Appendix G

Geotechnical Investigation Report

GEOTECHNICAL INVESTIGATION

SUNBOW II
PHASE 3
CHULA VISTA, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

LENNAR HOMES
SAN DIEGO, CALIFORNIA

APRIL 10, 2020
PROJECT NO. G2452-32-02

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. G2452-32-02
April 10, 2020

Lennar Homes
16465 Via Esprillo, Suite 150
San Diego, California 92127

Attention: Mr. David Shepherd

Subject: GEOTECHNICAL INVESTIGATION
SUNBOW II
PHASE 3
CHULA VISTA, CALIFORNIA

Dear Mr. Shepherd:

In accordance with your request, and our Proposal No. LG-19430 dated November 4, 2019, we have performed a geotechnical investigation on the subject property. The accompanying report presents our findings, conclusions and recommendations relative to the geotechnical aspects of developing the property as presently proposed.

The results of our study indicate that the site can be developed as planned, provided the recommendations of this report are incorporated into the design and construction of the project. An update to this report should be performed once the final grading plans have been prepared.

If there are any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Troy K. Reist	Trevor E. Myers	David B. Evans
CEG 2408	RCE 63773	CEG 1860

PROFESSIONAL GEOLOGIST ★ STATE OF CALIFORNIA ★ TROY K. REIST No. 2408 CERTIFIED ENGINEERING GEOLOGIST

REGISTERED PROFESSIONAL ENGINEER ★ STATE OF CALIFORNIA ★ TREVOR E. MYERS No. RCE63773 CIVIL

PROFESSIONAL GEOLOGIST ★ STATE OF CALIFORNIA ★ DAVID B. EVANS NO. 1860 CERTIFIED ENGINEERING GEOLOGIST

TKR:TEM:DBE:arm

(e-mail) Addressee

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GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation for the proposed Sunbow II, Phase 3 project located in Chula Vista, California (see *Vicinity Map*, Figure 1). The purpose of our study was to evaluate the soil and geologic conditions at the site, as well as geotechnical constraints, if any, that could impact the proposed project. This report provides recommendations relative to the geotechnical engineering aspects of the development as presently proposed based on the conditions encountered. As project plans progress, this study should be updated as necessary.

The scope of our work consisted of the following:

- Reviewing aerial photographs and readily available published and unpublished geologic literature.
- Reviewing the digital plans prepared by Hunsaker & Associates.
- Sampling and down-hole logging 7 large-diameter borings (see Appendix A).
- Performing 19 exploratory trenches using an excavator to evaluate the general extent and condition of surficial deposits. The study also included a 234-foot-long trench (Trench No. T-19) to evaluate the presence or absence of a fault mapped within the eastern portion of the property (see Appendix A).
- Performing laboratory tests on selected soil samples to evaluate their physical and chemical characteristics for engineering analysis (see Appendix B).
- Performing slope stability analyses along *Geologic Cross Sections A-A′ through K-K′* (see Appendix C).
- Performing an infiltration test within one of the proposed water quality basins and providing storm water BMP design information (See Appendix D).
- Preparing this report, geologic cross sections and geologic maps presenting our exploratory information and our conclusions and recommendations regarding the geotechnical aspects of developing the property as presently proposed.

The approximate location of the subsurface excavations as well as the proposed development is shown on the *Geotechnical Map*, Figure 2. The *Geology Map*, Figure 3, presents pertinent geologic information obtained during our field investigation without the proposed development layer. *Geologic Cross-Sections* A-A′ through K-K′ (Figures 4 through 8) represent our interpretation of the subsurface conditions across the site and served as the basis for our slope stability analysis. The ultimate finish grade configuration is shown on these figures.

It should be noted that several of the originally proposed borings and trenches during our study required relocation or elimination due to environmental restrictions (i.e. sensitive habitat, nesting birds). Where this occurred, geologic information from adjacent areas was extrapolated or inferred as part of our geotechnical analysis.

2. SITE AND PROJECT DESCRIPTION

The proposed Sunbow II, Phase 3 development is located south of Olympic Parkway, north of the Otay Landfill, east of Brandywine Avenue and west of Heritage Road in Chula Vista, California. The property is essentially undeveloped except for the two existing embankments and box culvert structures that abut Olympic Parkway located along the northern property boundary.

Based on a review of the plans provided by Hunsaker and Associates, we understand the property will be developed to create 718 attached condominium units with associated infrastructure improvements, a recreation area and water quality basins. Ingress and egress to the site will be provided by two primary roadways that intersect with Olympic Parkway. The mass grading study indicates that approximately 1,200,000 cubic yards of cut and fill, respectively, will be required to develop the project. We understand this estimate does not include remedial grading.

The locations and descriptions of the site and proposed development are based on our field investigation, site reconnaissance, a review of the available plans and our understanding of the project. If project details vary significantly from those described herein, Geocon Incorporated should be consulted to provide additional recommendations and/or analysis.

3. PREVIOUS GEOTECHNICAL STUDIES

A preliminary geotechnical investigation was performed by Geocon Incorporated in 1986 as part of an overall study for the 600-acre Rancho Del Sur property and included advancing three large diameter borings on a portion of the property (Reference No. 13). In addition, several monitoring wells (gas, vadose, and groundwater) were installed on the property between 1989 and 1994 as part of an environmental study adjacent to the Otay Landfill (Reference Nos. 8 and 14). We also performed a geotechnical investigation in 2006 on the adjacent Otay Ranch Village 2 West project located along the eastern boundary of the site (Reference No. 12). The subsurface information and as-graded geologic mapping from these studies was reviewed and incorporated into a geologic reconnaissance report for Sunbow, Planning Area 23 in November 2019 (Reference No. 11). The approximate location of the borings and trenches from the referenced reports has been incorporated onto Figures 2 and 3 and the logs have been included for reference in Appendix E.

4. SOIL AND GEOLOGIC CONDITIONS

Based on our investigation, previous geotechnical studies and observations during our reconnaissance, the geology underlying the property consists of surficial soil (previously placed fill, topsoil, alluvium and colluvium) and the San Diego, Otay and Sweetwater Formations. The surficial soils and geologic formations are discussed below in order of increasing age. The estimated extent of these units is shown on Figures 2 and 3, with the exception of topsoil.

4.1 Previously Placed Fill (Qpf)

Compacted fill associated with previous grading operations for Olympic Parkway is present along the northern project boundary. The northern portion of these embankments is underlain by alluvium, however, the potentially compressible portions of this unit were removed or compressed by surcharging during prior grading operations. Geocon Incorporated provided testing and observation services during placement of the embankments and information pertaining to the grading is included in Reference Nos. 9 and 10. Processing of the upper surface of these embankments will be required prior to additional fill placement.

4.2 Topsoil (Unmapped)

Topsoil was encountered in several of the exploratory borings and trenches with a maximum thickness of 4 feet. These deposits, in general, consist of unconsolidated, clayey sands to sandy clays with a high expansion potential and will require remedial grading where present within the development footprint.

4.3 Alluvium (Qal)

Alluvium is present within the three main drainages on the site and along Olympic Parkway. These deposits vary in thickness from 6 to 12 feet and primarily consist of expansive, silty to sandy clays to clayey sands. The alluvium will require remedial grading where structural improvements are planned.

4.4 Colluvium (Qcol)

Colluvial deposits are present along the hillsides above the alluvial drainages. These deposits consist of clayey sands to silty clays with a high expansion potential and vary from 3½ to 8-feet-thick. Remedial grading will be required where colluvium is located in areas of planned development.

4.5 San Diego Formation (Tsd)

The San Diego Formation overlies the Otay Formation and typically consists of dense, fine to medium-grained sandstone with relatively low cohesion and moderate to high permeability. In general, the San Diego Formation exhibits adequate shear strength and "very low" to "low" expansion characteristics in either an undisturbed or properly compacted condition. Due to the potentially friable and higher permeability characteristics of this unit, stability fills will be required where the San Diego Formation is exposed in cut slopes.

4.6 Otay Formation (To)

The Otay Formation, which overlies the Sweetwater Formation and underlies the San Diego Formation, is the predominant geologic unit on the site. This formation consists of dense, silty to clayey, sandstone and hard, siltstone and claystone beds with continuous to discontinuous interbeds of weak, highly-plastic bentonitic claystone. In some instances, the bentonite beds contain bedding plane shears as observed in the majority of the exploratory borings during our study.

The sandy portions of the Otay Formation typically possess a "very low" to "low" expansion potential and adequate shear strength. The siltstone and claystone portions of the formation can exhibit a "medium" to "very high" expansion potential. With the possible exception of the bentonitic claystone, the Otay Formation is suitable for the support of compacted fill and structural loads.

The laterally extensive bentonitic claystone beds, which are well documented in the area, can vary in thickness from several inches up to 7 feet (see Boring No. LB-7). The beds are typically flat lying to gently dipping (0 to 3 degrees) and possess a very high expansion potential and very low shear strength. A laterally continuous bentonitic claystone bed is mapped across the site between elevations 341 feet and 371 feet above mean sea level (see Figures 2 and 3). This unit will require important consideration with respect to slope stability and its expansion potential, and will require remedial grading measures.

The Otay Mesa Lateral Spread, commonly referred to as an ancient "intra-formational landslide" by geologists, is mapped within the site boundary (Reference No. 24). This ancient landslide, which is over 8-miles wide and approximately 2½-miles long, is entirely contained within the Otay Formation and terminates along the La Nación Fault to the west. We have also observed and mapped this feature during the grading operations for Olympic Parkway (Reference No. 9) and other neighboring residential developments.

The basal surface of the ancient "intra-formational landslide" occurred along a single, continuous, bentonitic clay bed that coincides with the bentonitic clay bed mapped on Figures 2 and 3. The slide mass consists of relatively undisturbed consolidated blocks of the Otay Formation that have low to very low compressibility characteristics. Some areas exhibit plastically deformed bentonite which has been squeezed into the overlying mass creating unpredictable diapirs and flame structures that vary in dimension and orientation. If present, these features can create problems for site improvements due to their expansion potential. Although not observed within the exploratory borings and trenches, the potential for these conditions will be evaluated during the grading phase of project development.

4.7 Sweetwater Formation (Tsw)

The Sweetwater Formation, commonly referred to as the "gritstone layer" of the Otay Formation, underlies the Otay Formation and is characterized as dense to very dense, gravelly, fine to coarse sandstone that is locally cemented. The Sweetwater Formation generally has a high shear strength and a low expansive potential.

5. GEOLOGIC STRUCTURE

The published regional dip of the Otay Formation and bentonitic claystone is generally 1 to 2 degrees to the west-southwest (Reference No. 24). During our study, we identified a prominent contact between a laterally continuous white bentonitic claystone bed and reddish-brown claystone (further described as the "key marker bed" herein) which revealed gently dipping strata to the southeast. This relationship was observed in Boring Nos. LB-1, LB-2, LB-5, LB-7 and Trench No. T-18. Further evidence of this orientation was observed in a study on the easterly adjacent Otay Ranch Village 2 West property and from the contact elevations measured between the Otay and Sweetwater Formations during our study (Boring Nos. LB-1, LB-2 and LB-7).

A computer-generated elevation contour plot of the "key marker bed" based on the piercing points from the borings is presented in green on Figure 3. Although general, this information was used as the basis for mapping the outcrop location of the bentonitic claystone shown in red on Figures 2 and 3. We also used geomorphic interpretation and information from Trench No. T-18 during this evaluation.

The bentonitic claystone bed varied in thickness from 4½ feet to 7 feet as observed in the borings and Trench T-18. In order to account for these variations, we added 5 feet above and below the "key marker bed" so the projected bed thickness shown on the *Geologic Cross Sections* will not necessarily match what is shown at the boring location. It should be noted that the exercise of creating the contour map and outcrop location of the bentonitic claystone is to evaluate its general trend and assist in future field identification/recommendations that will occur during site grading.

6. GROUNDWATER/SEEPAGE

Groundwater was identified in the monitoring wells MW-1 and MW-2 (1989, 1994) on-site at depths of 165 and 275 feet, respectively, below the existing ground surface. Minor seepage was observed in Trench Nos. T-1 and T-2 along the alluvium and bedrock contact approximately 7 feet below existing grade. Subdrain systems will be required in the main drainages, along with proposed buttress, shear key and stability fill excavations, and possibly where impervious layers daylight near the ultimate graded surface.

The groundwater elevations and seepage conditions are expected to fluctuate seasonally and may affect remedial grading. In this regard, remedial grading may encounter wet soils and excavation and compaction difficulty, particularly if grading is planned during the winter months. It should also be noted that areas where perched water or seepage was not encountered may exhibit groundwater during rainy periods.

7. SLOPE STABILITY

Eleven geologic cross-sections, A-A′ through K-K′ (Figures 4 and 8), were prepared to aid in evaluating the stability of proposed and natural slopes. Shear strength parameters for the soil and geologic materials encountered were determined from laboratory direct shear tests and engineering judgment. Residual shear strengths were used for bedding plane shear features and were determined from laboratory test results and using the *Journal of Geotechnical and Geoenvironmental Engineering, Drained Shear Strength Parameters for Analysis of Landslides (Stark, Choi, McCone, 2005)* and engineering judgment.

Table 7.1 presents the soil strength parameters that were utilized in the slope stability analyses. The values were derived from laboratory test results and experience with similar soil and geologic conditions.

TABLE 7.1
SOIL STRENGTH PARAMETERS

Geologic Unit (Geologic Unit Symbol/USCS Soil Type)	Angle of Internal Friction ϕ (degrees)	Cohesion C (psf)
Compacted Fill (Qcf)	29	300
San Diego Formation- Sandstone (Tsd-SM)	31	300
Otay Formation Sandstone (To-SM)	30	300
Otay Formation Siltstone/Claystone (To-ML/CL)	23	400
Otay Formation Bentonitic Claystone-Unsheared (To-MH/CH)	22	500
Bedding Plane Shear (BPS)	7	0
Sweetwater Formation (Tsw-SM)	36	500

The output files and calculated factor of safety for the cross sections used for the stability analyses are presented in Appendix C (Figures C-1 through C-29) and summarized in Table 7.2.

TABLE 7.2
SLOPE STABILITY SUMMARY

Cross Section	Figure Number	Condition Analyzed	Factor of Safety
A-A′	C-1	Proposed condition-block type thru BPS	1.2
	C-2	Proposed condition with buttress-block type thru BPS	1.6
	C-3	Proposed condition with buttress-block type thru To (MH/CH)	2.4
B-B′	C-4	Proposed condition-block type thru BPS	1.7
	C-5	Proposed condition-block type thru To (MH/CH)	3.4
	C-6	Proposed condition-circular type	2.6
C-C′	C-7	Proposed condition-block type thru To (MH/CH)	2.1
	C-8	Proposed condition with stability fill-block type thru To (MH/CH)	2.2
	C-9	Proposed condition with stability fill-circular type	1.9
D-D′	C-10	Proposed condition with stability fill-block type on To (ML/CL)	2.4
	C-11	Proposed condition with stability fill-circular type	1.8
E-E′	C-12	Proposed condition with stability fill-block type on To (ML/CL)	2.0
	C-13	Proposed condition with stability fill-circular type	1.8
F-F′	C-14	Proposed condition with stability fill-block type on lower To (ML/CL)	2.0
	C-15	Proposed condition with stability fill-block type on upper To (ML/CL)	2.1
	C-16	Proposed condition with stability fill-circular type	1.7
G-G′	C-17	Proposed condition-block type thru To (ML/CL)	2.4
	C-18	Proposed condition-circular type	1.9
H-H′	C-19	Proposed condition-circular type	2.2
I-I′	C-20	Proposed condition-block type thru BPS	2.4
	C-21	Proposed condition-block type thru To (MH/CH)	2.8
	C-22	Proposed condition-circular type	1.8
J-J′	C-23	Proposed condition-cut slope, block type thru To (MH/CH)	2.9
	C-24	Proposed condition-cut slope, circular type	2.7
	C-25	Proposed condition-cut slope, optimized circular type thru BPS	2.1
	C-26	Proposed condition-fill slope, circular type	2.1
K-K′	C-27	Proposed condition-block type thru BPS	1.2
	C-28	Proposed condition with shear key-block type on BPS	1.6
	C-29	Proposed condition with shear key-circular type	2.1

The results of the analyses indicate that a buttress, two shear keys, and stability fills will be required to achieve surficial stability or a static factor of safety of at least 1.5. The approximate limits of these features are shown on Figure 2 and/or depicted on the *Geologic Cross-Sections*. The extent of remedial grading in these areas may need to be modified depending on the conditions observed during grading.

Slope stability analyses for the proposed fill slopes were performed utilizing average drained direct shear strength parameters from the laboratory test results. These analyses indicate that the proposed 2:1 fill slopes, constructed of on-site materials, should have calculated factors of safety of at least 1.5 under static conditions for both deep-seated failure and shallow sloughing conditions to a height of 100 feet. Generalized slope stability calculations for both deep-seated and surficial fill slope stability are presented on Figure 10.

The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular "soil" fill to reduce the potential for surficial sloughing. In general, soils with an Expansion Index of less than 90 or at least 35 percent sand size particles should be acceptable as "granular" fill. Fill slopes with a height over 50 feet will require soil with a minimum phi angle of 29 degrees and cohesion of 300 psf. The horizontal width of this material should be one-half the slope height. Soils of questionable strength to satisfy surficial stability should be tested in the laboratory for acceptable drained shear strength.

8. GEOLOGIC HAZARDS

8.1 Faulting and Seismicity

A review of geologic literature indicates that the Newport-Inglewood Fault Zone, located approximately 9 miles west of the site, is the closest known “active fault”. An active fault is defined by the California Geologic Survey (CGS), as a fault showing evidence of activity roughly within the last 11,000 years (Holocene time). In addition, the main strand of the La Nación Fault is mapped approximately 1/3 of a mile west of the site and has been classified as “potentially active”, which is defined by CGS as a fault showing evidence of activity within the last 1.8 million years.

Published geologic maps depict a north-south striking fault within the eastern portion of the site. Our research did not reveal any discussion regarding the origin or activity of the fault other than it was “inferred from photographic evidence” (Reference No. 18). As part of our study we performed a 234-foot-long trench (Trench No. T-19) across the mapped fault trace within the eastern portion of the property. We did not observe any evidence of faulting in the trench. The detailed log for Trench No. T-19 is presented on Figure 9.

8.2 Seismicity-Deterministic Analysis

We used the computer program *EZ-FRISK* (Version 7.65) to determine the distance of known faults to the site and to estimate ground accelerations at the site for the maximum anticipated seismic event. According to the results, 6 known active faults are located within a search radius of 50 miles from the property. We used acceleration attenuation relationships developed by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) NGA in our analysis. The nearest known active faults are the Newport-Inglewood and Rose Canyon Fault Zones, located approximately 9 miles west of the site, respectively, and are the dominant sources of potential ground motion. Table 8.2.1 lists the estimated maximum earthquake magnitudes and PGA's for the most dominant faults for the site location calculated for Site Class C as defined by Table 1613.3.2 of the 2019 California Building Code (CBC).

TABLE 8.2.1
DETERMINISTIC SEISMIC SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2008 (g)
Newport-Inglewood	9	7.5	0.26	0.24	0.30
Rose Canyon	9	6.9	0.22	0.22	0.23
Coronado Bank	17	7.4	0.18	0.14	0.16
Palos Verdes	17	7.7	0.20	0.15	0.19
Elsinore	42	7.85	0.11	0.08	0.09
Earthquake Valley	46	6.8	0.06	0.05	0.04

We performed a site-specific probabilistic seismic hazard analysis using the computer program *EZ-FRISK*. Geologic parameters not addressed in the deterministic analysis are included in this analysis. The program operates under the assumption that the occurrence rate of earthquakes on each mappable Quaternary fault is proportional to the faults slip rate. The program accounts for fault rupture length as a function of earthquake magnitude, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS 2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2008) NGA in the analysis.

Table 8.2.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedance.

TABLE 8.2.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedance	Peak Ground Acceleration		
	Boore-Atkinson, 2008 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.37	0.36	0.40
5% in a 50 Year Period	0.26	0.25	0.27
10% in a 50 Year Period	0.19	0.19	0.19

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the California Building Code (CBC) guidelines currently adopted by the City of Chula Vista.

8.3 Liquefaction

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil densities are less than about 70 percent of the relative density. If all four criteria are met, a seismic event could result in a rapid increase in pore water pressure from the earthquake-generated ground accelerations. The potential for liquefaction at the site is considered to be negligible due to the dense formational material encountered, remedial grading, and lack of a shallow groundwater condition.

