in the Quarry.

1.3 SCOPE OF WORK

Lehigh commissioned Stantec to provide professional engineering and geologic services to investigate the limestone resource in the Rock Plant Reserve area at the southern end of the Permanente Quarry property and to prepare this report to support the amended Reclamation Plan. A geologic field investigation to confirm or expand the delineations of the existing model for the resource model was conducted between April 24, 2018, and May 14, 2018. Additional geologic mapping of faults was conducted in October 2018. Stantec’s scope of work included:

- Review previous geologic and geotechnical studies
- Analyze current and historical aerial photographs
- Map geological structures and lithology
- Plan and oversee drilling operations
- Log core and cuttings for geotechnical and geological properties
- Procure core and drill cutting samples for geotechnical laboratory analysis
- Evaluate historic and new data to determine rock strength parameters for stability analyses
- Revise geologic model with new drilling data and prepare cross-sections
- Design stable highwalls
- Evaluate geotechnical stability of highwalls under static and seismic conditions.

2.0 SITE INVESTIGATION

Lehigh is seeking a Reclamation Plan amendment, which will include reclaiming areas to be mined within the vested Rock Plant Reserve area of the site enabling Lehigh to expand its resource base in the area and support its nearby cement operations. This section provides a summary of the site investigation, which included a drilling program and field mapping to characterize resources, rock strength, and geologic structures in the project area. This evaluation relies on previous reports for both the Rock Plant Reserve area and other areas of the Quarry as well as site investigations completed by others (2011, 2015).

The Rock Plant Reserve area is located within the greater Permanente Property and southwest of the Rock Plant location, as shown in Figure 1.2. Figure 2.1 shows the regional geology that has been mapped for the greater project area, and Figure 2.2 shows the geology in the Rock Plant Reserve area. The study area is bounded on the south by the Stevens Creek Quarry property line.

2.1 DRILLING PROGRAM

The subsurface investigation of the Rock Plant Reserve area concentrated on better defining the extent of the limestone bodies identified in previous investigations. Five boreholes were drilled in 2018 as part of the Rock Plant Reserve characterization program. Drill holes from current and previous investigations are shown on Figure 2.2. The available relevant geologic information identified in the previous work was used as a basis for the development of this program.

Figure 2.2 shows the site plan with borehole locations from the 2018 drilling program and previous drilling programs. Table 2.1 summarizes details for previously completed boreholes, which provide geotechnical information. In general, the previous drilling programs were focused on resource delineation and allowed for identification of lithology with some indications of rock mass quality (e.g., rock quality designation (RQD) or percentage recovery), and the 2018 drilling allowed for the calculation of rock mass ratings (in particular, GT2-14). A simplified lithological classification of borehole GT2-14 is included in Appendix A.

Table 2.1 Borehole Details

Borehole ID[1]	Collar					Total Depth (ft)
	Easting (ft)[3]	Northing (ft)[3]	Elevation (ft)	Dip (°)	Azimuth (°)	
Geo 2-1A-08	-2,531	-37	779	-90	-	280
Geo 2-4A-07	-670	-2,470	897	-50	225	232
Geo 2-4AA-07	-670	-2,470	897	-90	-	433
Geo 2-6A-07	-25	-2,810	877	-90	-	350
Geo 2-6A-08	Unknown	Unknown	Unknown	-90	-	279
Geo 2-6B-07	-19	-2,809	877	-45	225	397
Geo 2-10A-08	-593	-3,223	1,215	-90	-	292
GT 2-1A-08	-491	-2,897	1,059	-60	250	349
GT 2-7-07	-818	-3,182	1,281	-90	-	477
P2-3-07	388	-3,256	855	-50	210	350
P2-7-07	-221	-2,971	1,012	-50	290	501
P2-11-07	-699	-3,386	1,255	-90	-	397
P2-11A-07	-699	-3,386	1,255	-50	90	542
P2-11B-07	-699	-3,386	1,255	-60	15	800
GEO 2-12	-282	-3,239	1,060	-90	-	250
GEO 2-13	-1,454	-3,037	1,270	-90	-	250
GEO 2-17	-1,069	-3,072	1,270	-90	-	356
GEO 2-19	-1,094	-2,938	1,232	-90	-	468
GT 2-14[2]	-851	-3,274	1,267	-90	-	265
Total Actual Footage Drilled (ft)						**7,268**

Notes:
[1]Holes from 2011 were limited to recovery and/or RQD data.
[2] Borehole GT-2-14 included information sufficient to calculate RMR values.
[3] Coordinates are local mine grid

Table 2.2 summarizes the major rock types identified from core logging and the amount present by footage as a percentage of total drill length. It is important to note that fault breccia was logged as making up approximately one third of the intersected rock types. This drilling was performed to determine the extents of the limestone resource resulting in a large percentage of the rock types being greenstone or fault breccia.

Table 2.2 Major Rock Types

Major Rock Type	Actual Footage Drilled (ft)	Actual Amount Present[1] (%)	Vertical Footage Drilled (ft)	Vertical Amount Present[2] (%)
Greenstone Overburden	558	8%	504	7%
Limestone	1,664	23%	1,505	22%
Graywacke	769	11%	731	11%
Fault Breccia	2,431	33%	2,247	33%
Metabasalt / Greenstone	1,408	19%	1401	21%
Chert	25	0%	22	0%
Unconsolidated Conglomerate	320	4%	245	4%

Notes:
1. Actual amount present calculated by normalizing actual footage drilled by total actual footage drilled.
2. Vertical amount present calculated by normalizing the equivalent vertical footage by the total equivalent vertical footage drilled.

2.2 FAULTING

The current understanding of major fault structures in the area is based on surface mapping, drill hole intercepts, aerial photography, mapping, and published reports. As noted from the previous reports for the site and available regional geological information, the Rock Plant Reserve area location is less than two miles from the San Andreas Fault and the Berrocal Fault. The Berrocal Fault has been mapped with multiple trace locations and has been mapped as running through the Permanente Property. The North Quarry area has numerous shear zones and faults running through it, which include both high and low angle faults (Foruria 2004). Similar faults are assumed to be present in the Rock Plant Reserve area. Given the potentially controlling nature of these faults on overall highwall stability, the development of a fault structure model was a critical step in evaluating the quarry. In consideration of potential structural impacts on quarry stability, conservative values for rock strength and quarry wall slopes were used for the design.

Fault and discontinuity mapping were performed by Stantec personnel in October 2018. Stantec concentrated on mapping exposed larger scale discontinuities and shear zones and collecting data on dominant discontinuities and fracture and bedding sets in the North Quarry and across the Permanente Property that comprises the Rock Plant Reserve area. Stantec acquired structural orientations along many of the discontinuities and shear zones exposed within the Quarry, with an emphasis on the larger structures that could be traced across the Quarry as these features are more likely to have an impact on the Rock Plant Reserve stability. In total, 145 discontinuity data points on joints, shears, shear-zones, and bedding were obtained while mapping the Permanente Property. In addition, Stantec accessed the Rock Plant Reserve area and the Steven's Creek Quarry Property (with permission) to investigate potential faults in this area. Fault mapping by Stantec indicated numerous moderate to high angle, north-south and northwest-southeast trending structures present throughout the both the North Quarry and Stevens Creek Quarry, and the results of the mapping are presented on Figure 2.2. The northwest oriented sets appear to be in agreement with the northwest trending faults mapped by Foruria (2004). It may be likely that the two distinct orientation groups represent a change in the overall faulting regime for the region; however, the timing of which of the orientations are more recent was not evident in the exposures.

Stantec's review of historical stereo-photographs from as early as 1960 indicated a large northwest trending fault, or wide fault zone, to the west of the proposed Rock Plant Reserve location. This fault is clearly visible in the stereo-paired historical photos, but it is difficult to identify on the ground due to vegetation and modifications to the terrain that have occurred since the photo was obtained. The fault zone trends to the northwest and appears to dip steeply to the northeast. The fault may be made up of multiple strands (en echelon), with the main strand trending northwest along the slope break of the ridge south of Permanente Creek, southeastward across the top of the ridge, and down a southeast trending drainage toward the Stevens Creek Quarry's northern and western highwall (Figure 2.2). While it is likely that this fault traverses the North Quarry to the northwest, it is difficult to identify how the numerous faults that traverse the North Quarry are connected, as the bottom of the quarry is obscured, and there appears to be two dominant trends as identified above. The interpretation is that the major fault visible on the historic aerial photos is possibly the western trace of the Berrocal Fault, with many other strands of faulting contained within the North Quarry walls. The eastern fault identified intercepts in the Rock Plant Reserve wall, and the quarry design considers the potential impacts of this structure.

Discontinuity orientations were obtained in multiple locations within the North Quarry and accessible locations in the Rock Plant Reserve area. Additional discontinuity data was also acquired from down hole geophysical logging. Dips software by Rocscience (ref, Version 7.006) was used for creating a stereonet of the surficial data collected in order to conduct a discontinuity analysis. The main discontinuity orientations delineated are shown on Figure 2.3.

Discontinuity data collected across the site suggests roughly three prominent orientations of discontinuities. Bedding is encountered within several of the limestone units exposed along the surveyed area, and generally dips moderately out of the slope with an average dip and dip direction of 33°/147° to the southeast (set 5m, Figure 2.3). Areas along the 1,200 to 1,300-foot levels along the western portion of the North Quarry exhibit more steeply dipping beds.

The collected discontinuity data indicated a prominent high angle, north-south trending series of faults exposed along the north, east, and south wall of the North Quarry (sets 1m and 2m, Figure 2.3). These discontinuities primarily dip westward with an average dip of 76° and dip direction of 270°, though some eastward dipping discontinuities are also present with an average dip of 75° and dip direction of 087°. Faults among this group typically exhibit moderately wide to wide zones of deformation, including gouge, drag folds, and mapped minor to moderate lithologic offset. These faults tend to persist over a range from tens to hundreds of feet, with the largest faults potentially traversing across the North Quarry and beyond. Other kinematic indications, such as slickensides, are sparse, but do appear on several surfaces. These largely indicate a combination of right lateral and reverse motion, but it is important to mention that the determination of recency of movement along these faults was beyond the scope of this mapping, and the presence of faults within the quarry does not imply that they are active. These discontinuities likely exist due to the extensively deformed nature of the Franciscan Formation Melange unit of the Permanente Block.

Collected data also indicated a second dominant orientation that is a high angle, northwest-southeast trending group of faults, exposed along the western, northern, and southern North Quarry highwalls (sets 3m and 4m, Figure 2.3). Discontinuities and faults along this trend are high angle and dip primarily to the southwest. Faults along this orientation persist on the order of hundreds of feet at minimum, and many likely traverse the Quarry and persist for thousands of feet to the northwest and southeast. Larger faults along this orientation exhibit wide shear zones, on the order of feet to tens of feet across, with clay gouge and brecciation along the shear zone. Few kinematic indicators were encountered along these discontinuities, shears, and deformation zones to indicate direction of offset. However, these are likely also present due to the deformation in the Permanente Block of the Franciscan Formation.

3.0 MINING AND RECLAMATION PLAN

3.1 MINING PLAN

Stantec has developed mine shell configurations based on Lehigh's geological resource models in order to delineate the potential quarry footprint and ultimate highwall heights. The existing topography for the Rock Plant Reserve area is shown on Figure 3.1. The database for the Rock Plant Reserve area shows that the rock mass properties are similar to those in other areas of the Permanente Property (Golder 2011). Based on this correlation, Stantec has provided geotechnical guidelines for the Rock Plant Reserve highwalls . The design vertical extents ranged from 1,340 feet to 920 feet elevation. Quarry wall heights range from 420 feet in the northwest wall to daylight on the eastern side of the quarry. The bench height of 50 feet is based on current operating practice and equipment sizing and assumes a multiple number of mining cuts make up the 50-foot bench height. This guidance is summarized in Table 3.1. The ultimate quarry design is shown in Figure 3.2, and cross-sections of the quarry are included in Figure 3.3.

This design focused on achieving long-term slope stability that takes into consideration the performance of the slopes in the North Quarry and the neighboring Stevens Creek Quarry. The quarry floor elevation was established to prevent a quarry lake from being formed. Benches will be mined in 25-foot intervals, with a catch bench every other bench or 50 vertical feet apart. Inter-ramp or inter-bench cut slope angles are 26.5° or 2H:1V for the south walls and 35° for the remaining walls. The slope gradients are appropriately conservative considering the presence of dipping limestone, weathered greenstone, and faults near the highwalls.

Table 3.1 Highwall Guidance

Component	Specification
Bench Height (competent rock)	50 ft
Bench Width	20-50 ft
Bench Face Angle (BFA)	1H:1V (45°)
Inter-ramp Angle (IRA)	Max. 26.5-35°
Cut slope in overburden (RMR<25)	2H:1V (26.5°)

These guidelines follow the general configuration for other highwalls within the Permanente Property. These guidelines assume adequate dewatering of the walls has been completed. Passive dewatering of the highwall is assumed as part of the ongoing operation during development. Ongoing monitoring of the highwall dewatering during development would be required to determine and/or confirm conditions. Additional development of a hydrogeological model including groundwater measurements for the Rock Plant Reserve area may be required to confirm the highwall guidelines if adverse or unexpected conditions are encountered.

3.2 RECLAMATION PLAN

Quarry highwalls will be mined to reclamation grade and limits. Topsoil and other amendments will be placed on the slopes and vegetation planted in a manner consistent with the revegetation plan component of the proposed

Reclamation Plan amendment. Stormwater will be managed according to the included plans and the quarry will be left in a condition that all water naturally drains from the quarry. The reclamation topography is shown on Figure 3.2.

4.0 GEOTECHNICAL EVALUATION

4.1 ROCK MASS CHARACTERIZATION

The rock mass has been characterized using the 1989 version of the Rock Mass Rating system (RMR_{89}). The RMR_{89} system provides an empirical methodology for estimating rock mass shear strengths for different rock units using guidelines set forth by Hoek et al. (2000) and Bieniawski (1989). Each rock unit is classified from “Very Poor Rock” to “Very Good Rock” based on a rating system with a maximum value of 100. Ratings are assigned based on the following categories:

- Uniaxial Compressive Strength (UCS) of intact rock.
- Rock Quality Designation (RQD).
- Spacing of discontinuities.
- Condition of discontinuities (persistence, aperture, roughness, infill and weathering).
- Groundwater conditions (typically set to dry or damp for boreholes where the data will be used in stability analyses that will account for groundwater conditions).

RMR_{89} ratings are then correlated to the Geological Strength Index (GSI). It should be noted that the current characterization is based on a single geotechnical borehole and additional information is recommended to confirm the rock strength calculations. Consequently, the quarry design includes conservative rock strength parameters which result in relatively shallow quarry slopes.

In general accordance with the RMR_{89}, inputs and numerical values are presented in metric system units where applicable.

4.2 UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK

Design UCS values for each rock type consider field estimates using a geological hammer, point load testing, and/or laboratory UCS test results. Typical values will be considered for rock types with limited information.

Rock hardness “H” was estimated in the field based on standardized criteria from the RMR_{89} procedures. Laboratory testing was carried out to quantitatively assess the compressive strength of core samples. Four UCS tests were carried out and verification testing is recommended to develop a more detailed database for the Rock Plant Reserve area and determine the correlation with the regional geotechnical database. Table 4.1 summarizes the field estimates and laboratory results for UCS.

Table 4.1 UCS Data Summary

Rock Type	Field Estimate		Lab UCS Testing	
	Hardness (H)	UCS Range (psi)	# of Tests	Mean UCS (psi)
Limestone	R3	>7,250	1	15,225
Fault Breccia	R1-R2	145 to 2,175	1	145
Metabasalt / Greenstone	R2-R3	580 to 7,250	2	3,770

4.3 ROCK QUALITY DESIGNATION

All recovered rock cores were evaluated for an RQD. RQD is defined as the summation of recovered core pieces of minimum length of 100 millimeters (mm) over the total length of the core run and is a good measure of the degree of jointing and discontinuity within a rock mass. A higher RQD generally indicates a higher quality, less fractured rock mass.

RQD values appear to fall into two different groupings. The breccia with clay zones and clay zones (fault gouge) have low RQD values (0 to 30) while the intact rock (limestone and metabasalt/greenstone) and breccia typically have higher RQD values based on the weighted averages (47 to 68). RQD values in excess of 80 occur in lengths of competent rock within the core so the weighted values for the more competent lithologies may be affected by disturbance due to movement along the faults that have been noted in the area of the quarry. Table 4.2 summarizes the weighted RQD values for each major rock type based on borehole GT2-14. The results from borehole GT2-14 are consistent with previous drilling conducted at the Permanente Property; therefore, the results are representative of the final highwalls.

Table 4.2 RQD Summary

Major Rock Type	Weighted RQD (%)	RQD Range (%)
Limestone	47	0 - 87
Metabasalt/Greenstone	68	0 - 100
Breccia	67	34 - 85
Breccia with clay	13	0 - 100

4.4 RMR SUMMARY AND CLASSIFICATION

Major rock types encountered are generally described as Fair Rock based on weighted average RMR_{89} values. However, similar to RQD, the weighted RMR_{89} values reflect a range including lower values likely resulting from fault related deterioration. Zones of competent intact rock have relatively high values (>61) which would place the rock in the “Good” rock quality category. RMR_{89} values for each rock type are shown in Table 4.3. These values correspond well with information from the North Quarry provided in earlier studies (Golder 2011).

Table 4.3 RMR_{89} Summary

Major Rock Type	RMR_{89} Summary	
	Weighted Average	Classification
Limestone	54	Fair Rock (40-60)
Metabasalt/Greenstone	57	Fair Rock (40-60)
Breccia	48	Fair Rock (40-60)
Breccia with Clay	45	Fair Rock (40-60)

4.5 GEOTECHNICAL STABILITY

The slope stability analyses were modeled using the software Slope-W® 2018 R2 version 9.1 by GeoStudio, released in 2018. The software used limit equilibrium on slices of potential failure surface to calculate factor of safety (FoS). The models were evaluated under static and pseudo-static conditions, with horizontal ground acceleration, for the closure configurations of the highwalls using the Spencer method. The minimum FoS for each model evaluation is included in this report. The two types of analysis have been summarized in Table 4.4. The minimum acceptable factors of safety for the analyses are 1.3 for static conditions, and 1.0 for pseudo-static conditions based on mining industry standards. For the pseudo-static model conditions, a horizontal seismic coefficient of 0.15 times the force of gravity (g) was applied to the static condition models to be consistent with previous studies (Golder 2011) and to follow recommendations for earthquakes with magnitudes up to 8-1/4 (Seed 1982). To evaluate the slope stabilities, cross-sections were analyzed for the reclamation surface. The cross-section locations are shown on Figures 3.1 and 3.2, and sections are shown on Figure 3.3.

Table 4.4 Stability Analyses

Analysis Type	Description	Minimum Acceptable Factor of Safety
Static Analysis	A limit equilibrium method of analysis which satisfies moment and force equilibrium to solve a slope stability problem. The output is a single FoS for the potential failure surface with the lowest FoS.	1.3
Pseudo-static Analysis	A limit equilibrium method of analysis which represents the effects of earthquake shaking by accelerations that create inertial forces. This is the simplest way to analyze the dynamic effects of earthquake loading of a soil or slope. The output is a single FoS for the potential failure surface with the lowest FoS.	1.0

Site-specific geotechnical information is available for each rock type on the property, and strength parameters for the material have been established in previous geotechnical analyses. These strength parameters are based on laboratory testing, back-calculation, and published values for material properties. These strength parameters are listed in Table 4.5.

Table 4.5 Geotechnical Strength Parameters

Material	Unit Weight (pcf)	Cohesion (psf)	Phi' (Degrees)
Greenstone (Mining Influenced Zone/Weathered)	165	1,800	27
Greenstone	165	12,500	30
Limestone	165	12,500	30

As previously discussed, the greenstone strengths can vary significantly depending on the degree of weathering, and Stantec focused on evaluating the greenstone strengths as part of the 2018 geotechnical investigation. The greenstone strengths were re-evaluated based on RMR classifications. The historic greenstone strength (ϕ'=27° and cohesion=1,800 pounds per square foot [psf]) is suitable for areas that have been influenced or will be influenced by mineral extraction; designated as the “Mining Influenced Zone”. A stronger strength for greenstone is expected for the area “beyond” the mining operation. A 75-foot horizontal distance from the highwall was used to define the mining influenced zone. This distance is one and one-half times the bench height following industry design guidelines (Hustrulid 2000).

The greenstone parameters from RMR classification were provided to estimate Mohr-Coulomb strength parameters. RocLab(1.0) free software from Roc Science were used to do the calculation. The calculations were based “General” application for failure envelope range. The disturbance factor D = 0 is used for the greenstone beyond the “Mining Influenced Zone”. The calculated friction angle and cohesion are listed in Table 4.6.

Table 4.6 Greenstone Strength Parameters

DH ID	RM Unit	Depth (ft)	Friction Angle (Degrees)	Cohesion (ksi)	Cohesion (psf)
GT-2-2018-14	RM-3	49.5 - 70.5	26.1	0.077	11,088
GT-2-2018-14	RM-5	78.0 - 104.0	31.9	0.269	38,736
GT-2-2018-14	RM-8	145.0 - 239.0	32.7	0.197	28,368
GT-1-2018-1	RM-1	1.0- 54.3	21.8	0.022	3,168
GT-1-2018-1	RM-4	144.0 - 410.0	34.9	0.313	45,072
GT-1-2018-1	RM-5	410 - 500	30.5	0.108	15,552
Average			**30**	**0.164**	**23,664**

The average value of calculated friction angle (30°) was selected for the greenstone. The average cohesion is 23,664 psf from the calculations; however, the cohesion is capped at 12,500psf based on the strength parameters used for limestone.

The configurations modeled as part of this analysis meet or exceed the minimum acceptable factor of safety, as defined in Table 4.4. Generally, geotechnical stability is governed by the mining influenced zone and the presence of limestone remaining in the highwall. Results from the stability analyses are shown in Table 4.7. Appendix B contains printouts of the slope stability sections.

Table 4.7 Geotechnical Stability Analyses Results

Section	Analysis	FoS
A-A’	Static	1.37
	Pseudo-static	1.06
B-B’	Static	1.43
	Pseudo-static	1.10
C-C’	Static	1.65
	Pseudo-static	1.27
D-D’	Static	1.94
	Pseudo-static	1.42

Seismic displacements were calculated using an empirical equation developed by Bray and Travasarou (Bray 2007). This method estimates the displacement of a rigid block on a slope and is consistent with previous displacement analyses. The peak ground acceleration (PGA) value of 0.6g was used for the calculations, which is also consistent with previous analyses. This PGA corresponds to an earthquake with a mean return time of 475 years (Petersen 2008). The yield acceleration (ky) was calculated using the Slope/W model by adjusting the seismic coefficient until the model provided a FoS = 1.0, and these values were used for the displacement calculation. The ky values and displacement results are listed in Table 4.8. The displacement calculations are included in Appendix C. Cross-sections with pseudo-static FoS greater than 1.15 will have minimal displacement during a seismic event (Seed 1982), and displacements for these cross-sections are assumed to be less than two inches. The actual displacements were not calculated for these sections. Literature on seismic slope displacements suggest that median displacements of less than 6 in (15 centimeters [cm]) are “minor” and displacements of greater than 3 feet (1 meter [m]) are “major” (Bray 2007). All displacements for the Rock Plant Reserve Quarry are ”minor” and unlikely to impact the reclaimed slope.

Table 4.8 Seismic Displacement Analyses Results

Section	Yield Acceleration ky (g)	Seismic Displacement (in)		
		Median	16% Exceedance	84% Exceedance
A-A’	0.185	2	4	1
B-B’	0.195	2	4	1
C-C’	na	<2	<2	<2
D-D’	na	<2	<2	<2

The geotechnical analysis assumes that groundwater does not impact the highwall slope stability, and these conditions must be confirmed, or drains must be installed wherever groundwater is present to lower the groundwater elevations beneath the mining influenced zone. The geotechnical analysis also assumes that discontinuities that may create slide planes or wedge failures are not present beyond those identified by the fault and structure mapping. The design considers the presence of these faults and adverse dipping structure, and geotechnical monitoring will continue during development to confirm conditions.

5.0 RECOMMENDATIONS

The development of site-specific highwall design criteria and the completion of stability analyses require that rock strength values be confirmed for the proposed Rock Plant Reserve. The following recommendations are provided to support future verifications of the quarry design for the Rock Plant Reserve:

- The current slope design is conservative and based on available information. Additional delineation of geologic structures, geotechnical drilling and analyses may generate data allowing for steepening or refinement of the slope design.
- Stantec recommends that Lehigh verify the absence of groundwater in the quarry slopes during development, which may include installation of additional groundwater monitoring instruments (standpipes, vibrating wire piezometers) during mining operations.
- Additional laboratory testing of representative rock lithologies during development and operation, and fault gouge zones if encountered during development and operation, should be completed as part of any future drilling programs to verify or refine the existing rock strength database. This would also allow for correlation with the existing Quarry geotechnical database.

6.0 CONCLUSION

This report provides the analysis and supporting information needed to demonstrate that Lehigh Southwest Cement Company's plan for reclamation operations at the Rock Plant Reserve Quarry meets SMARA and associated design and performance requirements. The Rock Plant Reserve Quarry will be excavated so that stable slopes remain, and positive drainage will remain for operational and reclamation periods. The geotechnical assessment provided in this report demonstrates that the proposed Reclamation Plan meets or exceeds the SMARA requirements for factors of safety under static and seismic conditions, and that these stable conditions are met during both the operational and reclamation periods.

This report has been prepared for Lehigh Southwest Cement Company to provide them with geotechnical guidance in support of the development and reclamation of the Rock Plant Reserve. As mutual protection to Lehigh, the public, and Stantec, this report and its figures are submitted for exclusive use by Lehigh Cement Company. Our report and recommendations should not be reproduced in whole or in part without our express written permission, other than as required in relation to agency review and submittals. The drawings included with the report are for regulatory review and are not intended as detailed construction drawings. All information and design results contained herein have been prepared by the authors who have signed below and attached drawings have been certified by Nelson Kawamura, California, PE. A draft of this report was reviewed by personnel from Lehigh Southwest Cement Company.

Stantec Consulting Ltd.

Paul Kos P.E.

Senior Geological Engineer
Phone: 720-889-6122
paul.kos@stantec.com

Nelson Kawamura G.E.

Principal, Civil Engineer, Waterpower & Dams
Phone: 503-220-5424
nelson.kawamura@stantec.com

REGISTERED PROFESSIONAL ENGINEER
NELSON KAWAMURA
GE 2868
EXP. 9/30/2019
GEOTECHNICAL
STATE OF CALIFORNIA

April 5, 2019

7.0 REFERENCES

Bieniawski, Z.T. 1989. *Engineering Rock Mass Classifications*. New York: Wiley. 1989.

Bray, J. D., and Travasarou, T., 2007. *Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements*, Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Foruria, J. September 2004. *Geology of the Permanente Limestone & Aggregate Quarry*, Santa Clara County, California, 2004.

Golder Associates, November 2011. *Geotechnical Evaluations and Design Recommendations*. (REVISED). *Permanente Quarry Reclamation Plan Update*, Santa Clara County, California. 2011.

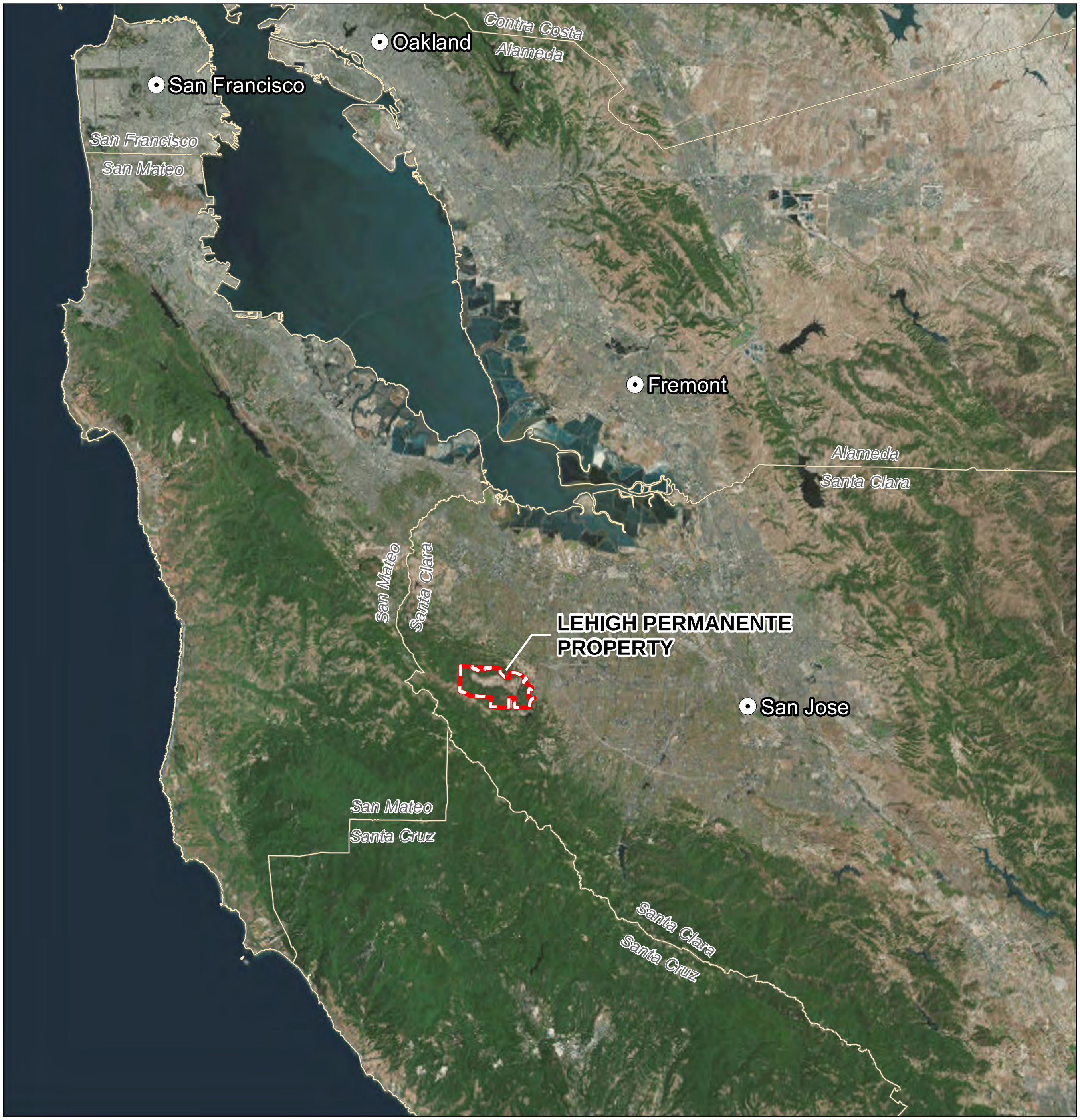
Hoek et al, November 2000. *Rock Slopes in Civil and Mining Engineering*. Proceedings of the International Conference on Geotechnical and Geological Engineering, GeoEng2000. Melbourne. 2000.

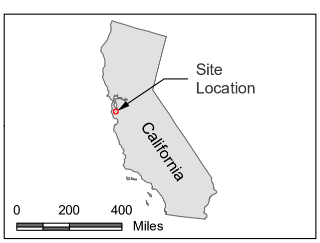
Hustrulid, William A., McCarter, Michael K., Van Zyl, Dirk J.A. 2000. Slope Stability in Surface Mining. Society for Mining, Metallurgy, and Exploration, Inc. (SME), Littleton, Colorado. 2000.

Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth S., 2008. Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008–1128, 61 p.

Seed, H. B., 1979. *Considerations in the Earthquake-Resistant Design of Earth and Rockfill Dams*, Geotechnique, vol. 29, No. 3, pp. 215-263.

FIGURES





City

Lehigh Permanente Property

County

0 4 8 Miles

(At original document size of 8.5x11)
1:500,000

N

Stantec

Project Location
T07N, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-12-20
Technical Review by PK on 2018-12-20
Finalized on 2019-04-05

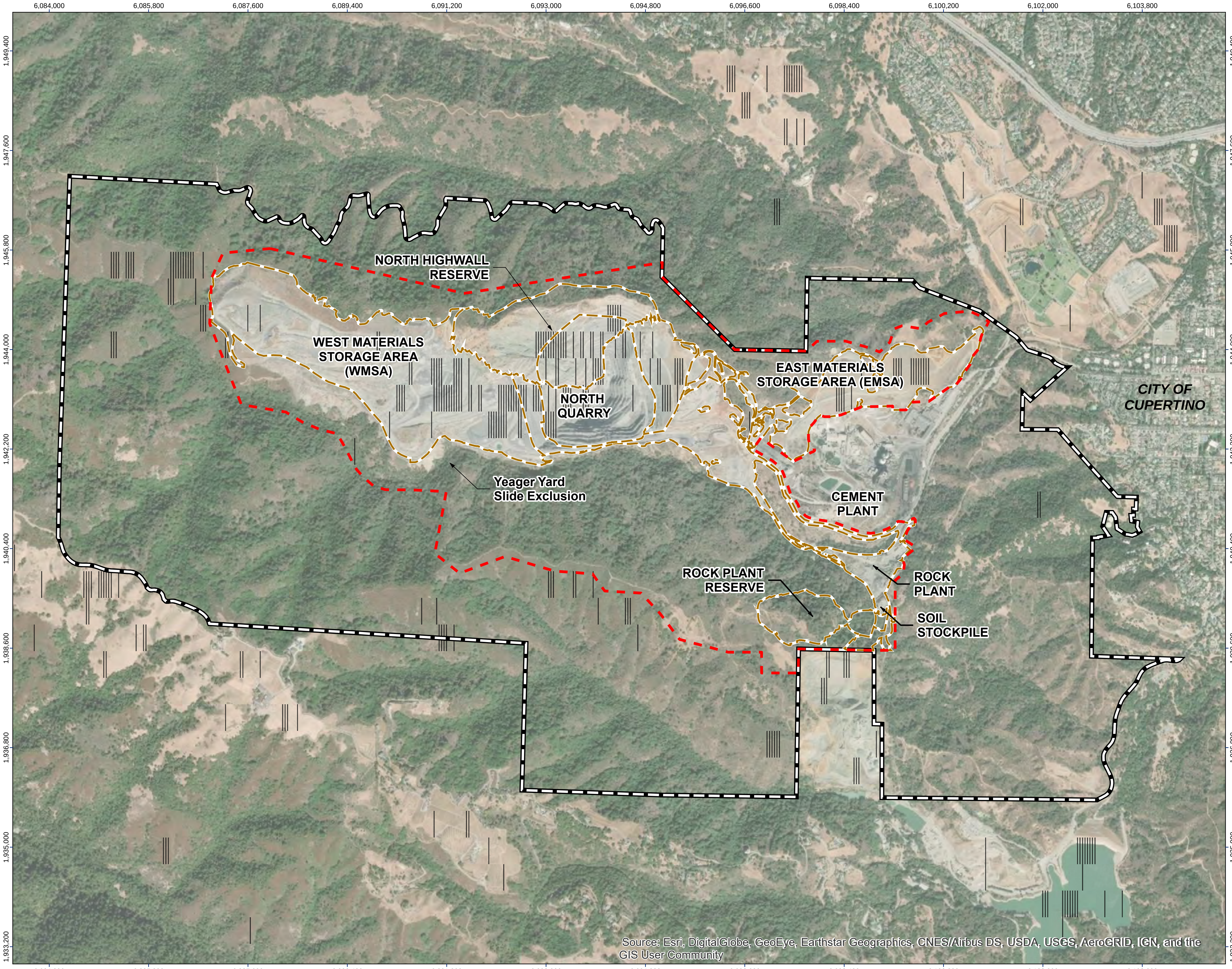
Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
1.1

Title
Regional Location Map

Notes
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

U:\233001289\gis_MXDs\Lehigh_Permanente_Regional_Location_11x17_Landsc_20181220.mxd Revised: 2018-12-20 By: cbolen



Stantec

Project Areas
RPA Boundary
Property Boundary

N

0 1,800 3,600 Feet

1:21,600 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Basemap Image: DigitalGlobe (8/28/2017)

Project Location	Review
T07S, R02W Santa Clara County, CA	Prepared by CBB on 2018-12-18 Technical Review by PK on 2018-12-19 Finalized on 2019-04-05

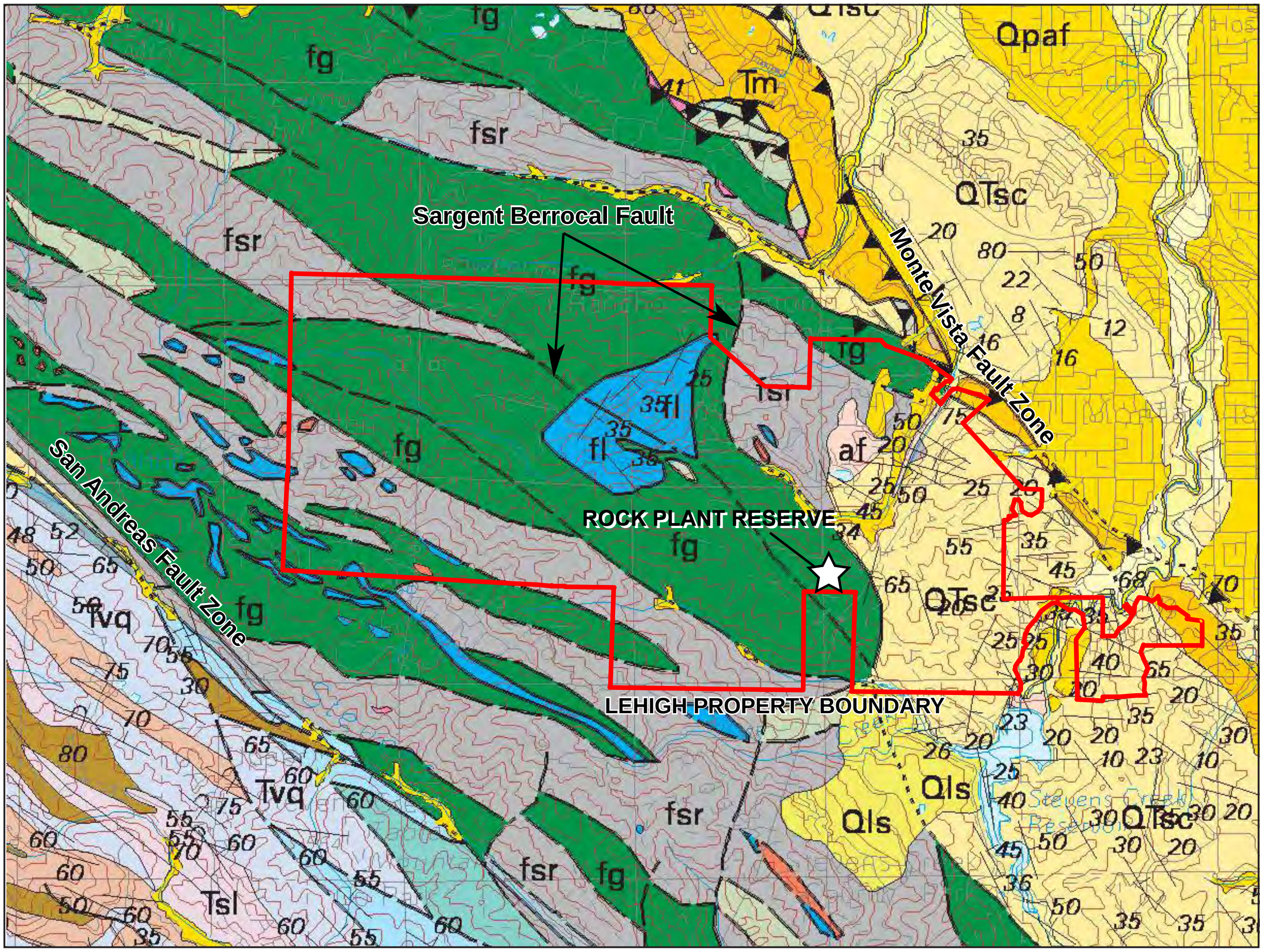
Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
1.2

Title

Project Overview



Explanation

Map symbols

Contact - dashed where approximately located; dotted where covered by alluvium

Fault - Dashed where approximately located; short dashed where inferred; dotted where concealed by alluvium.

Reverse or Thrust Fault - Dashed where approximately located, dotted where concealed by alluvium. Sawteeth on hanging wall

60 Strike and dip of bedding

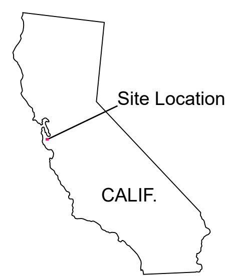
80 Strike and dip of overturned bedding

Map units

af	artifical fill
Qls	landslide deposits
Qpaf	alluvial fan and fluvial deposits
QTsc	Santa Clara Fm (conglomerate, sandstone, mudstone)
Tm	Monterey Fm (shale)
Tvq	Tvq - Vaqueros Sandstone (sandstone/mudstone/shale)
Tsl	San Lorenzo FM (shale/mudstone/siltstone)
Tbu	Butano Formation - undifferentiated (sandstone/conglomerate/shale)
Tblc	Butano Conglomerate
Tbs	Butano Sandstone
db	db - diabase and gabbro

Franciscan Assemblage Rocks

fl	fl - limestone
fs	fs - sandsone
fc	fc - chert
fg	fg - greenstone (metabasalt)
fsr	fsr - sheared rock (melange)



N

0 1 2 Miles

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Brabb, E.E., Graymer, R.W., and Jones, D.L., 2000, Geologic map and map database of the Palo Alto 30' X 60' quadrangle, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2332, U.S. Geological Survey, Menlo Park, CA.

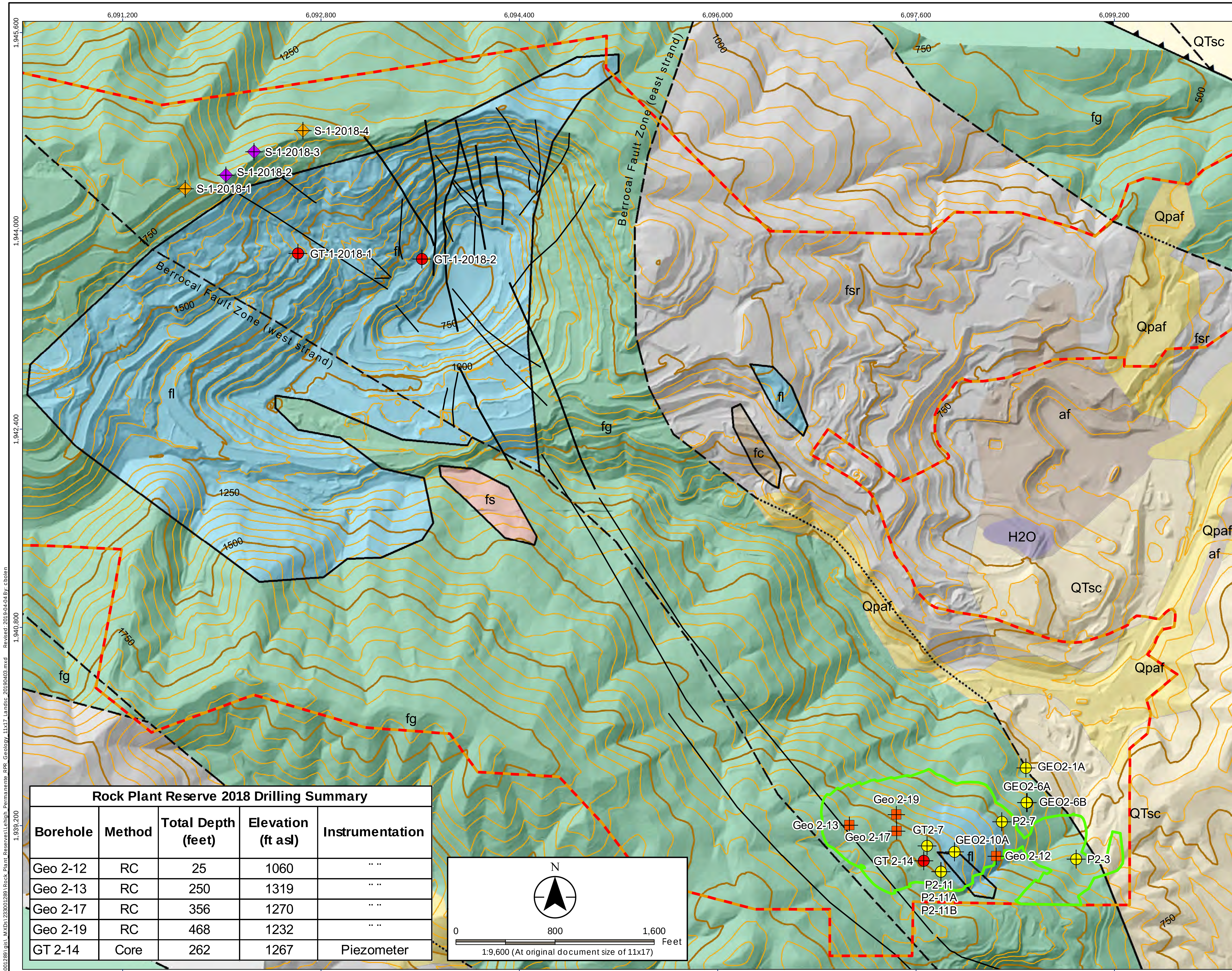
Project Location
T07S, R02W
Santa Clara County, CA

Review
Prepared by EDZ on 2018-07-05
Technical Review by JVP on 2018-07-05
Finalized on 2019-04-05

Client/Project
Lehigh Southwest Cement
Permanente Quarry Project

Figure No.
2.1

Title
Regional Geology Map



Rock Plant Reserve 2018 Drilling Summary

Borehole	Method	Total Depth (feet)	Elevation (ft asl)	Instrumentation
Geo 2-12	RC	25	1060	" "
Geo 2-13	RC	250	1319	" "
Geo 2-17	RC	356	1270	" "
Geo 2-19	RC	468	1232	" "
GT 2-14	Core	262	1267	Piezometer

Stantec

- Drill Hole (2007) - Core
- Drill Hole (2018) - Core
- Drill Hole (2018) - RC
- Drill Hole (2018) - Sonic
- Drill Hole (2018) - Sonic Vibrating Wire Piezometer
- Rock Plant Reserve Boundary
- Contour 50 ft
- Contour 250 ft
- 2012 RPA Boundary
- Proposed RPA Boundary
- Fault, moderate to large scale, dashed where certain, dotted where concealed
- Fault, small to moderate scale, dashed where uncertain, dotted where concealed
- Thrust Fault, certain
- H2O-water
- QTsc - Santa Clara Formation
- Qpaf - Alluvial fan and fluvial deposits (Pleistocene)
- af-Artificial fill
- fc-Franciscan complex, chert
- fg - Franciscan complex, greenstone
- fl - Franciscan complex, limestone
- fs-Franciscan complex, sandstone
- fsr - Franciscan complex, sheared rock (melange)

Notes
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Brabb, E.E., Graymer, R.W., and Jones, D.L., 2000, Geologic map and map database of the Palo Alto 30' X 60' quadrangle, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2332, U.S. Geological Survey, Menlo Park, CA.

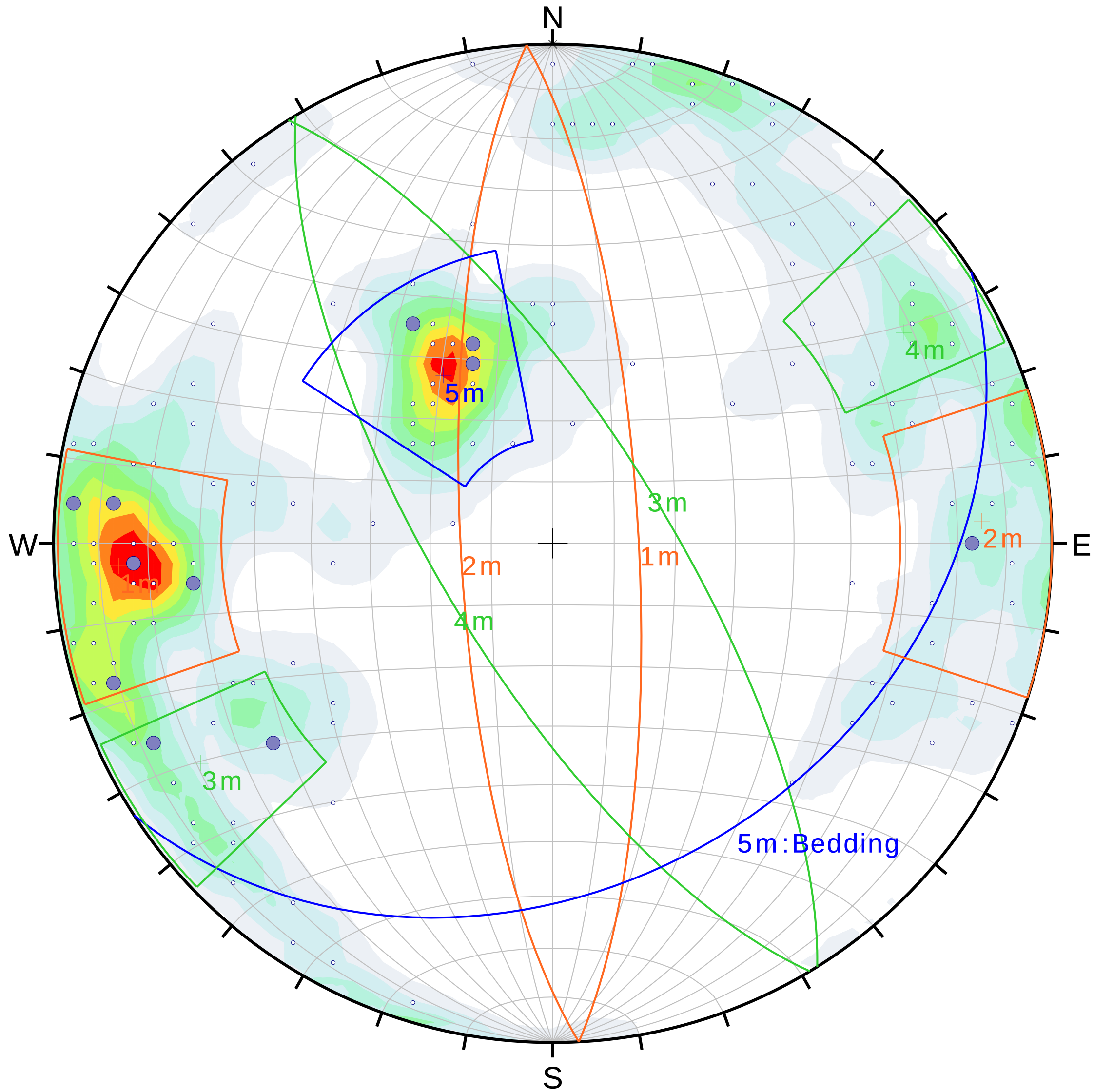
Project Location
T07S, R02W
Santa Clara County, CA

Review
Prepared by CBB on 2018-11-20
Technical Review by JVP on 2018-11-20
Finalized on 2019-04-05

Client/Project
Lehigh Southwest Cement
Permanente Quarry Project

Figure No.
2.2

Title
Rock Plant Reserve
Geology Map



Symbol	Scatter
∘	1 Pole Vectors
●	2 Pole Vectors

Color	Density Concentrations
	0.00 - 0.70
	0.70 - 1.40
	1.40 - 2.10
	2.10 - 2.80
	2.80 - 3.50
	3.50 - 4.20
	4.20 - 4.90
	4.90 - 5.60
	5.60 - 6.30
	6.30 - 7.00

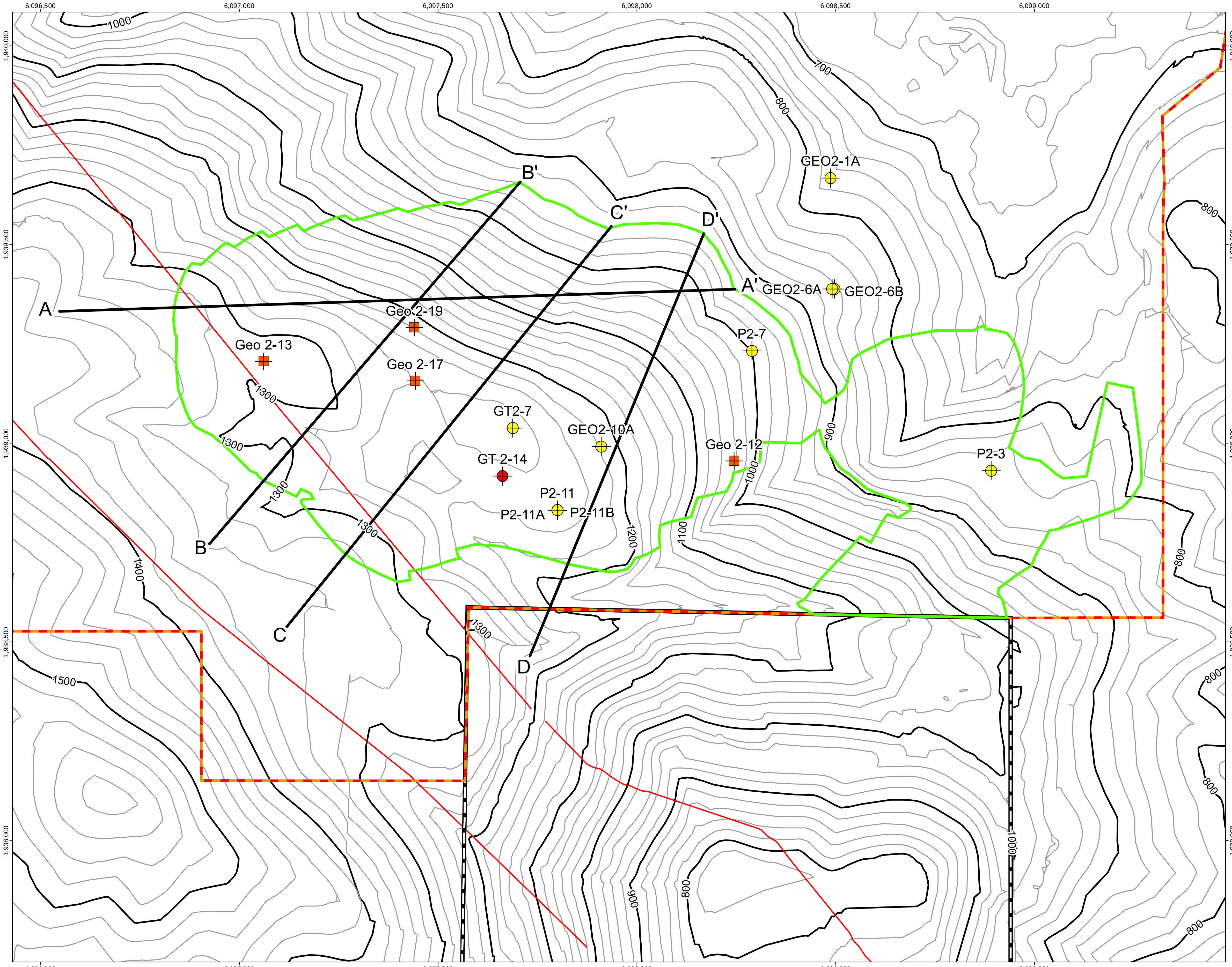
Contour Data	Pole Vectors
Maximum Density	6.90%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		76	87	N-S Fault/joint
2m		75	267	N-S Fault/joint
3m		72	58	NW-SE Joint/faul
4m		71	239	NW-SE Joint/faul
5m		33	147	Bedding

Plot Mode	Pole Vectors
Vector Count	145 (145 Entries)
Hemisphere	Lower
Projection	Equal Area

Project	Figure 2.3 Rock Plant Reserve Fault and Discontinuity Mapping
Analysis Description	
Drawn By	J. Van Pelt
Company	Stantec
Date	04/05/2019, 9:29:21 AM
File Name	Fault and discontinuities mapping.dips7

DIPS 7.006



Stantec

- Drill Hole (2007) - Core
- Drill Hole (2018) - Core
- Drill Hole (2018) - RC
- Rock Plant Reserve Boundary
- Cross-Section
- Fault
- 100 ft Index Contour
- 20 ft Contour
- 2012 RPA Boundary
- Proposed RPA Boundary
- Property Boundary

N

0 250 500 Feet

1:3,000 (At original document size of 11x17)

Note
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

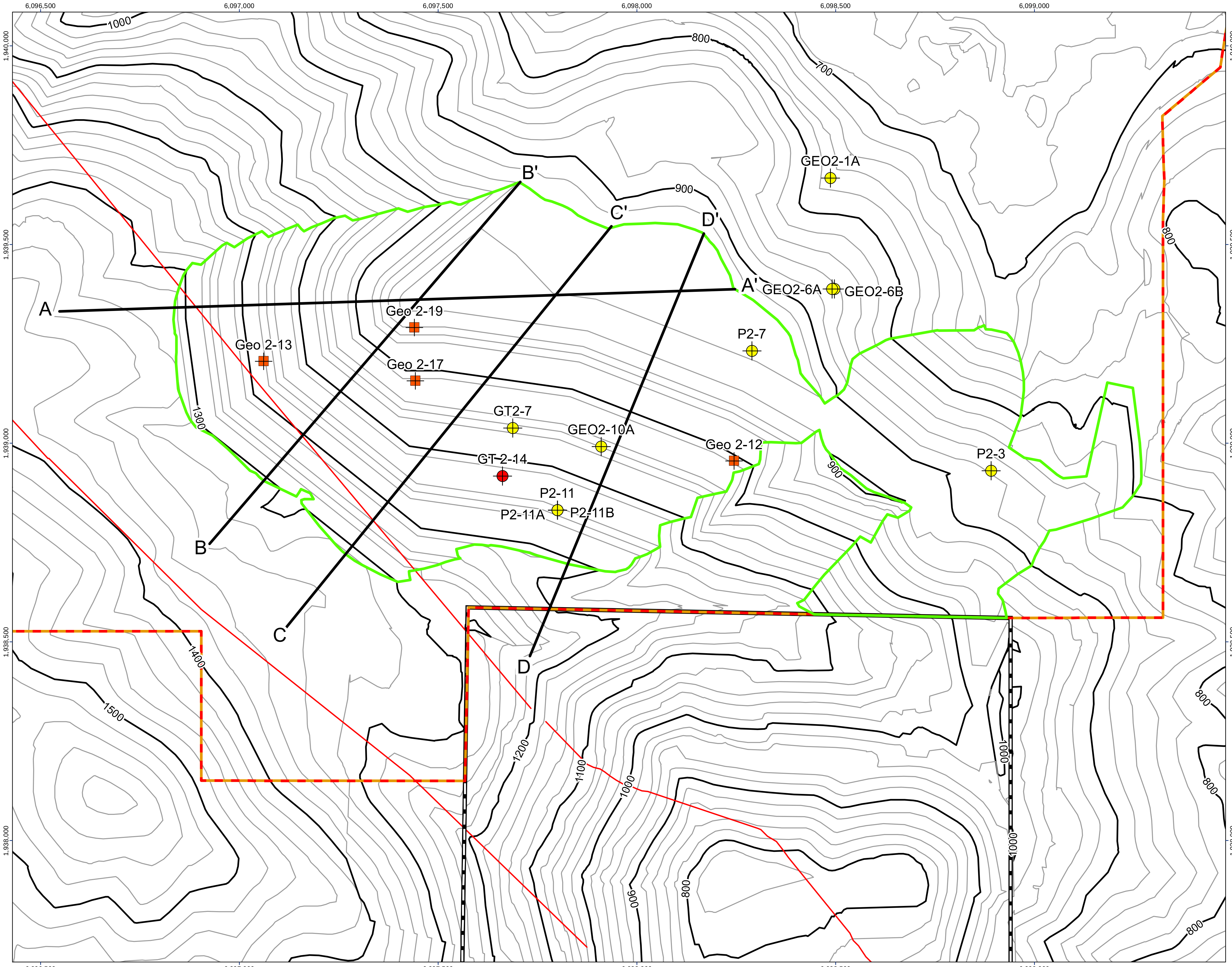
Project Location	Review
T07S, R02W Santa Clara County, CA	Prepared by CBB on 2018-12-18 Technical Review by PK on 2018-12-19 Finalized on 2019-04-05

Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
3.1

Title
Rock Plant Reserve
Existing Topography

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.



Stantec

Drill Hole (2007) - Core
Drill Hole (2018) - Core
Drill Hole (2018) - RC
Rock Plant Reserve Boundary
Cross-Section
Fault
100 ft Index Contour
20 ft Contour
2012 RPA Boundary
Proposed RPA Boundary
Property Boundary

N

0 250 500 Feet
1:3,000 (At original document size of 11x17)

Note
1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

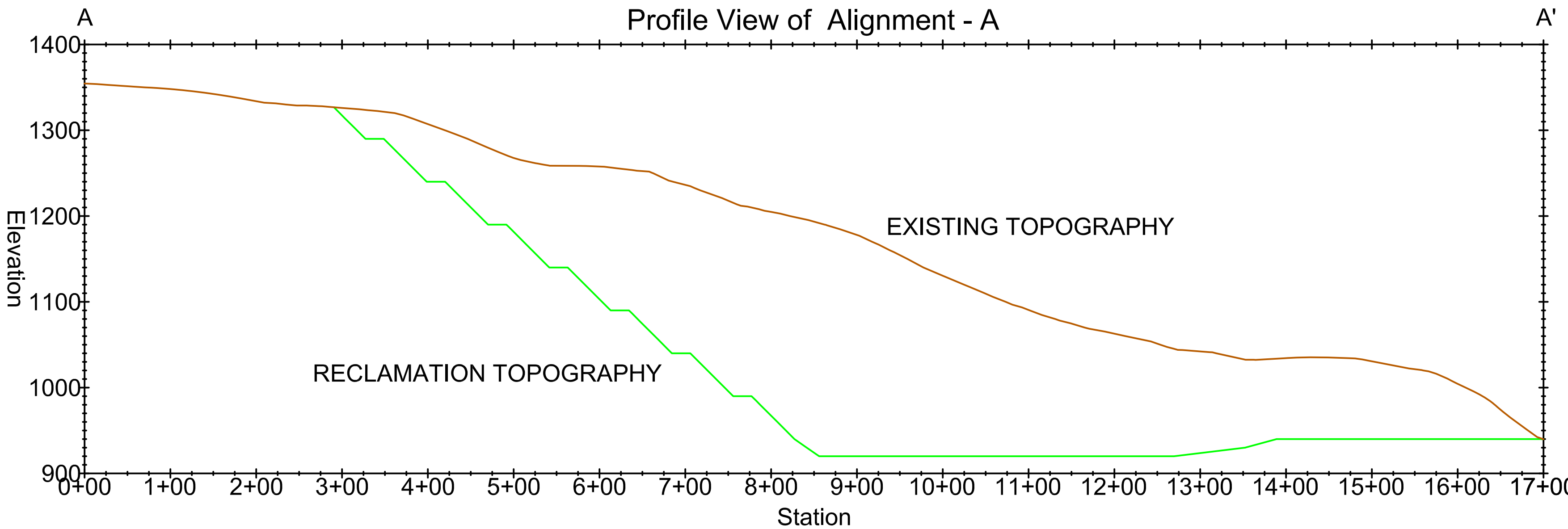
Project Location
T07S, R02W
Santa Clara County, CA

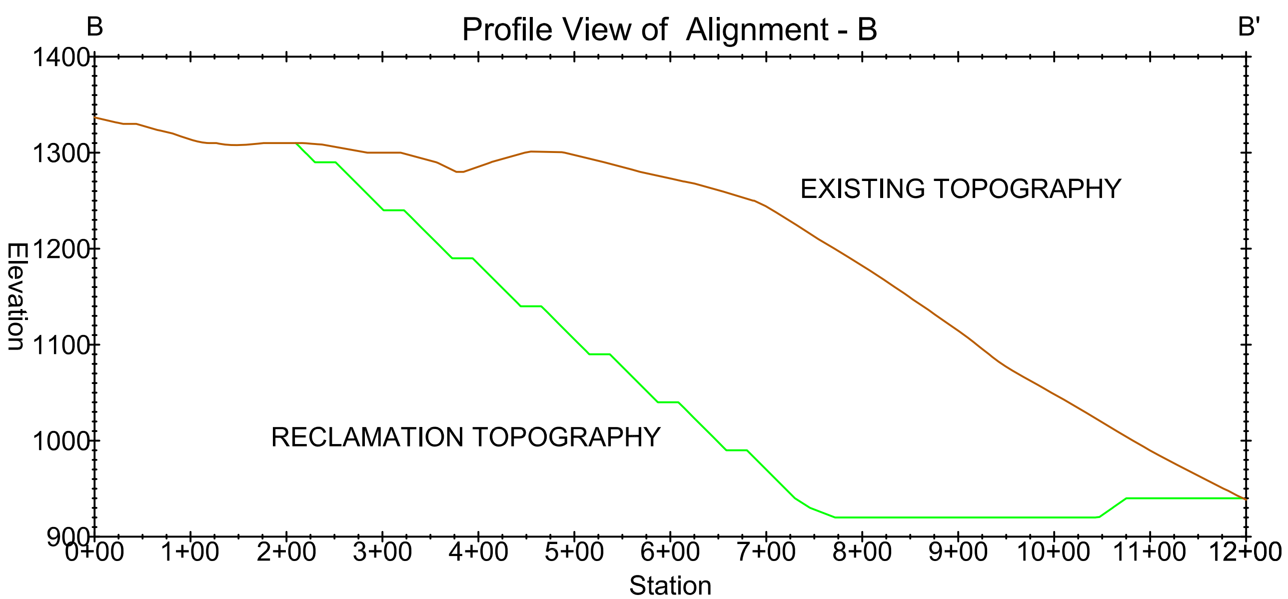
Review
Prepared by CBB on 2018-12-18
Technical Review by PK on 2018-12-19
Finalized on 2019-04-05

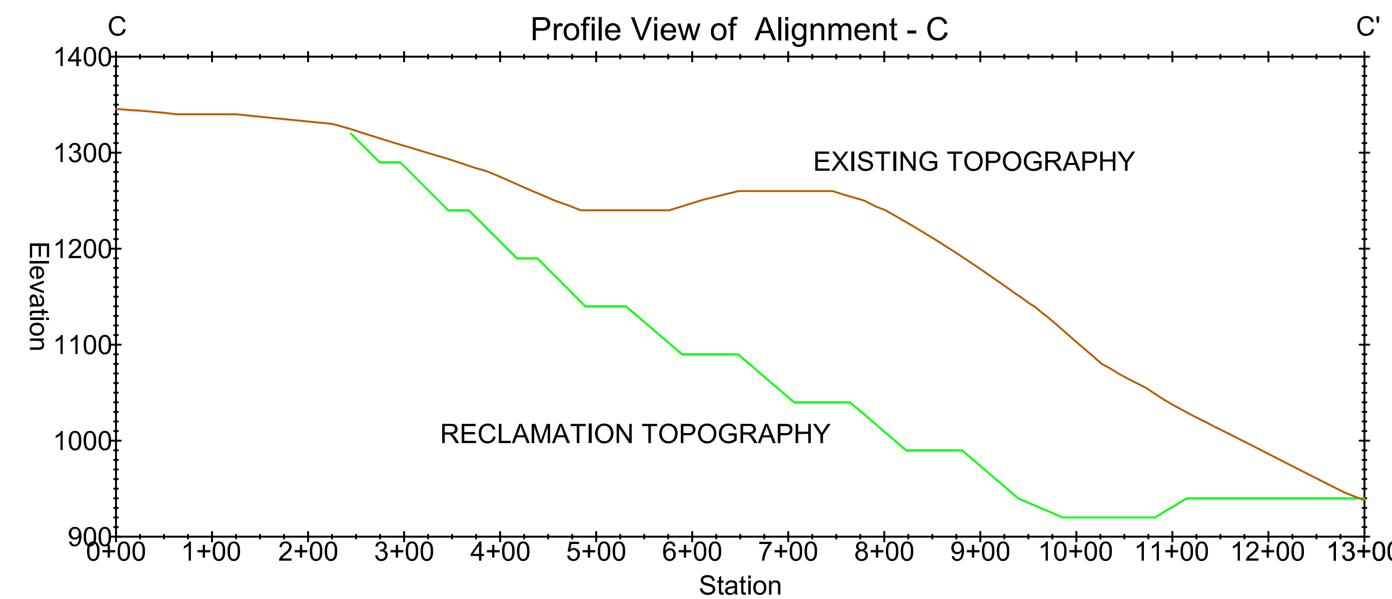
Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

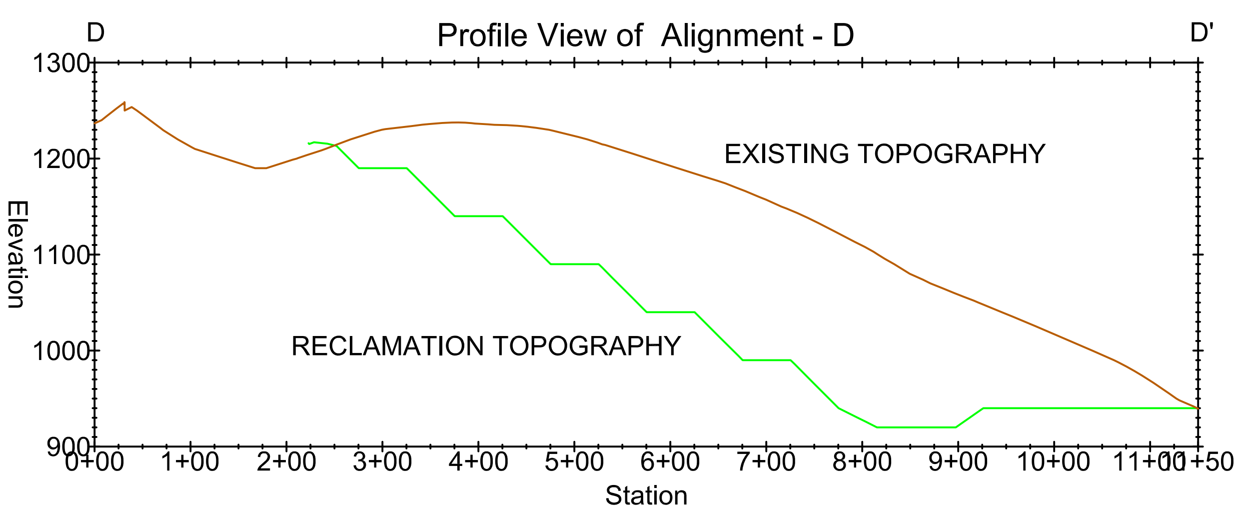
Figure No.
3.2

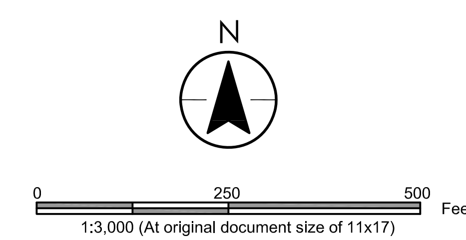
Title
Rock Plant Reserve
Reclamation Topography











Stantec

Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Figure No.
3.3

Title
Rock Plant Reserve
Cross-Sections

APPENDIX A

Drilling Program Data

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14** **Sheet No. 1 of 27**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery % (20 40 60 80)	RQD % (20 40 60 80)	Fractures per ft.	Discontinuity Data: Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							Poorly-graded SAND with silt and trace gravel (SP-SM), orangish red with gray gravel, dense to very dense, dry												augered to 15.2'
1266																			
	2																		
1264																			
	4																		
1262																			SPT-01 - 5.0-6.5 0.8'/1.5' 15/24/26 N=50
	6																		
1260																			
	8																		
1258																			

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14** **Sheet No. 2 of 27**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							Well-graded SAND with clay and trace gravel (SW-SC), brown, dense, dry												SPT-02 - 10.0-11.5' 1.0'/1.5' 10/15/24 N=39
1256																			
	12																		
1254																			
	14																		
1252																			SPT-03 15-15.4 50/4"
							LIMESTONE, light gray to dark gray, very fine grained, completely weathered to residual, extremely weak, subangular clasts ranging from 1/2" to 1 1/4" in diameter, some iron staining visible on surfaces, highly broken. Limestone weathers to well-graded SAND with clay and trace gravel (SW-SC), brown, dense, dry.			>10									15.3 - convert to HQ3 drilling Casing to 15.0' End drilling 5/15/2018 Begin drilling 5/16/2018
	16																		
										>10									
1250																			
			1					21	0	>10									
	18																		
										>10									
1248																			
				W2-W3	R2		19.4': boulder 0.6' in diameter			>10									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 3 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Comments
			2	W2-W3	R0	LIMESTONE, continued. Limestone weathers to poorly-graded coarse GRAVEL (GP), fines washed out, loose, predominantly coarse gravels	35	0	>10, >10	losing water drive casing to 20 ft.
1246										
	22	20	3	W2-W3	R0		73	0	>10, >10	
1244						GREENSTONE, dark grayish green, fine-grained, completely weathered to residual, extremely weak, very soft. Greenstone weathers to clayey SAND with gravel (SC), medium to coarse, angular to subangular, sands in low plasticity clay matrix				
	24	9	4				0	0	>10	
1242		19	5	W2-W3	R0		50	0	>10	Change bit to lower strength bit
			6	W2-W3	R0		30	0	>10	Drive casing to 25 ft.
1240	26				R0				>10	
	28	26	7	W2-W3		BRECCIA, sheared GREENSTONE and CLAY: clay gouge matrix with coarse sand to fine gravel sized greenstone/metabasalt clasts, low plasticity clay is soft when wet, stiff when dry, extremely weak, shearing at 25º to core axis.	83	18	>10	
1238					R2-R3	METABASALT/GREENSTONE, dark grayish green, fine to medium grained, slightly to moderately weathered, weak to moderately strong, hard, chloritic alteration throughout			>10	
						BRECCIA, sheared METABASALT/GREENSTONE and CLAY: clay gouge matrix with coarse sand to fine gravel sized greenstone/metabasalt clasts, low plasticity clay is soft when wet, stiff when dry, extremely weak, shearing at 25º to core axis.			>10	

Discontinuity Data

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	90	C	O	Fe, Ca	Pa - Fi	Pl	Sr
		Sz	O	Cl, Fe, Ca, Sd	Fi	Pl	Sr
	55	J	Vn	Cl, Fe, Ca, Sd	Fe	Pl	Sr
	55	Sz	Vn	Cl, Fe, Ca, Sd	Fi	Pl	Sr
	30	J	Vn	Fe, Ca, Sn	Sp	Pl	R
	70	J	Vn	Sa, Fe, Ca	Sp	Pl	Sr-R
	40	J	Vn	Fe, Ca	Sp,	Pl	Sr
	0-10	J	Vn	Fe, Ca	Pa	Wa-Ir	R
	45	J	Vn	Fe, Ca	Sp	Pl	Sr-R
	30	J	Vn	Fe, Ca	Sp	Wa-Pl	R
	40	J	Vn	Fe, Ca	Pa	Pl	R
		BZ		Fe, Ca, Sa	Pa Su		R-Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 4 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							BRECCIA, sheared METABASALT/GREENSTONE and CLAY, continued						BZ		Fe, Ca, Cl	Sp		Sr	
				W3-W4	R2-R3							60	J	Vn	Cl, Fe	Fi	Ir	Vr	
										6		50	C	T	Sa				
												70	J	Vn	Fe, Ca	Su	Pl	R	
1236				W2	R4							80	J	Vn	Fe, Ca	Su	Ir	R	
							31.3-33.3': shear zone, extremely weak, sharp transition					90	J	Vn	Fe	Su	Pl	Sr	
										4		85	J	Vn	Cl	Fi	Pl	Sr	
	32											30	V BZ	O	Ca	Cm	C	Sr	
		25	8	W2-W3	R1			66	8			50	J	Vn	Cl	Fi	Pl	R	
1234										4		90	J	Vn	Cl	Fi	Pl	R	
												80	J	Vn	Cl	Pa	Pl	R	
	34									>10									
										>10									
1232							CLAY with sand (CL), dark gray to black, moist (drilling), low plasticity, moderately soft when wet, very stiff to hard when dry. [gouge]												Casing to 35 ft.
										>10			BZ		Fe, Ca	Sp		Sr-R	
	36			W2	R0					>10									
1230													SZ		Cl, Ca	Fi		Sr-R	
		30	9					56	0				BZ		Ca, Fe	Sp		Sr-R	
	38									>10									
1228										>10									
										>10									

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 5 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
1226 – 1222	42 – 44	20	10	W1	R0-R2		CLAY, continued.	12	0	>10 >10 >10 >10 >10			SZ		Cl, Ca, Fe	Pa		Sr	
1222 – 1218	46 – 48	18	11	W2	R0 R1		BRECCIA/sheared zone with clay, sand, and gravel, dark gray and brownish-gray, low plasticity clay, moderately soft, moist [gouge] 45.5': moderately calcareous 45.9': grades to stiff (R1)	28	28	0 >10 >10 >10 >10			MBZ						driller indicates that material may be washing away

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14
Sheet No. 6 of 27

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	Total Depth: 262.0 feet
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %
				W5	R0	BRECCIA, continued.		
1216					R3-R4	METABASALT/GREENSTONE, dark green to gray, green, fine-grained, fresh, moderately strong to strong, close to moderately fractured with open and healed calcite and clay filled joints		
	52	13	12	W1	R0-R2	BRECCIA, sheared METABASALT/GREENSTONE and CLAY, as above at 29.2	78	8
1214								
	54							
1212		18	13	W1	R0-R3	55': grades to extremely weak within matrix, moderately strong greenstone clasts	44	20
	56							
1210					R2-R3	METABASALT/GREENSTONE, dark bluish gray, very fine-grained, fresh, moderately strong to strong, hard to very hard		
	58							
1208								

Fractures per ft.: 6, 2, 0, 0, >10, 0, 4, >10, >10, >10

Discontinuity Data

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	SZ		Cl, Ca	Fi		Sr
80	J	Vn	Cl, Ca	Pa	Pl	Sr
0	J	Vn	Cl, Ca	Sp	Wa	Sr
60	J	Vn	Cl, Ca	Sp	Pl	R
20	V	T	Cl, Sn, Ca	Pa	Ho	
50	V	T	Sn, Ca	Fi	Ho	
60	V	T	Un, H	Cm	Ho	Sr
80	V	T	Py, Ca	Sp	Ho	R
10	J	Vn	Py, Ca	Sp	Cu	
70	J	Vn	Py, Ca	Sp	Cu	R
80	J	Vn	No	No	Pl	R
90	J	Vn	No	No	Pl	R
40	J	Vn	Cl, Cu	Sp	Cu	
25	J	Vn,T	Cl, Cu	Sp, Pa	Pl	Sr
	SZ		Cl, Ca, Sd	Fi		Sr-R
	SZ		Cl, Sd, Ca	Fi - Pa		Sr
30	J	Vn	Cl, Sd	Su	Pl	Sr
45	J	Vn	Cl, Sd	Su	Pl	Sr
40	J	Vn	Cl	Sp	Pl	R
30	J	Vn	Cl, Ca	Sp	Pl	Sr
	MBZ			Pa		R-Sr

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular

ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Sheet No. 7 of 27

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Columns: Elevation, ft MSL | Depth, ft | Drill Time (min) | Run No./Box No. | Weathering Index | Strength Index | Graphic Log | Description | Recovery % (20 40 60 80) | RQD % (20 40 60 80) | Fractures per ft. | Discontinuity Data: Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness | Comments

Elevation ticks: 1206, 1204, 1202, 1200, 1198. Depth ticks: 62, 64, 66, 68.