8.4 Landslides

No evidence of landslide deposits were encountered during the geotechnical investigation, or geologic literature review other than the ancient “intra-formational landslide” within the Otay Formation that underlies the region.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

9.1.1 No soil or geologic conditions were encountered that, in the opinion of Geocon Incorporated, would preclude the development of the property as proposed, provided the recommendations of this report are followed.

9.1.2 Due to the presence of weak bentonitic claystones and bedding plane shears within the Otay Formation, two drained shear keys and a buttress will be necessary in select areas of the site to provide adequate slope stability. In addition, due to lower cohesion and high permeability characteristics of the San Diego Formation, stability fills will be required where this formation is exposed in cut slopes.

9.1.3 The approximate location of the shear keys, buttress and stability fills are shown on the *Geotechnical Map* and *Geologic Cross-Sections.* The detailed geometry of these features should be refined as grading plans progress. In addition, the anticipated remedial grading areas, including drain locations and connection points should be shown on the 40-scale grading plans.

9.1.4 Segmental excavation of the buttress proposed in the southwest portion of the site (*Geologic Cross Section A-A'*) may be necessary to provide an adequate temporary factor of safety during grading. We anticipate the buttress could be excavated in two segments, however, specific recommendations in this regard can be provided in an update correspondence as grading plans progress.

9.1.5 The proposed buttress and shear key located within the southwest and northeast portion of the property, respectively, will require grading beyond the property boundaries. In addition, the proposed grades for the northeast portion of site will require embankments that extend onto the adjacent property (see *Geologic Cross Section K-K'*).

9.1.6 Where bentonitic claystone is present near finish grade, removal and placement of these materials in deeper fills will be required. In some areas, mixing of the bentonite with granular materials at a prescribed ratio and placement at a designated depth below finish grade will be necessary.

9.1.7 The site is underlain by compressible surficial deposits (topsoil, alluvium and colluvium) that are unsuitable in their present condition and will require remedial grading in the form of removal and compaction where improvements are planned.

9.1.8 Excavations for cut lots, slopes, buttresses, shear keys and stability fills should be observed by an engineering geologist to verify that the soil and geologic conditions do not differ significantly from those anticipated. Particular attention should be given to cut lots exposing the Otay Formation where potholing may be necessary to verify that bentonitic claystone is not present near finish grade. In the event that unanticipated conditions are encountered, modifications to our recommendations (e.g. stability fills, additional undercutting, etc.) may be required.

9.1.9 Evaluation of the suitable and unsuitable soil types (i.e. bentonitic clay, sand, etc.) and how they relate to the project grading requirements (e.g. capping, buttress, shear key and stability fill material requirements) will require careful management by the contractor during grading. Special handling and/or stockpiling may be necessary to achieve the project recommendations.

9.1.10 Proposed grading will result in fills up to approximately 100-feet-thick. The settlement potential of these embankments will be an important design consideration. In addition, special foundation design considerations (i.e. total and differential settlements across the building footprints) may be required for buildings supported by fills greater than 75 feet thick.

9.1.11 The existing 12 monitoring wells (gas, vadose, and groundwater) installed on the property as part of a previous environmental study adjacent to the Otay Landfill will need to be destroyed in accordance with the County of San Diego Department of Environmental Health requirements. Once the project has been approved, a C57-licensed drilling contractor will need to be contracted to properly destroy the wells.

9.1.12 We understand that the existing reclaimed water line along the western project boundary may need to be removed and placed in a new location within the proposed development. If this procedure requires phased grading, buttress construction and bentonite undercutting in the vicinity of *Geologic Cross Section A-A'* should be considered during the planning of this procedure.

9.2 Settlement Considerations

9.2.1 Fill embankments up to approximately 100-feet-thick are proposed during site grading. As a consequence, the potential for total and differential settlement beneath proposed buildings and underground improvements (i.e. sewer, storm drain, etc.) in deep fill areas should be a consideration. Foundation design criteria taking into account the anticipated total and differential settlement can be provided as project plans progress. Based on our experience with similar fill depths and soil conditions, the estimated settlement of a compacted fill may vary between approximately 0.2 and 0.3 percent of the fill thickness, depending on the relative compaction and overburden load. We recommend a minimum relative compaction of 90 percent at or slightly above optimum moisture content for fills less than 50-feet-thick and a minimum of 93 percent at two percent above optimum moisture content for fills deeper than 50 feet. Based on these criteria, the estimated ultimate settlement potential for fills less than 50 feet is 0.3 percent of the fill thickness and 0.2 percent of the fill thickness for fills greater than 50 feet. Therefore, compacted fill up to 100-feet-thick may settle up to approximately 3-inches when fully wetted.

9.2.2 The settlement of compacted fill is expected to occur over a relatively extended time period resulting from both gravity loading and hydrocompression upon wetting from rainfall and/or landscape irrigation.

9.3 Settlement Monitoring

9.3.1 The proposed structural areas underlain by fills thicker than 50 feet should be monitored for settlement. In general, surface settlement plates should be installed at several locations within the development footprint and read periodically until primary consolidation has essentially ceased. Survey readings should be performed regularly following placement of the proposed fill. Specific details regarding the location and type of monitoring device as well as monitoring frequency will be provided once the development plans have been finalized.

9.4 Excavation and Soil Characteristics

9.4.1 Excavation of the surficial deposits (previously placed fill, topsoil, alluvium and colluvium) should be possible with light to moderate effort using conventional heavy-duty equipment. These deposits may be very moist to saturated during the winter or early spring depending on preceding precipitation. Overly wet soils will require drying or mixing with drier material prior to their use as compacted fill.

9.4.2 Excavating within the formational units should be possible with moderate to heavy effort using conventional heavy-duty excavation equipment. Cemented zones requiring very heavy effort may be encountered, however, it is anticipated that these conditions would be localized.

9.4.3 The soils encountered in the field investigation are considered to be “non-expansive” (expansion index [EI] of 20 or less) and “expansive” (expansion index [EI] of 130 or more) as defined by 2019 California Building Code (CBC) Section 1803.5.3. The soil materials collected and tested for expansion index indicate a “very low” to “very high” expansion, which are defined in Table 9.4 below.

TABLE 9.4
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	ASTM 4829 Expansion Classification	2019 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

9.5 Corrosion

9.5.1 Selected samples were subjected to laboratory water-soluble sulfate content tests. The results of the water-soluble sulfate tests are summarized in Appendix B. The test results indicate the on-site materials at the locations tested possess "S0" sulfate exposure to concrete structures as defined by 2019 CBC Section 1904 and ACI 318-14 Chapter 19 (see Appendix B for test results). Table 9.5 presents a summary of concrete requirements set forth by 2019 CBC Section 1904 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

TABLE 9.5
REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Exposure Class	Water-Soluble Sulfate (SO_4) Percent by Weight	Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight[1]	Minimum Compressive Strength (psi)
S0	SO_4<0.10	No Type Restriction	n/a	2,500
S1	0.10≤SO_4<0.20	II	0.50	4,000
S2	0.20≤SO_4≤2.00	V	0.45	4,500
S3	SO_4>2.00	V+Pozzolan or Slag	0.45	4,500

[1] Maximum water to cement ratio limits do not apply to lightweight concrete

9.5.2 Geocon Incorporated does not practice in the field of corrosion engineering; therefore, further evaluation by a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of underground pipes and buried metal in direct contact with the soils.

9.6 Canyon Subdrains

9.6.1 The geologic units encountered on the site have permeability characteristics and/or fracture systems that could be susceptible to groundwater transmission. Canyon subdrains are recommended to collect subsurface water within areas of planned development. The recommended canyon subdrain locations are presented on Figure 2, however, the locations are subject to change depending on the conditions encountered in the field. *Section 7* in Appendix F provides recommendations for canyon subdrains.

9.6.2 Upon completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map depicting their location and elevation.

9.7 Buttresses, Shear Keys, and Stability Fills

9.7.1 A 20-foot-wide drained buttress (shown in purple on Figure 2) will be required in the vicinity of *Geologic Cross Section I-I'* to provide an acceptable factor of safety for the proposed slope. As mentioned previously, segmental excavations may be necessary to provide adequate temporary stability during grading.

9.7.2 A 15-foot-wide and 40-foot-wide drained shear key will be required to obtain an acceptable factor of safety for two proposed fill slope areas (shown in blue on Figure 2).

9.7.3 A 15-foot-wide drained stability fill (shown in yellow on Figure 2) will be required on proposed cut slopes along the southern/southeastern portions of the property which will expose the San Diego and Otay Formations.

9.7.4 Typical buttress, shear key and stability fill details are shown on Figures 11 through 13, respectively. *Section 7* in Appendix F provides cut off wall and headwall details for the heel drains, if required. Depending on the geologic conditions exposed, deeper and/or wider keyways may be necessary. The actual recommended keyway dimensions, as well as backdrain geometry and connection points should be determined as grading plans progress.

9.8 Grading

9.8.1 All grading should be performed in accordance with the attached *Recommended Grading Specifications* (Appendix F). Where the recommendations of this section conflict with Appendix F, the recommendations of this section take precedence. All earthwork should be observed and all fills tested for proper compaction by Geocon Incorporated.

9.8.2 Prior to commencing grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer, and engineering geologist/geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

9.8.3 Site preparation should begin with the removal of all deleterious material and vegetation. The depth of removal should be such that material exposed in cut areas or soils to be used as fill are relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site.

9.8.4 All potentially compressible surficial soils (topsoil, alluvium, and colluvium) within areas where structural improvements are planned, or where discussed herein, should be removed to firm natural ground and properly compacted prior to placing additional fill and/or structural loads. Deeper than normal benching and/or stripping operations for sloping ground surfaces will be required where the thickness of potentially compressible surficial deposits exceeds 3 feet. In addition, processing of the upper 12 inches of the previously placed fill surface will be required prior to additional fill placement. The actual extent of unsuitable soil removals will be determined in the field during grading by the engineering geologist and/or geotechnical engineer.

9.8.5 After removal of unsuitable materials is performed, the site should then be brought to final subgrade elevations with structural fill compacted in layers. In general, soils native to the site are suitable for re-use as fill if free from vegetation, debris and other deleterious material. Layers of fill should be no thicker than will allow for adequate bonding and compaction. All fill, including backfill and scarified ground surfaces, should be compacted to at least 90 percent of maximum dry density at or above optimum moisture content, as determined in accordance with ASTM Test Procedure D1557. **Fills <u>greater than 50-feet-thick</u> (based on the ultimate design grades) should be compacted to at least <u>93 percent</u> of the laboratory maximum dry density at a minimum of <u>2 percent above</u> the optimum moisture content**. Fill materials below optimum moisture content will require additional moisture conditioning prior to placing additional fill.

9.8.6 Bentonitic claystone and/or other expansive claystone/siltstone that occurs within 5 feet of finish grade on cut lots should be removed and replaced with properly compacted fill that possesses a “very low” to “low” expansion potential (EI of 50 or less). Grading operations should be managed to allow for placement of these expansive soils in the deeper fill areas.

9.8.7 Bentonitic claystone placed in fills should be mixed with granular materials at a ratio of at least two parts sand to one-part bentonitic clay. This material should be placed at least 5 feet below finish grade, at least 15 feet from the slope face and not within a buttress, shear key or stability fill areas. Mixing of bentonitic clays will not be required if placed at least 10 feet below finish grade.

9.8.8 The City of Chula Vista requires that the upper 5 feet of fill, and the upper 3 feet of formational materials within the public right-of-way or public easement possess an expansion index of 90 or less. If material with an expansion index greater than 90 is exposed within the right-of-ways, the upper 5 feet of compacted fills and the upper 3 feet of formational materials should be removed and replaced with fill possessing an expansion index of 90 or less. Alternative methods, if proposed, should be approved by the City of Chula Vista within the right-of-way areas.

9.8.9 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular "soil" fill to reduce the potential for surficial sloughing. In general, soils with an Expansion Index of less than 90 or at least 35 percent sand size particles should be acceptable as "granular" fill. Fill slopes with a height over 50 feet will require soil with a minimum phi angle of 29 degrees and cohesion of 300 psf. The horizontal width of this material should be one-half the slope height. Soils of questionable strength to satisfy surficial stability should be tested in the laboratory for acceptable drained shear strength.

9.8.10 If encountered, oversize material (i.e. cobbles, boulders and concretions) greater than 6 inches in maximum dimension should not be placed within 5 feet of finish grade. Rock greater than 12 inches in maximum dimension should not be placed within 10 feet of finish pad grade or within 2 feet of the deepest utility.

9.8.11 To reduce the potential for differential settlement, it is recommended that the cut portion of cut/fill transition building pads be undercut at least 3 feet and replaced with properly compacted “very low” to “low” expansive fill soils. Where the thickness of the fill below the building pad exceeds 15 feet, the depth of the undercut should be increased to one-fifth of the maximum fill thickness.

9.8.12 It is the responsibility of the contractor and their competent person to ensure that all excavations, temporary slopes and trenches are properly constructed and maintained in accordance with applicable OSHA regulations in order to maintain safety and the stability of adjacent existing improvements.

9.8.13 Import materials should consist of “very low” to “low” expansive (Expansion Index of 50 or less) soils. Prior to importing the material, samples from proposed borrow areas should be obtained and subjected to laboratory testing to determine whether the material conforms to the recommended criteria. At least 5 working days should be allowed for laboratory testing of the soil prior to its importation. Import materials should be free of oversize rock and construction debris.

9.9 Seismic Design Criteria

9.9.1 Table 9.9.1 summarizes site-specific design criteria obtained from the 2019 California Building Code (CBC; Based on the 2018 International Building Code [IBC] and ASCE 7-16), Chapter 16 Structural Design, Section 1613 Earthquake Loads. We used the computer program *Seismic Design Maps*, provided by the Structural Engineers Association (SEA) to calculate the seismic design parameters. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.2.2 of the 2019 CBC and Table 20.3-1 of ASCE 7-16. The values presented herein are for the risk-targeted maximum considered earthquake (MCE_R) for Site Class C. The project structural engineer and architect should evaluate the appropriate Risk Category and Seismic Design Category for the planned structures. The values presented herein assume a Risk Category of II and resulting in a Seismic Design Category D.

TABLE 9.9.1
2019 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2019 CBC Reference
Site Class	C	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.817	Figure 1613.2.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.292g	Figure 1613.2.1(2)
Site Coefficient, F_A	1.2	Table 1613.2.3(1)
Site Coefficient, F_V	1.5	Table 1613.2.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.98g	Section 1613.2.3 (Eqn 16-36)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.437g	Section 1613.2.3 (Eqn 16-37)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.653g	Section 1613.2.4 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.292g	Section 1613.2.4 (Eqn 16-39)

* Using the code-based values presented in this table, in lieu of a performing a ground motion hazard analysis, requires the exceptions outlined in ASCE 7-16 Section 11.4.8 be followed by the project structural engineer. Per Section 11.4.8 of ASCE/SEI 7-16, a ground motion hazard analysis should be performed for projects for Site Class "E" sites with Ss greater than or equal to 1.0g and for Site Class "D" and "E" sites with S1 greater than 0.2g; however, Section 11.4.8 also provides exceptions which indicates that the ground motion hazard analysis may be waived provided the exceptions are followed.

9.9.2 Table 9.9.2 presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-16.

TABLE 9.9.2
2019 CBC SITE ACCELERATION PARAMETERS

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.356g	Figure 22-7
Site Coefficient, F_{PGA}	1.2	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.428g	Section 11.8.3 (Eqn 11.8-1)

9.9.3 Conformance to the criteria in Tables 9.9.1 and 9.9.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

9.9.4 The project structural engineer and architect should evaluate the appropriate Risk Category and Seismic Design Category for the planned structures. The values presented herein assume a Risk Category of II and resulting in a Seismic Design Category D. Table 9.9.3 presents a summary of the risk categories in accordance with ASCE 7-16.

TABLE 9.9.3
ASCE 7-16 RISK CATEGORIES

Risk Category	Building Use	Examples
I	Low risk to Human Life at Failure	Barn, Storage Shelter
II	Nominal Risk to Human Life at Failure (Buildings Not Designated as I, III or IV)	Residential, Commercial and Industrial Buildings
III	Substantial Risk to Human Life at Failure	Theaters, Lecture Halls, Dining Halls, Schools, Prisons, Small Healthcare Facilities, Infrastructure Plants, Storage for Explosives/Toxins
IV	Essential Facilities	Hazardous Material Facilities, Hospitals, Fire and Rescue, Emergency Shelters, Police Stations, Power Stations, Aviation Control Facilities, National Defense, Water Storage

9.10 Foundation and Concrete Slabs-On-Grade Recommendations

9.10.1 The following foundation recommendations are for proposed one- to three-story residential structures. For buildings greater than three stories, or two to three-story buildings supported by fills with a thickness in excess of 75 feet, additional recommendations should be provided considering the anticipated total and differential settlement. This information can be provided once the project foundation engineer is selected and total and differential settlement tolerances for each building are discussed. The foundation recommendations presented below have been separated into three categories based on either the maximum and differential fill thickness or Expansion Index. The foundation category criteria are presented in Table 9.10.1.

TABLE 9.10.1
FOUNDATION CATEGORY CRITERIA

Foundation Category	Maximum Fill Thickness, T (Feet)	Differential Fill Thickness, D (Feet)	Expansion Index (EI)
I	T<20	--	EI≤50
II	20≤T<50	10≤D<20	50<EI≤90
III	75≥T≥50	D≥20	90<EI≤130

9.10.2 Final foundation categories for each building or lot will be provided after finish pad grades have been achieved and laboratory testing of the subgrade soil has been completed.

9.10.3 Table 9.10.2 presents minimum foundation and interior concrete slab design criteria for conventional foundation systems.

TABLE 9.10.2
CONVENTIONAL FOUNDATION RECOMMENDATIONS BY CATEGORY

Foundation Category	Minimum Footing Embedment Depth (inches)	Continuous Footing Reinforcement	Interior Slab Reinforcement
I	12	Two No. 4 bars, one top and one bottom	6 x 6 - 10/10 welded wire mesh at slab mid-point
II	18	Four No. 4 bars, two top and two bottom	No. 3 bars at 24 inches on center, both directions
III	24	Four No. 5 bars, two top and two bottom	No. 3 bars at 18 inches on center, both directions

9.10.4 The embedment depths presented in Table 9.10.2 should be measured from the lowest adjacent pad grade for both interior and exterior footings. The conventional foundations should have a minimum width of 12 inches and 24 inches for continuous and isolated footings, respectively. A typical wall/column footing detail is presented on Figure 14.

9.10.5 The concrete slabs-on-grade should be a minimum of 4 inches thick for Foundation Categories I and II and 5 inches thick for Foundation Category III. The concrete slabs-on-grade should be underlain by 4 inches and 3 inches of clean sand for 4-inch thick and 5-inch-thick slabs, respectively. Slabs expected to receive moisture sensitive floor coverings or used to store moisture sensitive materials should be underlain by a vapor inhibitor covered with at least 2 inches of clean sand or crushed rock. If crushed rock will be used, the thickness of the vapor inhibitor should be at least 10 mil to prevent possible puncturing.

9.10.6 As a substitute, the layer of clean sand (or crushed rock) beneath the vapor inhibitor recommended in the previous section can be omitted if a vapor inhibitor that meets or exceeds the requirements of ASTM E 1745-97 (Class A), and that exhibits permeance not greater than 0.012 perm (measured in accordance with ASTM E 96-95) is used. This vapor inhibitor may be placed directly on properly compacted fill or formational materials. The vapor inhibitor should be installed in general conformance with ASTM E 1643-98 and the manufacturer's recommendations. Two inches of clean sand should then be placed on top of the vapor inhibitor to reduce the potential for differential curing, slab curl, and cracking. Floor coverings should be installed in accordance with the manufacturer's recommendations.

9.10.7 As an alternative to the conventional foundation recommendations, consideration should be given to the use of post-tensioned concrete slab and foundation systems for the support of the proposed structures. The post-tensioned systems should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI) DC10.5 as required by the 2019 California Building Code (CBC Section 1808.6.2). Although this procedure was developed for expansive soil conditions, we understand it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should incorporate the geotechnical parameters presented on Table 9.10.3. The parameters presented in Table 9.10.3 are based on the guidelines presented in the PTI, DC10.5 design manual.

TABLE 9.10.3
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI), Third Edition Design Parameters	Foundation Category		
	I	II	III
Thornthwaite Index	-20	-20	-20
Equilibrium Suction	3.9	3.9	3.9
Edge Lift Moisture Variation Distance, e_M (feet)	5.3	5.1	4.9
Edge Lift, y_M (inches)	0.61	1.10	1.58
Center Lift Moisture Variation Distance, e_M (feet)	9.0	9.0	9.0
Center Lift, y_M (inches)	0.30	0.47	0.66

9.10.8 Foundation systems for the lots that possess a foundation Category I and a “very low” expansion potential (expansion index of 20 or less) can be designed using the method described in Section 1808 of the 2019 CBC. If post-tensioned foundations are planned, an alternative, commonly accepted design method (other than PTI DC 10.5) can be used. However, the post-tensioned foundation system should be designed with a total and differential deflection of 1 inch. Geocon Incorporated should be contacted to review the plans and provide additional information, if necessary.