Description

METABASALT/GREENSTONE, continued.

CLAY with sand (CL), dark gray to black, moist (drilling), low plasticity, moderately soft when wet, very stiff to hard when dry

61.1'-63.9': shear zone 40-50 degrees from core axis with brecciated boudins, clasts up to 1" diameter

61.1'-61.7': very weak, sheared rock, gouge

65': clay gouge, as above

Runs

Run No./Box No.	Drill Time (min)	Weathering Index	Strength Index	Recovery %	RQD %
14	17	W1	R4, R1, R0, R3	62	20
15	21	W1	R0, R3, R0, R3, R0	32	0

Fractures per ft.

4, 7, 2, >10, >10, >10, >10, >10, >10, >10, >10

Discontinuity Data

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
5-10	J	Vn	CL	Su	Cu	Sr
60	J	VN	Ca, Cl	Sp	Ir	R
80	J	VN	Ca	Sp	Pl, Wa	Sr
60	S	O	Cl, Sd, Ca	Pa, Fi	Pl	Sr
40	S	O	Cl, Sd, Ca	Pa-Fi	Pl	Sr
80	J	VN	Ca, Py	Sp	Pl	Sr
75	J	VN	Ca, Py	Sp	Pl	Sr
85	J	VN	Cl, Ca	Pa	Ir-Wa	Sr
	BZ		Ca, Cl, Sd	Pa-Fi		Sr-R
45	J	N	Ca	Sp	Wa-Pl	R
40-30	J	VN	Ca, Cl	Sp	Pl-Wa	R
50	Sz	T	Ca, Cl, Fe	Fi-Sp	Wa	R-Sr
50	J	VN	Ca	Su	Wa	R
	MBZ					
	SZ/BZ		Cl, Ca	Pa-Fi		Sr-R
80	J	VN	Cl	Sp	Pl	Sr
75	J	VN	Cl	Fi	Pl	R
50	J	VN	Cl	Fi	Pl	Sr

Legend

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 8 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.
					R0		CLAY, continued.			
1196					R3-R4		LIMESTONE, light gray to dark gray with white calcite veins & black shale interbeds, very fine-grained, moderately strong to strong, moderately soft to moderately hard, moderate calcite veining, some stylolites			5
	72			W2	R4					9
		19	16		R3-R4			82	42	7
1194					R0-R2		METABASALT/GREENSTONE, greyish green, very fine-grained, slightly weathered, moderately strong, moderately soft to moderately hard			
					R3					3
	74									>10
1192					R0		LIMESTONE, light to dark gray with black and white veining, very fine-grained, slightly weathered to fresh, strong, moderately hard			
	76									3
		10	17		R4			110	87	2
1190				W1-W2						8
	78						METABASALT/GREENSTONE, dark greyish green, very fine-grained, fresh to slightly weathered, strong to very strong, moderately soft to moderately hard			9
1188		11	18		R4-R5			100	40	5

Recovery % / RQD % scale: 20 40 60 80

Discontinuity Data

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
	40	J	Vn	Ca, Py	Sp	Pl-Wa	Sr	
	60	J	Vn	Ca, Fe	Sp-Su	Pl	Sr	
	70	J	Vn	Ca	Sp	Pl	Sr	
	20	J	O-W	Fe, Ca	Pa-Fi	Pl	R	
	40	J	Vn	Fe, Ca	Su	Pl	R	
	25	J	Vn	Fe, Ca	Sp-Pa	Pl,	Sr	
	25	J	Vn	Fe, Cl, Ca	Sp	Cu	R	
	70	J	Vn	Fe, Cl, Ca	Su	Pl, Ir	Sr	
	70	J	Vn	Fe, Cl, Ca	Su-Sp	Pl	Sr-R	
	30	J	O-W	Cl, Fe, Ca	Pa-Fi	Pl	Sr	
	60	J	Vn-O	Cl, Ca	Pa-Fi	Pl	Sr	
	65	J	Vn	Ca	Su-Sp	Pl	Sr	
	70	J	Vn	Ca, Cl, Fe	Su-Sp	Pl	Sr	
	70	J	Vn	Ca, Sn	Su	Pl	Sr	
	50	V	T	H	Su	Pl,	R	
	70	J	Vn	Ca	Sp	Wa	R	
	60	J	Vn	Fe, Ca	Su	Pl	Sr	
	70	J	Vn	Ca		Ir		
	60	V	T	H		Pl,		
	50	V	T	H		Wa		
	80	J	Vn	Cl, Fe	Pa-Fi	Pl	Sr	
						Pl,		
	80	J	Vn	Cl, Fe	Sp-Pa	Wa	Sr	
	60	J	Vn	Cl, Fe	Sp-Pa-Fi	Pl,	R-Vr	
						Wa		
						Pl		
						Pl		
	90	S				Ir,		
						Wa		
						Pl		
		BZ		Cl, Ca	Pa		R	additional recovery likely from above run (Run 16)
	70	J	Vn	Cl, Ca	Sp	Pl	R	
	40	J	Vn	Fe, Ca	Pa	Pl	Sr-R	
	80	J	Vn	Ca	No	Pl	R	
	75	J	Vn	Fe	Sp-Pa	Pl	Sr-R	
	20	J	Vn	Fe, Cl	Sp-Pa	Pl-Wa	R	
	90	J	Vn	Fe, Cl	Sp-Pa	Wa	R	
	60	J	Vn	Cl, Fe	Su	Pl	Sr	
	60	J	Vn	Cl, Fe, Ca	Sp	Pl-Wa	Sr	
	70	MB	Vn	Ca, Fe, Cl	Su,	Ir	R	
	25	J	Vn	Fe, Ca	Sp	Pl	Sr	
	40	J	Vn	Fe, Ca	Sp-Pa	Pl	Sr	
	60	J	Vn	Fe, Sd	Pa	Pl	Sr	
	85	J	T-Vn	Fe, H	Pa	Wa	Sr	
	50	J	Vn	Fe, Sd	Pa	Pl	Sr	
	10	J	Vn	Fe	Pa	Pl	Sr	
	80	J	Vn	Fe	Pa	Pl	Sr-R	
	60	J	Vn-O	Fe, Ca, Ch	Pa-Fi	Pl-Ir		
	40	J	Vn	Fe	Sp	Pl	Sr	
	80	J	Vn	Fe	Sp	Pl	R	
	70	J	Vn	Fe	Sp	Pl	Sr	
	40	J	Vn	Fe	Sp	Pl-Wa	Sr	
	30	J	T	Fe, H	Fi-Cm	Pl-Wa		
	60	J	Vn	Fe, No	Sp	Pl	Sr	
	40	J	Vn	Fe, Cl	Sp	Pl	R	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 9 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.
	80					METABASALT/GREENSTONE, continued.			
									7
1186	81								
				W1	R2-R3	81.5': grades to moderately hard			10
	82								
		20	19				64	20	9
1184	83								
									>10
	84								>10
1182	85			W1	R0-R2	85.0'-85.3': broken zone, gravelly clay with sand, low plasticity 85.3' - 85.6': 1" greenstone cobble in clay and gravel matrix			>10
	86								>10
1180	87								>10
		16	20				12	0	>10
	88								>10
1178	89								>10

Discontinuity Data

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
40	J	Vn	Fe, Cl	Sp,Pa	Pl	Sr
90	J	Vn-O	Fe, Cl	Pa	Pl,Cu	Sr
60	J	Vn			Ir	R
	BZ			Pa	Ir	R
40	J	Vn	Ca, H	Pa-Sp	Pl	Sr
30	J	N	Ca, H	Sp-Pa	Pl	Sr
20	J	Vn	Cl,Fe	Sp	Pl	R
	BZ			Pa	Ir	R
80	J	Vn	Fe,Cl,Ca	Sp	Ir-W	Sr
70	J	Vn	Fe,Cl,Ca	Sp	Wa-Pl	R
40	J	Vn	Ca, H	Sp	Pl	Sr
60	J	Vn	Ca, H	Sp	Pl	Sr
50	J	Vn	No	No	Pl	Sr
20	J	Vn	Cl,Fe	Su	Pl	Sr
35	J	Vn	Ca,Cl	Su-No	Ir	R
	BZ				Ir	R
30	J/BZ	Vn	No	No	Ir/Pl	Vr
	BZ				Ir	R/Vr
30	J	Vn	Ca	Sp	Wa	Vr
30	J	Vn	Ca	Sp	Pl	Vr
	BZ				Ir	Vr
	BZ					Vr

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL: 1176, 1174, 1172, 1170, 1168
Depth, ft: 92, 94, 96, 98

Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
21	21	W2-W3	R0; R3-R4	89	26
5	22	W2		100	0
15	23	W3	R3	93	20
5	24	W3	R3	100	20

Description:

METABASALT/GREENSTONE, continued, similar to above, moderately weathered, moderately strong to strong, moderately hard, 50-70%, calcite veining, thinly laminate boudinage fabric.

90.0': iron staining on open joints

95.8': increase in iron staining and slight increase in degree of weathering

Fractures per ft.: 4, >10, 6, 7, 7, 6, 10, 7, 8, 8

Discontinuity Data

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	BZ		Cl,Sa	Pa-Fi	Ir	R
5	J	Vn/T	Fe,H	Fi-Cm	Cu	
70	J	Vn	Ca,Fe	Sp-Pa	Pl	R
80	J	Vn	Ca,Fe	Sp	Pl	R
65	J	Vn	Fe, Ca	Pa	Pl-St	R
40	J	Vn-N	Fe, Ca	Pa	Cu-Wa	Sr
65	Bz	Vn	Fe, Sn	Sp-Pa	Pl	Sr
50	J	Vn	Fe, Ca	Sp	Pl	Sr
	J		Fe, Sn		Ir	R
55	Bz	Vn	Fe, Ca, Sn	Pa	Pl	Sr
65	J	Vn	Fe, Ca, Sn	Pa	Pl-Ir	Sr
	J		Fe, Ca			
40	J	Vn	Fe, Ca	Pa	Pl	Sr
45	J	Vn	Fe, Ca	Pa	Pl	Sr
85	J	Vn	Fe, Ca, Cl	Pa	Pl-St	Sr
55	J	Vn	Fe	Pa-Fi	Pl	Sr
45	J	Vn	Fe	Pa	Pl	Sr
35	J	Vn-T	Fe, H, Ca	Fi	Pl	Sr
40	J	Vn	Ca	Su	Pl	Sr
60	J	Vn	Fe, Ca	Pa	Pl	Sr
80	J	Vn	Fe, Ca,Sn	Sp	Pl	Sr
40	J	Vn	Fe,Ca	Sp-Pa	Pl	R-Sr
10	J	Vn	Fe, Ca	Sp-Pa	Wa	R
45	J	Vn	Fe, Ca	Sp	Cu	Sr
30	J	Vn	Fe, Ca	Pa/Sp	Pl	Sr
35	J	Vn	Fe, Ca	Sp	Pl/Wa,	R
70-20	J	Vn	Fe, Ca	Sp	St	Sr
60	J	Vn	Cl, Fe, Ca	Sp, Su	Pl, Cu Pl	Sr
65	J	Vn	Fe, Ca, H	Fi,	Pl	Sr
75	J	Vn	Fe, Ca	Cm	Pl	R
55	J	Vn	Fe, Ca	Pa	Pl	Sr
65	J	T	Fe, Ca/H	Pa	Pl	R
20	J	T	Fe, Ca/H	Fi	W, Ir	Sr
80	J	VN	Fe, Ca	Fi	Cu,	Sr-R
65	J	T	Fe, Ca, H	Sp,Pa Cm	Pl Pl	
75	SZ		Cl, Sn, Fe, Ca			
50	J	Vn	Fe, Ca	Sp,Pa	Cu	R-Vr
40	J	Vn	Fe, Ca	Pa	Pl	Sr-R
50	J	Vn	Fe, Ca	Pa,Fi	Pl	R
30	J	Vn	Fe, Cl, Ca	Pa,Fi	Pl	R
60	J	Vn	Fe, Ca, Ch	Sp,Pa	Pl	R
85	J	Vn	Fe, Ca, Sn	Pa	Pl/St	Sr
	FZ		Fe, Ca, Sn, Cl	Pa,Fi	Ir	R-Vr
50	J	T	Fe, Sa, H	Fi,Cm	Pl	
50	J	T	Fe, Sa, H	Fi,Cm	Pl	Sr
70	J	O	Fe, Cl, Sa, Ca	Pa,Fi	Pl	Sr
40	J	Vn	Fe, Sn, Ca	Pa	Pl	Sr
35	J	Vn	Fe, Cl, Ca	Sp	Pl	
40	J	Vn	Fe, Ca	Pa	Pl,Cu	Sr-R
60	J	Vn	Fe, Ca	Pa,Fi	Pl	Sr
45	J	Vn	Fe, Ca	Pa,Sp	Pl	Sr
60	J	Vn	Fe, Ca, Ch	Pa	Pl	Sr
0	J	Vn	Fe, Ca, Ch	Pa	Wa	R
80	J	Vn	Fe, Ca	Sp	Pl	Sr
	BZ	Vn	Fe, Ca, Cl	Sp,Pa	Ir	R
30	BZ	O	Fe, Ca, Sn	Pa	Ir	Sr
10-20	J	Vn	Fe, Ca	Pa,Sp	Wa,Ir	R
	J	Vn	Fe, Ca	Pa,Su	Wa,Ir	R
70	J	Vn	Fe, Ca	Sp	Pl	Sr
30	BZ	Vn	Fe, Ca	Pa	Ir	R-Vr
	J		Fe, Ca	Pa	Pl	R
60	J	Vn	Fe, Ca	Su	Pl	Sr

Comments: Initial groundwater at 91 feet 05/31/2018

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 11 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Comments
		19	25	W3	R3-R4	METABASALT/GREENSTONE, continued, as above, calcite veining to 40-50%, weathering halos along joints.	94	38	7	
1166									>10	
	102								8	
1164						103.1': 1.5" calcite vein			4	
						103.6': .5" calcite vein				
	104								7	
1162		10	26	W3	R3 / R0 / R0-R3	LIMESTONE, dark gray and black, moderately to slightly weathered, moderately strong, moderately hard.	90	0	5	Run 26: air used to extract core instead of water blew core out in pieces.
	106					106': intact rock is moderately strong, matrix is extremely weak			>10	
1160			27	W3 / W1-W2	R3		77	0	9	
	108					108.0': dark gray to medium gray with black shale banding			5	Drilled casing down to 75 ft.
1158									>10	

Discontinuity Data

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	60	FZ	VN	Fe, Ca	Pa	Ir	R/Sr
	20	J	T	Fe, Ca	Sp	Pl	Sr
		J		Fe, Ca, H	Cm	Ir	Sr
	15	J	O	Fe, Cl, Ca	Sp,Pa	Pi,Wa	Sr
	60	J	VN	Fe, Ca	Su	Pl	Sr
	50	J	VN	No, Ca	No	Pl	R
	35	J	VN	Fe, Ca	Su	Pl	Sr/R
	50	J	VN	Ca, Fe	Su,Sp	Pl	R
	25	J	VN	Fe, Ca	Sp,Pa	Pl	Sr
		BZ		Fe, Ca, Cl	Pa,Fi		R
	60	J	VN	Fe, Ca	Sp,Su	Pl	Sr
	0-10	J	VN	Fe, Ca	Su,Pa	Ir	R/Vr
	0-10	J	VN	Fe, Ca	Pa	Pl	Sr
	60	J	VN	Fe, Ca	Su	Pl	Sr
	40	J	VN	Fe, Ca	Pa	Pl	R
	40	J	O	Fe, Ca	Pa,Fi	Pl	R
	50	J	VN	Fe, Ca	Pa,Pi	Pl/Ir	R/Vr
		FZ/BZ		Fe, Ca	Pa		Vr
	60	J	N	Fe, Ca	Pa,Fi	Pl/Cu	R
	40-50	J	T	Fe, Ca, H	Fi,Cm	Pl	
	0-10	J	T	Fe, Ca, H	Fi,Cm	W/Ir	
	50-60	J	T	Fe, Ca, H	Fi,Cm	W/Ir	
	30-60	J	VN	Cl, Fe, Ca	Sp,Pa	Cu	Sr
	80	J	VN	Fe, Ca	Sp,Pa	Pl	R
	40-50	J	O	Fe, Ca, Cl	Pa,Fi	Pl	Sr
	20	J	N	Ca	Un	Pl	Sr
	10-70	J	VN	Ca, Fe	Pa,Sp	Pl/St	R
	80	J	VN	Fe, Ca	Sp	Pl	Sr
	80	J	VN	Fe, Ca	Sp	Pl	Sr
	60	J	VN	Fe, Sn, Ca, Cl	Sp	Pl-Wa	Sr/R
	60	Sz		Fe, Sn, Ca, Cl	Pa,Fi		R
		Bz		Fe, Cl, Ca, Sn			Sr/R
		Bz					
	60	J	N	Fe	Sp	Pl	Sr
	0	J	T	Fe, H	H	Pl	R
	0	J	N/O	Fe, Ca	Pa,Fi	Pl/St	R/Vr
	85	J	VN	Fe, Cl	Pa	Pl	Sr
	80	J	VN	Fe, Cl	Sp,Su	Pl	Sr
	20	J	VN	Fe, Cl	Su	Pl	Sr
	60	J	VN	Fe	Su	Pl	R/Sr
	70	J	VN/T	Fe, Cl, H	Pa,Fi	W	Sr
	30	BZ	VN	Fe, Cl	Fi,Cm	Pl-Wa	R/Vr
	30	J	VN	Fe, Cl, Sn	Sp,Su	Pl	Sr
	60	J	VN	Fe, Cm	Pa,Fi	Pl	Sr/R
	60	SZ	VN	Fe, Ca, Cl	Pa,Sp	Pl-St	R/Vr
	60	J	VN	Fe, Cl	Sp	Pl-Wa	R
	60	J		Fe	Su	Pl	Sr
		J		Fe			Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL: 1156, 1154, 1152, 1150, 1148
Depth, ft: 112, 114, 116, 118

Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
11	28	W3	R3	36	16
9	29	W3	R3	100	0
9	30		R0-R1	100	27
7	31	W2	R2	100	74

Description

LIMESTONE, continued, moderately weathered, stong, thinly laminated with shale and chert.

115':grades to slightly weathered

116-116.1': clay, sheared, weak

117.6'-118.0': clay zone, sheared

BRECCIA, black to dark gray, brecciated limestone clasts up to 1.5" in diameter, clay with sand and silt matrix, moderately cemented.

Fractures per ft.: 7, >10, 6, >10, 9, 4, 5, 3, 0, 0

Discontinuity Data

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
20	J	Vn	Fe, Ca, H	Fi,	Pl	R
65	J	Vn	Fe, Ca	Cm	Pl	Vr
30	J	Vn	Fe, Cl, Ca	Sp-Pa Fi/Cm	Pl	
10	J	Vn	Fe, Ca	Sp-Pa	W	Vr
70	J	Vn	Fe	Sp-Su	Pl/Ir	R
	BZ		Fe, Ca	Pa	Ir	R-Sr
75	J	Vn	Fe	Su	Pl	Sr
65	S	Vn	Fe, Ca	Fi	Pl	R
40	BZ	Vn	Fe, Ca	Pa	Ir	R
80	J	Vn	Cl	Sp	Pl	Sr
10	J	Vn	Fe, Cl	Su	Ir	R-Vr
60	J	Vn	Fe	Su-Sp	Ir	Vr
	J		Fe, Cl	Pa	Pl	R
50	J	Vn	Fe, Cl	Sp	Pl/Cu	Vr
20	J	Vn	Fe	Su-Sp	Wa/Pl/Ir	R-Vr
75	J	Vn	Fe	Sp	Pl	R
30	J	Vn	Fe, Cl	Pa	Pl	Sr
	BZ		Fe, Cl	Pa-Fi	Ir	R
80	J	Vn	Fe	Sp-Su	Cu/Pl	R
60	J	Vn	Fe	Sp-Su	Pl	R
55	J	Vn	Fe	Sp-Su	Pl/St	R
80	BZ	Vn	Fe, Cl, Ca	Pa	Pl	Vr
60	J	Vn	Fe, Cl	Su	Pl	R
	J		Fe, Cl	Su	Pl	R
30	J	Vn	Fe	Su-Sp	Pl/St	R
10	J	T	Fe/H		Pl	
70	SZ	T	Cl	Fi	Pl	
70	SZ	T	Cl	Fi	Pl	
75	J	Vn	Fe	Su	Pl	
30	J	Vn	Fe, Cl, Ca	Sp-Fi	Pl	R
50	J	Vn			Pl	R/Vr
30	J	Vn	Fe, Ca	Su	Pl	Sr
30	C	T	Cl, Br	Fi	Pl	
30	C	T	Cl, Br	Fi	Pl	
15	J	Vn	Fe	Su	Pl	R
60	V	H0	Cl, Ca	Fi	Pl	

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14** **Sheet No. 13 of 27**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
						BRECCIA, continued.				70	J	VN	Cl	Pa	Pl	VR	
						120.5' - 121.0': greenstone cobble, 5", brecciated			2	40	J	VN	Cl	Pa-Fi	Pl	VR	
1146				W1	R2	121.1'-121.9': greenstone inclusion, shearted, brecciated											
		10	32				74	54	0								
	122										MBZ						
1144									>10								
	124	8	33				0	0	>10								
1142									>10								
				W1	R2	125': grades to weak					BZ			Pa			
	126								>10								
1140									>10								rapid drilling 1 ft/2 min
		10	34				18	0	>10								
	128																
1138									>10								
				W3	R2	LIMESTONE, gray to dark gray, fine-grained, slightly weathered, moderately strong, moderately hard			>10		BZ			Pa			

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14
Sheet No. 14 of 27

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC
Azimuth: / Inclination: -90	Checked By: CRL

Total Depth: 262.0 feet

Groundwater Data: 169.89 ft bgs, 07/20/2018

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
					R2	LIMESTONE, continued.					BZ		Ca, Cl, Fe	Sp	Ir	Sr	
1136						BRECCIA/CLAY, metabasalt/greenstone, very fine-grained, grayish green, extremely weak to moderately strong, slightly weathered to moderately weathered, soft to moderately hard			0								
	132			W2	R2-R0				1	50	J	VN	Fe, Ca	Fi	Pl	Vr	
		14	35				62	40									
1134				W3					7	30 30	J J MBZ	VN VN	Fe, Ca Fe, Ca	Fi Fi	Pl Pl	R R	
	134								>10								lost water circulation
1132									>10								
	136			W2	R0	135.0-136.2': CLAY with gravel, brecciated greenstone clasts up to 2.5", medium grayish-green, soft (wet) to stiff/hard (dry), low plasticity, angular to subangular clasts			>10		BZ						
1130									>10								
	138	15	36				24	0	>10								
1128									>10								
									>10								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	Total Depth: 262.0 feet
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	
Azimuth: / Inclination: -90	Checked By: CRL	

Run data

Run No./Box No.	Depth interval, ft	Drill Time (min)	Weathering Index	Recovery %	RQD %
37	to 144.0	13	W1	95	95
38	144.0–144.9	6	W1	100	0
39	144.9–148.0	14	W1 / W2	100	63
40	148.0–	7	W2	90	50

Elevation, ft MSL: 1126, 1124, 1122, 1120, 1118. Depth, ft: 142, 144, 146, 148.

Strength Index (top to bottom): R1-R2, R3, R1-R2, R1-R2, R3, R1-R2, R2, R1-R2, R3, R1, R3, R1, R3

Description

BRECCIA/CLAY, continued.

142.7': intact, unsheared greenstone, moderately strong

143.3-144.4': extremely weak to very weak

144.4-144.6': moderately strong
144.6'- 146.2': grades to extremely weak

METABASALT/GREENSTONE, very fine-grained, fresh, extremely weak to strong, some shear zones

147': moderate calcite veining (10%)

Fractures per ft. (top to bottom): 1, 0, 0, 5, 5, 1, 7, >10, 5, >10

Discontinuity Data

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
50	J	VN	Cl	Pa	Pl	R
70	V MB	N/O	Ca	Fi	Pl/W	
	MB					
70	J	VN	Cl, Ch	Fi	Pl	Vr
40	J	VN	Cl, Ch	Fi	Pl	R
70	J	VN	Cl, Ch	Fi	Pl	Vr
70	J	VN	Cl, Ch	Fi	Pl	Vr
65	J	VN	Ca, Cl	Sp	Pl	Sr
0	J	T	Ca		Pl	Sr
70	J	VN	Ca, Cl	Su	Pl/St	R
40	J	VN	Cl, Ca	Su	Pl	R
45	J	VN/T	Cl, Ca	Sp	Wa	R
60	J	VN	Cl, Ca	Sp	Cu	Vr
50	SZ J	VN	Ch, Cl	Fi	Pl/Wa	Sr/R
35	MB J	VN	Ch, Cl	Fi	Pl	R
	BZ MBZ			Pa	Ir	
20	J	VN	Cl, Ca	Pa/Sp	Pl	Sr
	BZ		Cl, Ca	Pa		R
65	J	O-W	Cl, Ca	Fi	Pl	Sr/S
60	J	VN/N	Cl, Ca, Fe	Pa	Pl	Sr
30	J	VN	Fe, Cl, Ca	Sp/Pa	Pl	Sr
10	V	T	Ca, H	Fi/Cm	Pl	
55	J	VN	Fe, Ca, Cl	Sp	Pl	Sr/R

Comments

Legend

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 16 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.
					R2	METABASALT/GREENSTONE, continued.			>10
1116						151.1': grades to strong 151.1'-151.9': brecciated			5
	152	20	41		R4		100	68	6
1114									5
	154				R0	154.7': grades to extremely weak, moderate iron staining			5
1112				W1		155': grades to strong 155.2': moderate calcite veining (10%)			1
	156								7
1110		21	42		R4		106	60	4
	158								5
1108									5

Discontinuity Data

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
50	J	VN	Cl, Ch	Fi	Pl	Sr
50	J	Vn	Cl, Ch	Fi	Pl	Sr
40	J	VN	Cl, Ch	Pa	Pl	Sr
65	J	VN/N	Cl	Sp	Pl	Sr
85	J	VN	Fe, Ca, Cl	Sp	Wa/Ir	Vr
85	J	VN	Cl	Su	Ir	R
20	J	VN	Cl, Fe	Su	Pl/Wa	Sr-R
70	J	VN	Cl, Fe	Sp	Pl	S-Sr
90	J	VN	Fe	Pa-Sp	Pl	Sr
20	J	VN	Cl	Su	Pl/Wa	Sr
55	J	VN	Cl	Sp-Pa	Pl	Sr
35	J	Vn	Cl	Su	Pl	R
70	J	Vn	Cl	Su	Pl	R
70	J	VN	Cl	Pa	Pl	Sr
65	J	N/O	Cl	Fi	Pl	
45	J	N	Cl	Fi	Pl	
90	J	VN	Cl, Fe	Su	Pl/Ir	Vr
60	J	VN	Cl	Su	Wa/Pl	R
45	J	T	H	Su	Pl	
30	J	O	Fe, Cl	Fi	Pl	Sr
10-20	J	N/O	Ca	Fi-Pa	Cu/Wa	Sr
80	J	VN	Ca			
10	J	VN	Ca, Fe, Cl	Sp	Ir	R
70	J	VN	Ca, Cl	Su	Pl	Sr
75	J	VN	Cl, Ca	Su-No	Pl	Sr
	BZ		Cl, Ch	Fi		
65	J	VN	Fe, Ca	Su	Pl	Sr
70	J	VN	Ca	Fi	Pl	Vr
60	J	VN	No, Cl	Su-No	Pl	Sr
70	J	VN	Ca, Ch	Fi	Pl	R
10	J	VN	Ch, Ca	Fi	Pl	Vr
50	J	VN	Ch, Ca	Fi	Pl	R
50	J	VN	Ch, Ca	Fi	Pl	R
55	J	VN	Cl, Fe	Su-No	Pl	Sr
60	J	VN	No	No	Ir	Vr
10	J	VN	No	No	Wa	R
60	J	VN	Fe, No	Su	Pl	R
50	J	VN	Fe, Ca	Sp	Pl-Wa	Sr
10	V	H0	Ca, Fe, Cl	Fi		

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Cl - Clay, Ca - Calcite, Ch - Chlorite, Ep - Epidote, Fe - Iron Oxide, Gy - Gypsum, H - Healed, Mi - Mica, Mn - Manganese, My - Mylonite, No - None, Py - Pyrite, Qz - Quartz, Sd - Sand, Si - Silt, Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Sheet No. 17 of 27

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Comments
1106					R3		METABASALT/GREENSTONE, continued.			
							161.1' - 163.1': shear zone, weak zones of calcite, chlorite, clay			
	162	11	43					100	88	
1104					R1					
	164	6	44				164': grades to extremely weak within matrix, strong greenstone clasts	100	76	
1102				W1			164.8'-166.5': shear zone, weak zones of calcite, chlorite, clay			
	166				R3-R0					
1100		17	45				167.4': grades to strong	96	78	
	168				R4					
1098										∇

Discontinuity Data

Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
		0	V	T	Ca, H	Fi/Cm	Sr	
		10	J	VN	Cl	Fi	Wa	
9		55	J	VN	Ca	Su	Wa	Sr
		30	J	T	Ca, CL	Fi	Pl	
		20	V	H	Ca, H	Fi/Cm	Ir	
		80	J		Ca	Sp	Wa	
		10-20	FZ/SZ	T	Ca, Cl	Fi	Ir	
		50	J		H	Cm	Ir	
2		15	SZ		Cl, Ca	Fi	Ir	
5								
6		40	J	VN	Cl, Ca	Sp	Pl	Vr
		20	J	O	Cl, Ca	Fi	Pl	Sr
		25	J	VN-N	Cl	Cm	Pl	Vr
		5	J	N	Cl, Ca	Fi	Pl-Wa	Vr
0		0-10	SZ	T	Cl, Ch, Ca	Fi		
4		40	J	VN	No	No	St	Vr
		25	J	VN	No	No	Pl	R
4		5	V	T	Ca, H	Pa-Cm	Pl-St	
		55	J	VN	Ca	Sp	Pl	Sr
		25	J	VN	Cl, Fe	Sp-Su	Pl	Sr
		15	V	T	Fe, H	Cm	Pl	
5		75	J	VN	Fe	Sp	Pl	Sr/R
		15	V	T	Fe, Ca, H	Cm	Pl	
		20	V	T	Fe, Ca, H	Cm	Ir	Vr
		30	J	VN	Cl, Fe	Su	Wa	
6		90	J	VN	Fe, H	Cm	Pl	Sr
		25	J	VN	Ca, Cl	Fi	Pl	
		15	V	T	Ca, Cl	Fi		
		70	J	VN	No	No	Pl	R
4			MBZ					

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Sheet No. 18 of 27

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Column headings: Elevation, ft MSL | Depth, ft | Drill Time (min) | Run No./Box No. | Weathering Index | Strength Index | Graphic Log | Description | Recovery % (20 40 60 80) | RQD % (20 40 60 80) | Fractures per ft. | Discontinuity Data: Drawing, Dip, Type, Width, Type of Infilling, Amount of Infilling, Surface Shape, Roughness | Comments

Elevation scale: 1096, 1094, 1092, 1090, 1088. Depth scale: 172, 174, 176, 178.

Description:

METABASALT/GREENSTONE, continued.

176.4'-178.4': shear zone, weak zones of calcite, chlorite, clay

Runs:

Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
17	46	W1	R3	98	42
20	47	W1	R3	104	74

Fractures per ft. (top to bottom): 4, 6, 1, 3, 7, 2, >10, 1, 3, 3

Discontinuity Data:

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
15	J	VN	No, Cl	Sp	Pl	Sr
30	J	VN	No, Ca	No-Sp	Pl	Sr
45	J	VN	Ca, Cl	Su	Pl	Sr
40	V	N	Ca, H	Fi/Cm	Wa	
20	J/V	VN	Ca	Pa	Pl	Sr
20	J	VN	Ca, No	Su-No	Wa	Sr
10	J	VN				
15	J	VN	Ca, Cl	Sp-Pa	Pl	Sr
25	J	VN	Ca	Sp-Su	Pl	Sr
20	S	VN	Ca, Cl	Fi	Pl	R
75	J	VN	No	No	Pl	Sr
20	V	N	Ca, H	Cm	Pl	
	MB					
40	J	VN	Ca, Ch	Fi	Pl	Sr
50	J	VN	Ca, Ch	Fi	Pl	Sr
30	J	VN	Cl	Pa	Pl	Sr
40	J	VN	Cl	Sp	Pl	Sr
0-20	S	VN	Cl, Ca	Pa-Fi	Pl	Sr
10	J	VN	Cl, Ca	Pa	Pl	Sr
15	J	VN	Cl, Ca	Sp-Pa	Pl,Wa	Sr
5	J	VN	Cl	Pa	Pl	Sr
70	J	VN	Cl	Sp	Cu	R-Vr
	BZ		Cl, Ca	Pa		Vr
70	J	VN	Ca, Cl	Sp	Pl	Sr
80	J	VN	Ca	Su	Ir	Vr
10-30	J	VN	Cl, Ca	Pa	Cu	Sr
	BZ	VN				
10	J	VN	Cl, Ca	Fi	Pl	Sr
20	J	VN	Cl, H	Fi/Cm	Ir,Pl	R
0-20	J	VN	Cl, Ca	Sp	Cu	Sr
15	J	VN	Cl, Ca	Sp	Wa	R
65	J	VN	Cl, Ca	Sp	Pl	Sr
70	J	VN	Cl	Sp-Su	Pl	R
20	J	VN	Cl	Su	Pl	Sr

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 19 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.
						METABASALT/GREENSTONE, continued.			
					R2-R3				3
1086									
									1
	182								
		26	48		R2		98	84	3
1084									
									3
	184								
									5
1082				W1	R2-R3				
									1
	186								
									2
1080						BRECCIA, grayish-green, fresh, weak.			
		16	49		R2		100	98	
						METABASALT/GREENSTONE, very fine-grained, fresh, moderately strong, moderately hard, some shear zones.			1
	188								
					R3				4
1078									
									2

Discontinuity Data

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	30	J	VN	Cl	Sp	Pl	Sr
	60	MB					
	65	MB	VN	Cl	Su	Pl,Cu	Sr
	15	J					
	40	J	VN	No	No	Pl	R-Vr
	40	MB					
		MB					
	25	J	VN	Ca	Pa-Fi	Pl	Sr
	90	J	VN	Cl,Sn	Fi/Cm	Pl	Vr
	15	SZ	T	Cl	H0	Pl	
	90	J	VN	No	No	Pl	Sr
	80	J	VN	No	No	Pl	R
	15	J	VN	Ca	Fi	Pl	Sr
	75	J	VN	Cl	Sp-Pa	Pl	R-Vr
	30	J	VN	Cl	Sp	Pl	Sr
	30	J	VN	Cl	Fi	Pl	Sr
		MBZ		Cl	Sp		R
	80	J	VN	Fe	Sp	Ir	Vr
	30	J	VN	Ca	Fi	Pl	S
	60	J	VN	Fe,Ca	Sp,Pa	Pl	R
	20	V	VN	Cl,Ca,Fe	Fi	Pl	S
	15	SZ		Cl,Ca	Fi		Sr
	15	J	VN	Ca,Fe	Fi	Pl	Sr
	15	J	VN	Fe,Ca	Pa	Pl	Sr
	70	J	VN	Fe,Ca,Cl	Sp-Pa	Pl	Sr
	0	J	VN	Fe,Ca	Sp	Pl	Sr
	45	J	VN	Fe,Ca	Pa-Fi	Pl	Sr
		V	H0	Ca	Fi	Pl	
		V	H0	Ca	Fi	Cu	

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Recovery %	RQD %
1076, 1074	192, 194	25	50	W1, W3	R3, R0	100	57
1072, 1070	196	20	51	W1	R1, R2, R3	100	64
1068	198	5	52			100	100

Graphic Log: Metabasalt/Greenstone

Description

METABASALT/GREENSTONE, continued.

191.0'-192.5': calcite veining up to ~10%, up to .25" wide

193.9' - 195.0': Metabasalt/Greenstone weathers to clayey SAND with gravel (SC), light olive green, loose to medium dense, moist.

Fractures per ft.: 4, 1, 4, 8, 2, >10, 5, 0, 0, 0

Discontinuity Data

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	30	J	VN	Cl	Sp/Su	Pl	Sr
	25	J	VN	Cl,Ca	Pa	Pl	Sr
	25	J	VN	Cl,Ca	Fi	Pl	Sr
	0	J	VN	Ca, Cl	Pa	Pl	R
	25	J	VN	Ca,Cl	Fi	Pl	Sr
		V	H0	Ca	Fi	Pl-Ir	
	80	J	VN	Ca,Cl	Su	Pl	Sr
	15	V	H0	Cl,Ca	Fi	Pl	
	20	J	VN	Cl	Sp	Ir	Vr
	20	J	VN	Ca,Cl	Pa	Pl	R
	10	J	VN	Cl,Ca	Pa	Pl	Sr
	10	J	VN	Cl,Ca	Pa	Pl	Sr
	10	J	VN	Cl,Ca	Pa	Pl	Sr
	40	J	VN	Ca,Cl	Pa	Pl-Cu	Sr-R
	60	J MBZ	VN	Cl	Fi	Pl	R
	0-5	J	VN	Ca,Cl	Fi	Pl	Sr-R
		BZ		Ca,Cl	Fi		
	15	J	VN	Ca,Cl,Sn	Fi	Pl	R
	15	J	VN	Ca	Fi	Pl	Sr
	40	J	VN	Ca	Fi	Pl	R
	40	J	VN	Ca	Fi	Pl	Sr
	40	J	VN	Ca	Fi	Pl	Sr
	15	J	VN	Ca	Fi	Pl	R
		BZ		Ca	Fi-Pa		
		MB					

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Sheet No. 21 of 27

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
						METABASALT/GREENSTONE, continued.				25	V	O	Ca/H0	Fi	Fl		
									2								
										70	J	VN	Ca/H0	Pa	Fl/Cu	R	
1066																	
										60	J	VN	Ca,Cl	Pa/Fi	Pl	Sr	
					R3												
									4								
	202									85	J	VN	Ca	Fi	Pl	Sr/R	
										25	J	N	Ca,Cl	Fi	Pl	Sr	
				W1						90	J	VN	Ca,Cl	Fi	Pl	R/Vr	
		23	53				94	75									
									5	20	J	N/O	Cl	Fi	Pl	Sr	
1064						203.0-205.0': brecciated, sheared					Bz		Cl	Pa		R	
										20-70	SA		Cl,Ca	Fi			
										15	J	VN	Cl	Fi	Pl	Sr	
					R1-R2				3								
	204																
											MBZ		Fe,Cl	Sp		R	
									4								
1062						205.7': grades to moderately strong				80	J	VN	Cl	Sp	Pl	Sr	
										10	J	VN	Ca,Cl	Sp	Pl/W	Sr/R	
					R1-R2						BZ		Ca,Cl	Sp/Pa		Sr/R	
									9	25	J	VN	Ca	Su	Pl	Sr/R	
	206																
										80	J	VN	Cl,Ca	Su	Pl	Sr	
										30	J	VN	Ca,Cl	Su	Pl/W	R	
									3								
1060																	
		16	54	W1			104	58									
											MB						
									7								
					R3												
	208									60	J	VN	Cl	Sp/Su	Pl	Sr	
										40	J	VN	Ca	Fi	Pl	Sr	
										0-10	J	VN	Ca	Su	PL	R	
										40	V	VN	Ca/H1	Fi/Cm	Pl		
										30	J	VN	Ca/Cl	Sp	Pl	R	
										10	J	VN	Ca,Cl	Sp	W	R	
									4	75	J	VN	Cl	Pa	Ir	Vr	
										20	J	VN	Cl,Ca	Sp/Su	Pl	R	
1058																	
										30	J	VN	Cl,Ca	Su	Pl	R	
										60	J	VN	Ca	Fi	Pl	Sr/R	
										50	J	VN	Ca	Pa	Pl	Sr/R	
									2								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	**Sheet No. 22 of 27**
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery % (20 40 60 80)	RQD % (20 40 60 80)	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
						METABASALT/GREENSTONE, continued.												
											30	J	VN	Cl,Ca	Pa	W/Pl	R-Vr	
									0									
												MB						
1056																		
												MB						
									2									
	212										50	V	T	Ca, H1	F	Pl	Sr	
					R3													
											40	J	VN	Cl,Ca	Su	Pl	Vr	
		25	55	W1			98	86										
									0									
1054																		
											45	V	T	Ca, H1	Fi	Pl	Sr-R	
									6		45	V	T	Ca, H1	Fi	Pl	Sr-R	
												MB						
	214																	
											60	J	VN	Cl,Ca	Sp	Cu	R-Vr	
						214.4' - 214.7': sheared weak zone						MBZ						
					R2													
									2									
1052																		
											40	J	VN	Ca,Cl	Pa	Pl	Sr	
									2									
											40	J	VN	Ca,Cl	Pa/Fi	Pl	R-Vr	
	216																	
						216.3-216.7': clayey zone					30	J	T	Cl	Fi	Pl		
											40	J	T	Cl	Fi	Pl		
									3		10	J	T	Cl	Fi	Pl/W		
1050																		
											15	SZ	T	Cl	Fi			
		20	56	W1	R2		100	70										
									2									
											45	J	T	Cl	Fi	Pl		
	218																	
						218.2-220.0': clay zone												
									1		85	J	T	Cl	Fi	Pl		
1048																		
											50	J	T	Cl	Fi	Pl		
											40	J	T	Ca	Fi	Pl		
									5		10	J	T	Cl	Fi	Pl		
												MBZ						

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	# CORE LOG GT 2-14
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	Sheet No. 23 of 27
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %
		17	57	W1	R2	METABASALT/GREENSTONE, very fine-grained, fresh, weak. 221.4'-229.9': shear zone	98	89
1046								
	222							
1044								
	224							
1042		16	58	W1	R2	225.6' - 225.8': shear zone	100	74
	226							
1040						227.4'-227.7': shear zone		
	228					228.6'-229.0': shear zone		
1038							113	95

Fractures per ft: 6, 6, 5, 7, 6, 6, 4, 2, 3, 1

Discontinuity Data

Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
30	J	VN	CL	Su	Pl	R
30	J	VN	Cl,Ca	Sp	Pl	Sr
55	J	VN	Cl	Sp	Pl	Sr
0	J	VN	Cl	Sp	Pl	R
0	J	VN	H	Pa	Wa	Sr
60	J	T	Cl	Sp	Pl	R
15	J	Vn	Cl	Pa	Pl	Sr
30	J	Vn	H	Cm	Pl	Sr
30	J	T	Cl	Su	Pl	Sr
25	J	Vn	Cl	Fi	Pl	R
20	J	Vn	Cl	Pa	pl	Sr
25	J	Vn	Cl	Fi	Pl	Sr
40	J	Vn	Cl	Fi	Pl	Sr
20	J	Vn	Cl,Ca	Sp	Pl	Sr
45	J	Vn	Cl,Ca	Sp	Pl	Sr
50	J	T	Ca,H	Cm	Pl	Sr
40	J	Vn	Cl	Su	Pl	R
40	V	O	Ca,H	Fi	Pl	R
	MB					
40	J	Vn	Cl,Ca	Sp	Pl	Sr
20	J	T	Cl,H	Fi	Pl	Sr
30	J	Vn	Cl,Ca	Pa	Pl	Sr
60	J	Vn	Cl,Ca	Fi	Pl	R
25	J	Vn	Cl	Sp	Pl	Sr
35	J	Vn	Cl,Ca	Sp	Pl	Sr
35	S	O	Cl,Ca	Cm	Pl	Sr
60	J	Vn	Ca	Fi	Pl	Sr
70	J	Vn	Ca	Fi	Pl	Sr
30	J	Vn	Cl,Ca	Fi	Pl	Sr
60	J	Vn	Cl,Ca	Fi	Pl	Sr
	MB					
30	J	Vn	Cl,Ca	Sp	Pl	Sr
15	J	Vn	Cl	Fi	Pl	Sr
30	SZ					
40	J	Vn	Cl	Sp	Pl	Sr
45	J	Vn	Cl,H	Cm	Pl	Sr
45	J	Vn	Cl	Sp	Pl	Sr
50	J	Vn	Cl,H	Su	Pl	R
	MB					
50	J	Vn	Cl	Pa	Pl	Sr

Comments

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14** **Sheet No. 24 of 27**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
				W1		METABASALT/GREENSTONE, continued.				30-0	SZ						
				W2		230.5' - 231.0': increase in weathering			3	25	J	T/VN	Cl,H1	Fi			
1036		20	59							60	J	T	Cl,H1	Fi/Cm	Pl		
										50	J	T	Cl,H1	Fi/Cm	Pl		
				W1			113	95	3	25	J	T	Cl,H1	Fi/Cm	Pl		
	232									50	J	T	Cl,H1	Fi/Cm	Pl		
										25	J	T	Cl,H1	Pa	Pl	Sr-R	
				W2		232.7' - 233.3': increase in weathering and shearing of rock. weak, and clayey.			>10	70	J	Vn	Cl	Sp	Pl	R	
1034											BZ						
											MB						
										20	J	T	Cl,H1	Fi/Cm	Pl		
	234	3	60				91	91	1								
					R2						MB						
									0								
1032										30	J MB	T	Cl,H1	Fi/Cm	Pl		
	236								1								
				W1						35	J	Vn	Cl	Su	Pl-St	Sr-R	
1030		8	61				84	84	1								
									1	20	J	Vn	Cl,H1	Fi/Cm	Pl	Sr	
	238									90	J	Vn	Cl	Fi	Ir	R	
1028									>10								
				W1	R1-R2	239.4': color change to gray	66	34	2	80	J	Vn	Cl	Fi	Pl	Sr	

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Stantec **CLIENT:** Lehigh Permanente - Heidelberg Cement Inc. **PROJECT:** Morris Property Geotech Investigation **PROJECT NO.** 233001289

CORE LOG GT 2-14

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL: 1026, 1024, 1022, 1020, 1018
Depth, ft: 242, 244, 246, 248

Run No./Box No.	Drill Time (min)	Weathering Index	Strength Index	Recovery %	RQD %
62	27	W1	R1-R2	66	34
63	7	W1	R1-R2	85	85
64	24	W1	R1-R2	100	44
			R2	100	74

Fractures per ft.: 1, 8, >10, >10, 0, 5, 5, 5, 7, 1

Description

METABASALT/GREENSTONE, continued.

LIMESTONE, dark bluish gray to black, very fine-grained, fresh, very weak to weak, thinly laminated with chert/shale, thinly laminated from 0.5mm to 3-4mm in width, deformation folding, calcite veining up to 15%

BRECCIA, metabasalt/greenstone in clayey gouge matrix, grayish-green, very fine-grained, fresh, very weak to weak.

METABASALT/GREENSTONE, grayish-green, very fine-grained, fresh, weak.

BRECCIA, metabasalt/greenstone in clayey gouge matrix, very fine-grained, fresh, very weak to weak.

LIMESTONE with chert/shale interbedding, dark gray, fine-grained, fresh, weak, with greenstone xenoliths and pyrite.

4" greenstone xenolith

Discontinuity Data

Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness
	30	J	Vn	Ca,Cl	Pa	Cu/Pl	Vr
	30	J	Vn	Ca,Cl	Pa	Cu/Pl	Vr
	10	V	T	Ca	Fi	Pl	
	20	J	Vn	Ca,Cl	Fi	Pl	R
		BZ					
	10-20	J	Vn	Ca,Cl	Fi	Pl	R
	50	J MBZ	Vn	Ca	Fi	Pl	R
	70	J	Vn	Ca	Fi	Su/Pa	
	20	V	T	Ca			
	30	J	Vn	Ca	Fi	Pl	Sr
		BZ	VN	Ca	Fi	Pl	
	10	V	Vn	Ca	Fi	Pl	
	15	V	T	Ca	Fi	Pl	
	15	J	T	Ca	Fi	Pl	Sr
	20	J	Vn	Ca	Fi	Pl	Sr
	15	J	Vn	Ca	Fi	Pl	Sr
	30	J	Vn	Ca	Fi	Pl	Sr
	30	J	Vn	Ca	Fi	Pl	Sr
	45	J	Vn	Ca,Cl	Pa	Pl	R
	45	V	T	Ca	Fi		

Comments

hole collapse back to 242

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

CORE LOG GT 2-14

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Description	Recovery %	RQD %	Fractures per ft.	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
						LIMESTONE, continued.				45	J	Vn	Cl	Pa	Pl	R	
						250.4'-250.7': brecciated zone with clay gouge matrix			4	45	J	Vn	Cl	Pa	Pl	R	
1016		16	65														
									0	45	V	H2	Ca				
	252				R2		100	74		30	J	Vn	Ca	Su	Pl	S	
										15	V	H2	Ca,Cl				
									3	30	J	Vn	Ca	Su	Pl	S	
1014										30	J	Vn	Ca	Su	Pl	S	
				W1						30	J	Vn	Ca	Su	Pl		
											MBZ						
						BRECCIA, metabasalt/greenstone in clayey gouge matrix, very fine-grained, fresh, very weak to weak.			5	30-60	J	Vn	Ca	Su	Pl-St	S-R	
	254																
1012					R1-R0				0	30	J	Vn	Cl	Fi	Pl	R	
										50	J	Vn	Fe,Cl	Fi	Pl	Sr	
									3	30	J	Vn	Cl	Fi	Pl	R	
	256									40	J	Vn	Cl	Pa	Pl-Cu	Sr	
		19	66				52	18									
1010									>10								
	258								>10								
						METABASALT/GREENSTONE, very fine-grained, fresh, weak.			>10	60	J	Vn	Cl	Su	Pl	Sr	
1008				W1	R3												150 ft of core rod broken off in hole fished out on 5/25 sand locked with cuttings. Drillers unable to gain any more depth with drilling as hole continues to collapse sandlocking rods. Drilling creating cavity.
							26	0			BZ						
			67						>10								

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie Cl - Clay Ca - Calcite Ch - Chlorite Ep - Epidote Fe - Iron Oxide Gy - Gypsum H - Healed Mi - Mica Mn - Manganese My - Mylonite No - None Py - Pyrite Qz - Quartz Sd - Sand Si - Silt Un - Unknown	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Date Start: 5/15/18 End: 5/30/18	Drilling Co.: Gregg Drilling Inc.	**CORE LOG GT 2-14** **Sheet No. 27 of 27**
Location: Cupertino, CA	Drill Rig: CME 075X / Drilling Method: HSA/WLC	
Northing: -3274 / Easting: -851	Drill Bit Type/Size: Diamond Impregnated / HQ3	
Surface Elevation: 1267 feet AMSL	Logged By: SRC/JVP	Total Depth: 262.0 feet
Bottom Elevation: 1005 feet AMSL	Prepared By: SRC	Groundwater Data: 169.89 ft bgs, 07/20/2018
Azimuth: / Inclination: -90	Checked By: CRL	

Elevation, ft MSL	Depth, ft	Drill Time (min)	Run No./Box No.	Weathering Index	Strength Index	Graphic Log	Description	Recovery %	RQD %	Fractures per ft.	Drawing	Dip	Type	Width	Type of Infilling	Amount of Infilling	Surface Shape	Roughness	Comments
							METABASALT/GREENSTONE, continued.	26	0	>10									
1006		12	68	W1	R3			75	0	>10									drilling terminated to hole collapse extreme difficulty in progressing hole to depth
	262																		

BOTTOM OF HOLE AT 262 FT
PIEZOMETER INSTALLED ON 06/12/18

DISCONTINUITY TYPE	APERATURE	INFILLING TYPE	INFILLING AMOUNT	SHAPE	ROUGHNESS	DISCONTINUITY SPACING	WEATHERING	STRENGTH
F - Fault J - Joint (Discontinuity) Fz - Fracture Zone S - Shear Sz - Shear Zone V - Vein Fo - Foliation B - Bedding Joint MB - Mechanical Break Bz - Broken Zone	Tight (T) 0" Very Narrow (Vn) <0.05" Narrow (N) 0.05-0.1" Open (O) 0.1-0.5" Wide (W) >0.5"	Bi - Biotitie, Mn - Manganese Cl - Clay, My - Mylonite Ca - Calcite, No - None Ch - Chlorite, Py - Pyrite Ep - Epidote, Qz - Quartz Fe - Iron Oxide, Sd - Sand Gy - Gypsum, Si - Silt H - Healed, Un - Unknown Mi - Mica	Clean (No) Stained (Su) Spotty (Sp) Partial Filled (Pa) Filled (Fi) Cemented (Cm)	Wa - Wavy Pl - Planer St - Stepped Ir - Irregular	Slickensided (Slk) Visual evidence of polishing and striations Smooth (S) Surface appears and feels smooth Slightly Rough (Sr) Asperities are distinguishable and can be felt Rough (R) Asperities are clearly visable, some ridges evident, surface feels abrasive Very Rough (Vr) Near-vertical ridges occur on surface	Extremely Wide (EW) >6ft Wide (W) 2ft-6ft Moderate (M) 8in-2ft Close (C) 2.4in-8in Very Close (VC) 0.75in-2.4in Extremely Close (Ex) <0.75in	Fresh (W1) Slightly (W2) Moderately (W3) Highly (W4) Completely (W5) Residuum (W6)	Extremely Weak (R0) Very Weak (R1) Weak (R2) Moderately Strong (R3) Strong (R4) Very Strong (R5) Extremely Strong (R6)

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 1

Photo ID:
GT 2-14 15.3'-31.7'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 1 of 22

Photograph ID: 2

Photo ID:
GT 2-14 31.7'-55.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 2 of 22

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 3

Photo ID:
GT 2-14 55.0'-72.3'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 3 of 22

Photograph ID: 4

Photo ID:
GT 2-14 72.3'-82.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 4 of 22

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 5

Photo ID:
GT 2-14 82.0'-98.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 5 of 22

Photograph ID: 6

Photo ID:
GT 2-14 98.0'-108.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 6 of 22

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 7

Photo ID:
GT 2-14 108.0'-118.3'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 7 of 22

Photograph ID: 8

Photo ID:
GT 2-14 118.3'-135.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 8 of 22

Stantec **Photographic Log**

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 9

Photo ID:
GT 2-14 135.0'-147.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 9 of 22

Photograph ID: 10

Photo ID:
GT 2-14 147.0'-155.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 10 of 22

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 11

Photo ID:
GT 2-14 155.0'-163.7

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 11 of 22

Photograph ID: 12

Photo ID:
GT 2-14 163.7'-172.2'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 12 of 22

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 13

Photo ID:
GT 2-14 172.2'-180.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 13 of 22

Photograph ID: 14

Photo ID:
GT 2-14 180.0'-188.6'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 14 of 22

Stantec **Photographic Log**

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 15

Photo ID:
GT 2-14 188.6'-197.3'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 15 of 22

Photograph ID: 16

Photo ID:
GT 2-14 197.3'-205.6'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 16 of 22

Stantec

Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 17

Photo ID:
GT 2-14 205.6'-214.7'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 17 of 22

Photograph ID: 18

Photo ID:
GT 2-14 214.7'-223.8'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 18 of 22

Stantec — Photographic Log

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 19

Photo ID:
GT 2-14 223.8'-232.9'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 19 of 22

Photograph ID: 20

Photo ID:
GT 2-14 232.9'-244.4'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 20 of 22

Client:	**Lehigh Hanson**	**Project:**	**Lehigh Southwest Cement**
Site Name:	**Permanente Quarry**	**Site Location:**	**Santa Clara County, CA**

Photograph ID: 21

Photo ID:
GT 2-14 244.4'-253.6'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

Comments:
Box 21 of 22

Photograph ID: 22

Photo ID:
GT 2-14 253.6'-262.0'

Photo Location:
GT 2-14

Date Taken:
5/31/2018

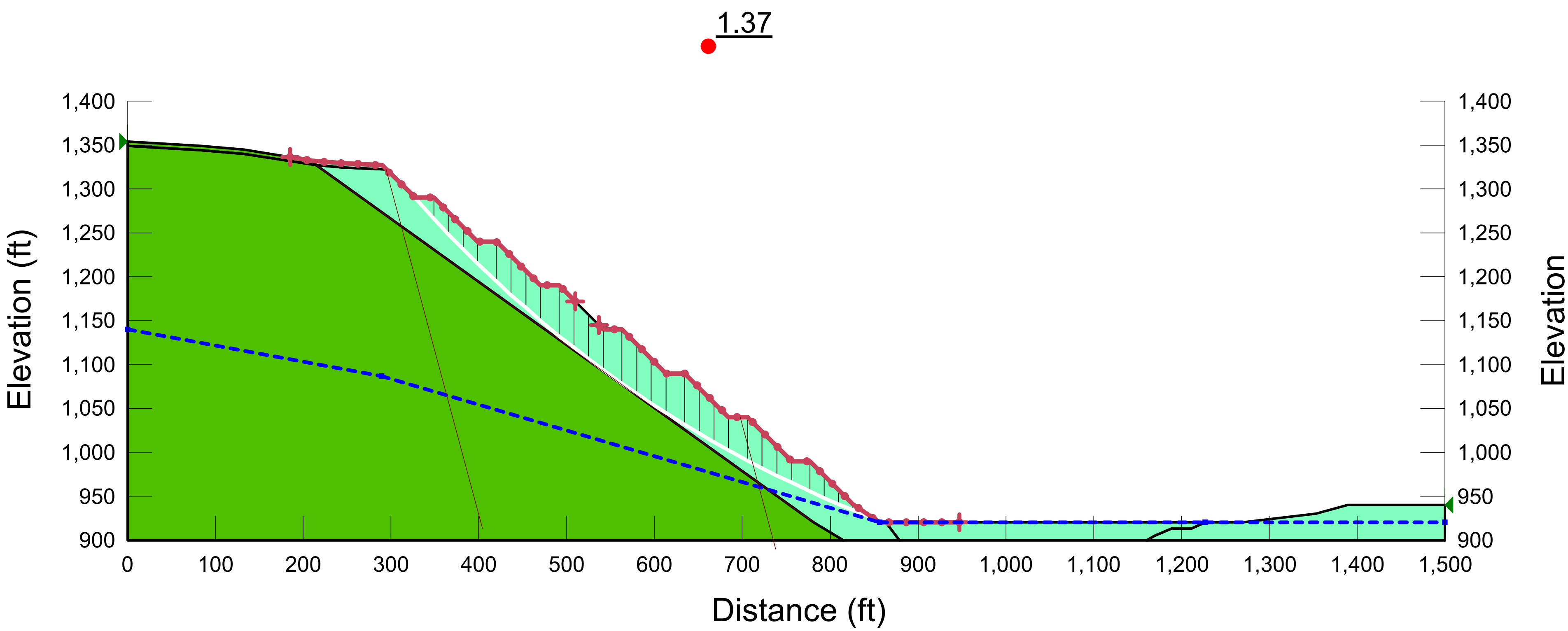
Comments:
Box 22 of 22

APPENDIX B

Stability Evaluation

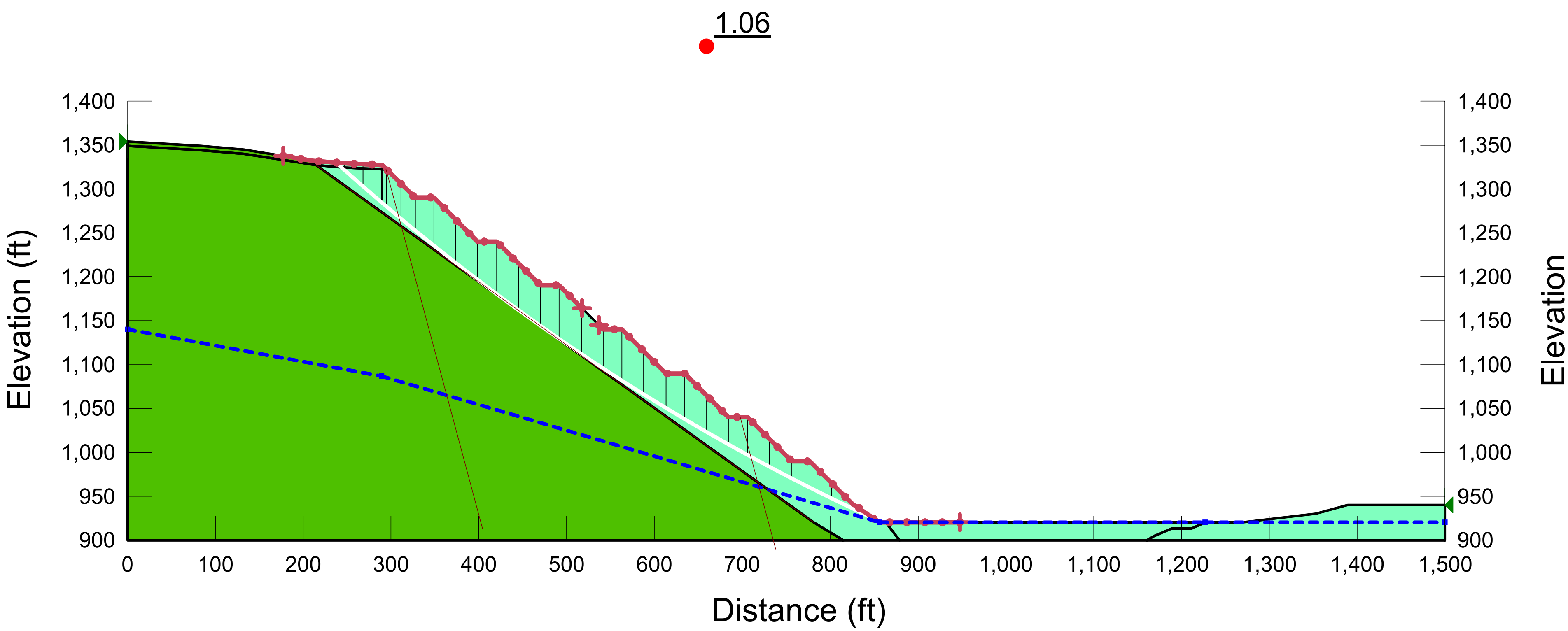
Title: Rock Plant Reserve - Section A
Name: 1. Static
Method: Spencer
Factor of Safety: 1.37
Horz Seismic Coef.:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	165	1,800	27	1



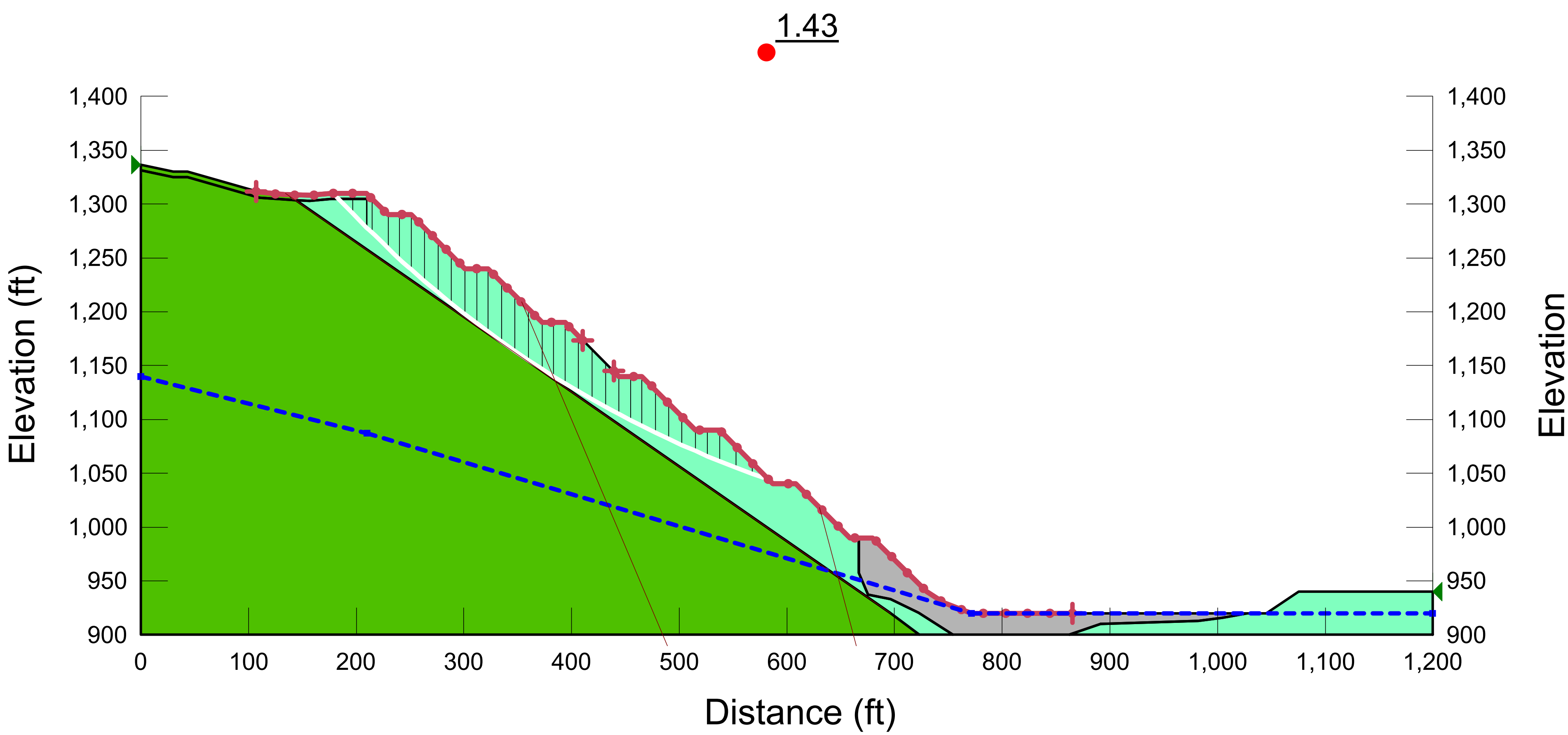
Title: Rock Plant Reserve - Section A
Name: 2. Pseudo-Static
Method: Spencer
Factor of Safety: 1.06
Horz Seismic Coef.: 0.15

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	165	1,800	27	1



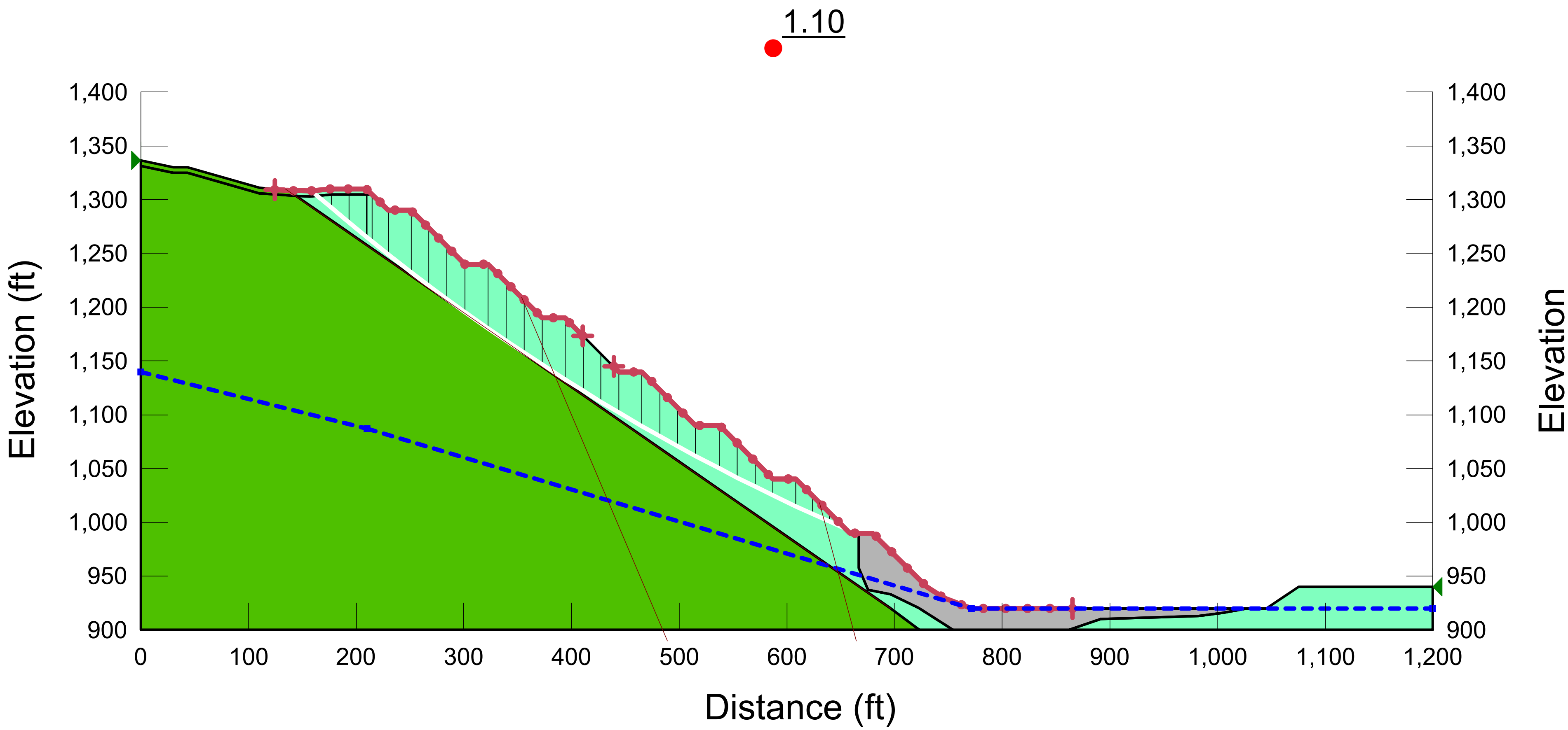
Title: Rock Plant Reserve - Section B
Name: 1. Static
Method: Spencer
Factor of Safety: 1.43
Horz Seismic Coef.:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	165	1,800	27	1
	Limestone Bedrock	165	12,500	30	1