9.10.9 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is planned, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer.

9.10.10 If the structural engineer proposes a post-tensioned foundation design method other than PTI, Third Edition:

- The deflection criteria presented in Table 9.10.3 are still applicable.
- Interior stiffener beams should be used for Foundation Categories II and III.
- The width of the perimeter foundations should be at least 12 inches.
- The perimeter footing embedment depths should be at least 12 inches, 18 inches and 24 inches for foundation categories I, II, and III, respectively. The embedment depths should be measured from the lowest adjacent pad grade.

9.10.11 Our experience indicates post-tensioned slabs are susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. Current PTI design procedures primarily address the potential center lift of slabs but, because of the placement of the reinforcing tendons in the top of the slab, the resulting eccentricity after tensioning reduces the ability of the system to mitigate edge lift. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.

9.10.12 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints be allowed to form between the footings/grade beams and the slab during the construction of the post-tension foundation system.

9.10.13 Category I, II, or III foundations may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf) (dead plus live load). This bearing pressure may be increased by one-third for transient loads due to wind or seismic forces.

9.10.14 Isolated footings, if present, should have the minimum embedment depth and width recommended for conventional foundations for a particular foundation category. The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended for Category III. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.

9.10.15 For Foundation Category III, consideration should be given to using interior stiffening beams and connecting isolated footings and/or increasing the slab thickness. In addition, consideration should be given to connecting patio slabs, which exceed 5 feet in width, to the building foundation to reduce the potential for future separation to occur.

9.10.16 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

9.10.17 Where buildings or other improvements are planned near the top of a slope steeper than 3:1 (horizontal:vertical), special foundations and/or design considerations are recommended due to the tendency for lateral soil movement to occur.

- For fill slopes less than 20 feet high, building footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

- When located next to a descending 3:1 (horizontal:vertical) fill slope or steeper, the foundations should be extended to a depth where the minimum horizontal distance is equal to H/3 (where H equals the vertical distance from the top of the fill slope to the base of the fill soil) with a minimum of 7 feet but need not exceed 40 feet. The horizontal distance is measured from the outer, deepest edge of the footing to the face of the slope. An acceptable alternative to deepening the footings would be the use of a post-tensioned slab and foundation system or increased footing and slab reinforcement. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.

- If swimming pools are planned, Geocon Incorporated should be contacted for a review of specific site conditions.

- Swimming pools located within 7 feet of the top of cut or fill slopes are not recommended. Where such a condition cannot be avoided, the portion of the swimming pool wall within 7 feet of the slope face be designed assuming that the adjacent soil provides no lateral support. This recommendation applies to fill slopes up to 30 feet in height, and cut slopes regardless of height. For swimming pools located near the top of fill slopes greater than 30 feet in height, additional recommendations may be required and Geocon Incorporated should be contacted for a review of specific site conditions.

- Although other improvements, which are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible, however, to incorporate design measures which would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

9.10.18 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

9.10.19 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

9.11 Retaining Walls and Lateral Loads Recommendations

9.11.1 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid with a density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an Expansion Index ≤50. Geocon Incorporated should be consulted for additional recommendations if backfill materials have an EI >50.

9.11.2 Retaining walls shall be designed to ensure stability against overturning sliding, excessive foundation pressure and water uplift. Where a keyway is extended below the wall base with the intent to engage passive pressure and enhance sliding stability, it is not necessary to consider active pressure on the keyway.

9.11.3 Where walls are restrained from movement at the top, an additional uniform pressure of 8H psf (where H equals the height of the retaining wall portion of the wall in feet) should be added to the active soil pressure where the wall possesses a height of 8 feet or less and 12H where the wall is greater than 8 feet. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to two feet of fill soil should be added (total unit weight of soil should be taken as 130 pcf).

9.11.4 Soil contemplated for use as retaining wall backfill, including import materials, should be identified in the field prior to backfill. At that time Geocon Incorporated should obtain samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength. City or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site soil to be used as backfill may or may not meet the values for standard wall designs. Geocon Incorporated should be consulted to assess the suitability of the on-site soil for use as wall backfill if standard wall designs will be used.

9.11.5 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The wall designer should provide appropriate lateral deflection quantities for planned retaining walls structures, if applicable. These lateral values should be considered when planning types of improvements above retaining wall structures.

9.11.6 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI ≤50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. A typical retaining wall drainage detail is presented on Figure 15. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.

9.11.7 In general, wall foundations having a minimum depth and width of one foot may be designed for an allowable soil bearing pressure of 2,000 psf, provided the soil within three feet below the base of the wall has an Expansion Index ≤ 90. The recommended allowable soil bearing pressure may be increased by 300 psf and 500 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable soil bearing pressure of 4,000 psf.

9.11.8 The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, Geocon Incorporated should be consulted where such a condition is anticipated. As a minimum, wall footings should be deepened such that the bottom outside edge of the footing is at least seven feet from the face of slope when located adjacent and/or at the top of descending slopes.

9.11.9 The structural engineer should determine the Seismic Design Category for the project in accordance with Section 1613.3.5 of the 2019 CBC or Section 11.6 of ASCE 7-10. For structures assigned to Seismic Design Category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 1803.5.12 of the 2019 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall. A seismic load of 15H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.428g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.3.

9.11.10 For resistance to lateral loads, a passive earth pressure equivalent to a fluid density of 350 pcf is recommended for footings or shear keys poured neat against properly compacted granular fill soils or undisturbed formational materials. The passive pressure assumes a horizontal surface extending away from the base of the wall at least five feet or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should not be included in the design for lateral resistance.

9.11.11 An ultimate friction coefficient of 0.35 may be used for resistance to sliding between soil and concrete. This friction coefficient may be combined with the passive earth pressure when determining resistance to lateral loads.

9.11.12 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 12 feet. In the event that walls higher than 12 feet are planned, Geocon Incorporated should be consulted for additional recommendations.

9.12 Storm Water Management BMP's

9.12.1 Based on the City of Chula Vista storm water standards manual, full or partial infiltration is infeasible and the site exhibits a "no infiltration" condition. The City of Chula Vista *Categorization of Infiltration Feasibility Condition Based on Geotechnical Conditions I-8A (Worksheet C.4-1)* forms are provided in Appendix D.

9.12.2 Both basins are located within 50 feet of a natural slope and are supported by the Otay and Sweetwater Formations. Highly expansive bentonitic clays are present in the Otay Formation beneath the basins. Water infiltration into highly expansive bentonite and bedding plane shear zones may result in soil heaving and distress to nearby public and private improvements and structures, lateral migration, daylight water seepage and slope instability. In addition, the eastern basin would be supported on a cut-fill transition resulting in approximately 20 feet of compacted fill or Otay Formation sandstone and claystone.

9.12.3 Due to the site geologic conditions, liners and subdrains should be incorporated into the design and construction of the planned storm water devices. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride, PVC) to prevent water migration. The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 4 inches in diameter and consist of Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. Seams and penetrations of the liners should be properly waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations. In addition, civil engineering provisions should be implemented to assure that the capacity of the system is never exceeded resulting in over topping or malfunctioning of the device. The system should also include a long-term maintenance program or periodic cleaning to prevent clogging of the filter media or drain envelope.

9.13 Slope Maintenance

9.13.1 Slopes that are steeper than 3:1 (horizontal:vertical) may, under conditions that are both difficult to prevent and predict, be susceptible to near-surface (surficial) slope instability. The instability is typically limited to the outer 3 feet of a portion of the slope and usually does not directly impact the improvements on the pad areas above or below the slope. The occurrence of surficial instability is more prevalent on fill slopes and is generally preceded by a period of heavy rainfall, excessive irrigation, or the migration of subsurface seepage. The disturbance and/or loosening of the surficial soils, as might result from root growth, soil expansion, or excavation for irrigation lines and slope planting, may also be a significant contributing factor to surficial instability. It is, therefore, recommended that, to the maximum extent practical: (a) disturbed/loosened surficial soils be either removed or properly recompacted, (b) irrigation systems be periodically inspected and maintained to eliminate leaks and excessive irrigation, and (c) surface drains on and adjacent to slopes be periodically maintained to preclude ponding or erosion. It should be noted that although the incorporation of the above recommendations should reduce the potential for surficial slope instability, it will not eliminate the possibility, and, therefore, it may be necessary to rebuild or repair a portion of the project's slopes in the future.

9.14 Site Drainage and Moisture Protection

9.14.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2019 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

9.14.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

9.15 Grading and Foundation Plan Review

9.15.1 Geocon Incorporated should review the grading plans and foundation plans for the project prior to final design submittal to evaluate whether additional analyses and/or recommendations are required.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

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N

NO SCALE

VICINITY MAP

GEOCON INCORPORATED

GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

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SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. 1

Plotted:06/10/2020 8:08AM | By:RUBEN AGUILAR | File Location:Y:\PROJECTS\G2452-32-02 Sunbow II, Ph.3\DETAILS\G2452-32-02 VicinityMap.dwg

GEOCON LEGEND

Qpf	PREVIOUSLY PLACED FILL
Qal	ALLUVIUM
Qcol	COLLUVIUM
Tsd	SAN DIEGO FORMATION
To	OTAY FORMATION
Tsw	SWEETWATER FORMATION
LB-7	APPROX. LOCATION OF LARGE DIAMETER BORING (GEOCON 2020)
T-19	APPROX. LOCATION OF EXPLORATORY TRENCH (GEOCON 2020)
I-1	APPROX. LOCATION OF INFILTRATION TEST (GEOCON 2020)
B-6	APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 1986)
B-77	APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 2006)
T-169	APPROX. LOCATION OF EXPLORATORY TRENCH (GEOCON 2006)
G-7	APPROX. LOCATION OF GAS MONITORING WELL (GEOCON 1989)
V-3	APPROX. LOCATION OF VADOSE MONITORING WELL (GEOCON 1989)
MW-2	APPROX. LOCATION OF MONITORING WELL (GEOCON 1994)
	APPROX. LOCATION OF GEOLOGIC CONTACT
K K'	APPROX. LOCATION OF GEOLOGIC CROSS-SECTION
12'	APPROX. THICKNESS OF SURFICIAL DEPOSITS REQUIRING REMEDIAL GRADING (In Feet)
-7'	APPROX. DEPTH TO GROUNDWATER (In Feet)
	ESTIMATED DAYLIGHT LOCATION OF BENTONITIC CLAYSTONE AND KEY MARKER BED AT NATURAL GRADE BASED ON INFORMATION PROJECTED FROM BORINGS
10 447.00' EL-PNT10	SPOT ELEVATION FROM GOOGLE EARTH
	APPROX. LOCATION OF CANYON SUBDRAIN
	CUT/FILL LINE
	PROPOSED STABILITY FILL
	PROPOSED BASE OF SHEAR KEY
	PROPOSED BUTTRESS
	ESTIMATED AREA WHERE BENTONITIC CLAYSTONE BED WILL REQUIRE 5-FOOT UNDERCUT

GEOTECHNICAL MAP

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

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PHONE 858 558-6900 - FAX 858 558-6159

SCALE 1" = 100' | DATE 04 - 10 - 2020
PROJECT NO. G2452 - 32 - 02 | FIGURE 2
SHEET 1 OF 1

Plotted:06/17/2020 9:29AM | By:RUBEN AGUILAR | File Location:Y:\PROJECTS\G2452-32-02 Sunbow II, Ph.3\SHEETS\G2452-32-02 GeotechnicalMap.dwg


OLYMPIC PARKWAY
FUTURE OTAY RANCH VILLAGE 2 WEST
PORTION REMAINDER LOT CHULA VISTA TRACT NO. 90-07 MAP NO. 13423
EXISTING RECLAIMED WATER MAIN
OTAY WATER DISTRICT
CITY OF CHULA VISTA
OTAY LAND FILL
COUNTY OF SAN DIEGO
Qpf
Qal
Qcol
Tsd
To
Tsw
GEOCON LEGEND
Qpf ....PREVIOUSLY PLACED FILL
Qal ....ALLUVIUM
Qcol ....COLLUVIUM
Tsd ....SAN DIEGO FORMATION
To ....OTAY FORMATION
Tsw ....SWEETWATER FORMATION
LB-7 ....APPROX. LOCATION OF LARGE DIAMETER BORING (GEOCON 2020)
T-19 ....APPROX. LOCATION OF EXPLORATORY TRENCH (GEOCON 2020)
I-1 ....APPROX. LOCATION OF INFILTRATION TEST (GEOCON 2020)
B-6 ....APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 1986)
B-77 ....APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 2006)
T-169 ....APPROX. LOCATION OF EXPLORATORY TRENCH (GEOCON 2006)
G-7 ....APPROX. LOCATION OF GAS MONITORING WELL (GEOCON 1989)
V-3 ....APPROX. LOCATION OF VADOSE MONITORING WELL (GEOCON 1989)
MW-2 ....APPROX. LOCATION OF MONITORING WELL (GEOCON 1994)
........APPROX. LOCATION OF GEOLOGIC CONTACT
K K' ....APPROX. LOCATION OF GEOLOGIC CROSS-SECTION
12' ....APPROX. THICKNESS OF SURFICIAL DEPOSITS REQUIRING REMEDIAL GRADING (In Feet)
-7' ....APPROX. DEPTH TO GROUNDWATER (In Feet)
........ESTIMATED DAYLIGHT LOCATION OF BENTONITIC CLAYSTONE AND KEY MARKER BED AT NATURAL GRADE BASED ON INFORMATION PROJECTED FROM BORINGS
348' ....ELEVATION OF KEY MARKER BED ENCOUNTERED IN BORING/TRENCH (In Feet)
353 ....ELEVATION CONTOUR OF KEY MARKER BED (In Feet)
10 447.00' EL-PNT10 ....SPOT ELEVATION FROM GOOGLE EARTH
0' 100' 200' 300' 400'
SCALE 1"=100' (On 42x30)
GEOLOGY MAP
SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA
GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
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SCALE 1" = 100'
DATE 04 - 10 - 2020
PROJECT NO. G2452 - 32 - 02
FIGURE 3
SHEET 1 OF 1
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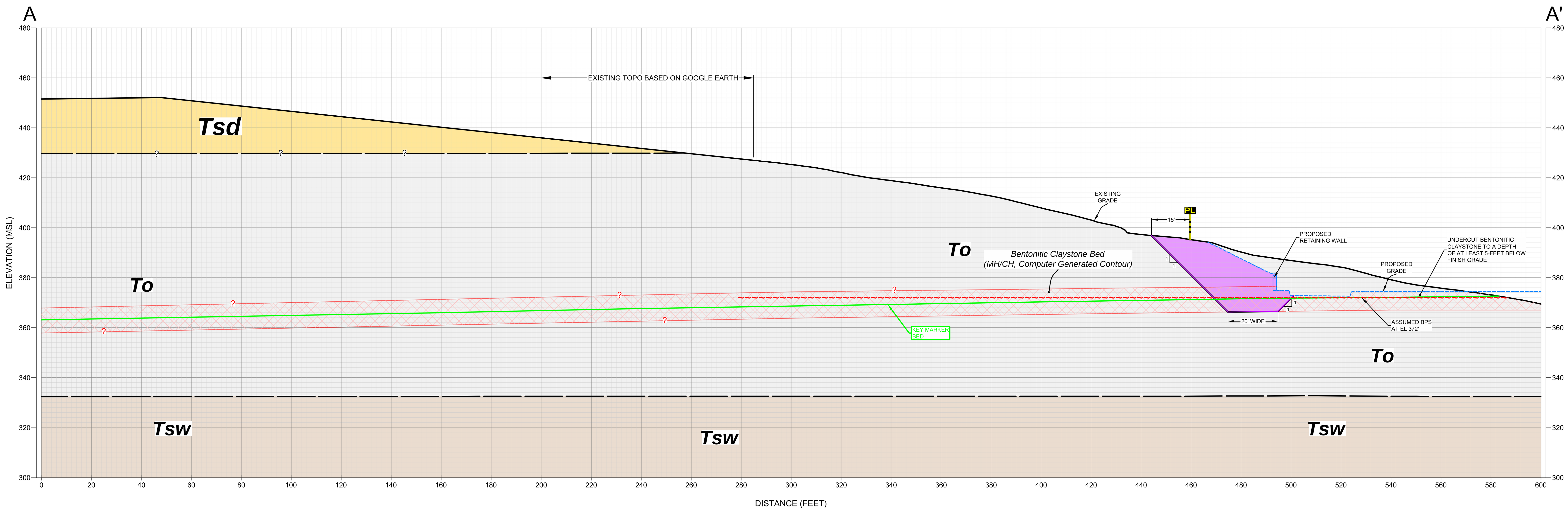
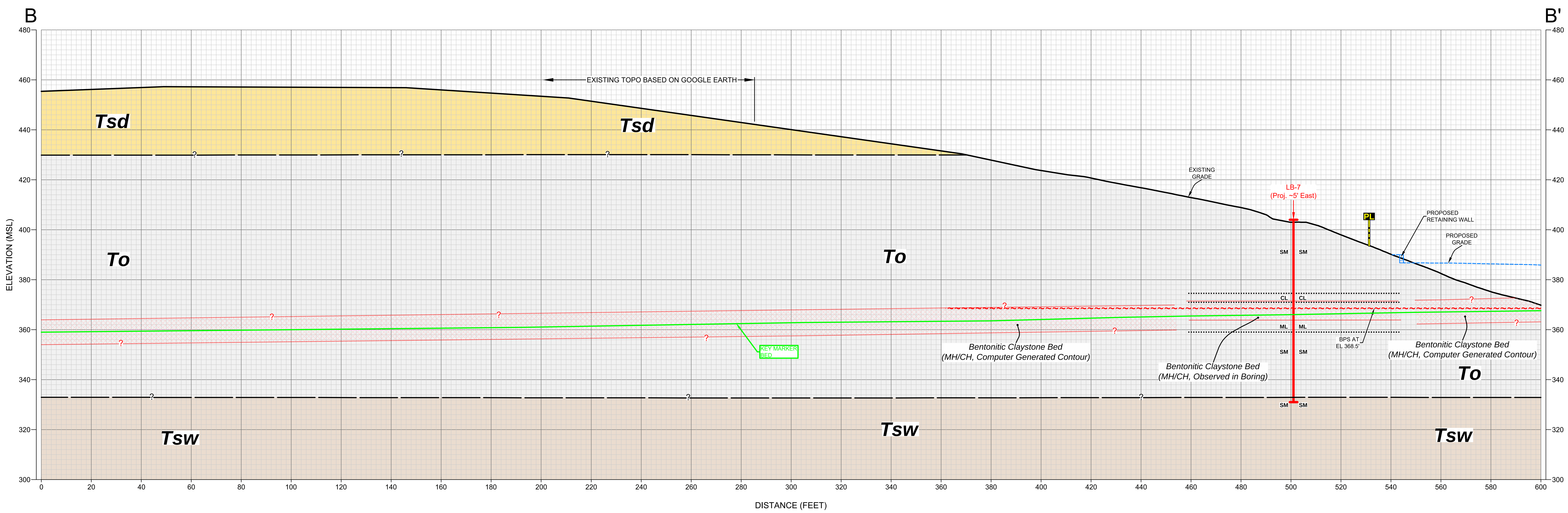


GEOLOGIC CROSS-SECTION A-A'

SCALE: 1" = 20' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION B-B'

SCALE: 1" = 20' (Vert. = Horiz.)