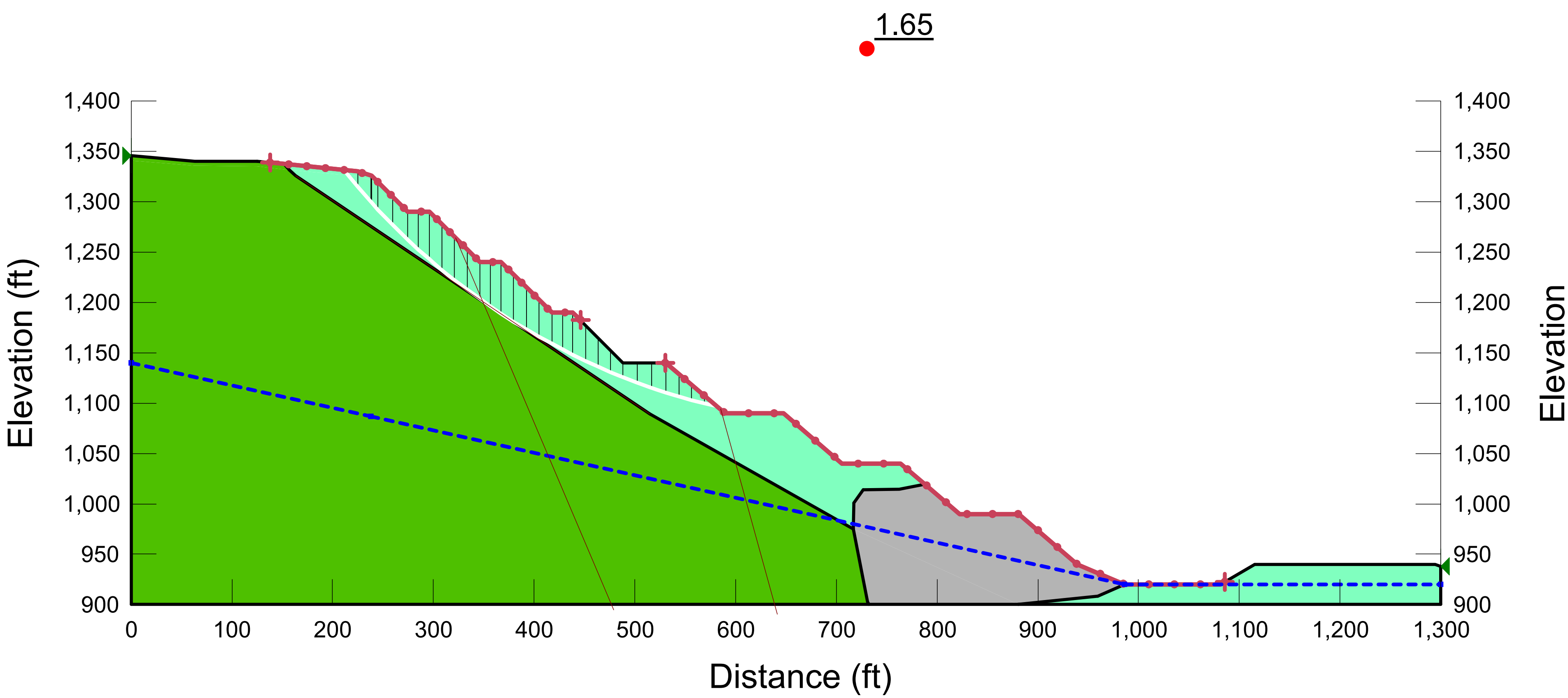
Title: Rock Plant Reserve - Section B
Name: 2. Pseudo-Static
Method: Spencer
Factor of Safety: 1.10
Horz Seismic Coef.: 0.15

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	165	1,800	27	1
	Limestone Bedrock	165	12,500	30	1



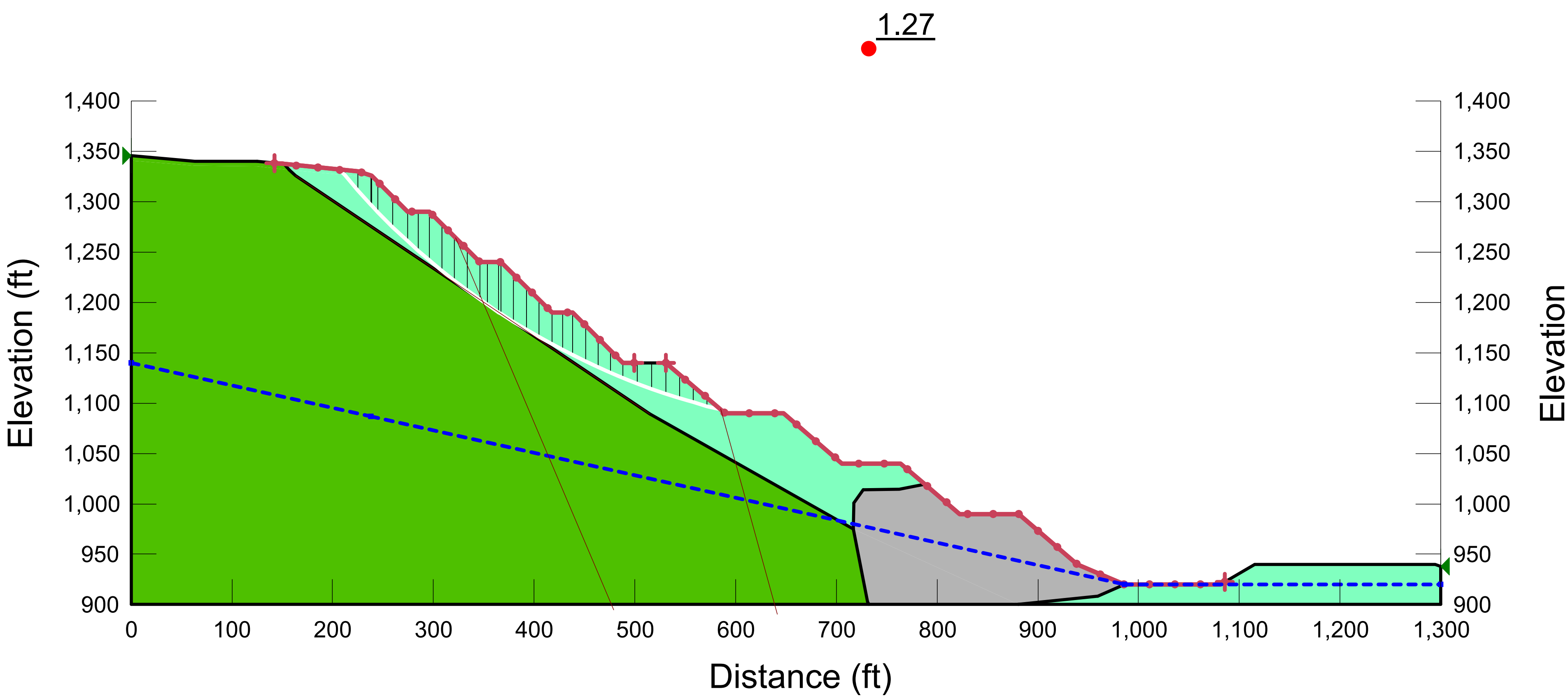
Title: Rock Plant Reserve - Section C
Name: 1. Static
Method: Spencer
Factor of Safety: 1.65
Horz Seismic Coef.:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	165	1,800	27	1
	Limestone Bedrock	165	12,500	30	1



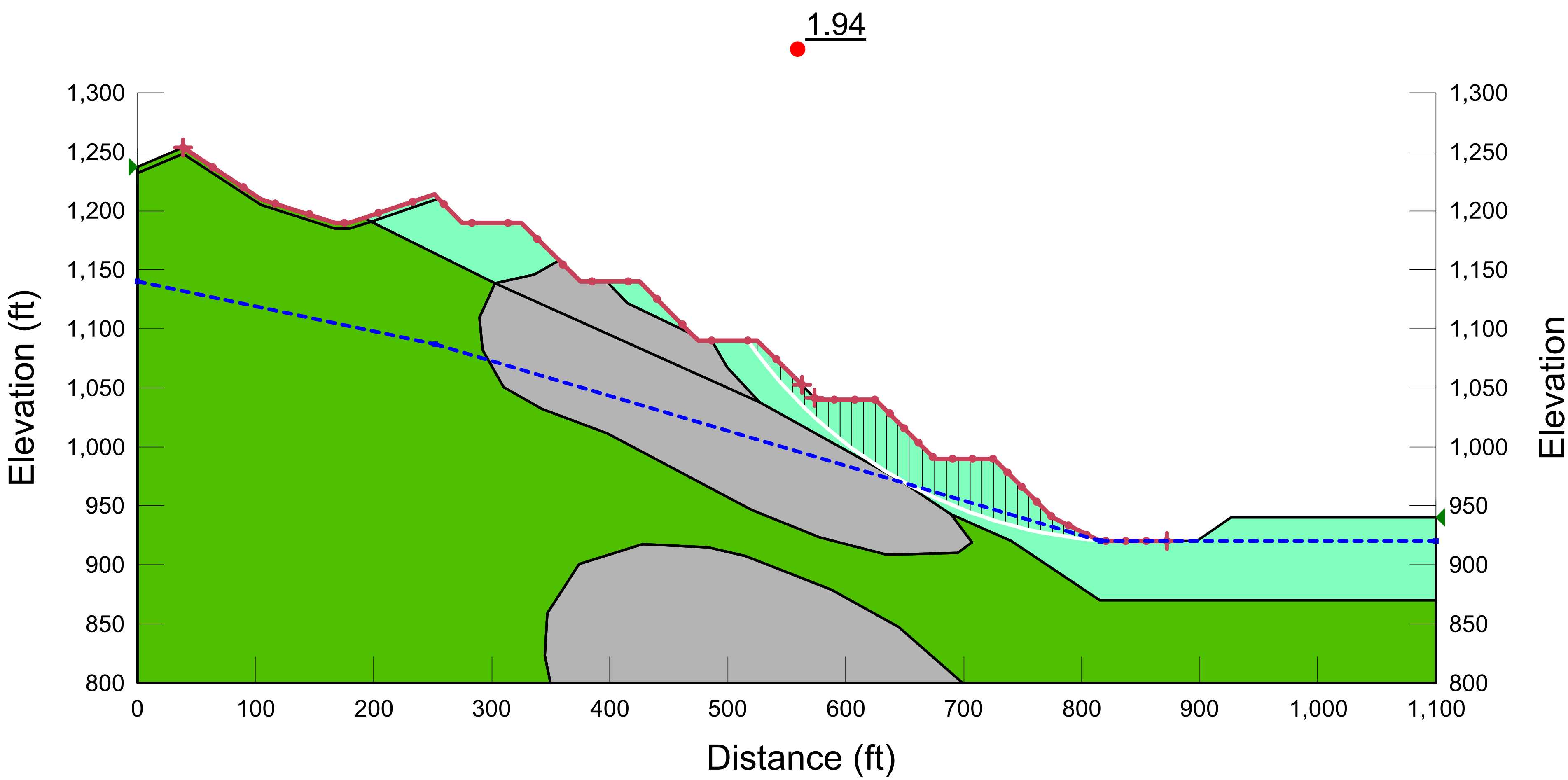
Title: Rock Plant Reserve - Section C
Name: 2. Pseudo-Static
Method: Spencer
Factor of Safety: 1.27
Horz Seismic Coef.: 0.15

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	165	1,800	27	1
	Limestone Bedrock	165	12,500	30	1



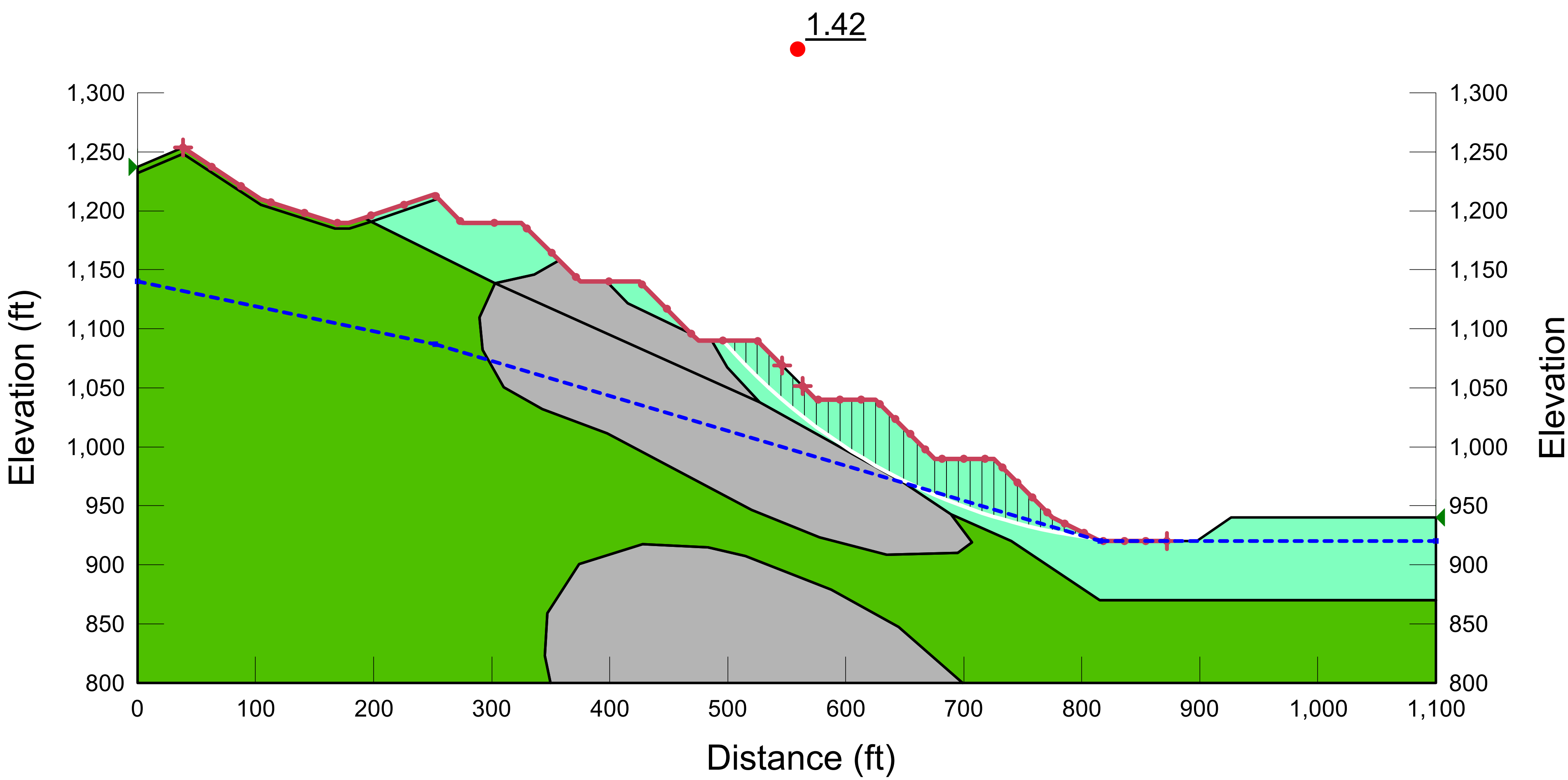
Title: Rock Plant Reserve - Section D
Name: 1. Static
Method: Spencer
Factor of Safety: 1.94
Horz Seismic Coef.:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	165	1,800	27	1
	Limestone Bedrock	165	12,500	30	1



Title: Rock Plant Reserve - Section D
Name: 2. Pseudo-Static
Method: Spencer
Factor of Safety: 1.42
Horz Seismic Coef.: 0.15

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Greenstone Bedrock	165	12,500	30	1
	Greenstone Bedrock (Mining Influenced Zone)	165	1,800	27	1
	Limestone Bedrock	165	12,500	30	1



APPENDIX C

Seismic Displacement Calculations

Rock Plant Reserve Seismic Displacement Analysis

Section	Yield Acceleration ky (g)	Average Failure Surface Height (ft)	Seismic Displacement (in) (Bray and Travasarou		
			Median	16% exceedence	84% exceedence
Section A	0.185	37	2	4	1
Section B	0.195	37	2	4	1
Section C	na	na	na	na	na
Section D	na	na	na	na	na

Note: Seismic displacement analyses were done for all models that have a FOS < 1.15 for Pseudo-static stability

Based on: Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, ASCE, V. 133(4), pp. 381-392, April 2007

MODEL INPUTS:	**Value**	**Reference**
Moment Magnitude Mw	7.1	Golder
PGA	0.6g	Golder
Non-ZeroStandard Deviation	0.66	Bray & Travasarou paper
Ts Coefficient	1.5	Bray & Travasarou paper

APPENDIX G-5

ROCK PLANT HAUL ROAD AND UTILITY ROAD GEOTECHNICAL EVALUATION

To:	Talia Flagan	From:	Paul Kos
	Lehigh Hanson		Denver, Colorado Office
File:	Lehigh Utility Road Geotech Review Stantec PN 233001289	Date:	May 21, 2019

Utility Road Grading Plan and Geotechnical Analysis

BACKGROUND

Lehigh Hanson (Lehigh) improved an approximately 800-foot long portion of an existing utility road that climbs southerly from the Permanente aggregate plant and continues along a ridge toward the neighboring quarry site (**Figure 1**). The alignment has been in use for 50 plus years and does not represent an engineered design. This roadway began as a narrow, bulldozed exploration and utility access road. It was subsequently used as a maintenance road to access this portion of the property, and by Pacific Gas and Electric Company (PG&E) to access power lines in the area. The road was improved in 2018 to allow for off-site materials transport. Lehigh plans to grade the utility road to decrease slope gradients while continuing to allow access by site personnel for maintenance and exploration purposes, PG&E maintenance vehicles, and potentially emergency response vehicles. No further hauling is planned for the road.

Figure 1 Utility Road Location

EXISTING CONDITIONS

The utility road was improved along its preexisting alignment. While the road contains steep slopes and grades, it is within typical mining industry standards for grading, slopes, and drainage controls. A key consideration of this road is that it is an internal road that cannot be accessed by the public. It must remain serviceable as it serves the primary access to the southern property and as an easement for PG&E utility lines. Roads such as this are typically constructed following existing site practices that have been proven to work at the site. Photographs of the improved road are included below. **Figure 2** shows the road cross-section and presents the range of excavation heights. **Figure 3** shows the fill profile. It should be noted that the slopes pictured have been revegetated since these photographs were taken.

Figure 2 Utility Road Cross-Section

Figure 3 Utility Road Fill Profile

The road is steep compared to typical public roads, with grades up to 20%. These grades are common for unpaved mine access roads which are not intended for public use. These grades are also consistent with the grades for retained roads in the currently approved Reclamation Plan Amendment for the Permanente Quarry. The road is sloped toward the hillside, which directs stormwater to the inside of the road. Water flows either to the aggregate plant at Permanente Quarry to the north or Stevens Creek Quarry to the south, where it enters one of the existing stormwater management systems.

The utility road was constructed by placing a key at the toe of the fill slope. The key included excavating material from the toe of the fill area and backfilling it with compacted fill. Water was added to the fill to achieve optimal moisture content, and it was compacted with a vibratory sheep's foot roller. Once the key was constructed, the utility road was improved by cutting material from the uphill slope and placing compacted fill on the downhill slope above the key. The fill slope was cleared and grubbed, but the surface soil was not removed, except where the key was placed. The cut slopes vary, but they are generally steep at approximately 1:1 (45°), with cut heights are up to 30 feet. The fill slopes are also steep at approximately 1.2:1 (39°), with fill slopes up to 50 feet high. Internal mine roads are often constructed with cut and fill slopes in this range, and any erosion that occurs is managed by the site maintenance crews. A safety berm was constructed on the outside edge of the utility road, consistent with Mine Safety and Health Administration (MSHA) requirements and standard safety practices, which improves the safety of maintenance or utility worker use. This configuration consisting of a berm on the outside and a ditch on the inside is a preferred design for site roads, because it limits the potential for discharges to the environment.

A Stantec Certified Engineering Geologist (CEG) inspected the utility road in May 2019 to evaluate the lithology along the road cut. The inspection confirmed the road was constructed primarily in the Santa Clara Formation; however, the southern section (including C-C') was constructed in Franciscan Limestone and Greenstone. The limestone is not present at the two areas where a geotechnical assessment is required (see below). **Figures 4** and **5** show the Santa Clara Formation at the road cut at cross-section B-B' and Greenstone at the road cut at cross-section C-C', respectively. **Drawing 1** includes the cross-section locations, and the cross-sections are included as **Drawing 2**.

Figure 4 Road Cut at Cross-Section B-B'

Figure 5 Road Cut at Cross-Section C-C'

SURVEY DATA

Lehigh provided Stantec with survey data from before and after the road improvements. The pre-construction survey was performed in April 2007, and the existing conditions survey was performed in September 2018. These surfaces were used to create the grading plan and to create the cross-sections used to analyze the slope stability. Stantec believes the April 2007 survey was impacted by dense vegetation in the vicinity of the utility road, and the survey appears to present the top of vegetation in several areas rather than the ground surface. To compensate for these differences in elevation, Stantec adjusted the original ground topography in the cross-sections based on known facts. These include the extents of cutting and filling from the road improvement – the 2007 topography and 2018 topography should match outside this area. Also, aerial photographs available from Google Earth were used to determine the distances from the original road, key road, and current road edges and centerlines to confirm extents of disturbances. The 2007 topography, while showing the top of vegetation, likely represents the original slope, and the surface was lowered to match the extents of disturbance.

PROPOSED GRADING

Stantec recommends grading the road to reduce fill slope gradients to comply with local rules and regulations. City and County grading regulations require slope gradients be 2h:1v, or the design be certified by a Certified Engineering Geologist. The grading design is based on a minimum 20-foot road width, which includes sufficient space for one-way travel, a ditch, and a berm. Road widths for retained roads, in the currently approved Reclamation Plan Amendment for the Permanente Quarry, vary and are as narrow as 12 feet. Wherever practical, the road will be wider than 20 feet to provide turn-off locations. The grading plan has an overall road gradient of approximately 12%, with short sections that exceed 20% gradient. These grades are consistent with the original utility road and other roads that will be retained during reclamation per the currently approved Reclamation Plan Amendment for the Permanente Quarry.

The road can be graded to 2h:1v slopes the entire length of the road, except for two areas as shown on **Drawing 1**. Both sections where steeper slopes are required are approximately 100 feet long. The grading for both areas includes narrowing the road width to 16 feet and increasing the slope gradient to the necessary slope that does not increase the disturbance area beyond the existing area. Narrowing the road to 16 feet allows the slope gradient to be decreased closer to the 2h:1v target, while maintaining sufficient road width for the potential traffic. The northern section requires a maximum gradient of 1.70h:1v, and the southern section requires a maximum gradient of 1.76h:1v. These gradients follow the pre-construction topography; therefore, the entire length of road will be graded to 2h:1v slopes or to pre-construction topography. This grading requires excavating and hauling away approximately 9,000 cubic yards of material. The material will be placed on the Permanente Quarry property in accordance with the current Reclamation Plan.

Cross-sections of the proposed utility road through a typical 2h:1v slope and the two areas requiring slope gradients steeper than 2h:1v are included as **Drawing 2**. These figures present the original topography based on the 2007 pre-improvement survey, current topography based on the September 2018 survey, and the design topography.

SLOPE STABILITY DISCUSSION

Lehigh is required to submit slope stability calculations pursuant to California Code of Regulations, Title 14, § 3704(f). This regulation applies to final cut slopes and requires a slope stability factor of safety suitable with the proposed end land use. As discussed above, the utility road will be retained following mine reclamation for internal site access, PG&E access, and emergency vehicle use. The road will not be open for public use.

SLOPE STABILITY EVALUATION

Stantec performed a geotechnical evaluation of the slope stability for the two sections where fill slopes must be steeper than 2h:1v. Stantec evaluated both the cut and fill slopes. The slope stability analyses were modeled using the software Slope-W® 2018 R2 version 9.1 by GeoStudio, released in 2018. The software used limit equilibrium on slices of potential failure surface to calculate factor of safety (FoS). The models are evaluated under static and pseudo-static conditions, with horizontal ground acceleration, using the Spencer method. The minimum acceptable factors of safety for the analyses are 1.3 for static conditions, and 1.0 for pseudo-static conditions based on mining industry standards. For the pseudo-static model conditions, a horizontal seismic coefficient of 0.15 times the force of gravity (g) was applied to the static condition models to be consistent with previous studies (Golder 2011) and to follow recommendations for earthquakes with magnitudes up to 8-1/4 (Seed 1982).

Site-specific geotechnical information on the backfill materials is available for the overburden fill, bedrock, and native soils. Strength parameters for the material have been established in previous geotechnical analyses of the Lehigh property and are based on laboratory testing, back-calculation, and published values for material properties (Golder 2011). These strength parameters are listed in **Table 1** below.

The fill material rock strength is consistent with the material strength parameters used for waste rock fill slope assessments at the Lehigh property (Golder 2011). Stantec feels the shear strength values are representative of the materials used for the fill, albeit conservative due to no consideration for cohesion, considering the existing fill slopes were placed at a gradient of approximately 39 degrees.

There is a thin layer of residual soil between the bedrock and fill material, and Stantec used material strength parameters for soils that are based on laboratory testing results and published strength values for Sandy Clay/Clayey Sand/Clayey Gravel/Silty Sand material. The laboratory results included values for cohesion; however, the stability analysis assumed a cohesionless material to be conservative. These strength values are representative of native soils above the Santa Clara Formation and have previously been used for slope assessments at the Lehigh property (Golder 2011).

The Santa Clara Formation is present in the road cut at cross-sections A-A' and B-B' and occurs as both fine- and coarse-grained materials. The fine-grained material at cross-section A-A' is primarily a medium to high plasticity clay with gravel, sand, and some silt. The coarse-grained material at cross-section B-B' is a well-graded gravel with clay and sand, with fine to coarse, rounded to sub-rounded gravels. Strength values for the Santa Clara Formation are provide by California Geological Survey for the Cupertino 7.5-minute Quadrangle (CGS 2002). Values for both "favorable bedding conditions" (coarse-grained) and "adverse bedding conditions" (fine -grained) were used in the stability analysis considering both are present in the project area. The unit weight for the Santa Clara Formation was assumed to be the same as the Greenstone and Limestone bedrock.

Weathered Greenstone and Limestone are present along the road cut at cross-section C-C'. Site specific geotechnical information is available for the Greenstone and Limestone rock types, and strength parameters for the material have been established in previous geotechnical analyses (Golder 2011 and Stantec 2019). These strength parameters are based on laboratory testing, back-calculation, rock mass rating (RMR) calculations, and back-analysis of landslide areas. The strength parameters, from RMR classification, were provided to estimate Mohr-Coulomb strength parameters. RocLab (1.0) free software from Roc Science were used to do the calculation. The calculations were based "General" application for failure envelope range. The disturbance factor of D = 0 was used.

Table 1 Shear Strength Values

Material	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Soil	120	30	200
Fill	125	35	0
Santa Clara (favorable bedding conditions)	165	33	550
Santa Clara (adverse bedding conditions)	165	24	820
Greenstone	165	23	1,400
Limestone	165	30	12,500

Stantec modeled the slope stability factors of safety for static and pseudo-static conditions using Slope/W 2012 (Version 8.14) software. Slope/W performs a two-dimensional, limit-equilibrium analysis to calculate the factor of safety. The pseudo-static analysis used a seismic coefficient of 0.15, which is consistent with previous analyses at the Lehigh property (Golder 2011).

The slope stability results identify the minimum factors of safety for each analysis, and these results are summarized in **Table 2** below and the model reports are included in **Attachment 1**. The results indicate that the cut and fill slopes are stable (FOS>1.0) during both the static and pseudo-static conditions. There is no infrastructure or any sort of facility below the road that can be impacted by potential slope movements. Stantec recognizes that the location of the pre-construction topography is approximate, and a sensitivity analysis was performed to assess the fill slope stability if the entire road bench is fill material. This sensitivity demonstrates that the slope is stable in this unlikely scenario. Stantec also recognizes that the strength of the Santa Clara Formation may not be uniform along the road cut, and a sensitivity analysis was performed using published strengths for fine-grained sections of the formation with “adverse bedding conditions” (CGS 2002). The sensitivity also demonstrates that the slope is stable if there is fine-grained Santa Clara Formation present; see **Attachment 1**.

Table 2 Slope Stability Results

Section	Slope	Static FOS	Pseudo-Static FOS
A-A’	Cut Slope (coarse-grained)	1.88	1.46
	Cut Slope (fine-grained)	1.87	1.41
	Fill Slope	2.06	1.52
B-B’	Cut Slope (coarse-grained)	1.87	1.45
	Cut Slope (fine-grained)	1.88	1.45
	Fill Slope	1.93	1.52
C-C’	Cut Slope	2.86	2.44
	Fill Slope	2.67	1.94

Utility Road Grading Plan and Geotechnical Analysis

Recommendations for Future Actions

Stantec recommends several actions to improve the functionality of the road and minimize erosion and maintenance requirements. Foremost, the slopes should continue to be seeded to establish vegetation, which will reduce erosion. Similar to what was completed in 2018, the seeding should occur before each rainy season, as necessary.

Stantec also recommends maintaining the road and repairing any areas where erosion may occur.

Closure

This report has been prepared for Lehigh Hanson to provide a geotechnical evaluation of proposed grading activities to further improve to the existing utility road based on site observations and provided data. As mutual protection to Lehigh, the public, and Stantec, this memorandum and its figures are submitted for exclusive use by Lehigh Hanson. We specifically disclaim any responsibility for losses or damages incurred through the use of our work for a purpose other than as described in this memorandum. Our memorandum and recommendations should not be reproduced, except in whole, without our express written permission.

Stantec Consulting Services Inc.

Paul Kos, P.E.
Senior Geological Engineer

(720) 889-6122
Paul.Kos@stantec.com

Jennifer Van Pelt, CEG, PG
Engineering Geologist

(925) 627-4565
Jennifer.VanPelt@stantec.com

CERTIFIED ENGINEERING GEOLOGIST
JENNIFER
VAN PELT
2662
STATE OF CALIFORNIA

Attachments:

Drawing 1 Utility Road Grading Plan
Drawing 2 Utility Road Cross-Sections
Slope Stability Analysis Results

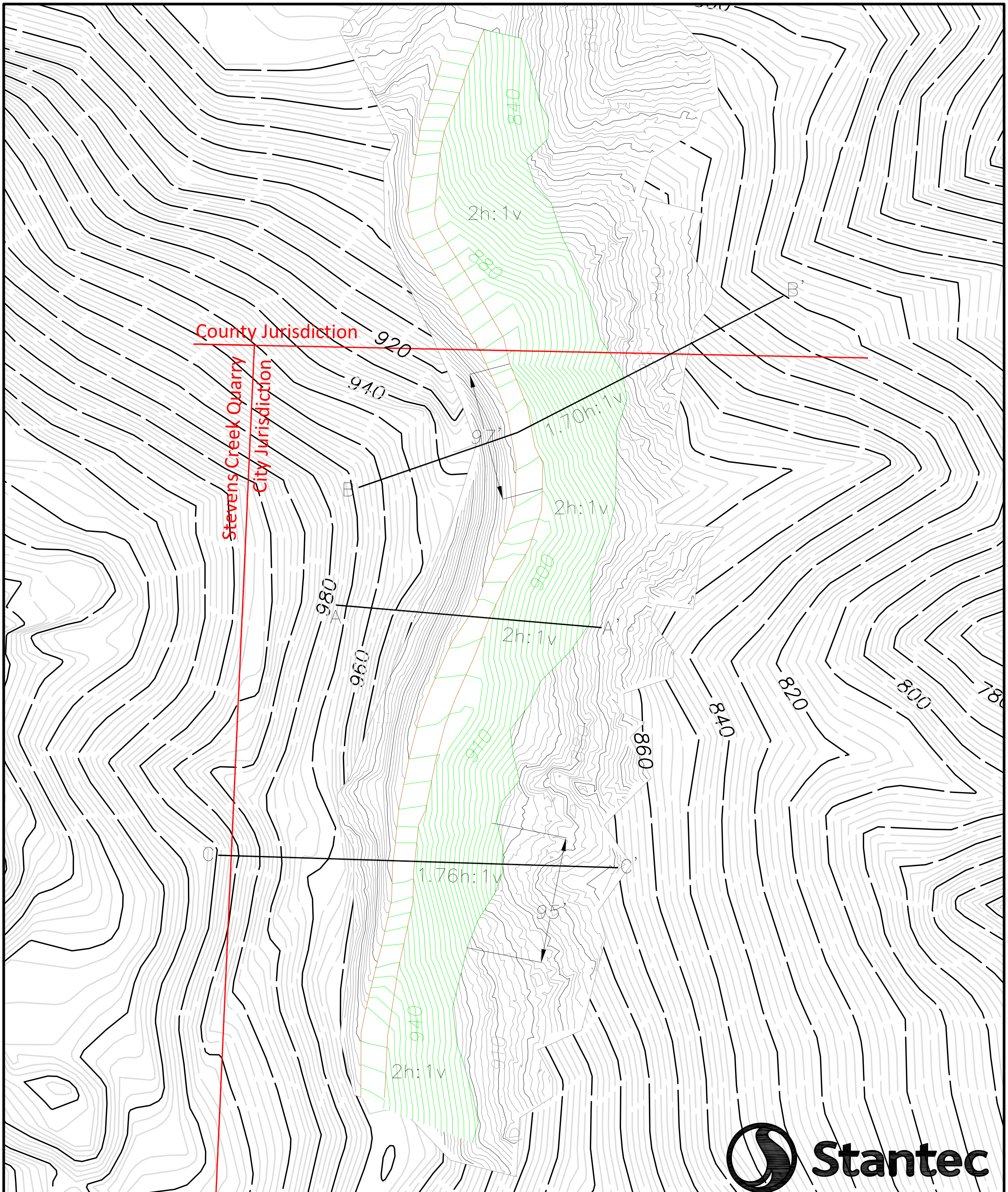
References:

CGS, 2002. Seismic Hazard Zone Report for the Cupertino 7.5-Minute Quadrangle, Santa Clara County, California. Seismic Hazard Zone Report 068. Department of Conservation, California Geological Survey. 2002.

Golder, 2011. Geotechnical Evaluations and Design Recommendations (Revised), Permanente Quarry Reclamation Plan Update, Santa Clara County, California, Revision 1.1_12-7-11. November 2011.

Seed, H. B., 1979. “Considerations in the Earthquake-Resistant Design of Earth and Rockfill Dams,” Geotechnique, vol. 29, No. 3, pp. 215-263.

Stantec, 2019. North Highwall Reserve Geotechnical Evaluation, Permanente Quarry. Prepared for Lehigh Southwest Cement. April 5, 2019.



v:\2274\active\233001289\lehigh_s_437\437-3_223001328_permanentsesesaw\disc\geotech\scq road\response to city_may2019\scq road grading plan_20may2019

2019.05.20 2:24:02 PM

Legend

- 2007 Topography
- 2018 Topography
- Proposed Topography
- Proposed Utility Road
- Property Boundary
- Extent of Fill
- Cross-Section

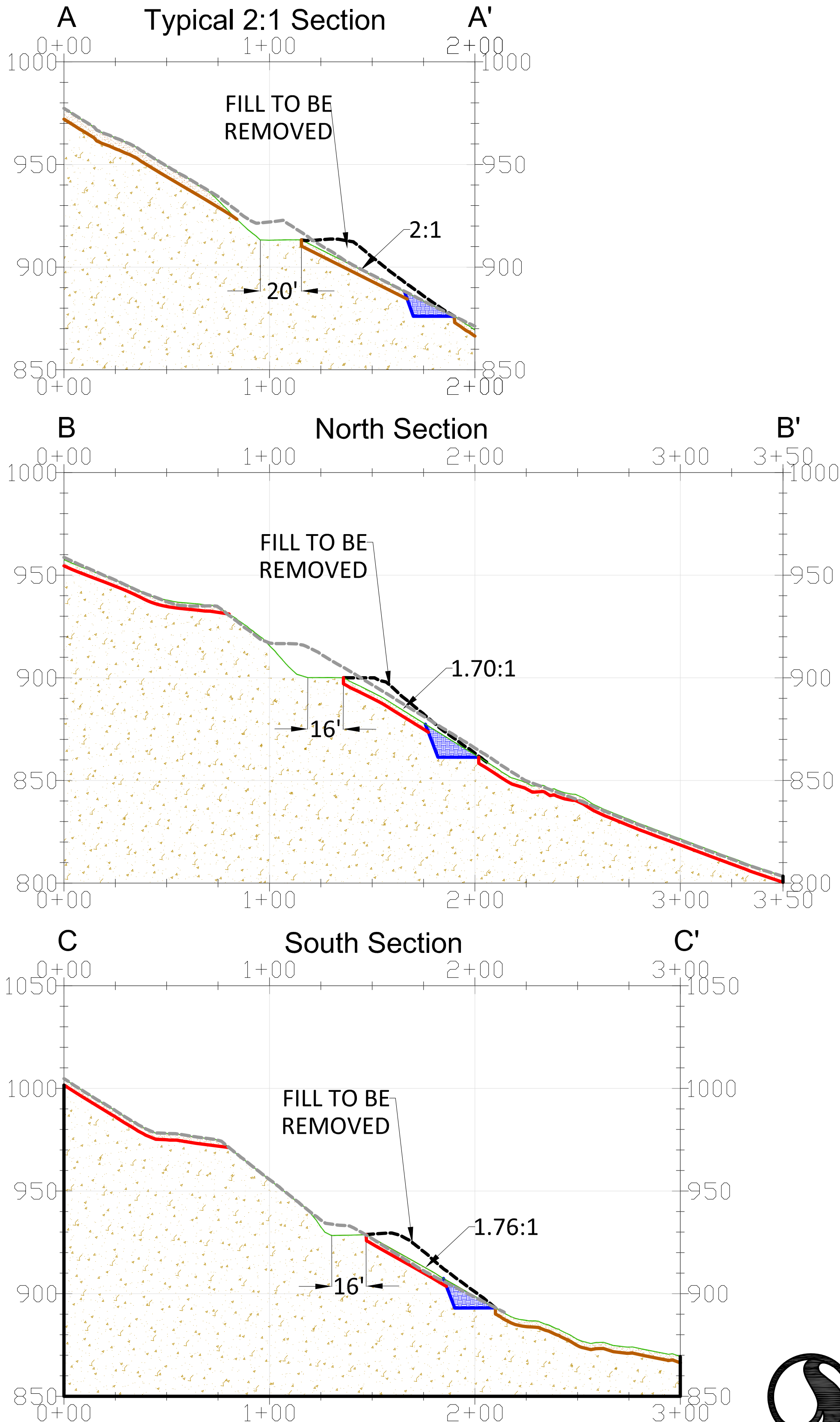
N

0 100' 200'

Client/Project
Lehigh Southwest Cement Company
Permanente Quarry

Drawing
1

Title
Utility Road Grading Plan



v:\2274\active\233001289\lehigh_s_437\437-3, 223001328_permanentseesaw\disc\geotech\scq road\response to city_may2019\scq road grading plan_20may2019

2019.05.20 2:24:39 PM

Stantec

Legend

- PROPOSED SURFACE
- EXISTING SURFACE
- ORIGINAL SURFACE
- COMPACTED KEY
- SOIL LAYER

0 80' 160'

Client/Project

Lehigh Southwest Cement Company
Permanente Quarry

Drawing

2

Title

Utility Road Cross-Sections

Attachment 1

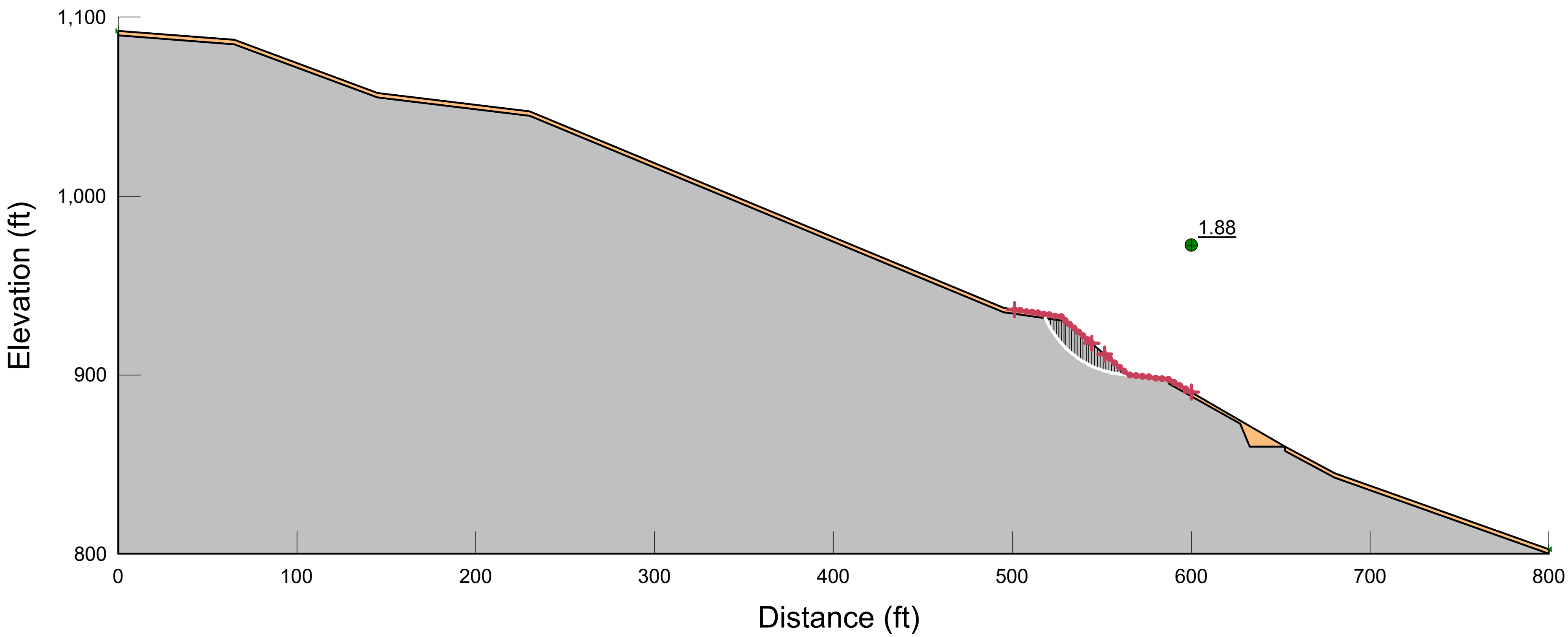
Slope Stability Analysis Results

Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 1. Cut Slope (Local)
Name: 1a. Static Analysis

Factor of Safety: 1.88

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

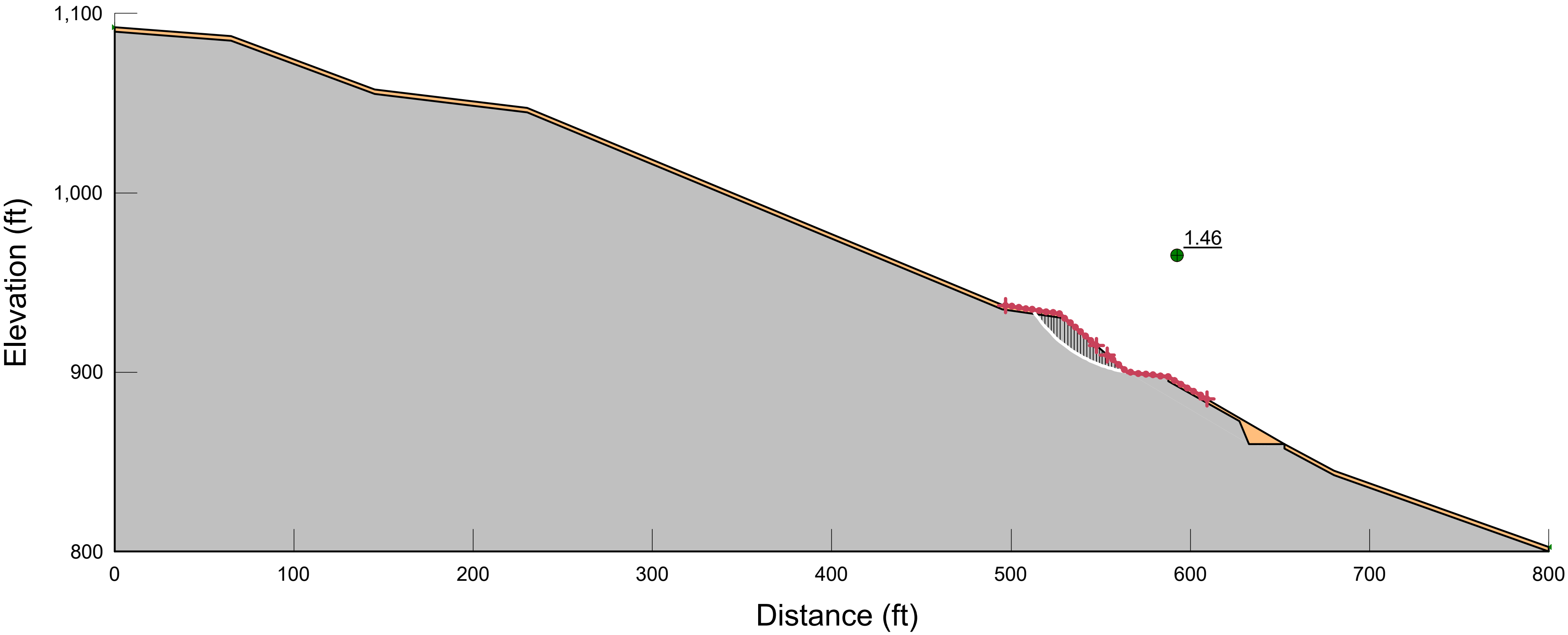


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 1. Cut Slope (Local)
Name: 1b. Pseudostatic Analysis

Factor of Safety: 1.46

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

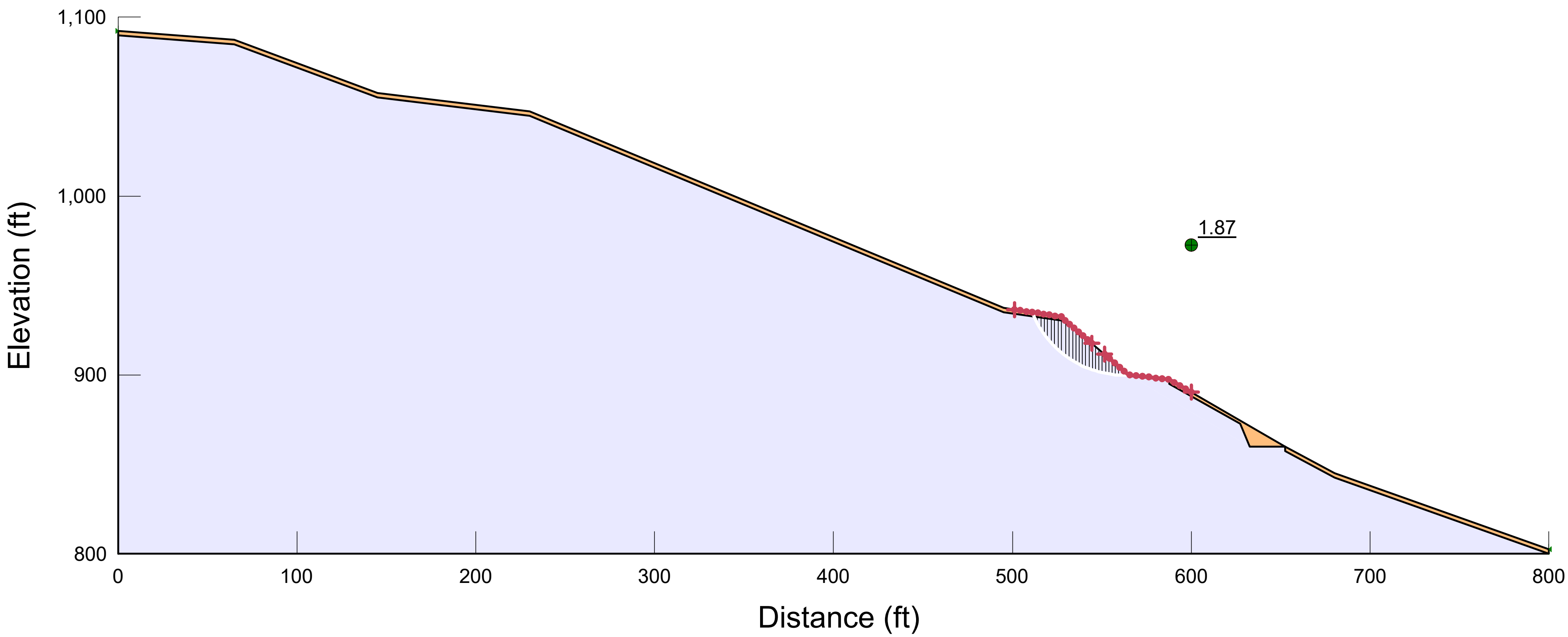


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 1. Cut Slope (Local)
Name: 1c. Static Analysis (Sensitivity)

Factor of Safety: 1.87

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara (Sensitivity)	Mohr-Coulomb	165	820	24

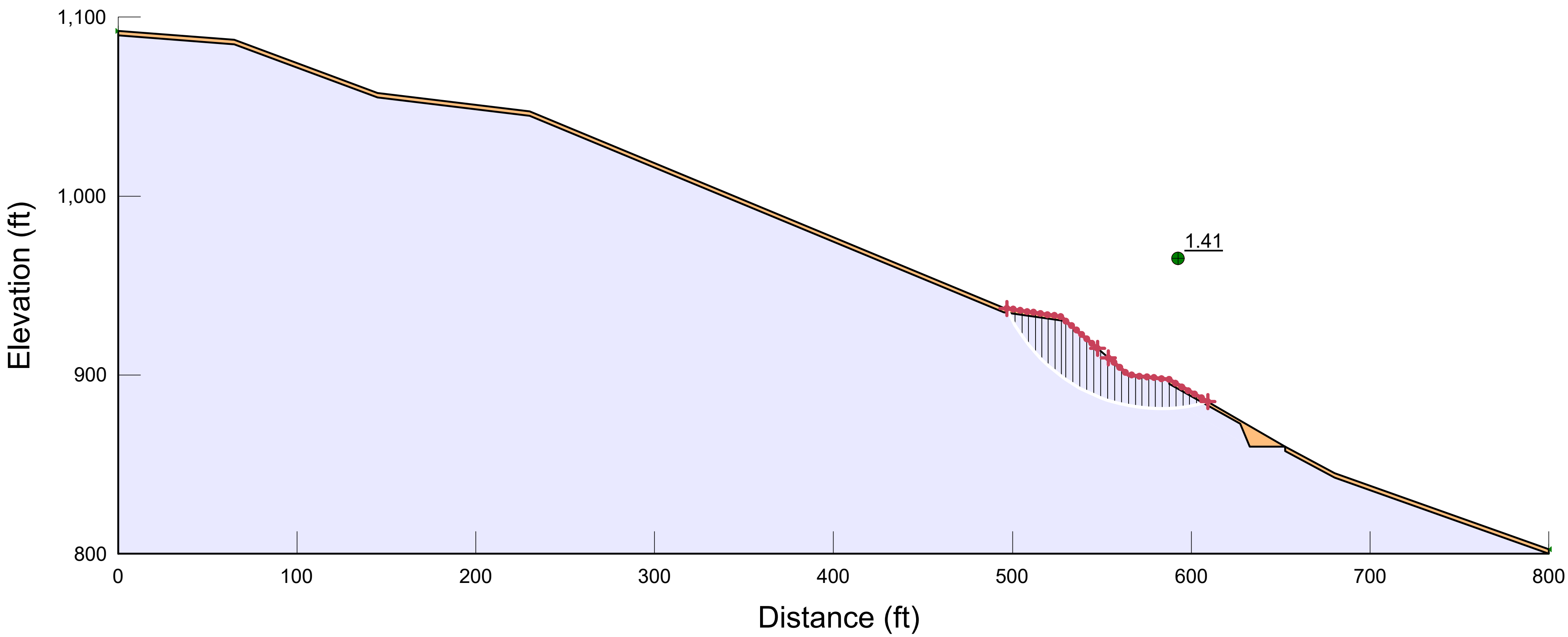


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 1. Cut Slope (Local)
Name: 1d. Pseudostatic Analysis (Sensitivity)

Factor of Safety: 1.41

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara (Sensitivity)	Mohr-Coulomb	165	820	24

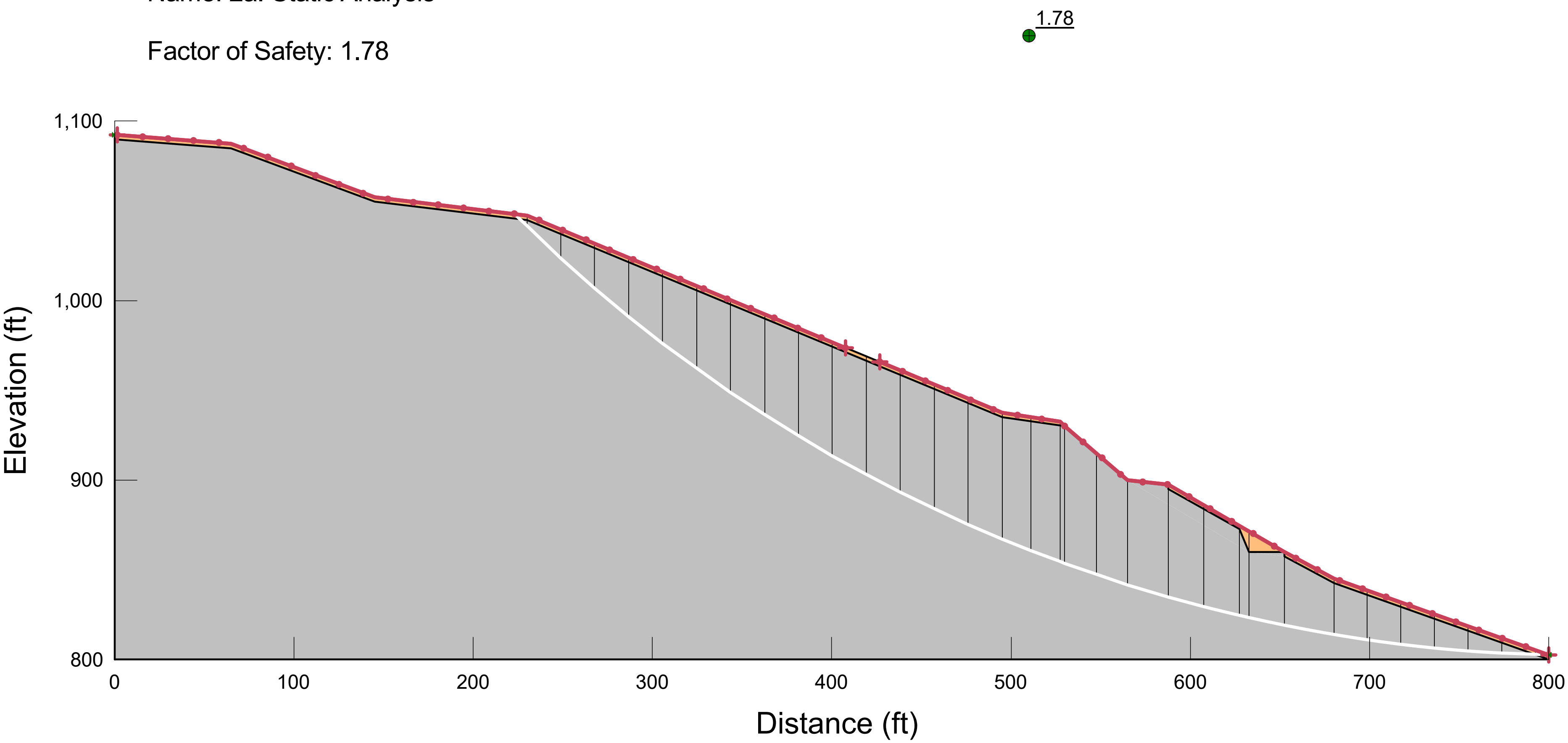


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 2. Cut Slope (Global)
Name: 2a. Static Analysis

Factor of Safety: 1.78

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

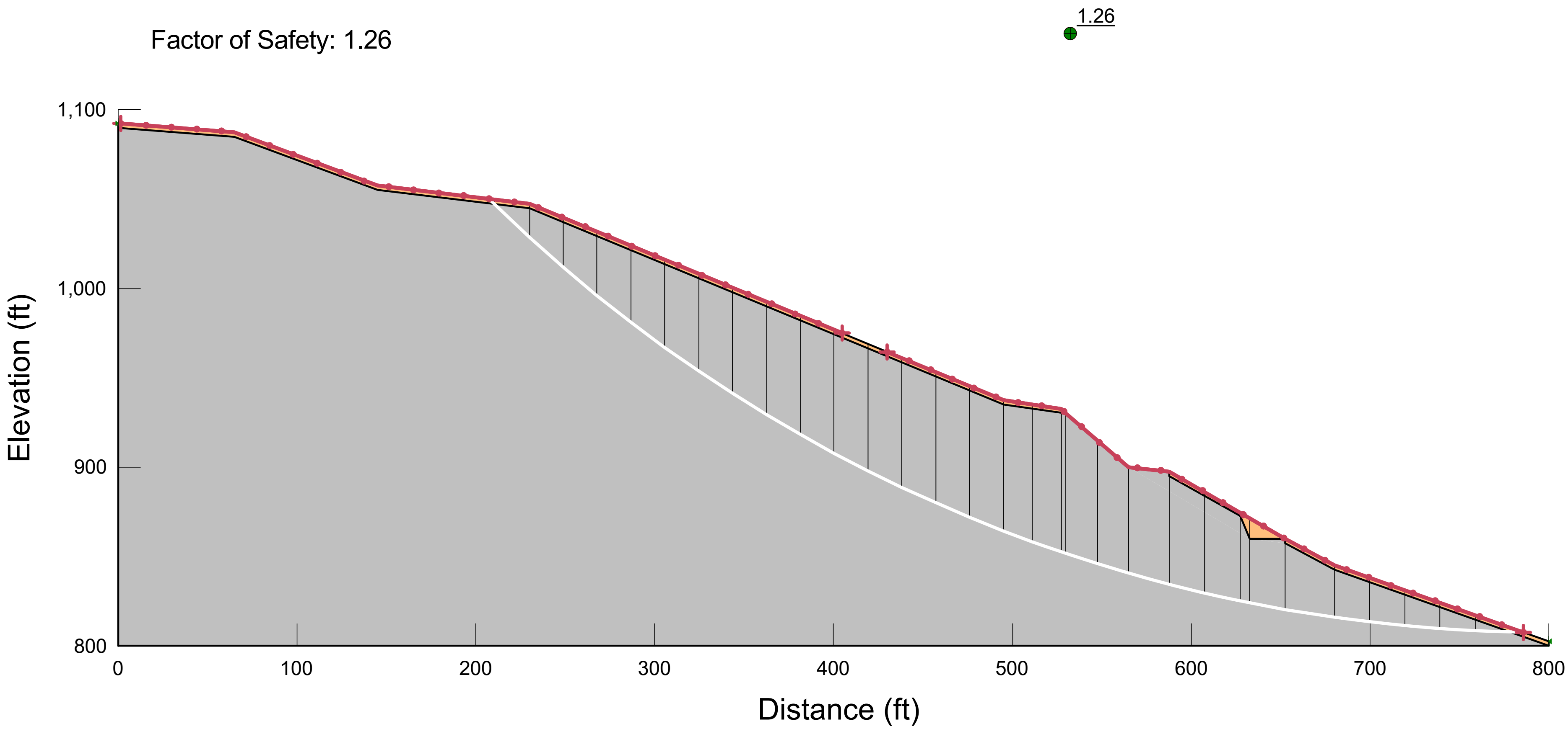


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 2. Cut Slope (Global)
Name: 2b. Pseudostatic Analysis

Factor of Safety: 1.26

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

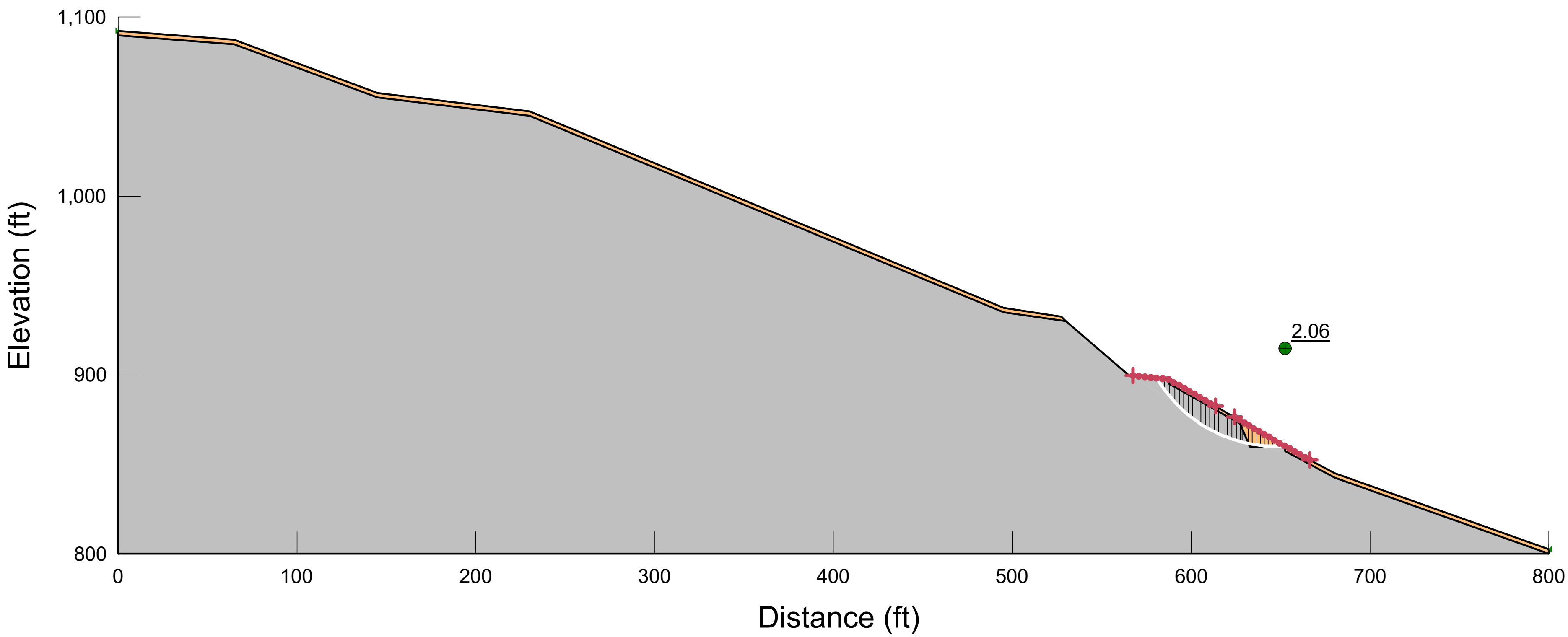


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 3. Fill Slope
Name: 3a. Static Analysis

Factor of Safety: 2.06

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

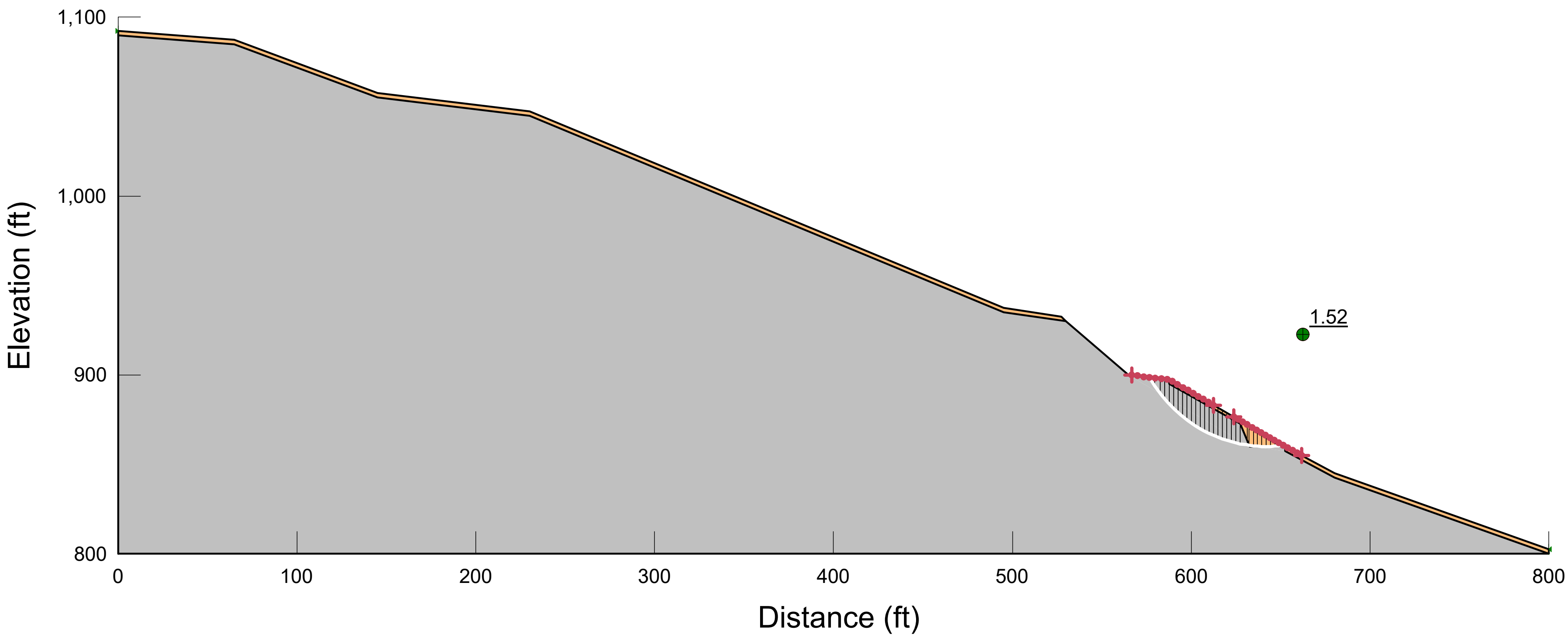


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 3. Fill Slope
Name: 3b. Pseudostatic Analysis

Factor of Safety: 1.52

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

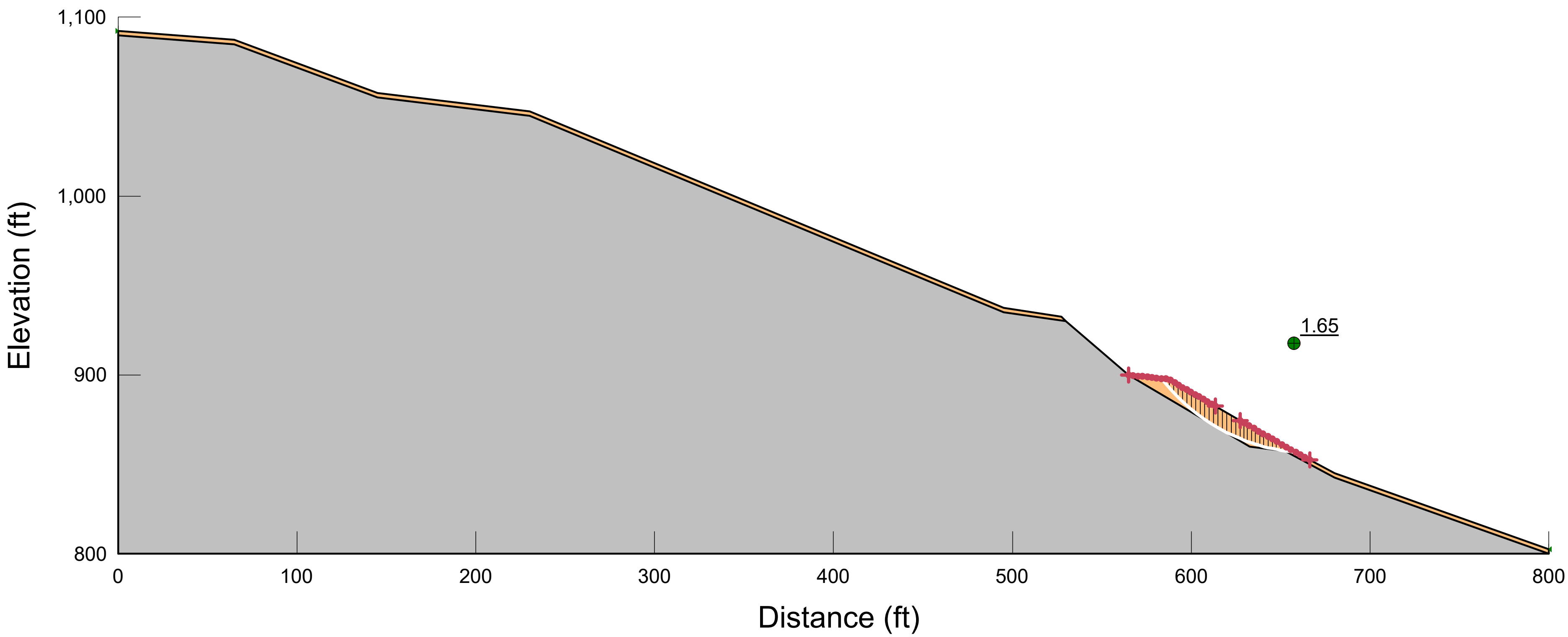


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 4. Fill Slope (Sensitivity)
Name: 4a. Static Analysis

Factor of Safety: 1.65

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

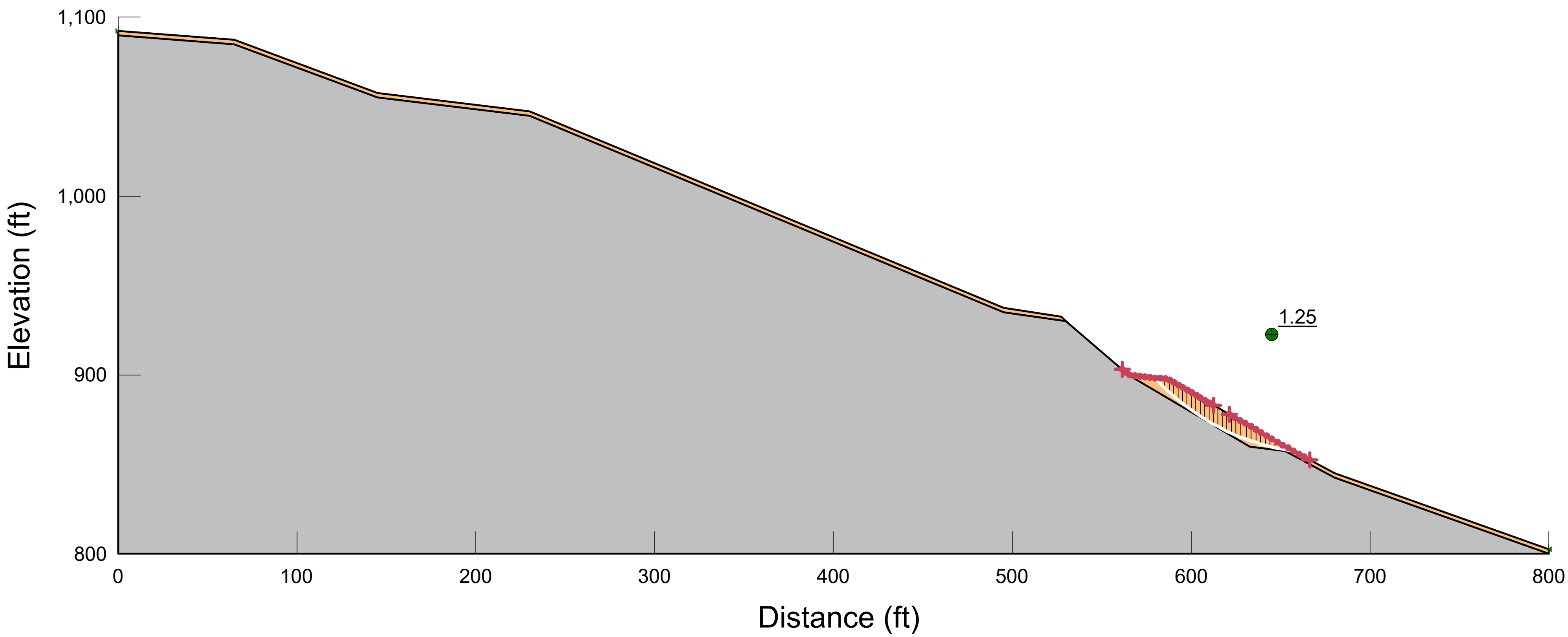


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 4. Fill Slope (Sensitivity)
Name: 4b. Pseudostatic Analysis