GEOCON LEGEND

- **Qal** ....ALLUVIUM
- **Tsd** ....SAN DIEGO FORMATION
- **To** ....OTAY FORMATION
- **Tsw** ....SWEETWATER FORMATION
- LB-7 ....APPROX. LOCATION OF LARGE DIAMETER BORING (GEOCON 2020)
- T-19 ....APPROX. LOCATION OF TRENCH (GEOCON 2020)
- B-6 ....APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 1986)
- ....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- ....APPROX. LOCATION OF INTRAFORMATIONAL CONTACT
- ....APPROX. LOCATION OF BEDDING PLANE SHEAR
- ....PROPOSED STABILITY FILL
- ....PROPOSED SHEAR KEY
- ....PROPOSED BUTTRESS

GEOLOGIC CROSS - SECTIONS

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

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SCALE 1" = 20'	DATE 04 - 10 - 2020	
PROJECT NO. G2452 - 32 - 02		FIGURE 4
SHEET 1 OF 5		

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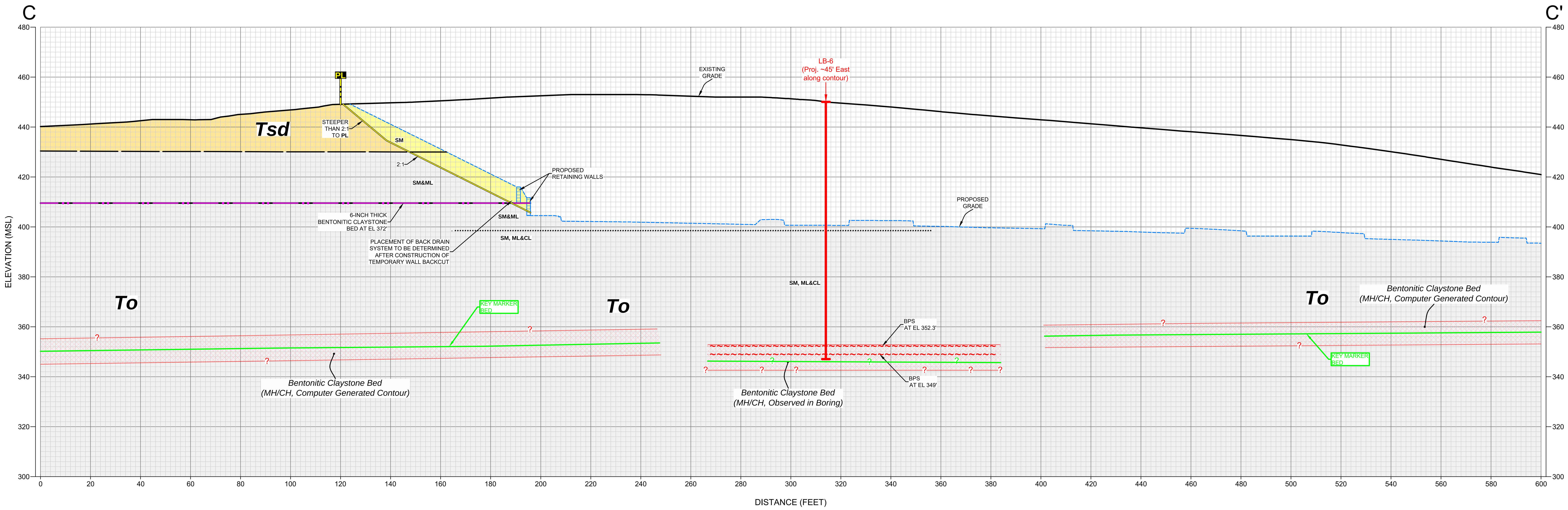
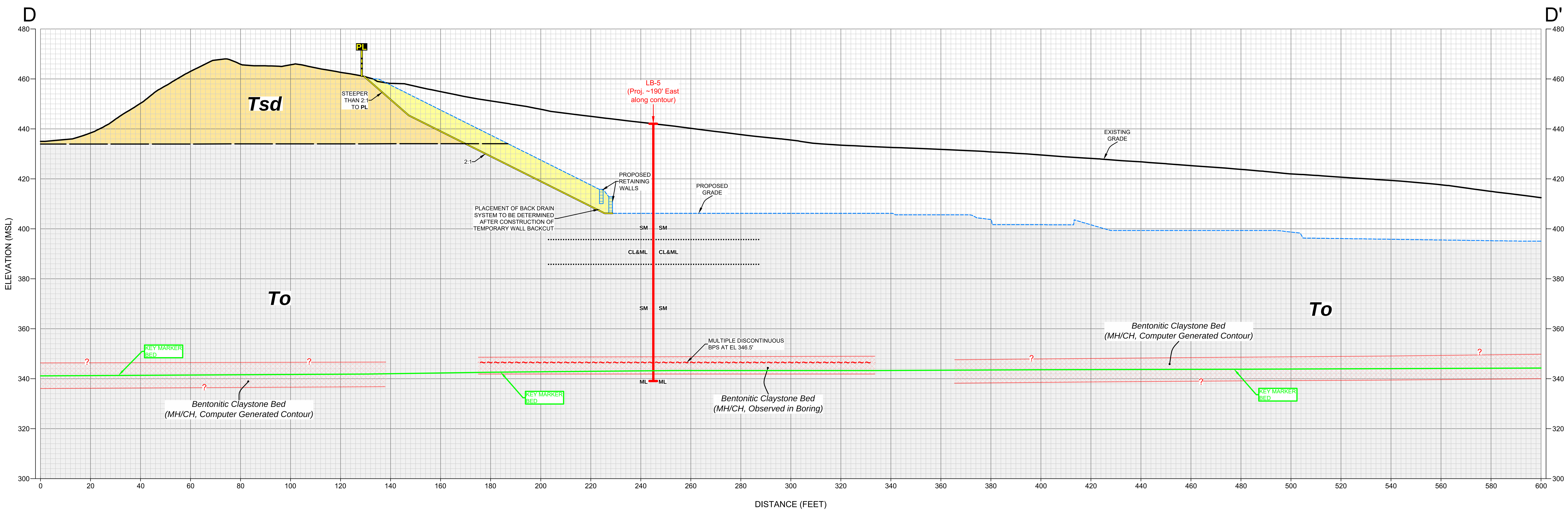


GEOLOGIC CROSS-SECTION C-C'

SCALE: 1" = 20' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION D-D'

SCALE: 1" = 20' (Vert. = Horiz.)

GEOCON LEGEND

- **Qal** ......ALLUVIUM
- **Tsd** ......SAN DIEGO FORMATION
- **To** ......OTAY FORMATION
- **Tsw** ......SWEETWATER FORMATION
- LB-7 ......APPROX. LOCATION OF LARGE DIAMETER BORING (GEOCON 2020)
- T-19 ......APPROX. LOCATION OF TRENCH (GEOCON 2020)
- B-6 ......APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 1986)
- ......APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- ......APPROX. LOCATION OF INTRAFORMATIONAL CONTACT
- ......APPROX. LOCATION OF BEDDING PLANE SHEAR
- ......PROPOSED STABILITY FILL
- ......PROPOSED SHEAR KEY
- ......PROPOSED BUTTRESS

GEOLOGIC CROSS - SECTIONS

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

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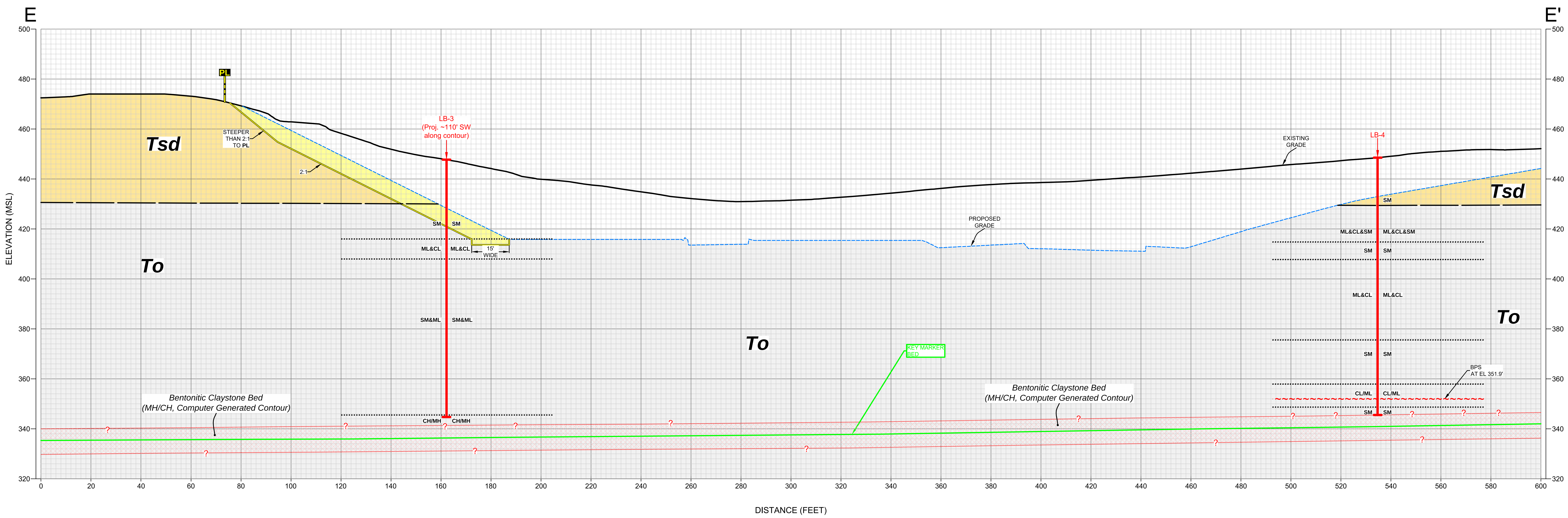
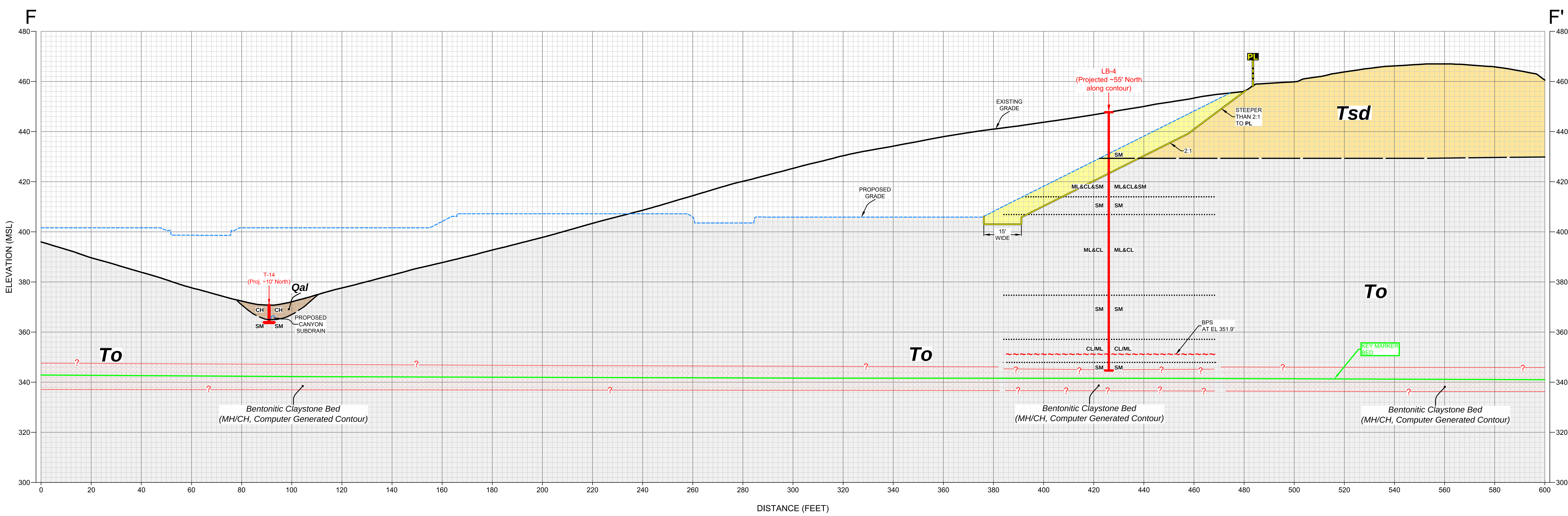
SCALE	1" = 20'
DATE	04 - 10 - 2020
PROJECT NO.	G2452 - 32 - 02
FIGURE	5
SHEET	2 OF 5



GEOLOGIC CROSS-SECTION E-E'

SCALE: 1" = 20' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION F-F'

SCALE: 1" = 20' (Vert. = Horiz.)

GEOCON LEGEND

- **Qal** ....ALLUVIUM
- **Tsd** ....SAN DIEGO FORMATION
- **To** ....OTAY FORMATION
- **Tsw** ....SWEETWATER FORMATION
- LB-7 ....APPROX. LOCATION OF LARGE DIAMETER BORING (GEOCON 2020)
- T-19 ....APPROX. LOCATION OF TRENCH (GEOCON 2020)
- B-6 ....APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 1986)
- ....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- ....APPROX. LOCATION OF INTRAFORMATIONAL CONTACT
- ....APPROX. LOCATION OF BEDDING PLANE SHEAR
- ....PROPOSED STABILITY FILL
- ....PROPOSED SHEAR KEY
- ....PROPOSED BUTTRESS

GEOLOGIC CROSS - SECTIONS

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

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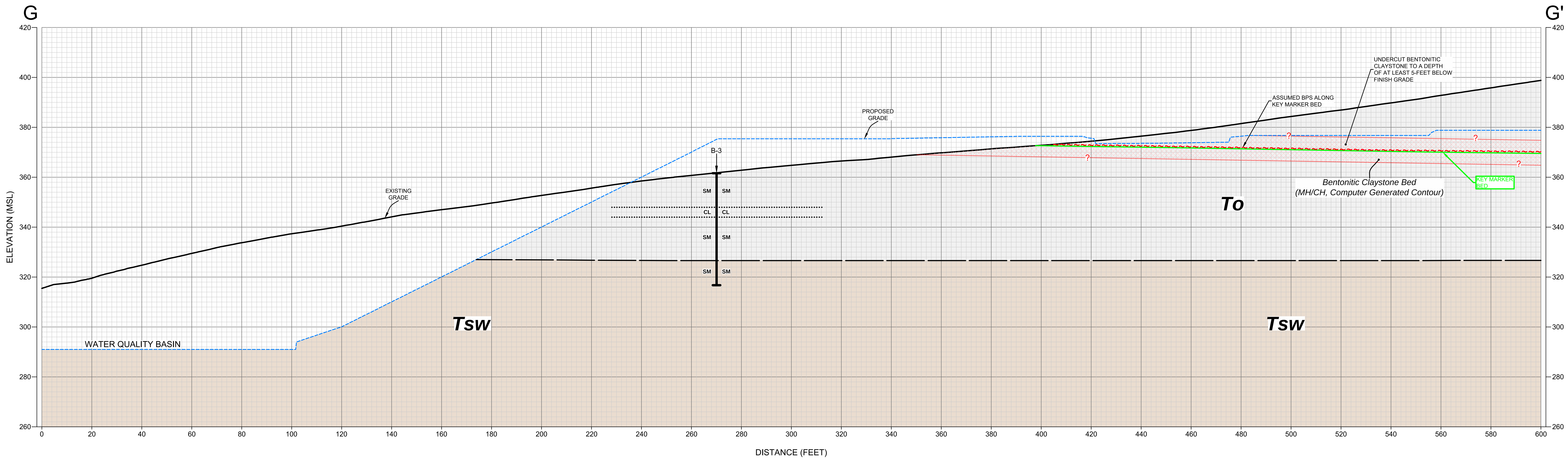
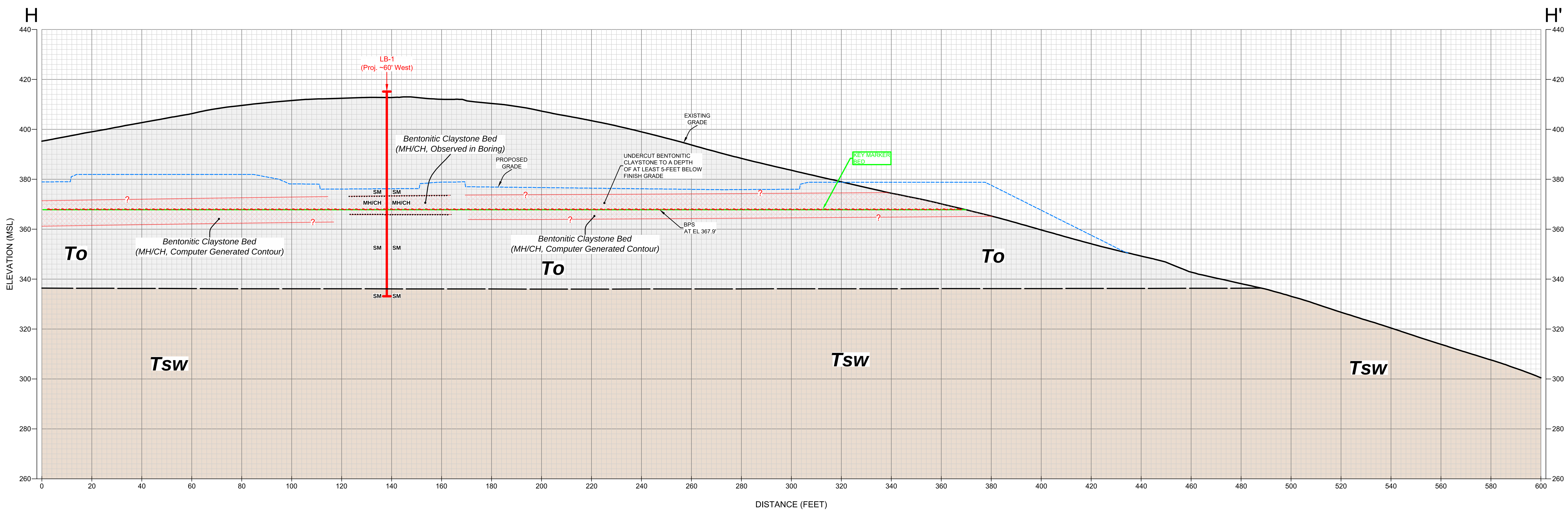
SCALE 1" = 20'	DATE 04 - 10 - 2020	
PROJECT NO. G2452 - 32 - 02		FIGURE 6
SHEET 3 OF 5		



GEOLOGIC CROSS-SECTION G-G'

SCALE: 1" = 20' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION H-H'

SCALE: 1" = 20' (Vert. = Horiz.)