Factor of Safety: 1.25

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

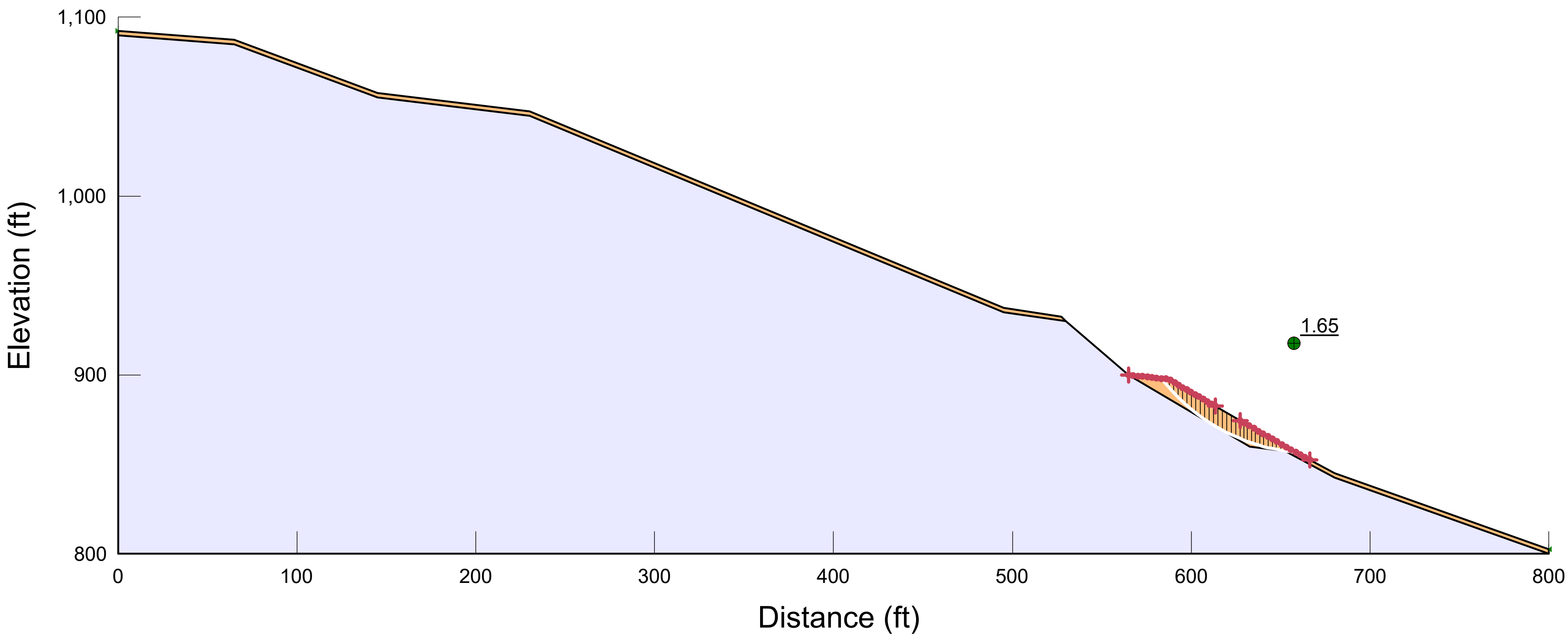


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 5. Santa Clara (Sensitivity)
Name: 5a. Static Analysis

Factor of Safety: 1.65

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara (Sensitivity)	Mohr-Coulomb	165	820	24

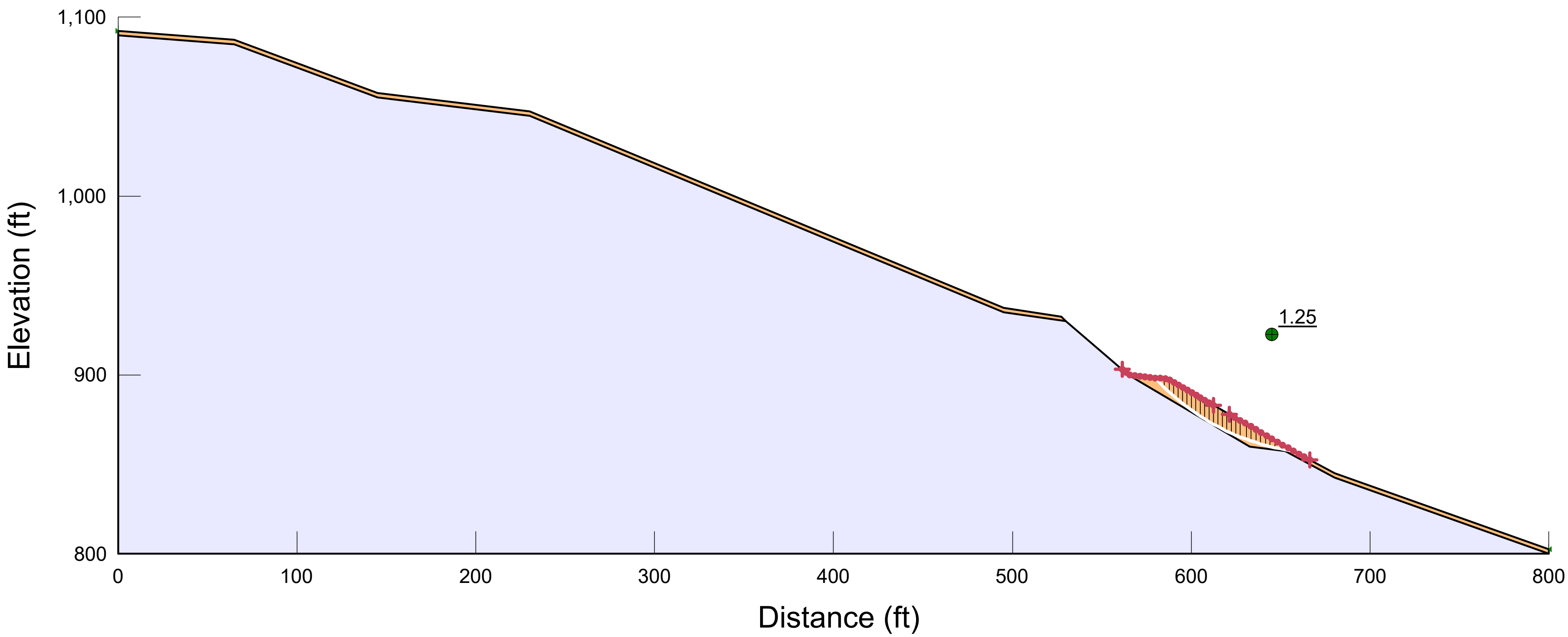


Title: Stevens Creek Road (Section A)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section A (20190516).gsz

Parent: 5. Santa Clara (Sensitivity)
Name: 5b. Pseudostatic Analysis

Factor of Safety: 1.25

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara (Sensitivity)	Mohr-Coulomb	165	820	24

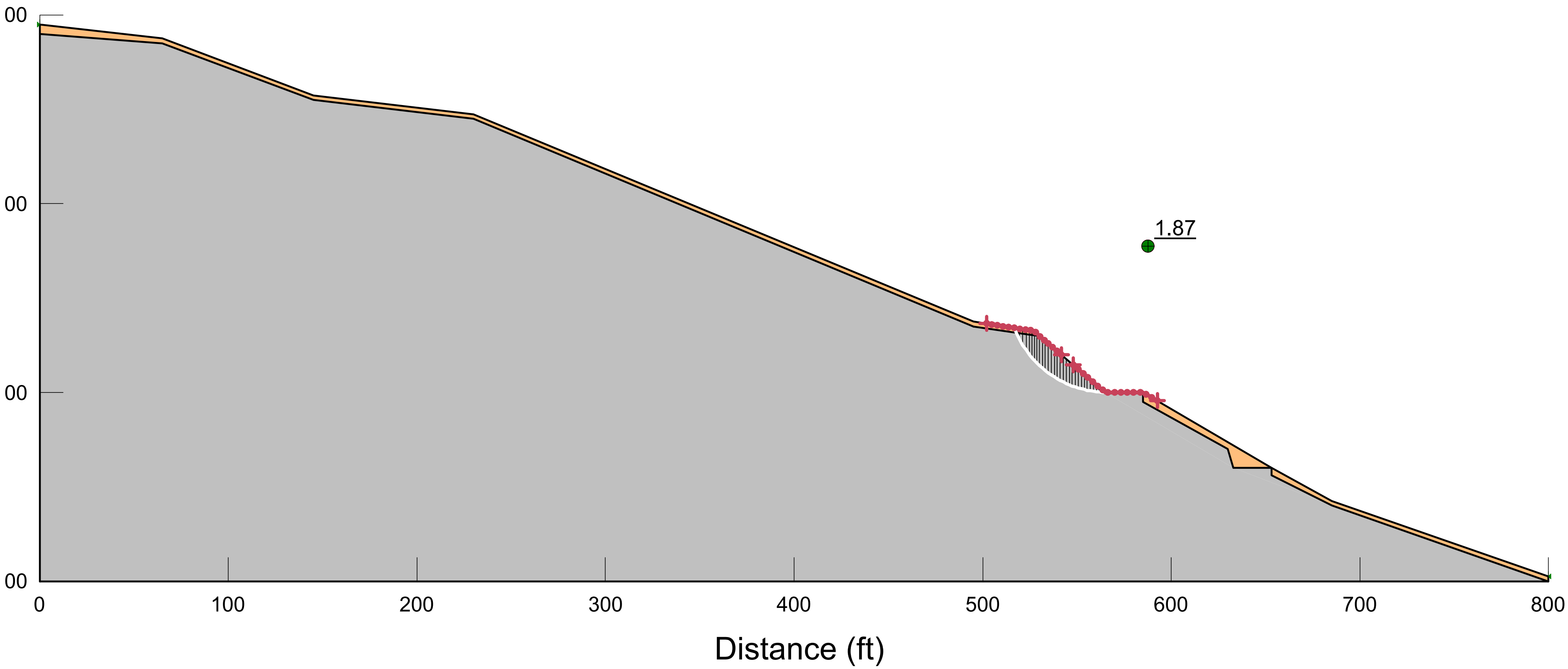


Title: Stevens Creek Road (Section B)
Date: 05/16/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 1. Cut Slope (Local)
Name: 1a. Static Analysis

Factor of Safety: 1.87

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

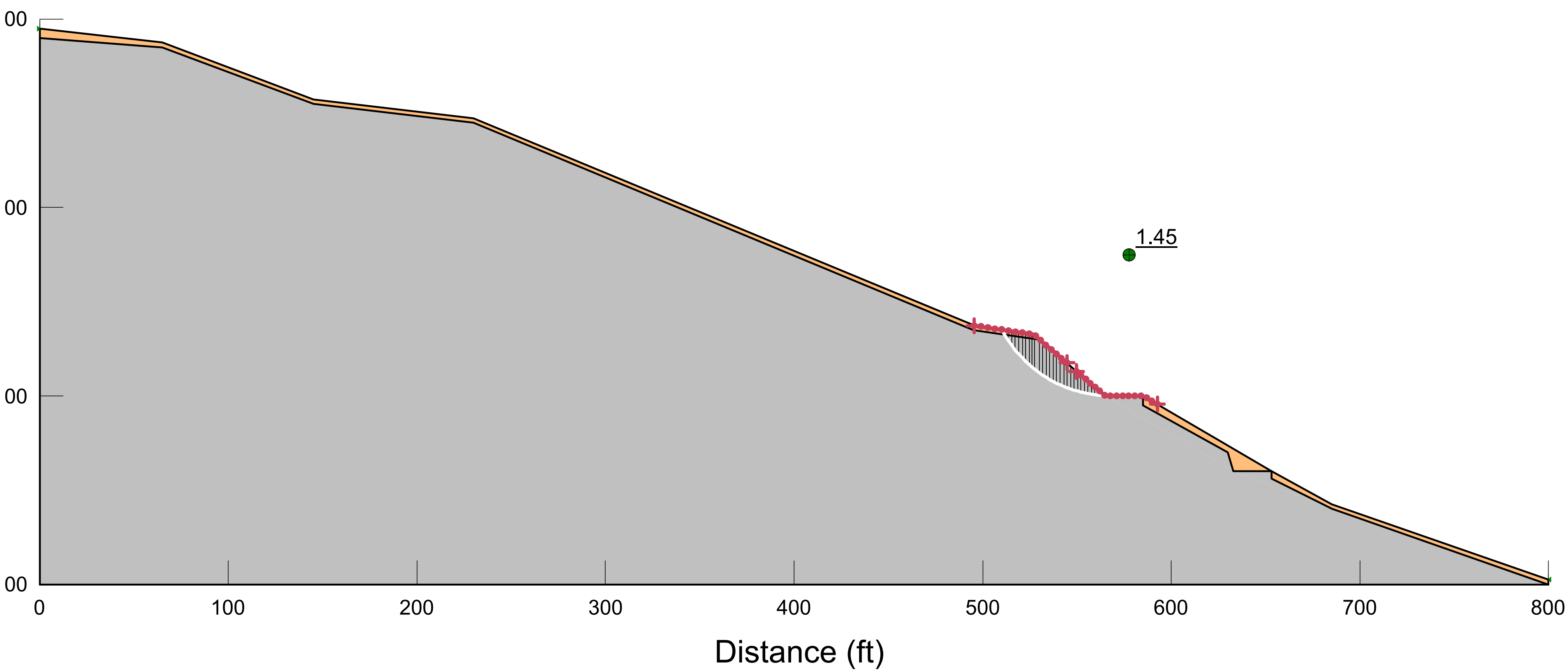


Title: Stevens Creek Road (Section B)
Date: 05/16/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 1. Cut Slope (Local)
Name: 1b. Pseudostatic Analysis

Factor of Safety: 1.45

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

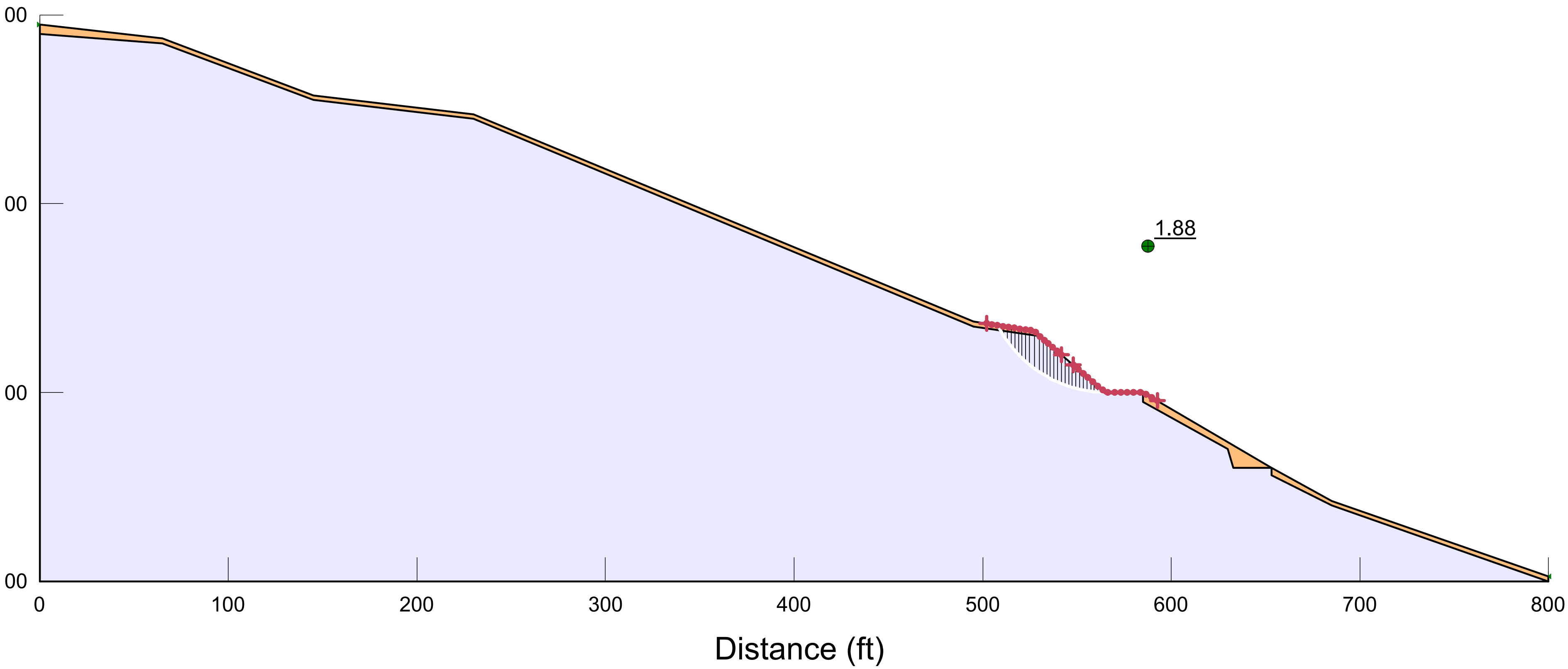


Title: Stevens Creek Road (Section B)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 1. Cut Slope (Local)
Name: 1c. Static Analysis (Sensitivity)

Factor of Safety: 1.88

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara (Sensitivity)	Mohr-Coulomb	165	820	24

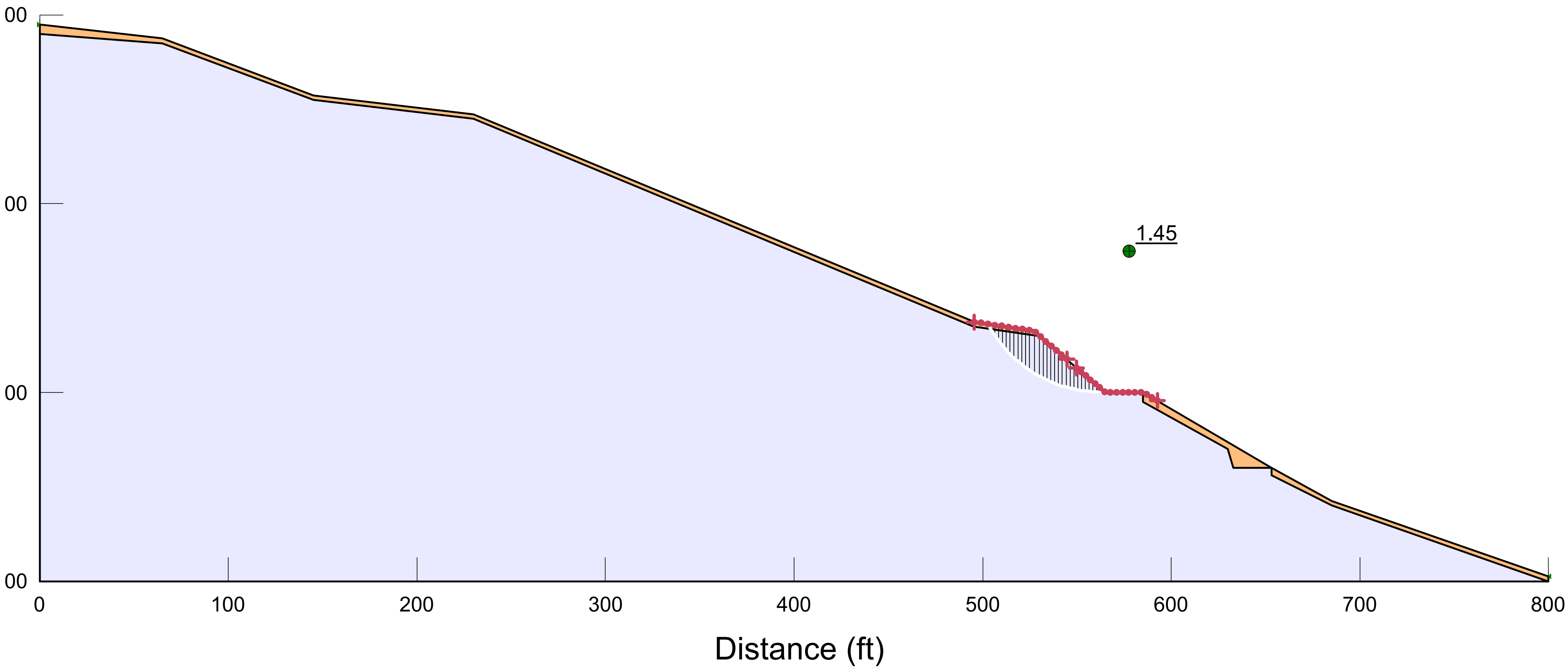


Title: Stevens Creek Road (Section B)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 1. Cut Slope (Local)
Name: 1d. Pseudostatic Analysis (Sensitivity)

Factor of Safety: 1.45

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara (Sensitivity)	Mohr-Coulomb	165	820	24

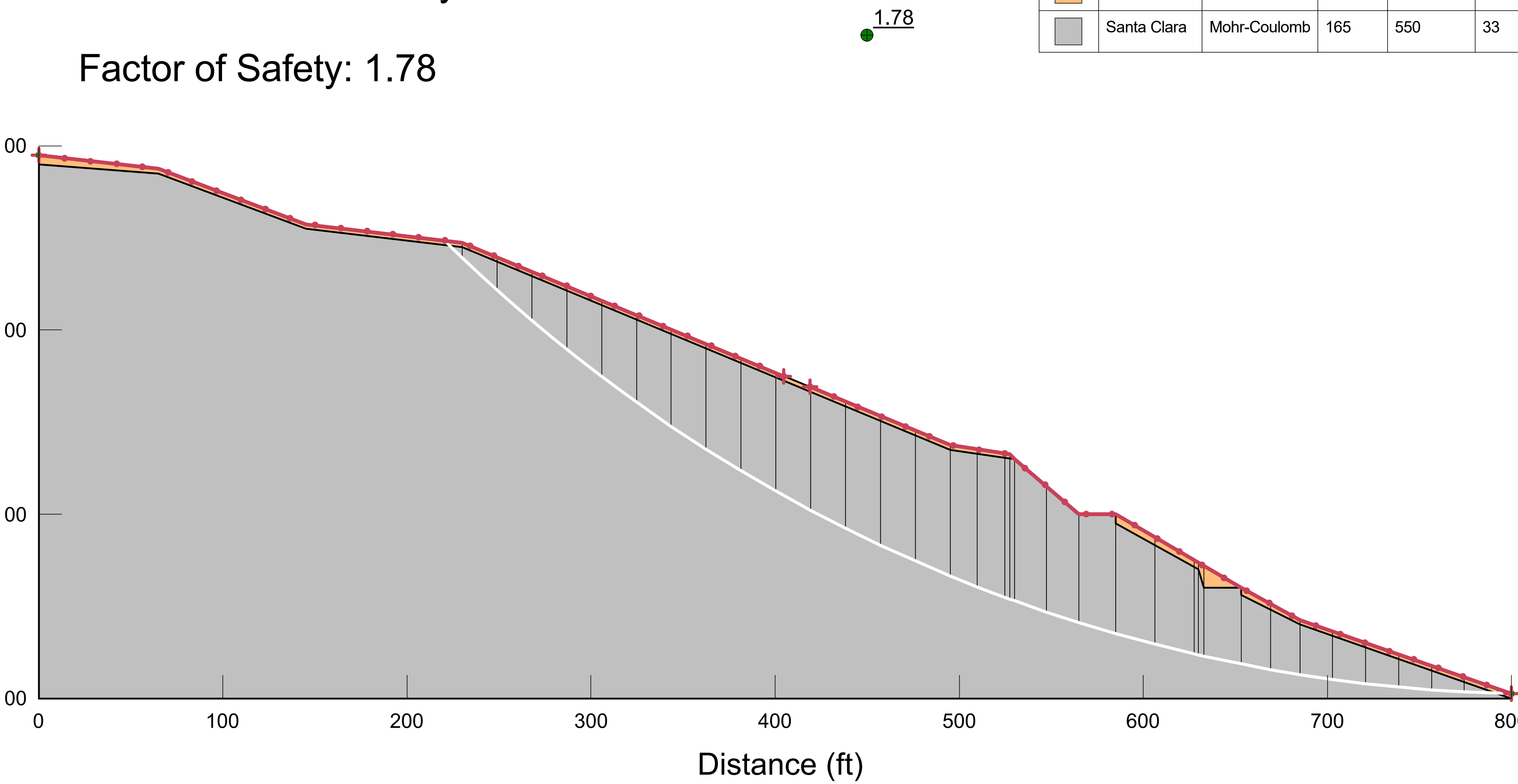


Title: Stevens Creek Road (Section B)
Date: 05/16/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 2. Cut Slope (Global)
Name: 2a. Static Analysis

Factor of Safety: 1.78

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

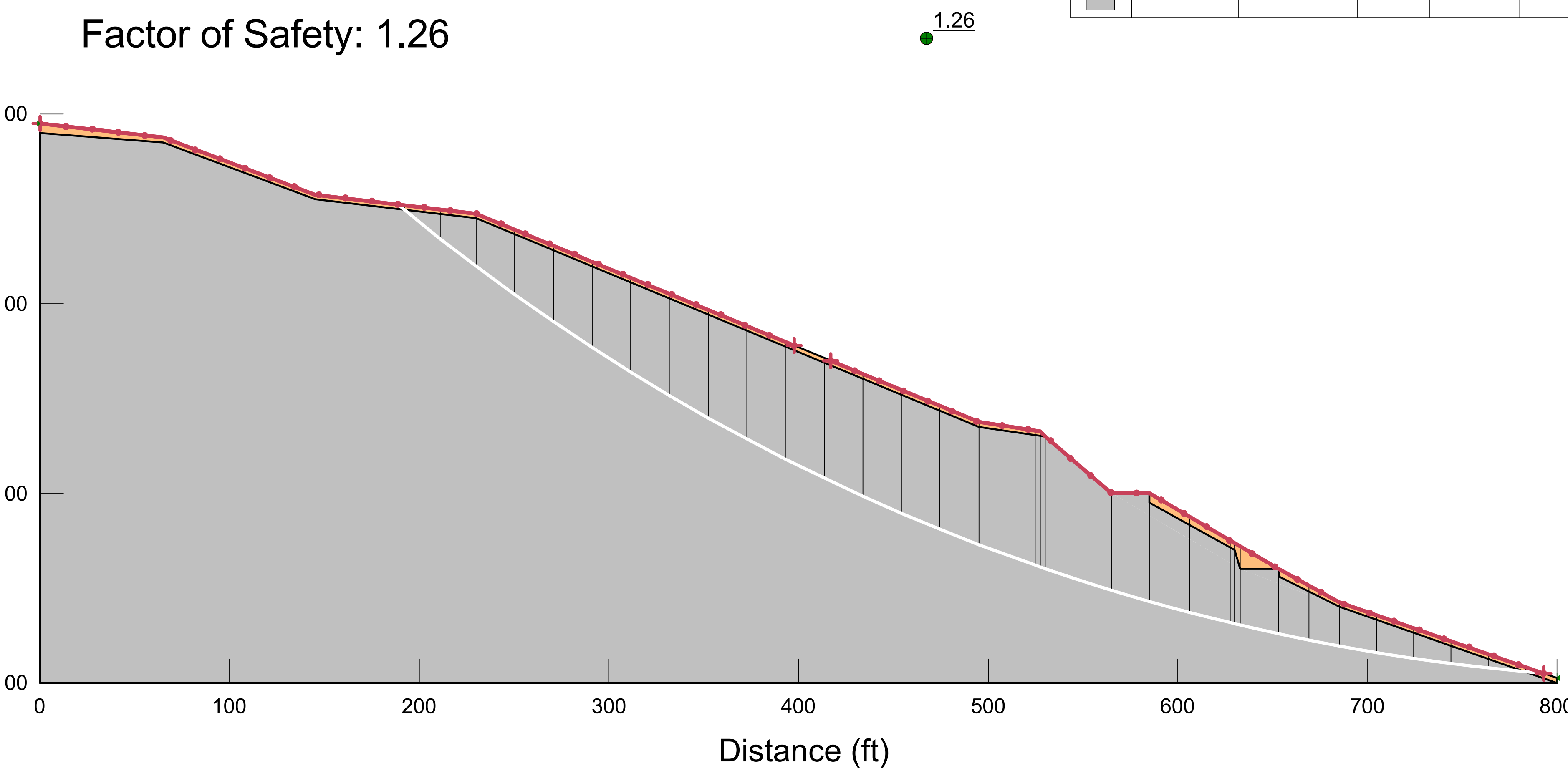


Title: Stevens Creek Road (Section B)
Date: 05/16/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 2. Cut Slope (Global)
Name: 2b. Pseudostatic Analysis

Factor of Safety: 1.26

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

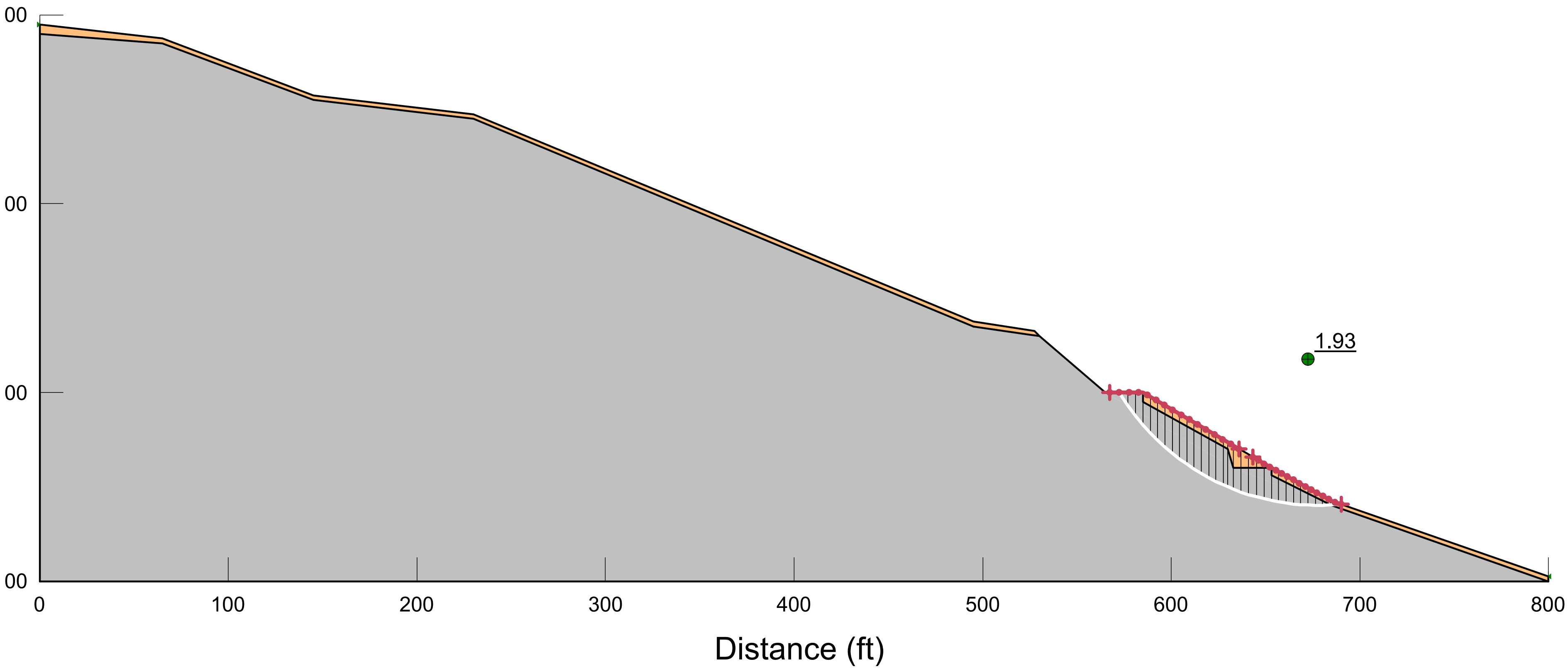


Title: Stevens Creek Road (Section B)
Date: 05/16/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 3. Fill Slope
Name: 3a. Static Analysis

Factor of Safety: 1.93

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

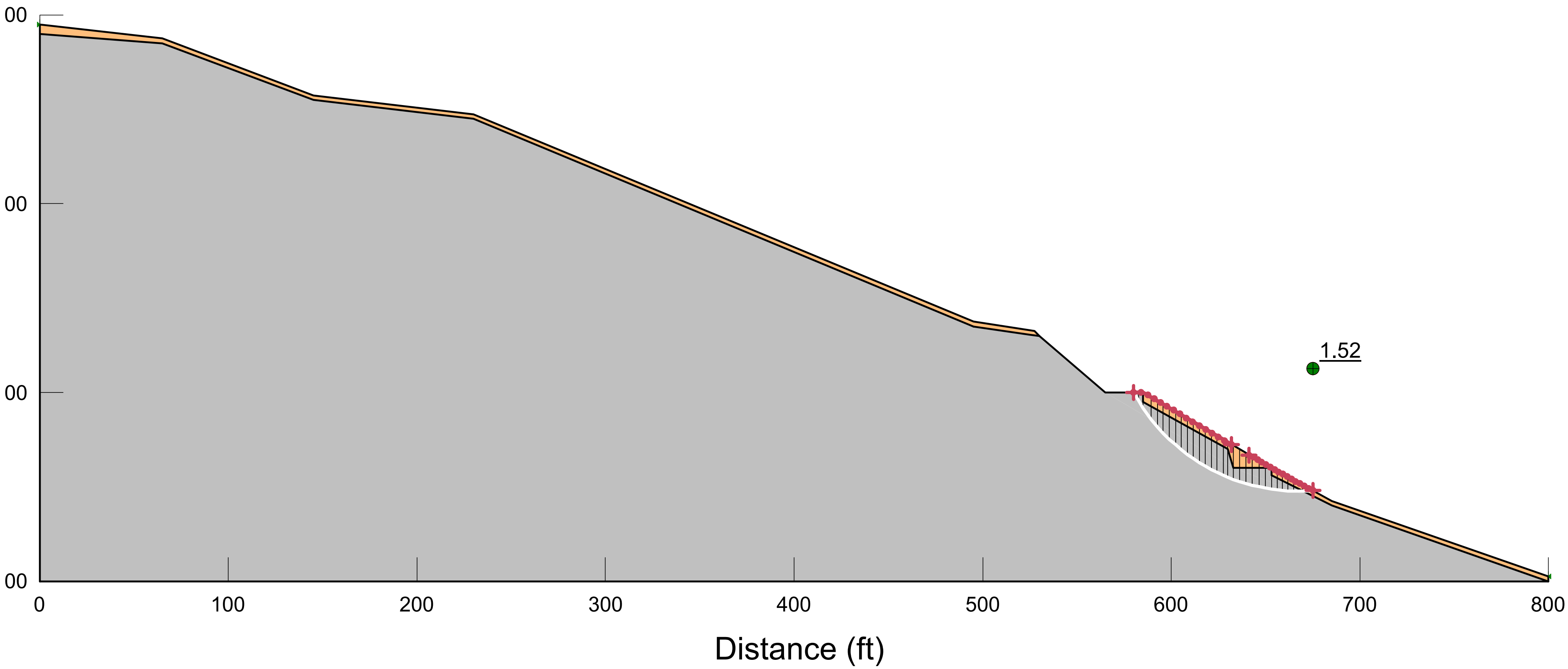


Title: Stevens Creek Road (Section B)
Date: 05/16/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 3. Fill Slope
Name: 3b. Pseudostatic Analysis

Factor of Safety: 1.52

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

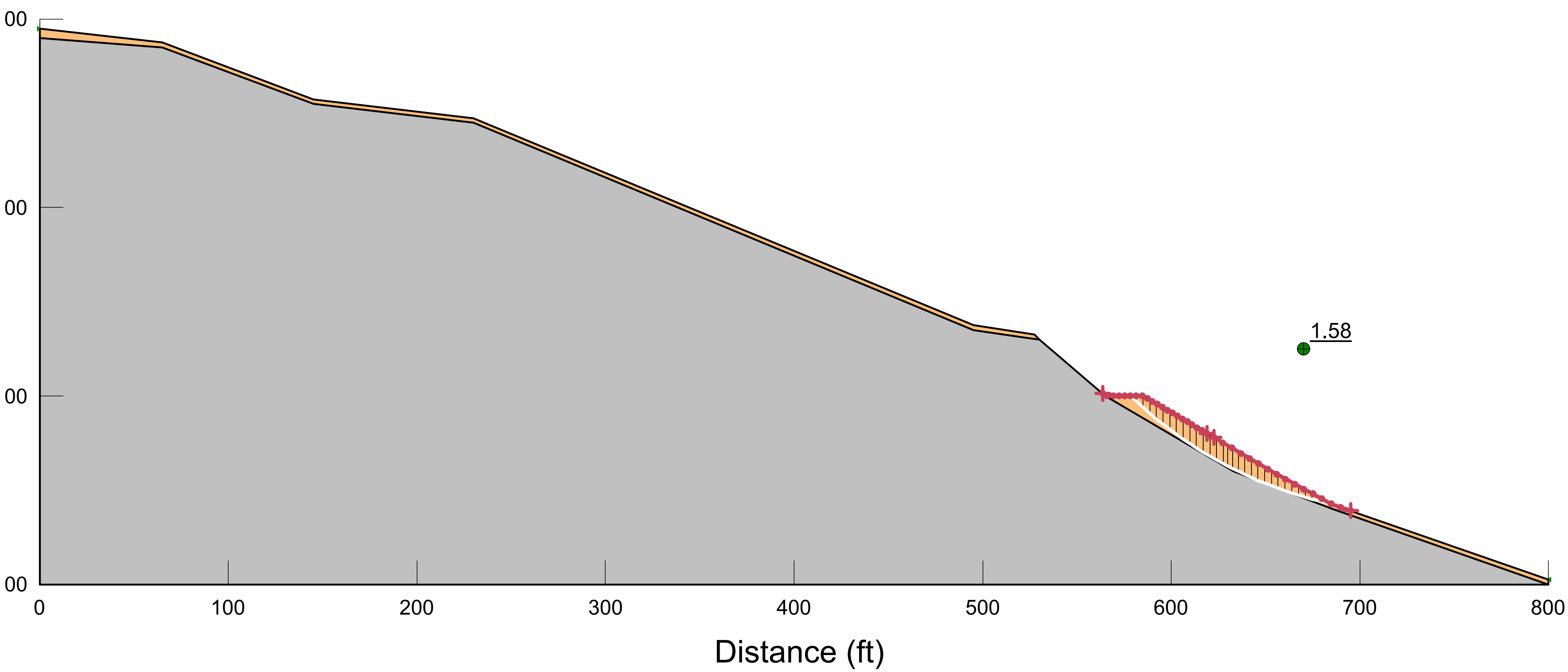


Title: Stevens Creek Road (Section B)
Date: 05/16/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 4. Fill Slope (Sensitivity)
Name: 4a. Static Analysis