GEOCON LEGEND

- Qal ....ALLUVIUM
- Tsd ....SAN DIEGO FORMATION
- To ....OTAY FORMATION
- Tsw ....SWEETWATER FORMATION
- LB-7 ....APPROX. LOCATION OF LARGE DIAMETER BORING (GEOCON 2020)
- T-19 ....APPROX. LOCATION OF TRENCH (GEOCON 2020)
- B-6 ....APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 1986)
- ....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- ....APPROX. LOCATION OF INTRAFORMATIONAL CONTACT
- ....APPROX. LOCATION OF BEDDING PLANE SHEAR
- ....PROPOSED STABILITY FILL
- ....PROPOSED SHEAR KEY
- ....PROPOSED BUTTRESS

GEOLOGIC CROSS - SECTIONS

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

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SCALE 1" = 20'	DATE 04 - 10 - 2020	
PROJECT NO. G2452 - 32 - 02		FIGURE 7
SHEET 4 OF 5		

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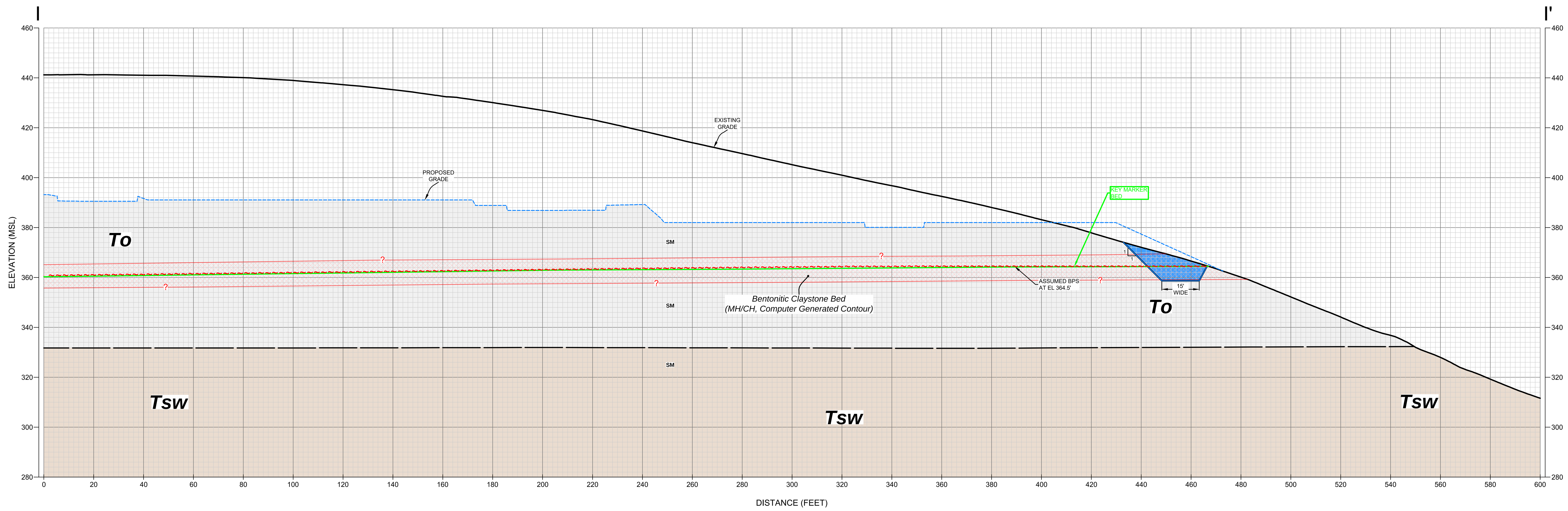
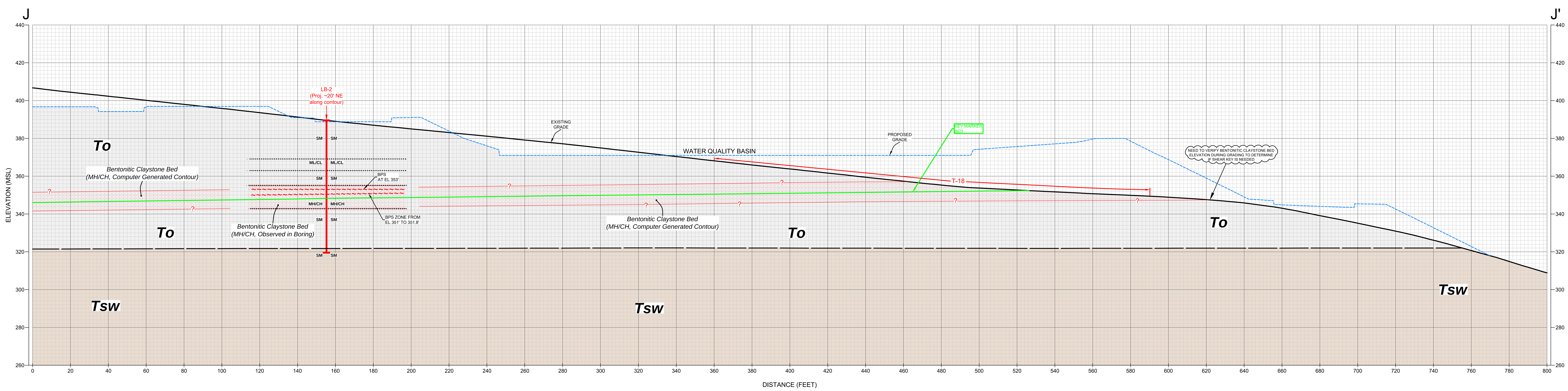


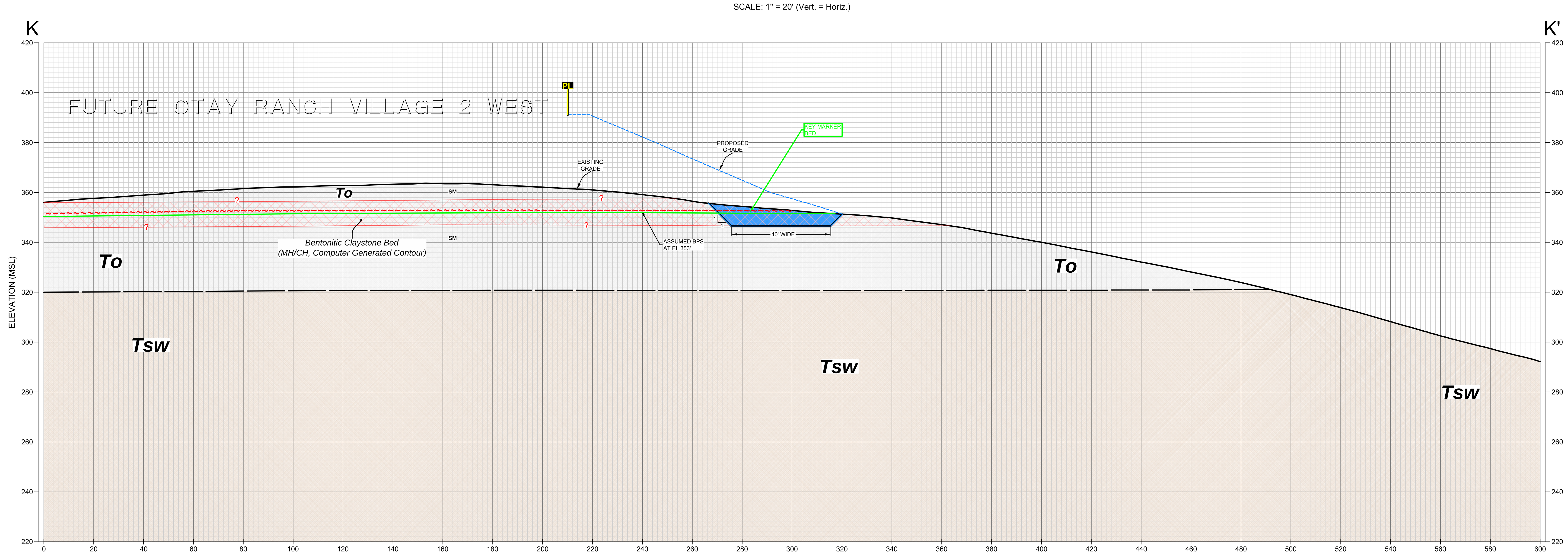
GEOLOGIC CROSS-SECTION I-I'

SCALE: 1" = 20' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION J-J'

SCALE: 1" = 20' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION K-K'

SCALE: 1" = 20' (Vert. = Horiz.)

GEOCON LEGEND

- Qal ....ALLUVIUM
- Tsd ....SAN DIEGO FORMATION
- To ....OTAY FORMATION
- Tsw ....SWEETWATER FORMATION
- LB-7 ....APPROX. LOCATION OF LARGE DIAMETER BORING (GEOCON 2020)
- T-19 ....APPROX. LOCATION OF TRENCH (GEOCON 2020)
- B-6 ....APPROX. LOCATION OF LARGE - DIAMETER BORING (GEOCON 1986)
- ?........APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- ....APPROX. LOCATION OF INTRAFORMATIONAL CONTACT
- ....APPROX. LOCATION OF BEDDING PLANE SHEAR
- ....PROPOSED STABILITY FILL
- ....PROPOSED SHEAR KEY
- ....PROPOSED BUTTRESS

GEOLOGIC CROSS - SECTIONS

SUNBOW II, PHASE 3
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SCALE	1" = 20'
DATE	04 - 10 - 2020
PROJECT NO.	G2452 - 32 - 02
SHEET	5 OF 5
FIGURE	8

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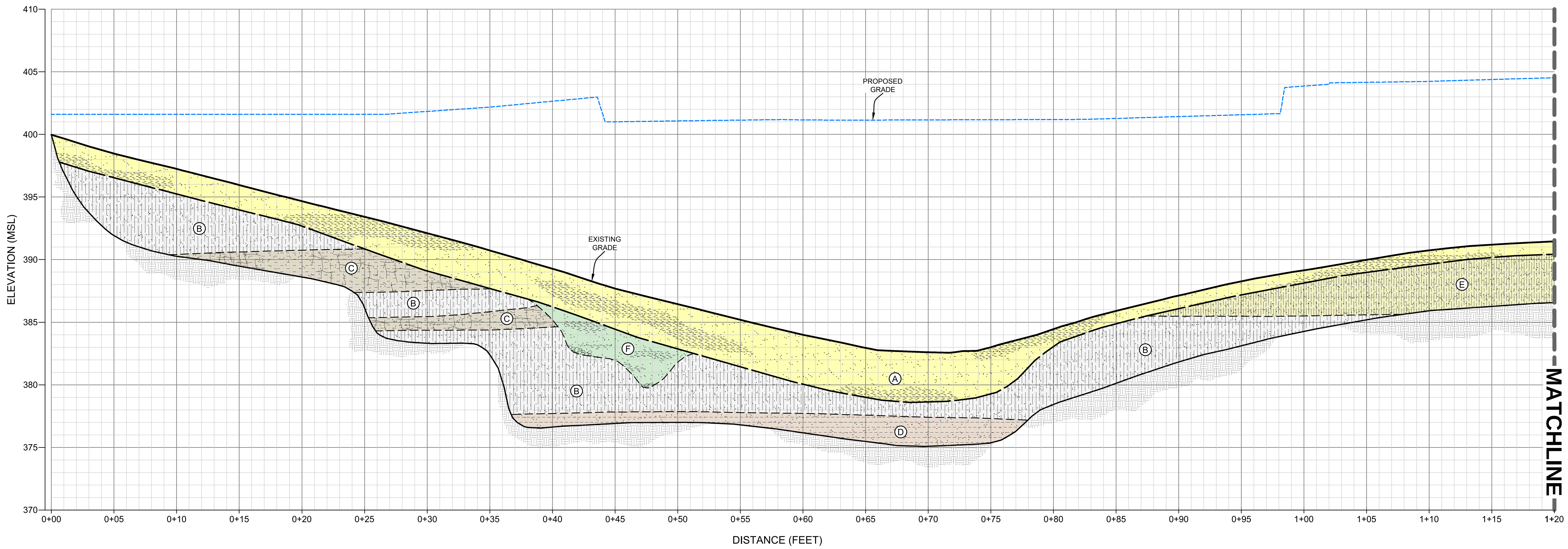
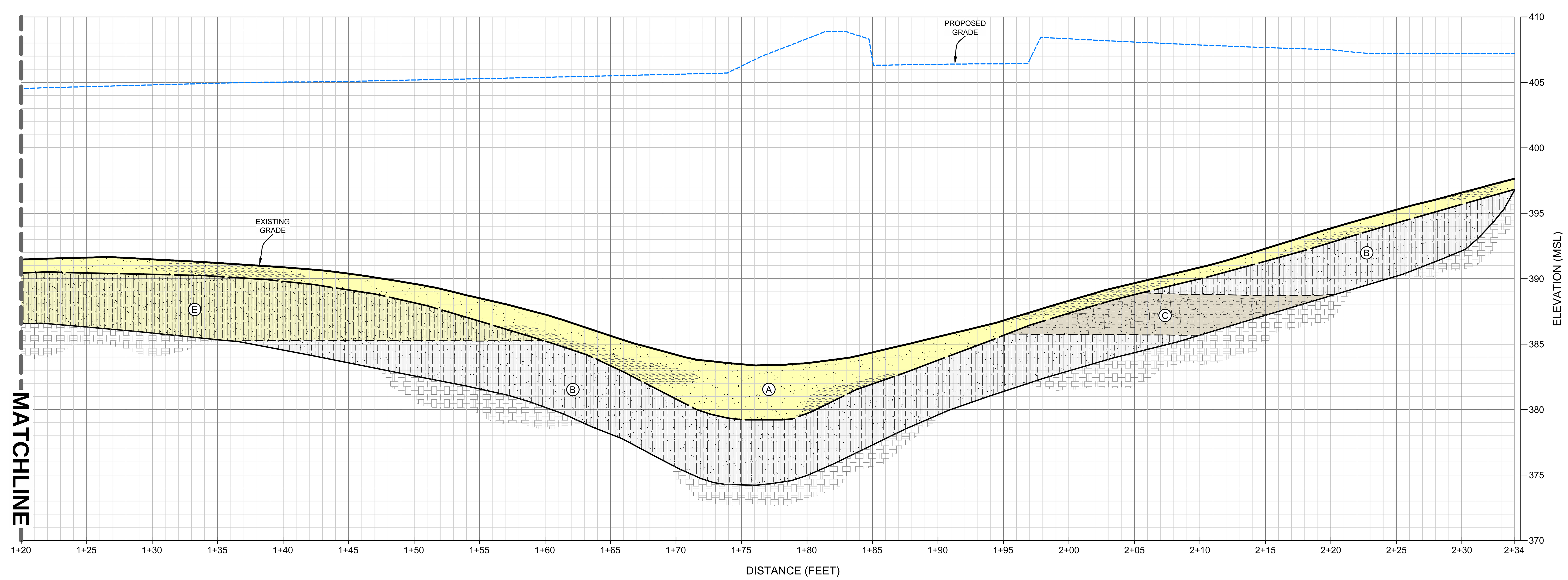


TRENCH NO. T-19

SCALE: 1" = 5' (Vert. = Horiz.)



TRENCH NO. T-19

SCALE: 1" = 5' (Vert. = Horiz.)

GEOCON LEGEND

TOPSOIL/ALLUVIUM

Ⓐ ....Sandy CLAY (CH) - Soft, damp, very dark grayish brown, fine-grained; clear, smooth contact below, thin zone of weathering at base.

To - OTAY FORMATION

Ⓑ ....Silty SANDSTONE (SM) - Dense to very dense, damp, light gray, Silty, fine- to medium-grained; massive to crudely stratified; abundant random calcium-carbonate stringers throughout; abrupt, smooth contact.

Ⓒ ....Sandy SILTSTONE (ML) - Very stiff, damp, grayish brown, fine-grained; blocky texture; abrupt, smooth contact.

Ⓓ ....Sandy CLAYSTONE (CL) - Very stiff, damp, brown, fine-grained; basal contact not visible.

Ⓔ ....Sandy SILTSTONE (ML) - Very stiff to hard, damp, grayish to greenish brown, fine-grained, abundant random calcium-carbonate stringers throughout; clear, smooth contact.

Ⓕ ....Clayey SAND (SC) - Paleo-channel; stiff, damp, greenish brown, fine- to medium-grained; rounded cobbles near base, up to 2-inch size; abundant random calcium-carbonate stringers throughout; upper portion is very diffuse with overlying topsoil.

........APPROX. LOCATION OF GEOLOGIC CONTACT

........APPROX. LOCATION OF INTERFORMATIONAL CONTACT

TRENCH NO. T-19

SUNBOW II, PHASE 3

CHULA VISTA, CALIFORNIA

GEOCON INCORPORATED

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SCALE 1" = 5'	DATE 04 - 10 - 2020	
PROJECT NO. G2452 - 32 - 02		FIGURE 9
SHEET 1 OF 1		

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Surficial Fill Slope Stability Evaluation

Slope Height, H (feet)	∞	
Vertical Depth of Stauration, Z (feet)	3	
Slope Inclination	2.00	:1
Slope Inclination, I (degrees)	26.6	
Unit Weight of Water, γW (pcf)	62.4	
Total Unit Weight of Soil, γ_T (pcf)	120	
Friction Angle, ϕ (degrees)	29	
Cohesion, C (psf)	300	
Factor of Safety = $(C+(\gamma_T-\gamma_W)Z\cos^2 i\tan\phi)/(\gamma_T Z\sin i\cos i)$	2.62	

References: (1) Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage* , Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62.

(2) Skempton, A. W., and F. A. Delory, *Stability of Natural Slopes in London Clay* , Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81.

Fill Slope Stability Evaluation

Slope Height, H (feet)	100	
Slope Inclination	2.0	:1
Total Unit Weight of Soil, γ_T (pcf)	120	
Friction Angle, ϕ (degrees)	29	
Cohesion, C (psf)	300	
$\gamma_{C\phi} = (\gamma H\tan\phi)/C$	22.2	
N_{Cf} (from Chart)	60	
Factor of Safety = $(N_{Cf}C)/(\gamma H)$	1.50	

References: (1) Janbu, N. *Stability Analysis of Slopes with Dimensionless Parameters,* Harvard Soil Mechanics, Series No. 46, 1954.

(2) Janbu, N. *Discussion of J.M. Bell, DimensionlessParameters for Homogeneous Earth Slopes,* Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

GEOCON
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6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
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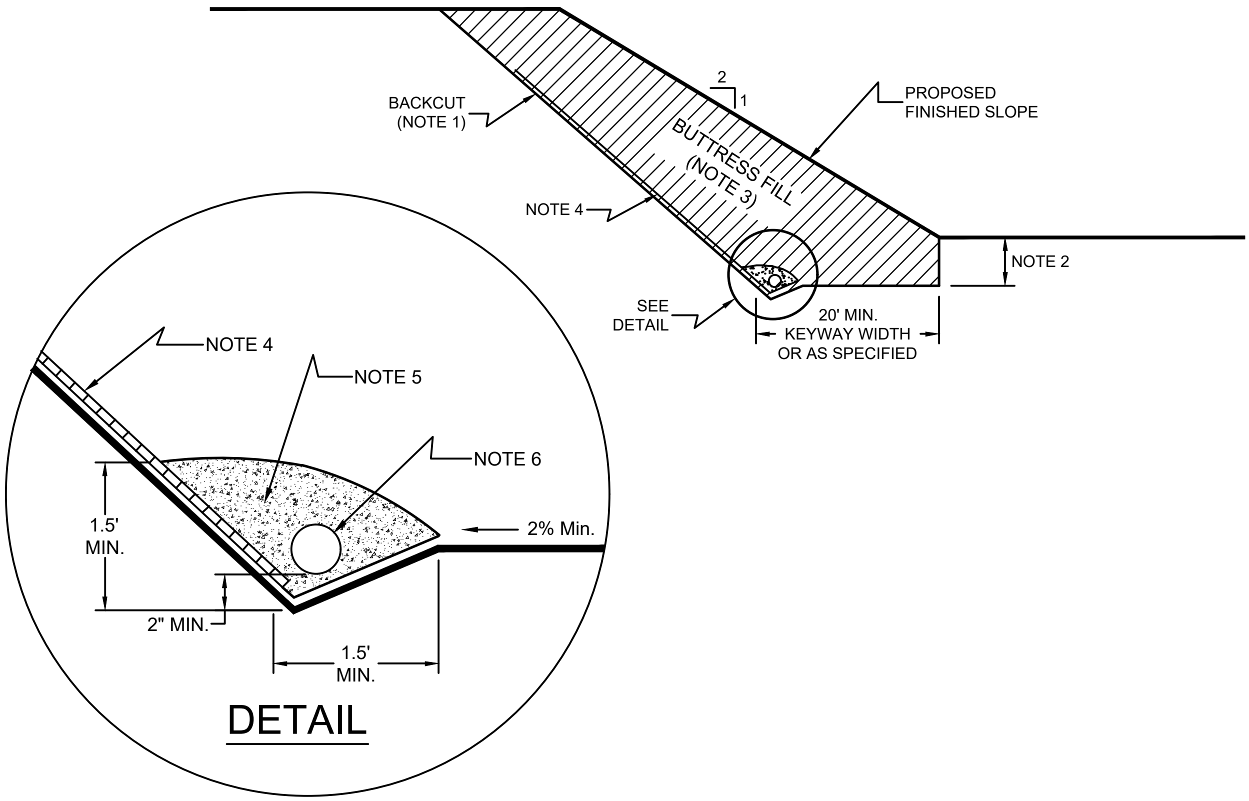
FILL SLOPE STABILITY ANALYSIS

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

DATE 04-10-2020 | PROJECT NO. G2452-32-02 | FIG. 10



NOTES:

1.....EXCAVATE BACKCUT IN ACCORDANCE WITH GEOTECHNICAL CONSULTANTS RECOMMENDATION TO ACHIEVE REQUIRED KEY WIDTH.

2.....BASE OF BUTTRESS KEY TO EXPOSE DENSE, FORMATIONAL MATERIAL SLOPING A MINIMUM 2% INTO SLOPE. FORECUT MAY BE SLOPED PER GEOTECHNICAL ENGINEERS RECOMMENDATIONS.

3.....BUTTRESS FILL TO BE COMPOSED OF PROPERLY COMPACTED, GRANULAR SOIL WITH MINIMUM SHEAR STRENGTH AS SPECIFIED.

4.....CHIMNEY DRAINS TO BE APPROVED, PREFABRICATED DOUBLE SIDED CHIMNEY DRAIN PANELS (MIRADRAIN, TENSAR, OR EQUIVALENT) SPACED APPROXIMATELY 30 FEET CENTER TO CENTER. ADDITIONAL DRAINS WILL BE REQUIRED WHERE AREAS OF SEEPAGE ARE ENCOUNTERED.

5.....DRAIN MATERIAL (9 CUBIC FEET) TO BE 3/4-INCH, OPEN-GRADED, CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC .

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

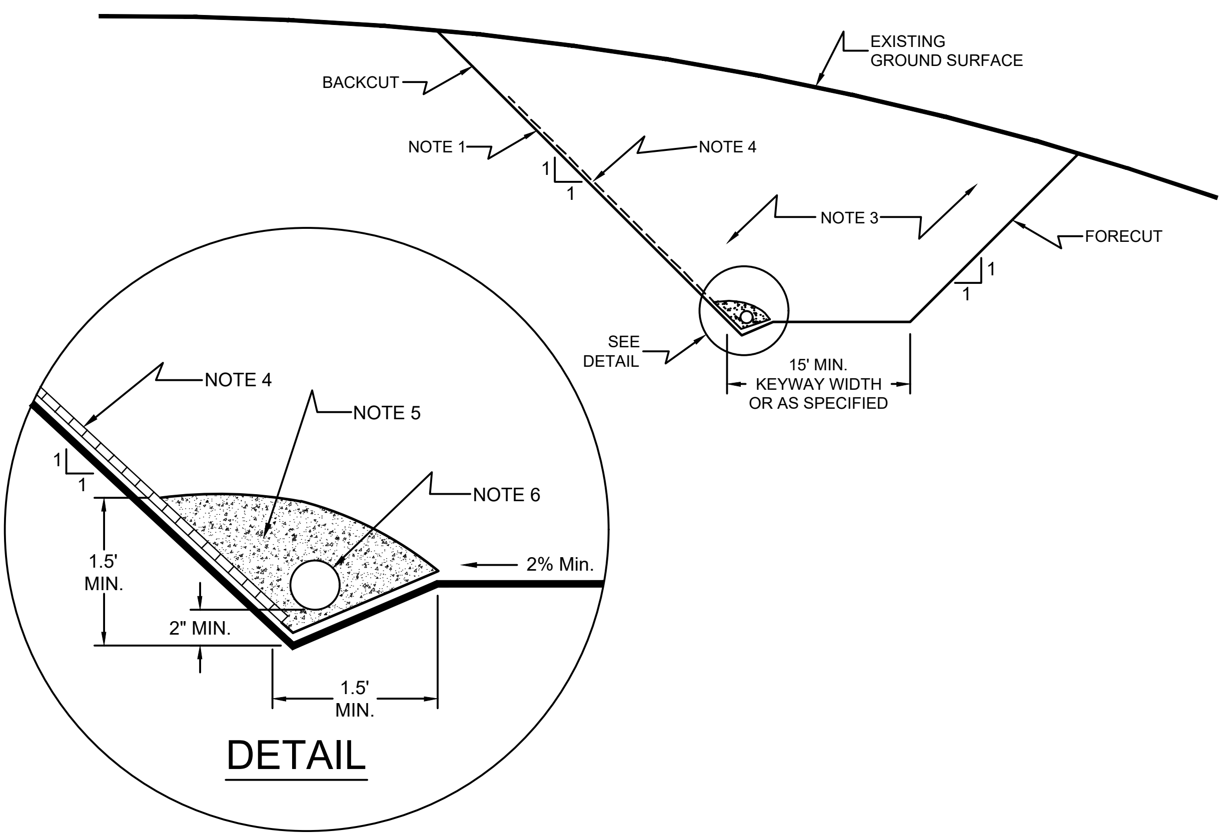
TYPICAL BUTTRESS FILL DETAIL

GEOCON
INCORPORATED

GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. 11



NOTES:

1.....EXCAVATE BACKCUT IN ACCORDANCE WITH GEOTECHNICAL CONSULTANTS RECOMMENDATION TO ACHIEVE REQUIRED KEY WIDTH.

2.....BASE OF SHEAR KEY TO EXPOSE DENSE, FORMATIONAL MATERIAL SLOPING A MINIMUM 2% INTO SLOPE.

3.....COMPACTED FILL TO BE COMPOSED OF PROPERLY COMPACTED, GRANULAR SOIL WITH MINIMUM SHEAR STRENGTH AS SPECIFIED.

4.....CHIMNEY DRAINS TO BE APPROVED, PREFABRICATED DOUBLE SIDED CHIMNEY DRAIN PANELS (MIRADRAIN, TENSAR, OR EQUIVALENT) SPACED APPROXIMATELY 30 FEET CENTER TO CENTER. ADDITIONAL DRAINS WILL BE REQUIRED WHERE AREAS OF SEEPAGE ARE ENCOUNTERED. HEIGHT OF CHIMNEY DRAINS TO BE DETERMINED BY GEOTECHNICAL ENGINEER.

5.....DRAIN MATERIAL (9 CUBIC FEET) TO BE 3/4-INCH, OPEN-GRADED, GRAVEL SURROUNDED BY MIRAFI 140N OR EQUIVALENT FILTER FABRIC.

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, SCHEDULE 40 PVC, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO SUITABLE TIGHT LINE OUTLET.

NO SCALE

TYPICAL SHEAR KEY DETAIL

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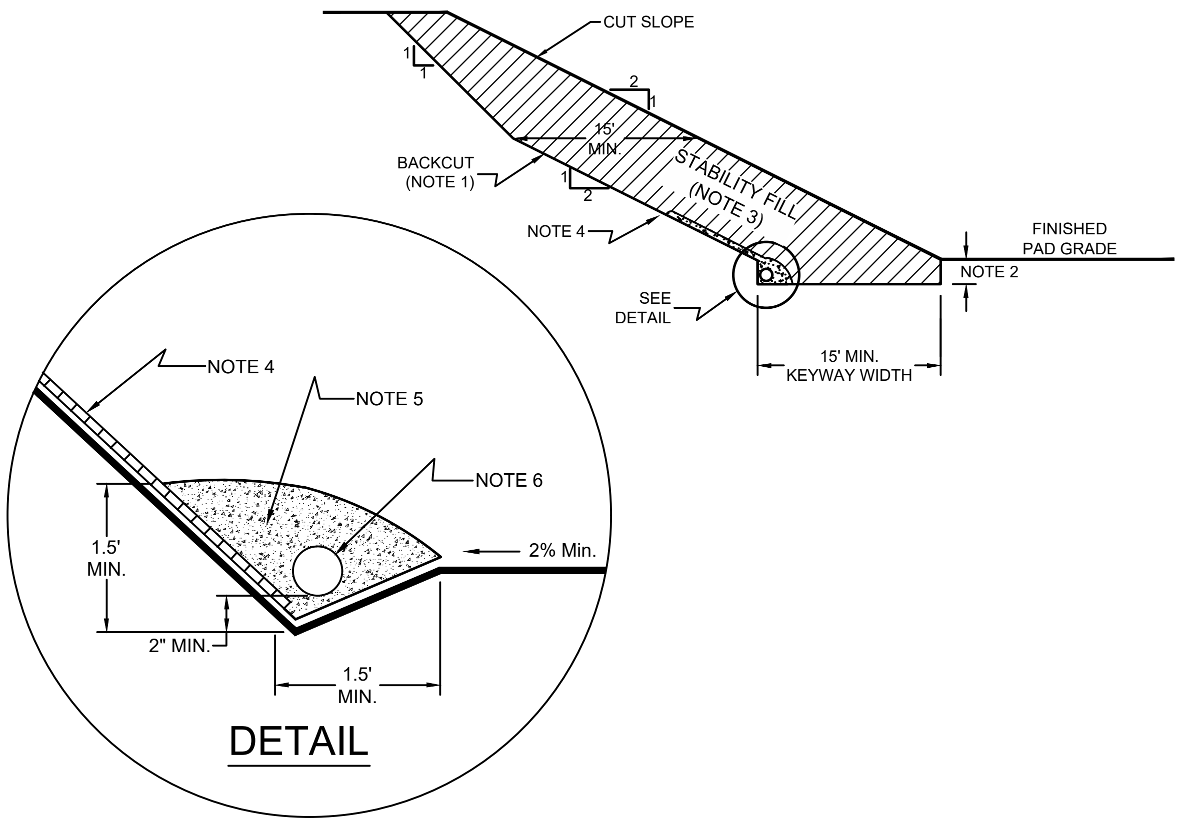
SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. 12



NOTES:

1.....EXCAVATE BACKCUT IN ACCORDANCE WITH GEOTECHNICAL CONSULTANTS RECOMMENDATION.

2.....BASE OF STABILITY FILL TO BE INTO DENSE, FORMATIONAL MATERIAL SLOPING A MINIMUM 2% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED, GRANULAR SOIL WITH MINIMUM SHEAR STRENGTH AS SPECIFIED.

4.....CHIMNEY DRAINS TO BE APPROVED, PREFABRICATED DOUBLE SIDED CHIMNEY DRAIN PANELS (MIRADRAIN, TENSAR, OR EQUIVALENT) SPACED APPROXIMATELY 30 FEET CENTER TO CENTER. ADDITIONAL DRAINS WILL BE REQUIRED WHERE AREAS OF SEEPAGE ARE ENCOUNTERED.

5.....DRAIN MATERIAL (9 CUBIC FEET) TO BE 3/4-INCH, OPEN-GRADED, CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC .

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

TYPICAL STABILITY FILL DETAIL

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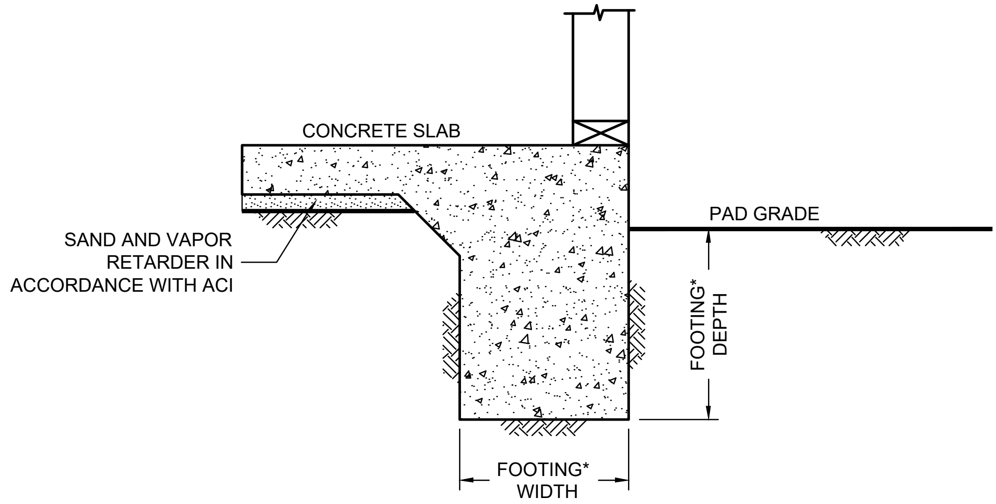
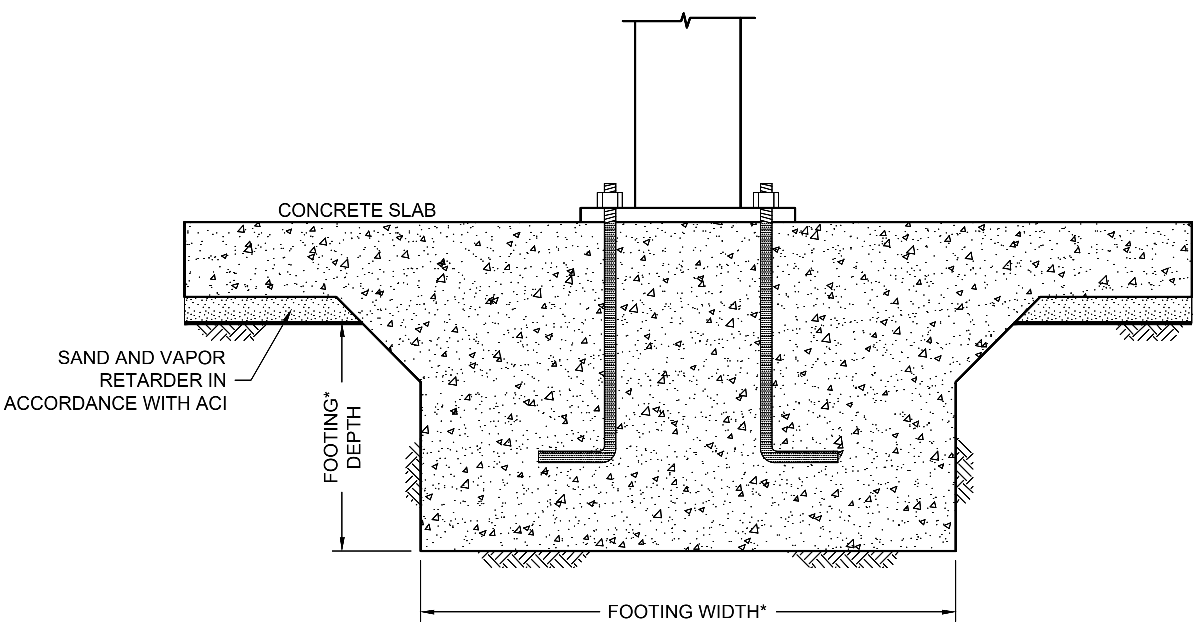
SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. 13





*....SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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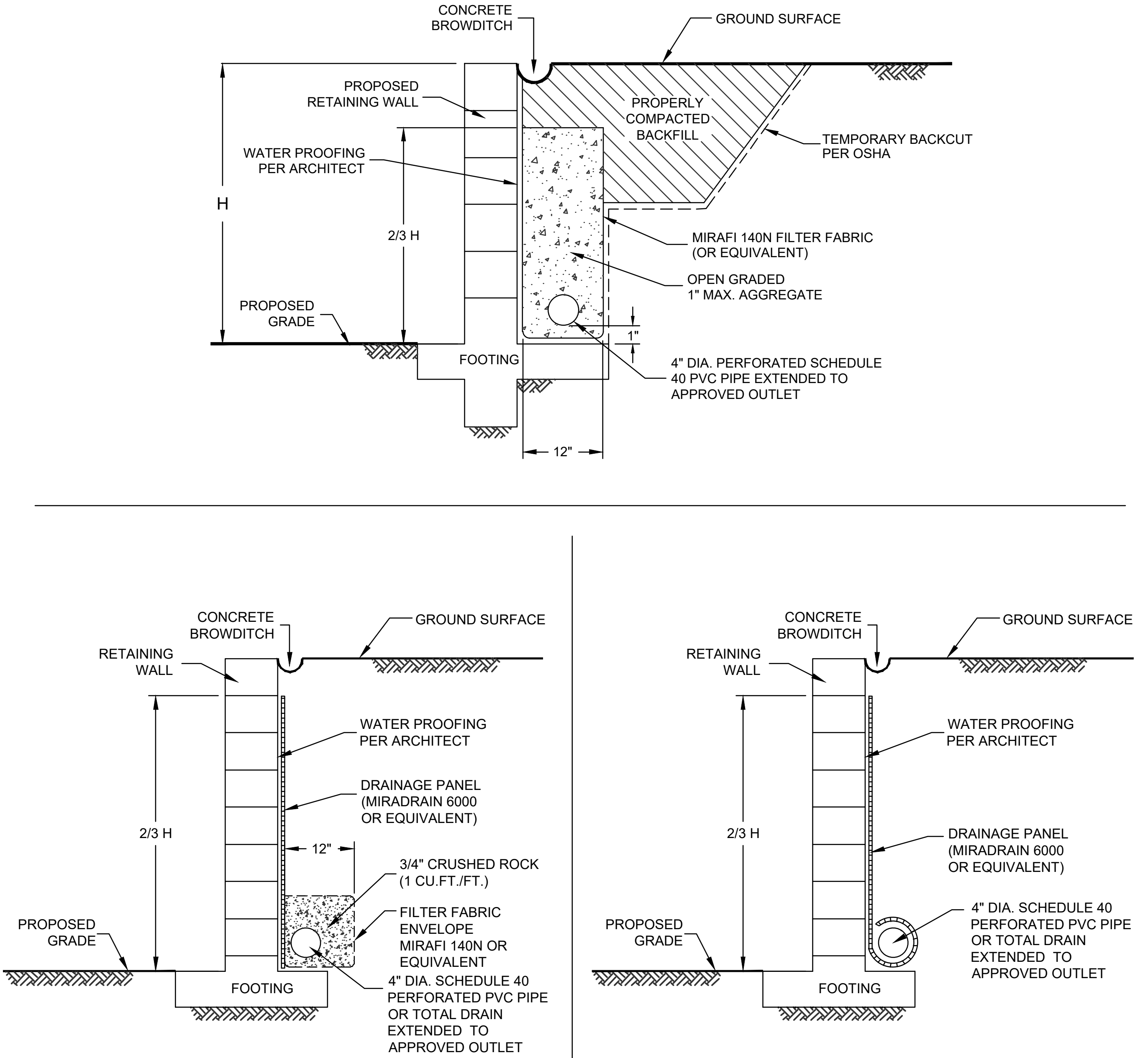
SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. 14



NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

GEOCON INCORPORATED
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6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. 15

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

Our field investigation was performed between March 20 and 25, 2020, and consisted of a site reconnaissance, the excavation of 7 large-diameter borings (Boring Nos. LB-1 through LB-7) and 19 exploratory trenches (Trench Nos. T-1 through T-19). In addition, an infiltration test (I-1) was performed within Trench No. T-17 in order to provide storm water BMP design information. The results and discussion of the infiltration testing is discussed in Appendix D of this report. The approximate locations of the subsurface excavations are shown on Figures 2 and 3, including our previous borings and trenches (see Appendix E for these logs).

The 7 large-diameter borings were performed by Dave's Drilling and advanced to a maximum depth of 103 feet below existing grade using an EasyBore 120 truck-mounted drill rig equipped with a 30-inch-diameter bucket auger. Relatively undisturbed samples were obtained by driving a 3-inch, O.D., split-tube sampler into the "undisturbed" soil mass with the drill rig kelly bar. The sampler was equipped with 1-inch by 2⅜-inch brass sampler rings to facilitate removal and testing. Bulk samples were also obtained. In general, a dip and dip direction convention was used to present the orientation of bedding and structural features measured in the borings. The logs of the borings depicting the soil and geologic conditions encountered and the depth at which samples were obtained are presented on Figures A-1 through A-7.

The trenches were advanced by LB3 Enterprises Inc. using a John Deere 135G excavator equipped with a 30-inch-wide bucket. Trench No. T-18 was performed specifically to identify where the continuous bentonitic claystone bed was exposed at the surface. Trench No. T-19 consisted of a 234-foot-long excavation that included detail mapping of the exposed geology to evaluate the absence or presence of a mapped fault within the eastern portion of the site (no faulting was observed). Bulk samples were also collected for laboratory analysis. The logs of the trenches depicting the soil and geologic conditions encountered and the depth at which samples were obtained are presented on Figures A-8 through A-25, and Figure 9 depicts the detail log for Trench No. T-19.

The soils encountered in the excavations were visually classified and logged in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual Manual Procedure D 2488).

PROJECT NO. G2452-32-02

BORING LB 1

ELEV. (MSL.) **415'** DATE COMPLETED **03-20-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	LB1-1			CL/CH	**TOPSOIL** Stiff, moist, dark brown, Sandy CLAY			
2				SM	**OTAY FORMATION (To)** Dense to very dense, damp, light gray, Silty, fine to medium SANDSTONE; with calcium carbonate in upper 5 feet			
4								
	LB1-2				-Bedding from 4.8 to 5.3 feet (6º, S60ºE) -6-inch thick, olive gray, clayey siltstone bed at 5.5 feet	3		
6					-6 to 8-inch thick, claystone bed at 6.5 feet			
	LB1-3							
8								
					-3 to 5-inch-thick, brown claystone bed with irregular thickness at 9.1 feet			
10	LB1-4					5		
12								
14								
	LB1-5					7		
16								
18								
20	LB1-6					5		
22								
					-3 to 4-inch-thick, brown clayey sandstone bed at 23 feet; contact slightly undulatory and near horizontal			
24								
	LB1-7					5	116.4	10.7
26								
28					-Some 1/8-1/4-inch wide, high angle sand filled fractures present from 28 to 32 feet; 1/8-inch of aperture observed on portion of fracture			

Figure A-1,
Log of Boring LB 1, Page 1 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING LB 1

ELEV. (MSL.) **415'** DATE COMPLETED **03-20-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB1-8			SM	-Poor recovery	8		
32					-1 to 3-inch thick, olive brown, claystone bed at 32.5 feet; contact slightly undulatory, (2º-3º, due South); no remolding			
34								
36	LB1-9					10		
38					-Becomes slightly coarser grained below 37 feet			
40	LB1-10					10	116.7	7.1
42								
44				MH/CH	-Cemented; highly undulatory contact (10º, N75ºW)			
	LB1-11				Hard, gray, brown and white, **BENTONITIC CLAYSTONE**; waxy and highly plastic; blocky	4	70.9	50.5
46	LB1-11A						69.7	51.4
	LB1-12							
48					-**BEDDING PLANE SHEAR at 47.1 feet; (7º, N45ºE)**; 1/2 to 1-inch thick, soft, moist, white, moderately remolded and moderately developed plastic clay gouge; 18-inch thick, reddish brown claystone bed (key marker bed el. 367.9') below BPS			
				SM	-4-inch thick, pink, bentonitic claystone bed at 48.8 feet; no remolding			
50	LB1-13				Very dense, damp, gray, Silty, fine to medium SANDSTONE	10	115.2	18.0
52								
54								
	LB1-14					15/7"	114.4	6.9
56								
58								
					-Becomes dark brown below 59.8 feet			

Figure A-1,
Log of Boring LB 1, Page 2 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING LB 1

ELEV. (MSL.) **415'** DATE COMPLETED **03-20-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	LB1-15			SM		15/10"		
62					-Becomes gray below 62 feet			
64								
66	LB1-16					15/8"		
68					-Becomes finer grained below 67 feet			
70	LB1-17					20/6"		
72								
74								
76	LB1-18				-Becomes fine to coarse grained below 75 feet	20/5"	123.9	7.6
78								
				SM	**SWEETWATER FORMATION (Tsw)** Very dense, damp, light brown, Silty, fine to coarse SANDSTONE			
80	LB1-19					25/6"	111.8	12.7
82					PRACTICAL REFUSAL AT 82 FEET			

Figure A-1,
Log of Boring LB 1, Page 3 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING LB 2

ELEV. (MSL.) **390'** DATE COMPLETED **03-20-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **D. EVANS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CH	**TOPSOIL** Stiff, very moist, black, Silty CLAY			
2				SM	**OTAY FORMATION (To)** Very dense, damp, light gray, Silty, fine to medium SANDSTONE; calcium carbonate veining, massive			
5	LB2-1				-One-foot-thick cemented bed at 5.5 feet	5/7"		
10	LB2-2					4	120.0	11.9
11	LB2-3							
12					-4 to 6-inch thick, horizontal, olive gray, siltstone/claystone bed at 12 feet			
15	LB2-4					5		
17					-Continued high angle calcium carbonate fracture infillings at 17'			
19					-1 to 4-inch thick, near horizontal bed with reddish-brown claystone rip-up clasts at 19 feet			
20	LB2-5				-Sharp contact (6º, S80ºE)	4	116.2	16.7
21				ML/CL	Very hard, damp, olive gray, fine, Sandy SILTSTONE/CLAYSTONE; slightly fractured and micaceous; gunbarrel appearance			
22	LB2-6							
24					-Becomes blocky at 24 feet			
25	LB2-7				**-POORLY DEVELOPED BEDDING PLANE SHEAR at 25.9 feet**; 1/16" to 1/8" thick, reddish brown, poorly remolded clay, well defined and horizontal -Gradational contact at 27 feet	5	104.8	21.1
27				SM	Very dense, damp, light gray, fine to medium SANDSTONE -1 to 3-inch thick, horizontal CLAYSTONE bed at 28.7'			

Figure A-2,
Log of Boring LB 2, Page 1 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING LB 2

ELEV. (MSL.) **390'** DATE COMPLETED **03-20-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **D. EVANS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB2-8			SM	-Becomes massive below 30 feet	6		
32								
34								
					-At 35 feet; irregular near horizontal contact			
	LB2-9			CH/MH	Hard, damp, pink to green, **BENTONITIC CLAYSTONE**; highly fractured, crumbles under blow of hammer; shiny parting surfaces; manganese staining	4	67.5	54.4
36	LB2-10							
					-**BEDDING PLANE SHEAR at 37 feet (horizontal)**; 1/4" to 3/4" thick, highly remolded plastic clay gouge; grayish green, well developed and continuous			
38	LB2-10A				**BEDDING PLANE SHEAR ZONE from 38.2 to 39 feet (horizontal)**; zone containing 4 to 5, remolded clay gouge planes; highly sheared and continuous; irregular thickness			
40	LB2-11					6	91.0	29.5
	LB2-12				-Base of bentonitic claystone at 41.6 feet with 5-inch thick white bed (key marker bed at el. 348.6')			
42				CH	Hard, damp, reddish-brown, silty claystone -Grades to siltstone/claystone at 43 feet			
44								
	LB2-13					10	111.3	16.0
46								
				SM	Very dense, damp, light gray, Silty, fine to medium SANDSTONE			
48								
50	LB2-14					10/10"		
52								
54					-Becomes very silty below 54 feet			
	LB2-15					10/10"	105.6	19.6
56					-3-inch thick, siltstone/claystone bed at 56.5 feet			
58								

Figure A-2,
Log of Boring LB 2, Page 2 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING LB 2 ELEV. (MSL.) 390' DATE COMPLETED 03-20-2020 EQUIPMENT 30" BUCKET AUGER BY: D. EVANS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
60	LB2-16			SM	-Concretionary bed at 61'	10/10"		
62								
64								
	LB2-17					10/8"		
66								
68				SM	**SWEETWATER FORMATION (Tsw)** Very dense, damp, light brown, Silty, fine to coarse SANDSTONE			
70					BORING TERMINATED AT 70 FEET			

Figure A-2,
Log of Boring LB 2, Page 3 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. G2452-32-02

BORING LB 3

ELEV. (MSL.) **444'** DATE COMPLETED **03-21-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	LB3-1			SC	**TOPSOIL** Loose, moist, reddish brown, Clayey, fine SAND			
4				SM	**SAN DIEGO FORMATION (Tsd)** Dense, damp, light brown, Silty, fine to medium SANDSTONE; micaceous			
	LB3-2					4		
6	LB3-3							
8					-Orange oxidation present below 8 feet			
10	LB3-4					5	106.4	10.5
					-Trace gravel present at 11 feet			
					-Scoured, undulatory contact with gravel at base			
14				ML/CL	**OTAY FORMATION (To)** Hard, moist, olive gray, Clayey SILTSTONE/Silty CLAYSTONE			
	LB3-5					6	95.8	28.9
					-Bedding at 15.6 feet with olive green claystone (4º, S25ºE); no remolding			
18				SM	Very dense, damp, light gray, Silty, fine to medium SANDSTONE; massive			
20	LB3-6					6/6"		
25	LB3-7					6/6"	114.8	7.9
					-4-inch thick, brown claystone bed at 27.5 feet			
28				ML&CL	Hard, damp, olive gray to brown, Clayey SILTSTONE with interbedded Silty CLAYSTONE			

Figure A-3,
Log of Boring LB 3, Page 1 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING LB 3

ELEV. (MSL.) 444' DATE COMPLETED 03-21-2020

EQUIPMENT 30" BUCKET AUGER BY: A. REKANI

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB3-8	ML&CL		8/10"	111.6	18.1
35	LB3-9		-Difficult drilling below 35 feet; auger used	10/10"	118.7	13.7
36		SM	Very dense, damp, light gray and olive brown, Silty, fine to medium SANDSTONE			
40	LB3-10			10/8"		
45	LB3-11		-4-inch thick, dark brown claystone bed at 44.5 feet; horizontal; no remolding	10/7"		
49		CL	Hard, moist, dark brown, Silty CLAYSTONE			
50	LB3-12			10		
51		SM/ML	-Gradational contact Very dense, damp, light gray to olive gray, Silty, fine SANDSTONE/fine Sandy SILTSTONE			
55	LB3-13			15		

Figure A-3,
Log of Boring LB 3, Page 2 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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BORING LB 3

ELEV. (MSL.) **444'** DATE COMPLETED **03-21-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	LB3-14			SM/ML		15/7"		
62								
				SM	-Becomes fine to medium grained sandstone below 63 feet			
64								
	LB3-15					15/7"		
66								
68								
70	LB3-16					15		
72								
					-Dark brown rip-up clasts present at 73 feet			
74					-10-inch thick, dark brown claystone bed at 74.3 feet			
	LB3-17					15/8"		
76								
78								
80	LB3-18					20/7"		
82								
84								
	LB3-19				-Becomes fine to coarse grained below 85 feet	20/5"		
86								
88					-6 to 7-inch thick, dark brown claystone bed at 88 feet			

Figure A-3,
Log of Boring LB 3, Page 3 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING LB 3 ELEV. (MSL.) 444' DATE COMPLETED 03-21-2020 EQUIPMENT 30" BUCKET AUGER BY: A. REKANI	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
90	LB3-20			SM		20/8"		
92								
94								
96	LB3-21					25/8"		
98								
100	LB3-22					30/8"		
102								
	LB3-23			MH/CH	Very stiff, moist, white, **BENTONITIC CLAYSTONE**; plastic			
					BORING TERMINATED AT 103 FEET			

Figure A-3,
Log of Boring LB 3, Page 4 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING LB 4

ELEV. (MSL.) **448'** DATE COMPLETED **03-21-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose, moist, light reddish brown, Clayey SAND			
2								
4				SM	**SAN DIEGO FORMATION (Tsd)** Dense, damp, light brown with orange staining, Silty, fine to medium SANDSTONE; micaceous			
	LB4-1					2		
6	LB4-2							
8								
10	LB4-3					2	86.9	8.2
12					-Lower cohesion below 12 feet			
14								
	LB4-4					5	112.6	9.9
16					-Trace gravel present below 16 feet			
18					-4 to 5-inch thick, gravel bed present at 17.5 feet -Scoured, undulatory contact			
				SM	**OTAY FORMATION (To)** Dense, damp, light gray, Silty, fine to medium SANDSTONE			
20	LB4-5					3		
				CL/ML& SM	Hard, moist, reddish brown and olive green, Silty CLAYSTONE and Clayey SILTSTONE with some interbedded sandstones			
22								
24								
	LB4-6					4		
26								
28								
	LB4-8							

Figure A-4,
Log of Boring LB 4, Page 1 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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PROJECT NO. G2452-32-02

BORING LB 4

ELEV. (MSL.) **448'** DATE COMPLETED **03-21-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB4-7					8/8"		
				SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE; massive			
32								
34								
	LB4-9					8/10"	112.0	16.9
36								
38					-1/8-inch wide, high angle clay filled fracture from 37.5 to 39.8 feet with soft clay gouge present along trace			
40								
	LB4-10			ML	Hard, moist, gray-brown, Clayey SILTSTONE	8	107.9	20.9
42								
44								
				SM	Dense, damp, light gray, Silty SANDSTONE			
	LB4-11					8/8"		
46								
48				CL/ML	Hard, moist, dark brown, Silty CLAYSTONE and Clayey SILTSTONE			
50	LB4-12				-Becomes reddish brown and olive green below 50 feet	4	99.0	25.9
	LB4-13							
52								
54								
				SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE			
	LB4-14					10/8"		
56								
58								
				CL/ML	Hard, moist, olive green and reddish brown, Silty CLAYSTONE/Clayey SILTSTONE			

Figure A-4,
Log of Boring LB 4, Page 2 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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GEOCON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING LB 4 ELEV. (MSL.) 448' DATE COMPLETED 03-21-2020 EQUIPMENT 30" BUCKET AUGER BY: A. REKANI MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60				CL/ML				
62								
64					-18-inch thick, light gray sandstone bed at 63.5 feet -1/8 to 1/4-inch wide, clay filled fracture from 64 to 67.1 feet; (50º, N45ºW) with soft clay gouge along trace			
66								
68								
70								
72				SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE			
74								
76					-12-inch thick, weak, waxy, olive green claystone bed at 75.5 feet; contact slightly undulatory (18º, N8ºW)			
78								
80								
82								
84								
86								
88					-12-inch thick, brown siltstone/claystone bed at 87 feet			

Figure A-4,
Log of Boring LB 4, Page 3 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING LB 4

ELEV. (MSL.) **448'** DATE COMPLETED **03-21-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
90				CL/ML	Hard, moist, brown, Silty CLAYSTONE/Clayey SILTSTONE			
92								
94								
96	LB4-15				**-POORLY DEVELOPED BEDDING PLANE SHEAR at 96.1 feet**; (undulatory); 1-inch thick, soft, moist, poorly remolded in areas and poorly developed plastic clay gouge			
98								
				SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE			
100								
102								
					BORING TERMINATED AT 103 FEET			

Figure A-4,
Log of Boring LB 4, Page 4 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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GEOCON

BORING LB 5

ELEV. (MSL.) **442'** DATE COMPLETED **03-22-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose, moist, reddish brown, Clayey, fine to medium SAND			
4				SM	**SAN DIEGO FORMATION (Tsd)** Dense, damp, light brown with orange staining, Silty, fine to medium SANDSTONE; micaceous			
	LB5-1					4	101.6	11.3
					-1 to 2-inch thick, gravel bed at 6.8 feet			
8					-Sharp, horizontal contact			
				SM	**OTAY FORMATION (To)** Dense, damp, light gray, Silty, fine to medium SANDSTONE			
10	LB5-2					5/10"		
	LB5-3				-4-inch thick, clayey siltstone bed at 14.8 feet	6	108.9	12.2
					-3-inch thick, light brown clayey siltstone bed at 16.5 feet			
20	LB5-4					5/8"		
					-4-inch thick, olive gray, clayey siltstone bed at 22.5 feet			
	LB5-5					6	110.1	18.0
					-5-inch thick, light brown, clayey siltstone bed at 28.9 feet			

Figure A-5,
Log of Boring LB 5, Page 1 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

PROJECT NO. G2452-32-02

BORING LB 5

ELEV. (MSL.) **442'** DATE COMPLETED **03-22-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB5-6			SM		8/8"		
35	LB5-7					10	117.9	12.4
36.8					-5-inch thick, brown, clayey siltstone bed at 36.8 feet			
40	LB5-8					10/10"		
42					-5-inch thick, olive brown, clayey siltstone bed at 42 feet			
46	LB5-9			CL/ML	Hard, moist, gray-brown, Silty CLAYSTONE/Clayey SILTSTONE	10	96.1	27.4
50	LB5-10					8	99.3	25.4
56				SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE			
58.2					-4-inch thick, gray-brown, clayey siltstone bed at 58.2 feet			

Figure A-5,
Log of Boring LB 5, Page 2 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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GEOCON

BORING LB 5

ELEV. (MSL.) **442'** DATE COMPLETED **03-22-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60				SM				
72					-6-inch thick, gray-brown clayey siltstone bed at 71.5 feet			
78					-Becomes fine to coarse below 78 feet			
					-Sharp and undulatory contact			
80				CL	Hard, moist, gray-brown, Silty CLAYSTONE with bentonitic claystone rip-ups			
82				SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE			
84								
86								
88								

Figure A-5,
Log of Boring LB 5, Page 3 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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BORING LB 5

ELEV. (MSL.) **442'** DATE COMPLETED **03-22-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
90				SM	-12-inch thick, olive green, clayey siltstone bed at 90 feet			
92								
					-Slightly scoured, partially, undulatory contact			
94	LB5-11			MH/CH	Hard, white gray and pink, **BENTONITIC CLAYSTONE**; highly plastic with manganese staining	20		
	LB5-11A							
96	LB5-12				**-BEDDING PLANE SHEAR ZONE at 95.5 feet (horizontal)**; 4 to 6-inch thick zone of multiple, poorly developed and poorly remolded plastic clay gouge planes			
98					-18-inch thick, reddish brown claystone bed at 98.3 feet (key marker bed el. 343.7')			
					-3-inch white to pink bentonitic claystone bed at 99.5 feet			
100				ML	Hard, moist, olive brown, fine, Sandy/Clayey SILTSTONE			
102								

BORING TERMINATED AT 103 FEET

Figure A-5,
Log of Boring LB 5, Page 4 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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GEOCON

BORING LB 6

ELEV. (MSL.) **450'** DATE COMPLETED **03-24-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	LB6-1			SC	**TOPSOIL** Loose, moist, reddish brown, Clayey, fine to medium SAND			
4				SM	**SAN DIEGO FORMATION (Tsd)** Dense, damp, light brown with orange staining, Silty, fine to medium SANDSTONE; micaceous with some calcium carbonate stringers			
	LB6-2					3		
6	LB6-3							
10	LB6-4					5	94.7	5.1
	LB6-5					8	110.3	7.3
18					-1 to 2-inch thick, gravel bed at 17.7 feet			
					-Scoured contact			
20	LB6-6			SM/ML	**OTAY FORMATION (To)** Dense/hard, damp, light gray, Silty, fine SANDSTONE/fine, Sandy SILTSTONE -5-inch thick, brown claystone bed at 20.2 feet	8	115.1	10.8
22	LB6-7							
24					-3-inch thick, brown claystone bed at 24.3 feet			
	LB6-8					8/10"	112.7	6.1

Figure A-6,
Log of Boring LB 6, Page 1 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

BORING LB 6

ELEV. (MSL.) **450'** DATE COMPLETED **03-24-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30		SM/ML				
	LB6-9	ML	Hard, moist, gray-brown, Clayey SILTSTONE	8		
32	LB6-10					
34			-2 to 3-inch thick, brown claystone bed at 33.9 feet			
	LB6-11			10	104.8	20.9
36		SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE			
38			-2-inch thick, brown claystone bed at 38.1 feet			
40	LB6-12 LB6-12A LB6-13	CL/ML	Hard, damp, reddish brown, Silty CLAYSTONE/Clayey SILTSTONE -6-inch thick, pink and white, **BENTONITIC CLAYSTONE** bed at 40.5 feet; (7º, N35ºE); no remolding	8	104.5	18.4
42		ML	Hard, moist, gray-brown, Clayey SILTSTONE			
44						
	LB6-14		-2-inch thick, brown claystone beds at 45.4 and 45.9 feet	10	106.2	21.7
46						
48						
50	LB6-15		-3-inch thick, brown claystone beds at 50 and 50.7 feet	10	101.8	22.1
52		SM&CL&ML	Very dense, damp, light gray, Silty, fine to medium SANDSTONE with random interbedded claystone and siltstone beds			
54						
	LB6-16			15/8"		
56						
58						

Figure A-6,
Log of Boring LB 6, Page 2 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

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GEOCON

BORING LB 6

ELEV. (MSL.) **450'** DATE COMPLETED **03-24-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
60	LB6-17			SM&CL& ML		15/10"		
62								
64	LB6-18							
	LB6-19					20/10"		
66								
68								
70	LB6-20					20/8"		
72								
74								
76								
78								
80								
82								
84								
86								
88				ML	Hard, moist, gray-brown, Clayey SILTSTONE			

Figure A-6,
Log of Boring LB 6, Page 3 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

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GEOCON

BORING LB 6

ELEV. (MSL.) **450'** DATE COMPLETED **03-24-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
90				ML				
92 – 96				SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE			
98	LB621			CL	Very stiff to hard, moist, pink, white and gray, **BENTONITIC CLAYSTONE**; waxy and highly plastic			
100	LB6-22				-**BEDDING PLANE SHEAR at 97.7 feet; (2º, N65ºE)**; 1/2 to 3/4-inch thick, soft, moist, highly remolded and well developed plastic clay gouge -12-inch thick, light gray sandstone bed at 98.5 feet	25/10"		
102	LB6-23				-**POORLY DEVELOPED BEDDING PLANE SHEAR at 101 feet**; 1/4-inch thick, soft, moderately remolded, poorly developed plastic clay gouge			

Figure A-6,
Log of Boring LB 6, Page 4 of 4

G2452-32-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

GEOCON

BORING LB 7

ELEV. (MSL.) **404'** DATE COMPLETED **03-25-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	LB7-1			CH	**TOPSOIL** Stiff, moist, black, Silty CLAY			
2								
4				SM	**OTAY FORMATION (To)** Dense, damp, light gray, Silty, fine to medium SANDSTONE with calcium carbonate stringers present to 6 feet			
	LB7-2					8		
6								
8								
10	LB7-3					4		
12								
14	LB7-4					4		
16					-6 to 10-inch thick, reddish brown and olive green siltstone/claystone bed at 15.5 feet			
18								
20	LB7-5					4	116.3	7.5
22								
24					-Random high angle, 1/4 to 1/2-inch wide, sand filled fractures present below 23.5 feet			
	LB7-6					4	120.0	11.8
26								
28								
				ML/CL	Hard, moist, brown, Silty CLAYSTONE/Clayey SILTSTONE			

Figure A-7,
Log of Boring LB 7, Page 1 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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GEOCON

BORING LB 7

ELEV. (MSL.) **404'** DATE COMPLETED **03-25-2020**

EQUIPMENT **30" BUCKET AUGER** BY: **A. REKANI**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB7-7			ML/CL		6	90.2	30.4
	LB7-8							
32								
				MH/CH	Hard, moist, gray and white, **BENTONITIC CLAYSTONE**			
34	LB7-9					4	78.0	43.2
36					-**POORLY DEVELOPED BEDDING PLANE SHEAR at 35.5 feet; (10º, S85ºW)**; paper thin to 1/4-inch thick, soft, gray, poorly remolded and developed plastic clay gouge			
	LB7-10							
38					-18-inch thick, reddish brown claystone bed at 38.2 feet (key marker bed el. 365.8')			
40					-2 to 3-inch thick, pink bentonitic claystone bed at 40 feet			
	LB7-11			ML	Hard, moist, gray-brown, Clayey SILTSTONE	10		
42								
44					-2 to 3-inch thick, brown claystone bed at 44 feet			
46	LB7-12			SM	Dense, damp, light gray, Silty, fine to medium SANDSTONE	10		
48								
50	LB7-13					10		
52					-2-foot thick, gray-brown, clayey siltstone bed at 52 feet			
54								
	LB7-14					15/8"		
56								
58					-Becomes fine to coarse grained below 58 feet			
					-12-inch thick, gray-brown, clayey siltstone bed at 59.7 feet			