Factor of Safety: 1.58

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

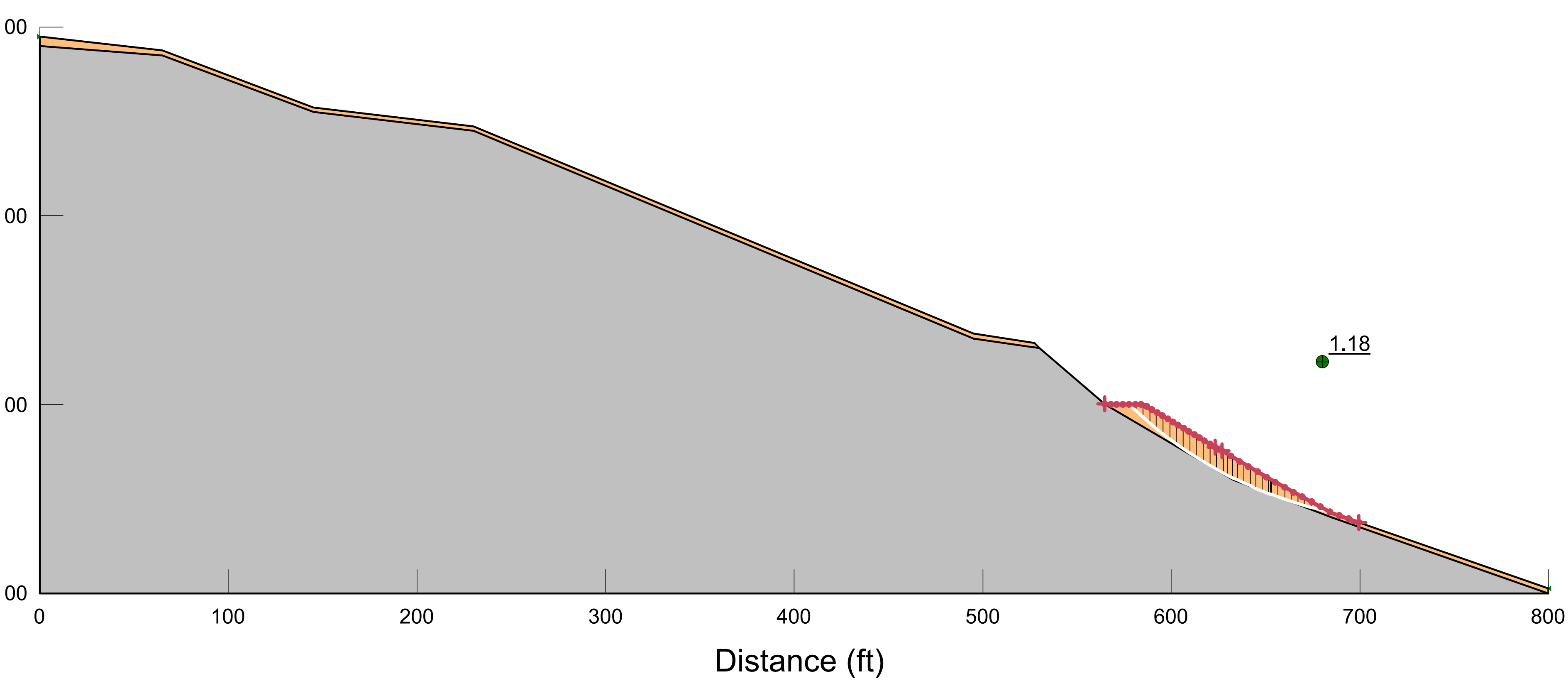


Title: Stevens Creek Road (Section B)
Date: 05/16/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 4. Fill Slope (Sensitivity)
Name: 4b. Pseudostatic Analysis

Factor of Safety: 1.18

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara	Mohr-Coulomb	165	550	33

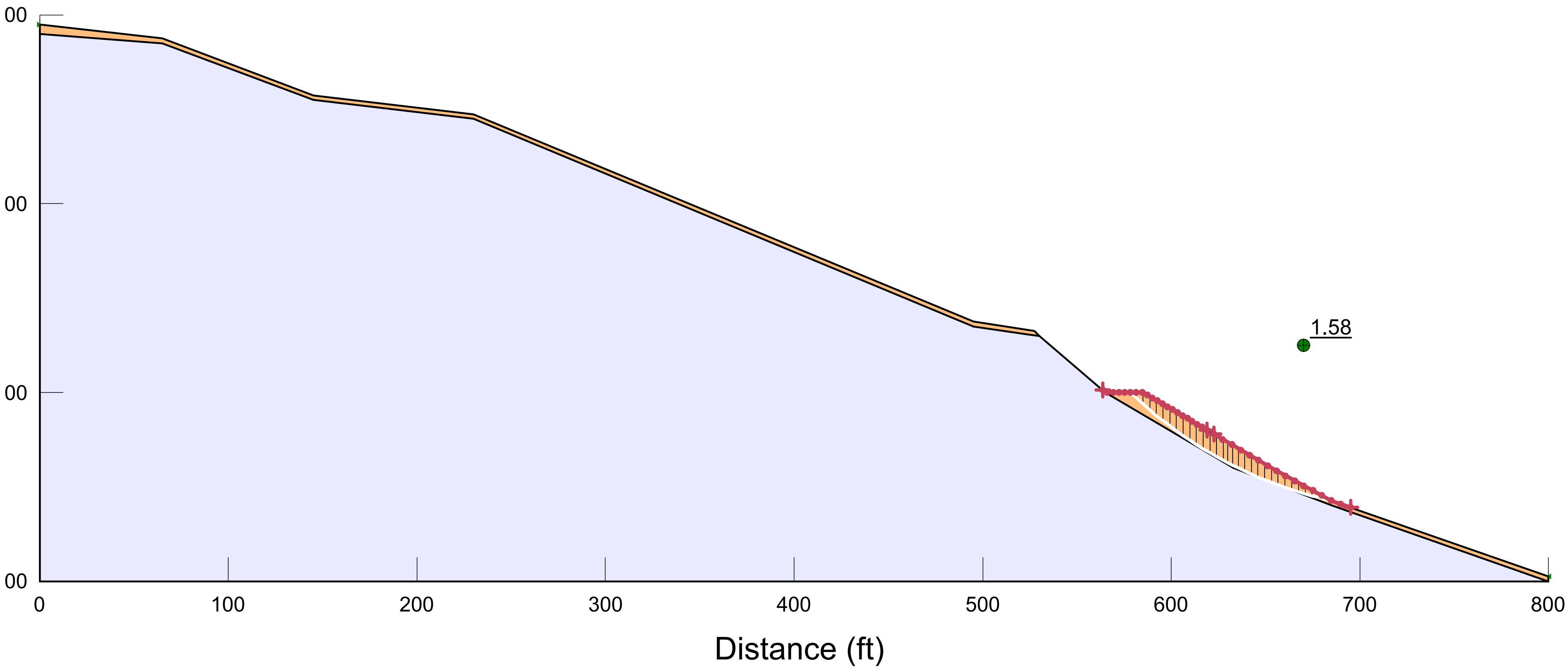


Title: Stevens Creek Road (Section B)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 5. Santa Clara (Sensitivity)
Name: 5a. Static Analysis

Factor of Safety: 1.58

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara (Sensitivity)	Mohr-Coulomb	165	820	24

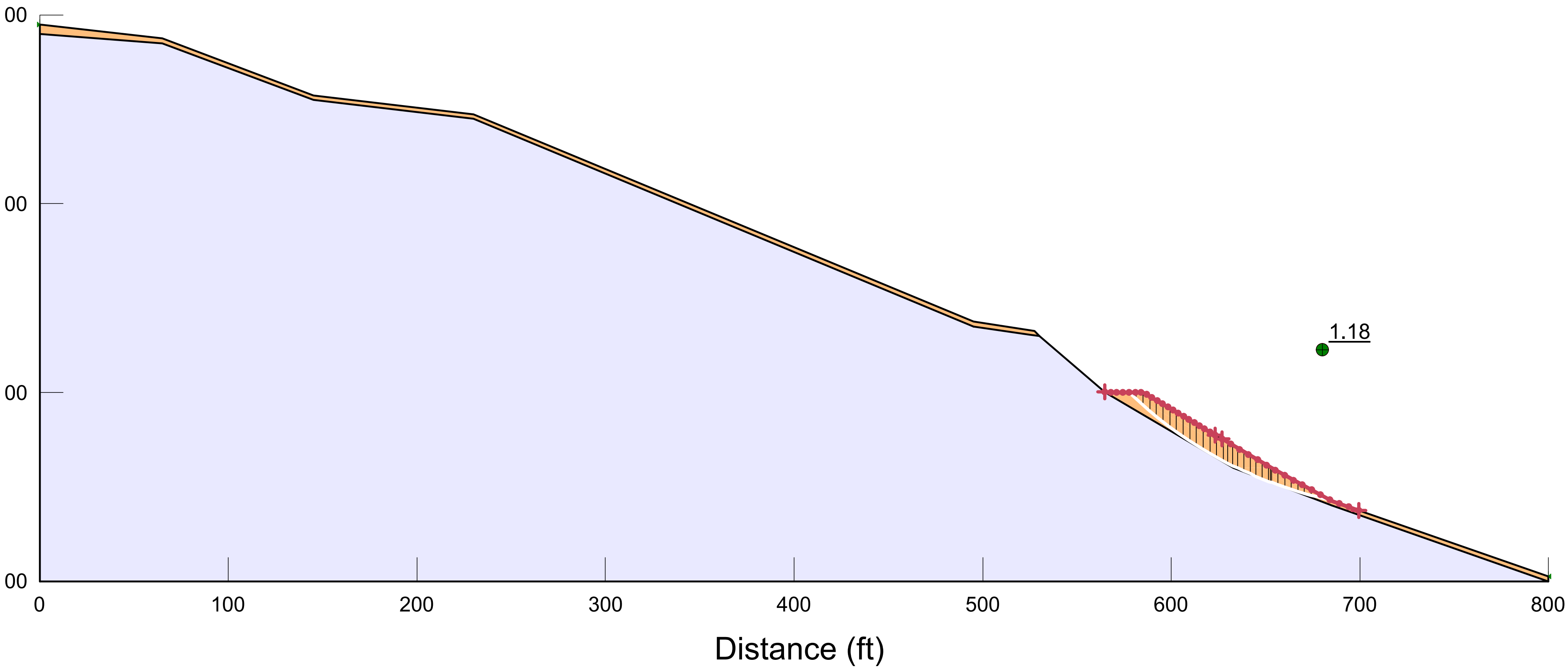


Title: Stevens Creek Road (Section B)
Date: 05/20/2019
File Name: 233001328 SCQ Road Section B (20190516).gsz

Parent: 5. Santa Clara (Sensitivity)
Name: 5b. Pseudostatic Analysis

Factor of Safety: 1.18

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Residual Soil	Mohr-Coulomb	120	200	30
	Santa Clara (Sensitivity)	Mohr-Coulomb	165	820	24

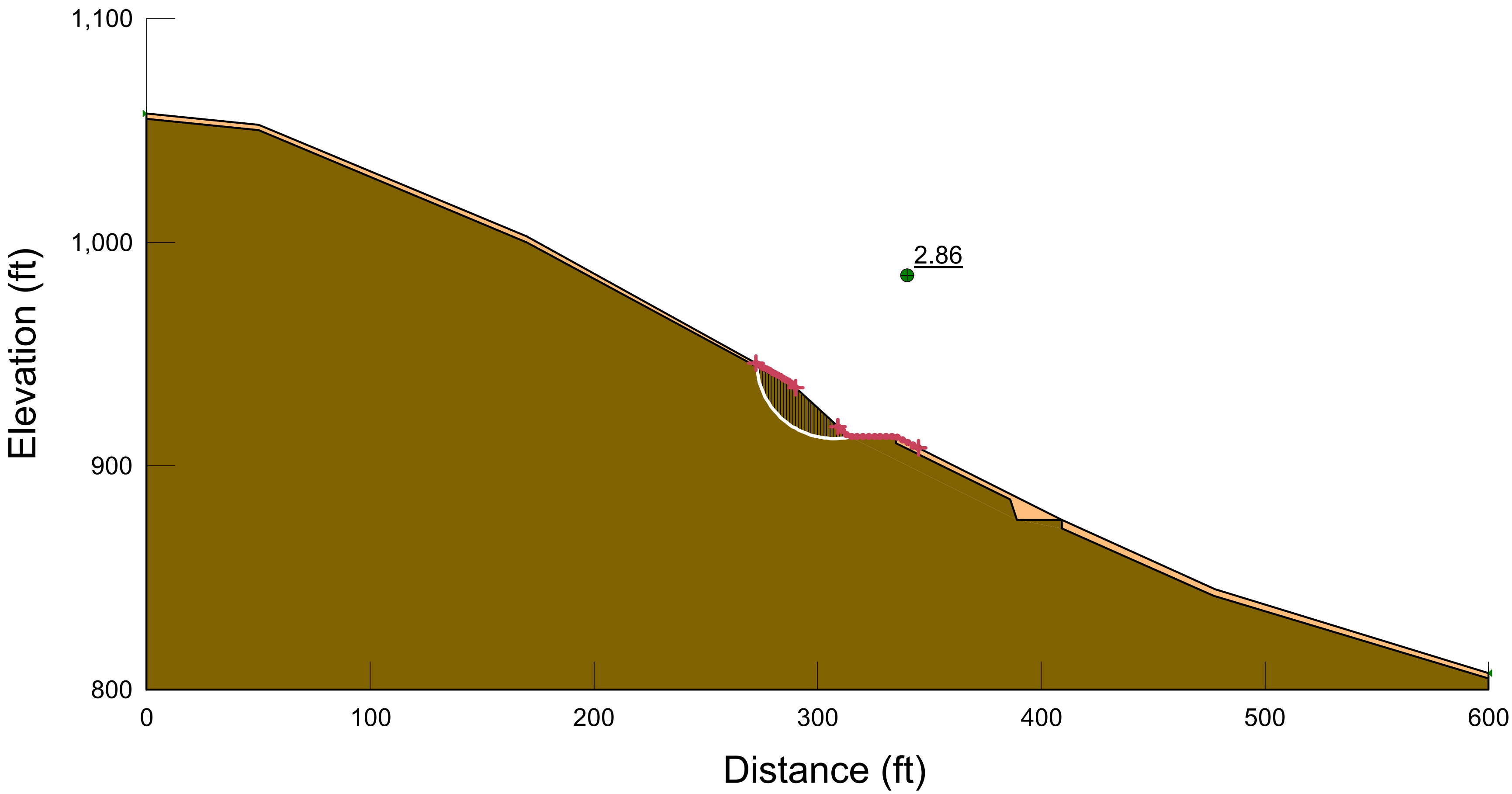


Title: Stevens Creek Road (Section C)
Date: 05/21/2019
File Name: 233001328 SCQ Road Section C (20190521).gsz

Parent: 1. Cut Slope (Local)
Name: 1a. Static Analysis

Factor of Safety: 2.86

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone	Mohr-Coulomb	165	1,400	23
	Residual Soil	Mohr-Coulomb	120	200	30

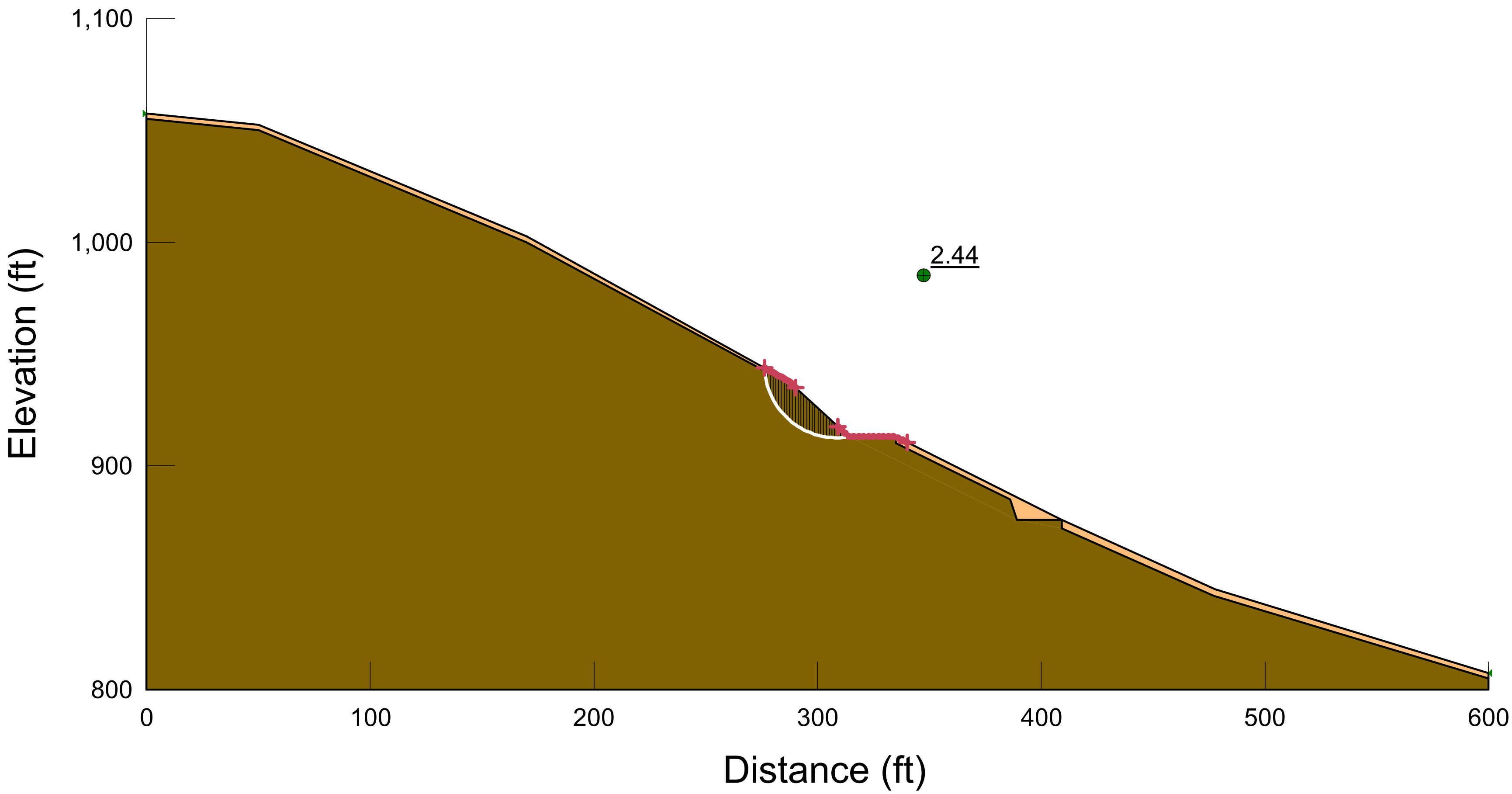


Title: Stevens Creek Road (Section C)
Date: 05/21/2019
File Name: 233001328 SCQ Road Section C (20190521).gsz

Parent: 1. Cut Slope (Local)
Name: 1b. Pseudostatic Analysis

Factor of Safety: 2.44

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone	Mohr-Coulomb	165	1,400	23
	Residual Soil	Mohr-Coulomb	120	200	30

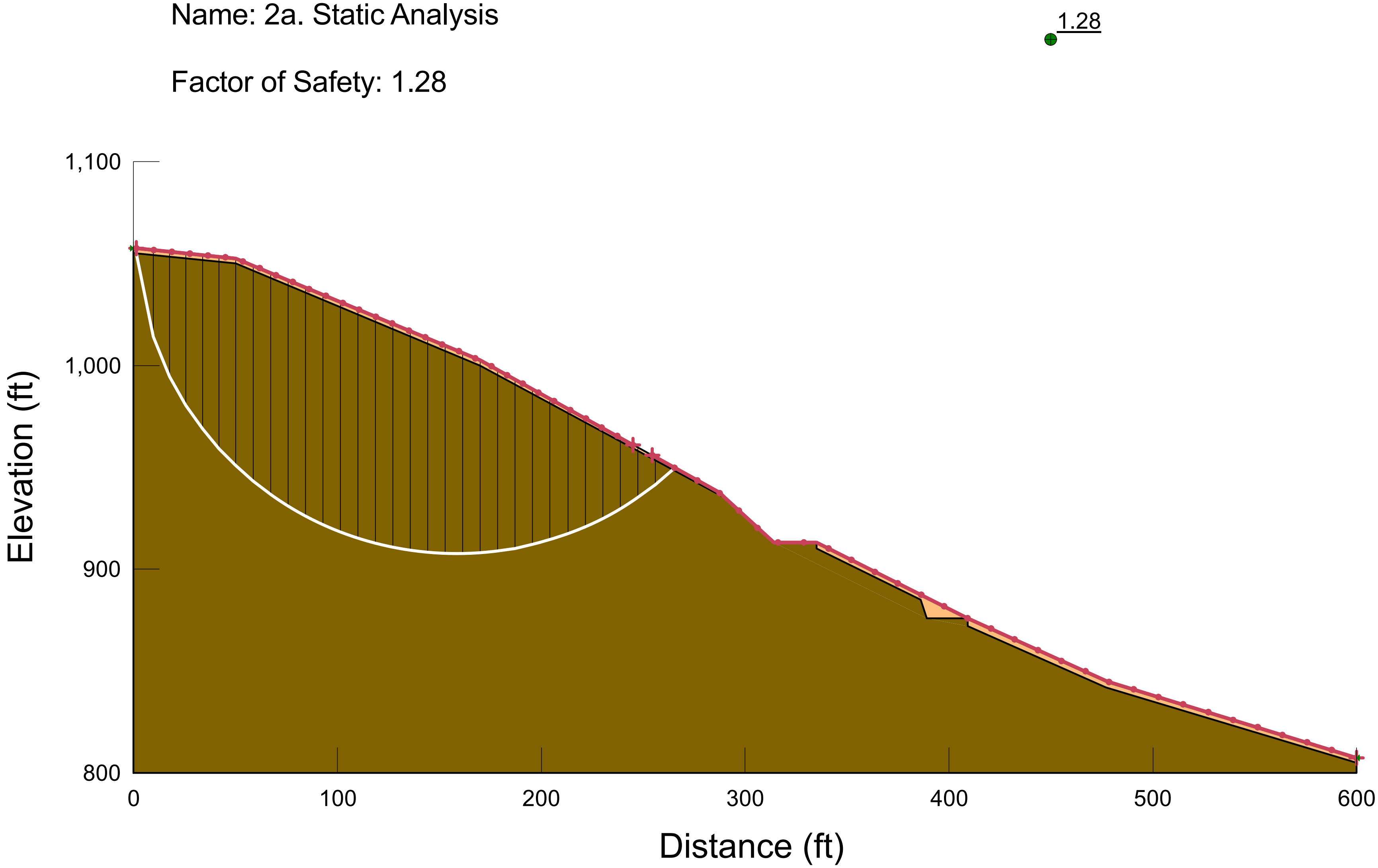


Title: Stevens Creek Road (Section C)
Date: 05/21/2019
File Name: 233001328 SCQ Road Section C (20190521).gsz

Parent: 2. Cut Slope (Global)
Name: 2a. Static Analysis

Factor of Safety: 1.28

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone	Mohr-Coulomb	165	1,400	23
	Residual Soil	Mohr-Coulomb	120	200	30



Title: Stevens Creek Road (Section C)
Date: 05/21/2019
File Name: 233001328 SCQ Road Section C (20190521).gsz

Parent: 2. Cut Slope (Global)
Name: 2b. Pseudostatic Analysis

Factor of Safety: 1.02

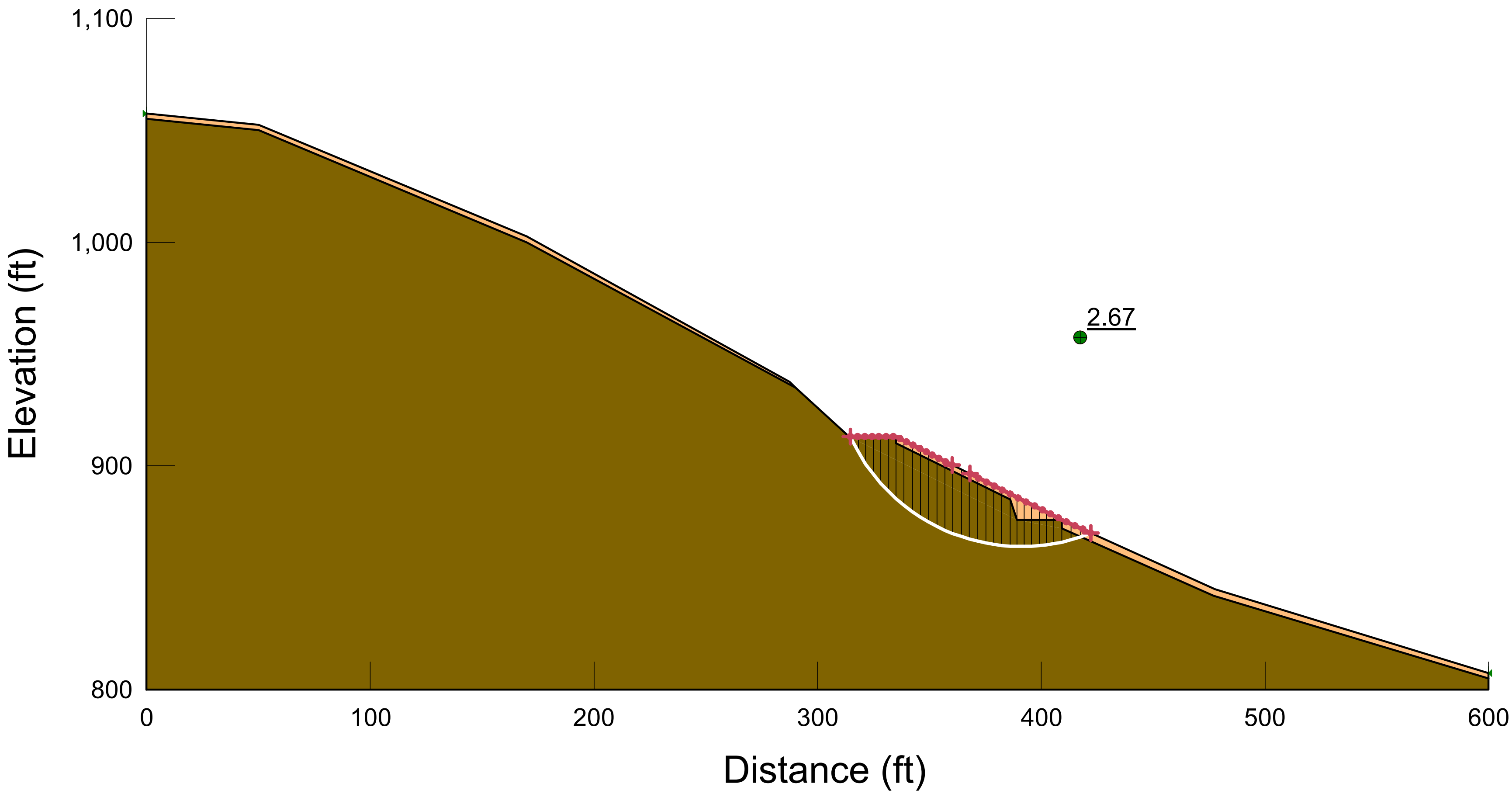
Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone	Mohr-Coulomb	165	1,400	23
	Residual Soil	Mohr-Coulomb	120	200	30

Title: Stevens Creek Road (Section C)
Date: 05/21/2019
File Name: 233001328 SCQ Road Section C (20190521).gsz

Parent: 3. Fill Slope
Name: 3a. Static Analysis

Factor of Safety: 2.67

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone	Mohr-Coulomb	165	1,400	23
	Residual Soil	Mohr-Coulomb	120	200	30

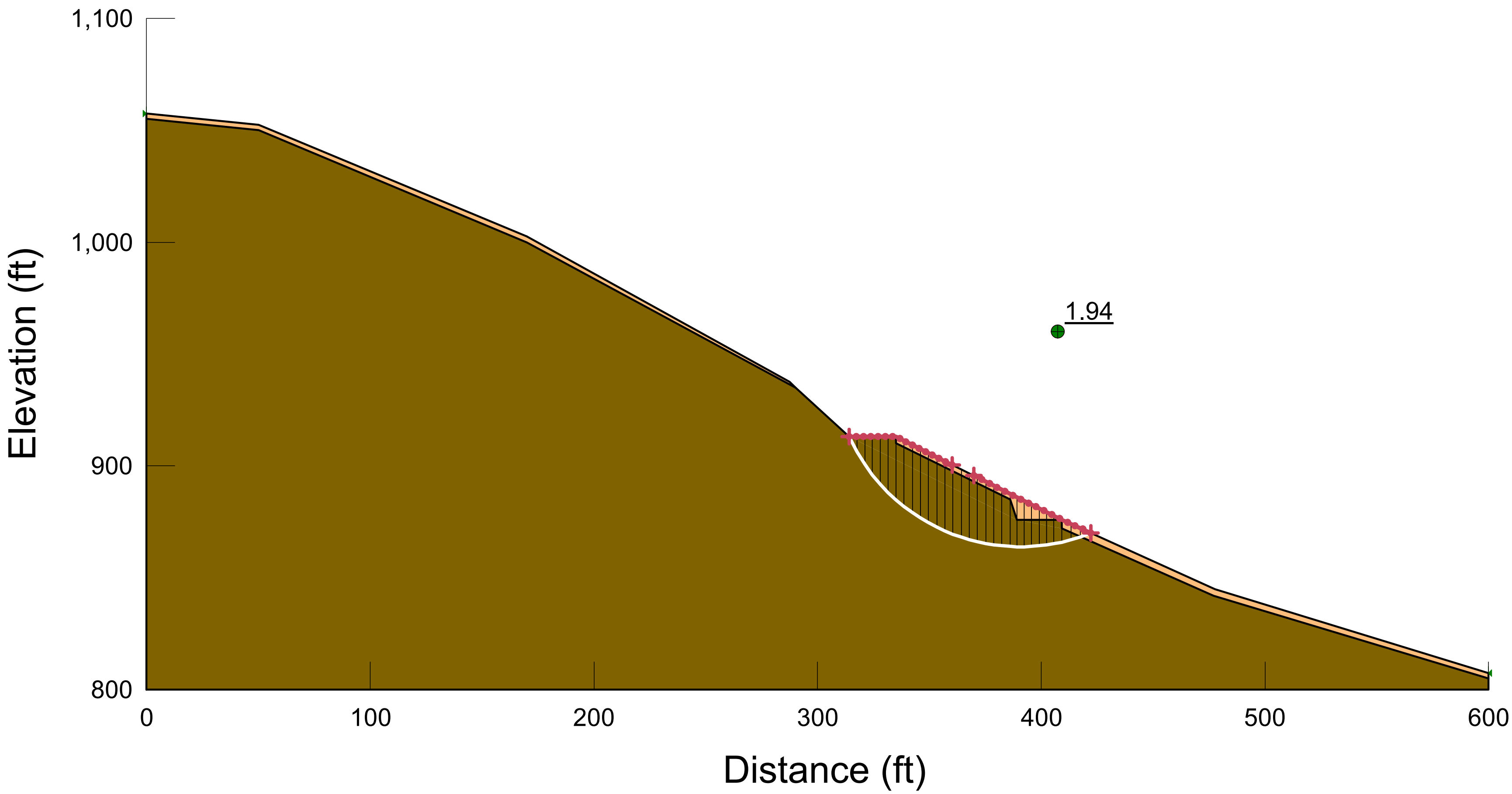


Title: Stevens Creek Road (Section C)
Date: 05/21/2019
File Name: 233001328 SCQ Road Section C (20190521).gsz

Parent: 3. Fill Slope
Name: 3b. Pseudostatic Analysis

Factor of Safety: 1.94

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone	Mohr-Coulomb	165	1,400	23
	Residual Soil	Mohr-Coulomb	120	200	30

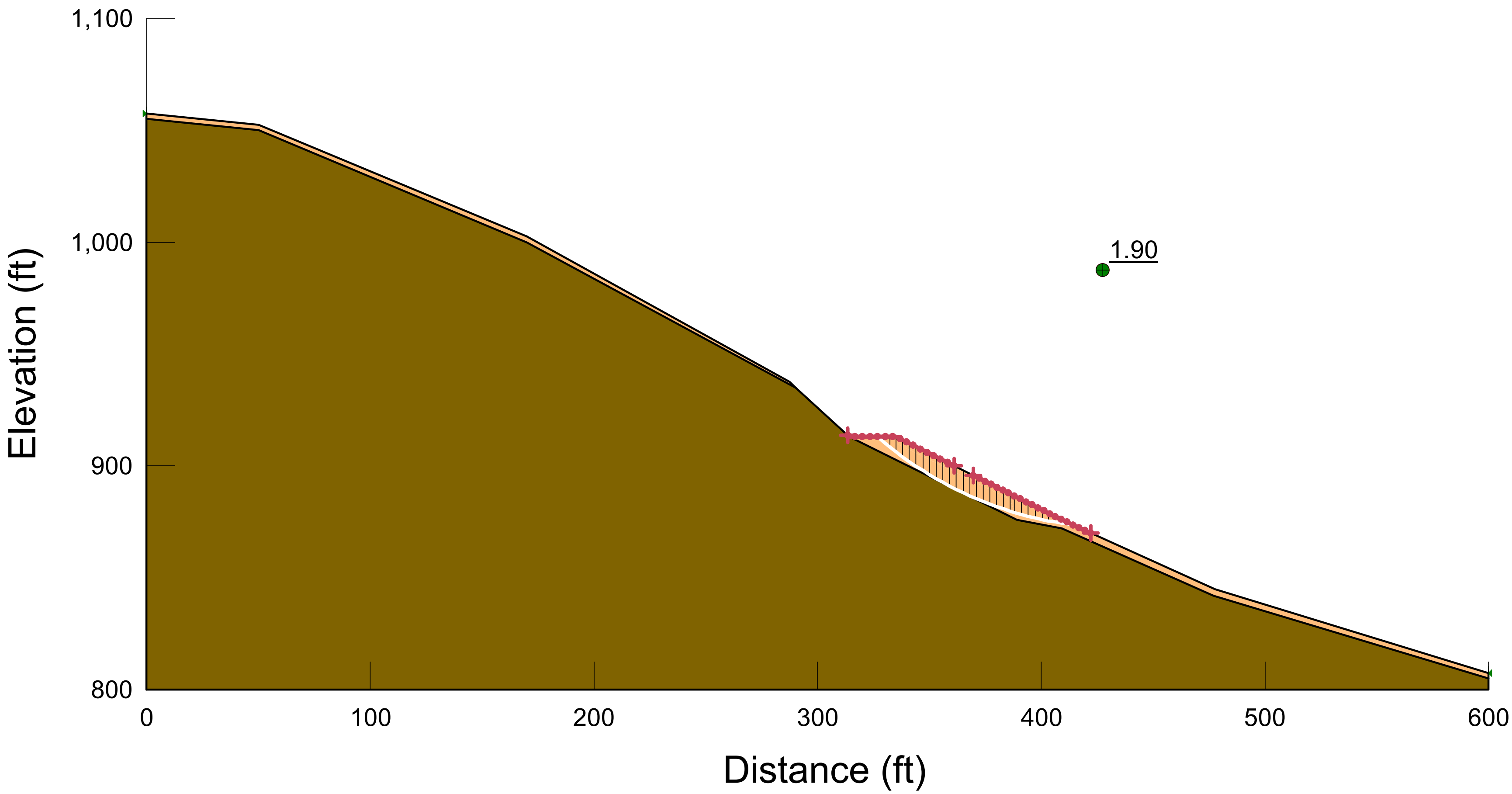


Title: Stevens Creek Road (Section C)
Date: 05/21/2019
File Name: 233001328 SCQ Road Section C (20190521).gsz

Parent: 4. Fill Slope (Sensitivity)
Name: 4a. Static Analysis

Factor of Safety: 1.90

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone	Mohr-Coulomb	165	1,400	23
	Residual Soil	Mohr-Coulomb	120	200	30



Title: Stevens Creek Road (Section C)
Date: 05/21/2019
File Name: 233001328 SCQ Road Section C (20190521).gsz

Parent: 4. Fill Slope (Sensitivity)
Name: 4b. Pseudostatic Analysis

Factor of Safety: 1.38

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Greenstone	Mohr-Coulomb	165	1,400	23
	Residual Soil	Mohr-Coulomb	120	200	30