Figure A-7,
Log of Boring LB 7, Page 2 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING LB 7 ELEV. (MSL.) 404' DATE COMPLETED 03-25-2020 EQUIPMENT 30" BUCKET AUGER BY: A. REKANI	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
60	LB7-15			SM		15/8"		
62								
64								
66								
68								
70								
	LB7-16			SM	**SWEETWATER FORMATION (Tsw)** Very dense, damp, light brown, Silty, fine to coarse SANDSTONE	15/6"	122.8	11.5
72	LB7-17							
					PRACTICAL REFUSAL AT 73 FEET			

Figure A-7,
Log of Boring LB 7, Page 3 of 3

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 1

ELEV. (MSL.) **357'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL/CH	**ALLUVIUM (Qal)** Soft, moist to wet, dark grayish brown, Silty CLAY; free water at surface			
2	T1-1							
4								
6			▽		-Minor seepage along contact at 7 feet			
7				SM	**OTAY FORMATION (To)** Very dense, moist, light brown, Silty, fine SANDSTONE			
8								

TRENCH TERMINATED AT 9 FEET
Minor seepage at 7 feet

Figure A-8,
Log of Trench T 1, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 2

ELEV. (MSL.) **317'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL/CH	**ALLUVIUM (Qal)** Soft, moist to wet, dark grayish brown, Silty CLAY			
2								
4								
6								
			▽		-Minor seepage along contact at 7 feet			
				SM	**SWEETWATER FORMATION (Tsw)** Very dense, moist, light brown, Silty, fine SANDSTONE			
8								
					TRENCH TERMINATED AT 9 FEET Minor seepage at 7 feet			

Figure A-9,
Log of Trench T 2, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 3

ELEV. (MSL.) **281'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL/CH	**ALLUVIUM (Qal)** Soft, moist to wet, dark grayish brown, Silty CLAY			
5				SC	Loose to medium-dense, moist to wet, dark grayish brown, Clayey, fine to medium SAND			
6	T3-1							
10				SM	**SWEETWATER FORMATION (Tsw)** Very dense, moist, grayish brown, Silty, fine to coarse SANDSTONE with trace gravel			
12					TRENCH TERMINATED AT 12 FEET Groundwater not encountered			

Figure A-10,
Log of Trench T 3, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 4

ELEV. (MSL.) **289'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**COLLUVIUM (Qcol)** Loose to medium-dense, damp, grayish brown, Clayey, fine to medium SAND			
2								
	T4-1							
4								
6								
8				SM	**SWEETWATER FORMATION (Tsw)** Very dense, damp, grayish brown, Silty, fine to coarse SANDSTONE with trace gravel			
10					TRENCH TERMINATED AT 10 FEET Groundwater not encountered			

Figure A-11,
Log of Trench T 4, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

PROJECT NO. G2452-32-02

TRENCH T 5

ELEV. (MSL.) **362'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose, damp, grayish brown, Clayey, fine to medium SAND			
2				SM	**OTAY FORMATION (To)** Dense, damp, light gray, Silty, fine to medium SANDSTONE			
4					TRENCH TERMINATED AT 4 FEET Groundwater not encountered			

Figure A-12,
Log of Trench T 5, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2452-32-02

TRENCH T 6

ELEV. (MSL.) **386'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM (Qal)** Soft, moist to wet, dark grayish brown, fine, Sandy CLAY			
2								
4								
6								
8				SC	Medium dense, moist, grayish brown, Clayey, fine to medium SAND			
10				SM	**OTAY FORMATION (To)** Dense, most, light gray to light grayish brown, Silty, fine to medium SANDSTONE			
12					TRENCH TERMINATED AT 12 FEET Groundwater not encountered			

Figure A-13,
Log of Trench T 6, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

TRENCH T 7

ELEV. (MSL.) 354' DATE COMPLETED 03-20-2020

EQUIPMENT JD 135G EXCAVATOR W/30" BUCKET BY: J. PAGNILLO

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM (Qal)** Soft, moist to wet, dark grayish brown, fine, Sandy CLAY			
2	T7-1							
4								
6								
7				ML	Stiff, moist, brown, fine, Sandy SILT			
8	T7-2							
10				ML	**OTAY FORMATION (To)** Hard, damp, light brown, fine, Sandy SILTSTONE			
12					TRENCH TERMINATED AT 12 FEET Groundwater not encountered			

Figure A-14,
Log of Trench T 7, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. G2452-32-02

TRENCH T 8

ELEV. (MSL.) **328'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM (Qal)** Soft, moist, dark grayish brown, fine, Sandy CLAY			
2								
4								
6								
8				SM	**SWEETWATER FORMATION (Tsw)** Dense, damp, brown, Silty, fine to coarse SANDSTONE with trace gravel			
10					TRENCH TERMINATED AT 10 FEET Groundwater not encountered			

Figure A-15,
Log of Trench T 8, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2452-32-02

TRENCH T 9

ELEV. (MSL.) **278'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM (Qal)** Soft, moist, dark grayish brown, fine, Sandy CLAY			
2								
4								
5	T9-1							
6								
8								
10								
11				SM	**SWEETWATER FORMATION (Tsw)** Dense, damp, brown, Silty, fine to coarse SANDSTONE with trace gravel			
12								
13					TRENCH TERMINATED AT 13 FEET Groundwater not encountered			

Figure A-16,
Log of Trench T 9, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 10

ELEV. (MSL.) **319'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose, damp, dark grayish brown, Clayey, fine to medium SAND			
2				SM	**SWEETWATER FORMATION (Tsw)** Dense, damp, brown, Silty, fine to coarse SANDSTONE with trace gravel			
4								
6								
					TRENCH TERMINATED AT 7 FEET Groundwater not encountered			

Figure A-17, Log of Trench T 10, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 11

ELEV. (MSL.) **303'** DATE COMPLETED **03-20-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM (Qal)** Soft, moist, dark grayish brown, fine, Sandy CLAY			
2								
4								
6	T11-1							
8								
10								
12				SM	**SWEETWATER FORMATION (Tsw)** Dense, damp, brown, Silty, fine to coarse SANDSTONE with trace gravel			
					TRENCH TERMINATED AT 13 FEET Groundwater not encountered			

Figure A-18,
Log of Trench T 11, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 12

ELEV. (MSL.) 320' DATE COMPLETED 03-21-2020

EQUIPMENT JD 135G EXCAVATOR W/30" BUCKET BY: J. PAGNILLO

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL/CH	**ALLUVIUM (Qal)** Soft, moist, black, fine, Sandy/Silty CLAY			
2								
4								
6								
8								
10				SM	**SWEETWATER FORMATION (Tsw)** Very dense, damp, light brown, Silty, fine to coarse SANDSTONE			
12					TRENCH TERMINATED AT 12 FEET Groundwater not encountered			

Figure A-19,
Log of Trench T 12, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 13

ELEV. (MSL.) **346'** DATE COMPLETED **03-21-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL/CH	**ALLUVIUM (Qal)** Soft, moist, black, fine, Sandy/Silty CLAY			
2								
4								
6								
8								
10								
				CL	**OTAY FORMATION (To)** Hard, damp, olive brown, fine, Sandy CLAYSTONE			
12								
					TRENCH TERMINATED AT 13 FEET Groundwater not encountered			

Figure A-20,
Log of Trench T 13, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. G2452-32-02

TRENCH T 14

ELEV. (MSL.) **372'** DATE COMPLETED **03-21-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 6				CL/CH	**ALLUVIUM (Qal)** Soft, wet, black, fine, Sandy/Silty CLAY with some gravel and cobble			
6 – 7				SM	**OTAY FORMATION (To)** Dense, moist, light gray, Silty, fine to medium SANDSTONE			
					TRENCH TERMINATED AT 7 FEET Groundwater not encountered			

Figure A-21,
Log of Trench T 14, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 15

ELEV. (MSL.) **376'** DATE COMPLETED **03-21-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**COLLUVIUM (Qcol)** Soft, damp, dark grayish brown, fine, Sandy CLAY			
2								
4				SM	**OTAY FORMATION (To)** Dense, damp, light gray, Silty, fine to medium SANDSTONE			
6								
8					TRENCH TERMINATED AT 8 FEET Groundwater not encountered			

Figure A-22,
Log of Trench T 15, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 16

ELEV. (MSL.) **380'** DATE COMPLETED **03-21-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML/CL	**COLLUVIUM (Qcol)** Soft, very moist, black, Clayey SILT/Silty CLAY			
2								
4				SC	Loose, moist, brown, Clayey, fine to medium SAND			
6								
				SM	**OTAY FORMATION (To)** Dense, damp, light brown, Silty, fine to medium SANDSTONE			
8					TRENCH TERMINATED AT 8 FEET Groundwater not encountered			

Figure A-23,
Log of Trench T 16, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. G2452-32-02

TRENCH T 17

ELEV. (MSL.) **376'** DATE COMPLETED **03-21-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose, very moist, brown, Clayey, fine to medium SAND			
2				SM	**OTAY FORMATION (To)** Dense, damp, light gray, Silty, fine to medium SANDSTONE			

TRENCH TERMINATED AT 2.5 FEET
Groundwater not encountered

Figure A-24,
Log of Trench T 17, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2452-32-02

TRENCH T 18

ELEV. (MSL.) **359'** DATE COMPLETED **03-21-2020**

EQUIPMENT **JD 135G EXCAVATOR W/30" BUCKET** BY: **T. REIST**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose, moist, dark brown, Clayey, fine to medium SAND			
2	T18-1			SC/CL	**OTAY FORMATION (To)** Dense, damp, light gray, Clayey, fine to medium SANDSTONE/Sandy CLAYSTONE			
4				MH/CH	Very stiff to stiff, moist, white, gray and pink, **BENTONITIC CLAYSTONE**; waxy and highly plastic			
6					-18-inch thick, reddish brown claystone bed at 6.5 feet; contact (3-10°, SE) (key marker bed el. 352.5') -4-inch thick, pink bentonitic claystone bed at base			
8				SM	Dense, damp, gray, Silty, fine to medium SANDSTONE			
10					TRENCH TERMINATED AT 10 FEET Groundwater not encountered *Logged from elevation 359'			

Figure A-25,
Log of Trench T 18, Page 1 of 1

G2452-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected relatively undisturbed ring and bulk samples were tested for their in-place dry density and moisture content, maximum dry density and optimum moisture content, gradation, plasticity index, water-soluble sulfate content, expansion index and shear strength characteristics.

The results of our laboratory tests are summarized on Tables B-I through B-V and Figure B-1. A composite graph depicting the direct shear test results for the geologic units is presented on Figures B-2 through B-7. The results of the dry density and moisture content tests are presented on the boring logs in Appendix A.

TABLE B-I
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS

Sample No.	Geologic Unit Symbol (USCS Soil Type)	Dry Density (pcf)	Moisture Content (%)	Peak [Ultimate] Cohesion (psf)	Peak [Ultimate] Angle of Shear Resistance (degrees)
*LB1-3	To (SM)	98.5	17.6	400 [450]	32 [30]
LB1-7	To (SM)	116.4	10.7	1,200 [800]	31 [31]
LB1-11	To (MH/CH)	70.9	50.5	750 [550]	40 [40]
LB1-11A	To (MH/CH)	69.7	51.5	1,450 [1,200]	24 [25]
LB1-13	To (SM)	115.2	18.0	1,470 [400]	32 [36]
LB1-19	Tsw (SM)	111.8	12.7	1,100 [1,000]	30 [31]
LB2-7	To (ML/CL)	104.8	21.1	1,700 [1,100]	35 [32]
LB2-11	To (MH/CH)	91.0	29.5	500 [550]	33 [26]
LB2-13	To (CH)	111.3	16.0	0 [0]	55 [52]
LB2-15	To (SM)	105.6	19.6	550 [450]	28 [27]
*LB3-3	Tsd (SM)	99.3	15.5	400 [450]	32 [29]
LB3-5	To (ML/CL)	95.8	28.9	1,450 [750]	17 [23]
LB3-8	To (ML/CL)	111.6	18.1	450 [425]	36 [34]
LB4-3	Tsd (SM)	86.9	8.2	300 [300]	32 [32]
*LB4-8	To (ML/CL)	99.8	17.2	650 [600]	28 [29]
LB4-9	To (SM)	112.0	16.9	500 [400]	31 [31]
LB4-12	To (ML/CL)	99.0	25.9	450 [650]	34 [25]

TABLE B-I (Concluded)
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS

Sample No.	Geologic Unit Symbol (USCS Soil Type)	Dry Density (pcf)	Moisture Content (%)	Peak [Ultimate] Cohesion (psf)	Peak [Ultimate] Angle of Shear Resistance (degrees)
LB5-1	Tsd (SM)	101.6	11.3	650 [500]	31 [31]
LB5-5	To (SM)	110.1	18.0	900 [600]	30 [33]
LB5-10	To (ML/CL)	99.3	25.4	700 [400]	28 [30]
*LB6-3	Tsd (SM)	98.3	15.0	400 [400]	32 [32]
LB6-4	Tsd (SM)	94.7	5.1	600 [450]	33 [35]
*LB6-7	To (SM/ML)	94.0	20.8	650 [650]	27 [27]
LB6-8	To (SM/ML)	112.7	6.1	750 [700]	40 [33]
*LB6-10	To (ML)	92.4	19.6	1,110 [750]	22 [25]
LB6-12	To (MH/CH)	104.5	18.4	600 [100]	42 [42]
LB6-14	To (ML)	106.2	21.7	1,700 [500]	40 [38]
LB7-7	To (ML/CL)	90.2	30.4	800 [550]	30 [30]
LB7-9	To (MH/CH)	78.0	43.2	1,300 [1,100]	28 [22]
LB7-16	Tsw (SM)	122.8	11.5	700 [750]	42 [36]
*T7-1	Qal (CL)	102.8	14.1	1,020 [1,070]	28 [27]
*T7-2	Qal (ML)	103.1	15.5	550 [550]	21 [21]
*T18-1	To (SC/CL)	99.3	15.4	780 [600]	27 [29]

*Sample was remolded to 90 percent relative compaction at near optimum moisture content.

TABLE B-II
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS

Sample No.	Description (Geologic Unit)	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
LB1-3	Light gray, Silty, fine to medium SAND (To)	109.4	17.4
LB3-3	Light brown, Silty, fine to medium SAND (Tsd)	110.5	14.7
LB4-8	Reddish brown, Clayey SILT (To)	111.9	16.6
LB6-3	Light brown, Silty, fine to medium SAND (Tsd)	109.0	15.5
LB6-7	Light gray, Silty, fine SAND (To)	106.4	18.6
LB6-10	Light grayish brown, Clayey SILT	102.8	19.6
T1-1	Dark brown, Silty CLAY (Qal)	112.6	15.7
T7-1	Dark brown, Sandy CLAY (Qal)	115.3	13.2
T7-2	Brown, fine, Sandy SILT (Qal)	115.1	15.5
T18-1	Gray, Clayey, fine to medium SAND (To)	110.2	15.7

TABLE B-III
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS

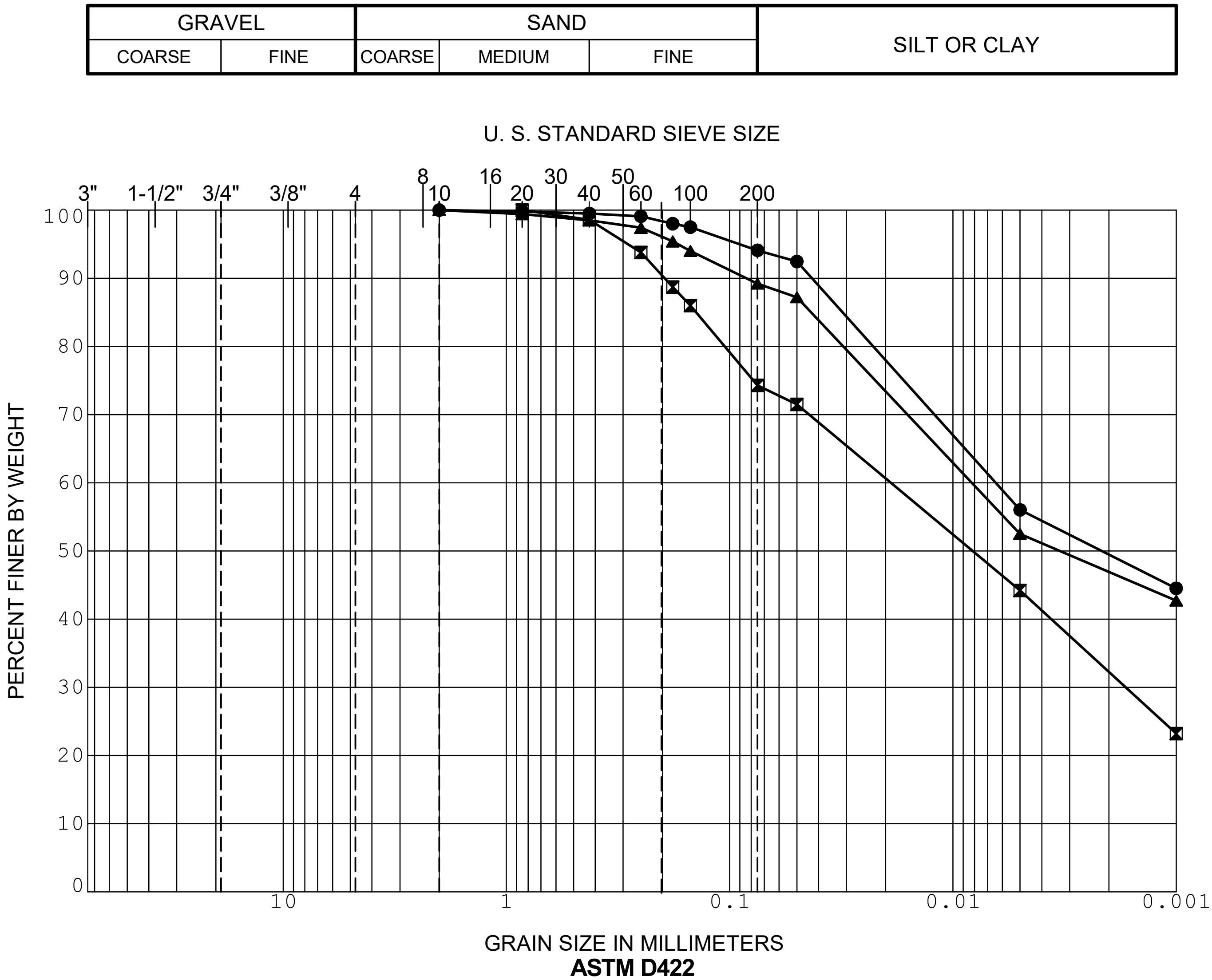
Sample No.	Geologic Unit (USCS Soil Type)	Moisture Content (%)		Dry Density (pcf)	Expansion Index
		Before Test	After Test		
LB1-3	To (SM)	14.6	25.9	94.1	25
LB1-12	To (MH/CH)	26.1	65.7	69.4	174
LB3-3	Tsd (SM)	12.7	21.8	100.0	1
LB4-8	To (ML/CL)	14.6	28.5	96.9	66
LB6-10	To (ML)	17.7	39.9	88.5	109
LB7-8	To (ML/CL)	13.1	26.5	99.1	49
T1-1	Qal (CL/CH)	13.9	31.4	95.1	88
T18-1	To (SC/CL)	14.2	33.1	95.4	95

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE CALIFORNIA TEST NO. 417

Sample No. (Geologic Unit)	Water-Soluble Sulfate (%)	Classification
LB1-3 (To)	0.0003	Not Applicable (S0)
LB3-3 (Tsd)	0.035	Not Applicable (S0)
LB4-8 (To)	0.008	Not Applicable (S0)
T18-1 (To)	0.004	Not Applicable (S0)

TABLE B-V
SUMMARY OF LABORATORY PLASTICITY INDEX TEST RESULTS

Sample No.	Geologic Unit	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Unified Soil Classification (Group Symbol)
LB2-10A	To- (Bentonitic Claystone)	122	52	70	MH
LB3-23	To- (Bentonitic Claystone)	103	50	53	MH
LB5-12	To- (Bentonitic Claystone)	128	57	71	MH
LB7-10	To- (Bentonitic Claystone)	121	56	65	MH

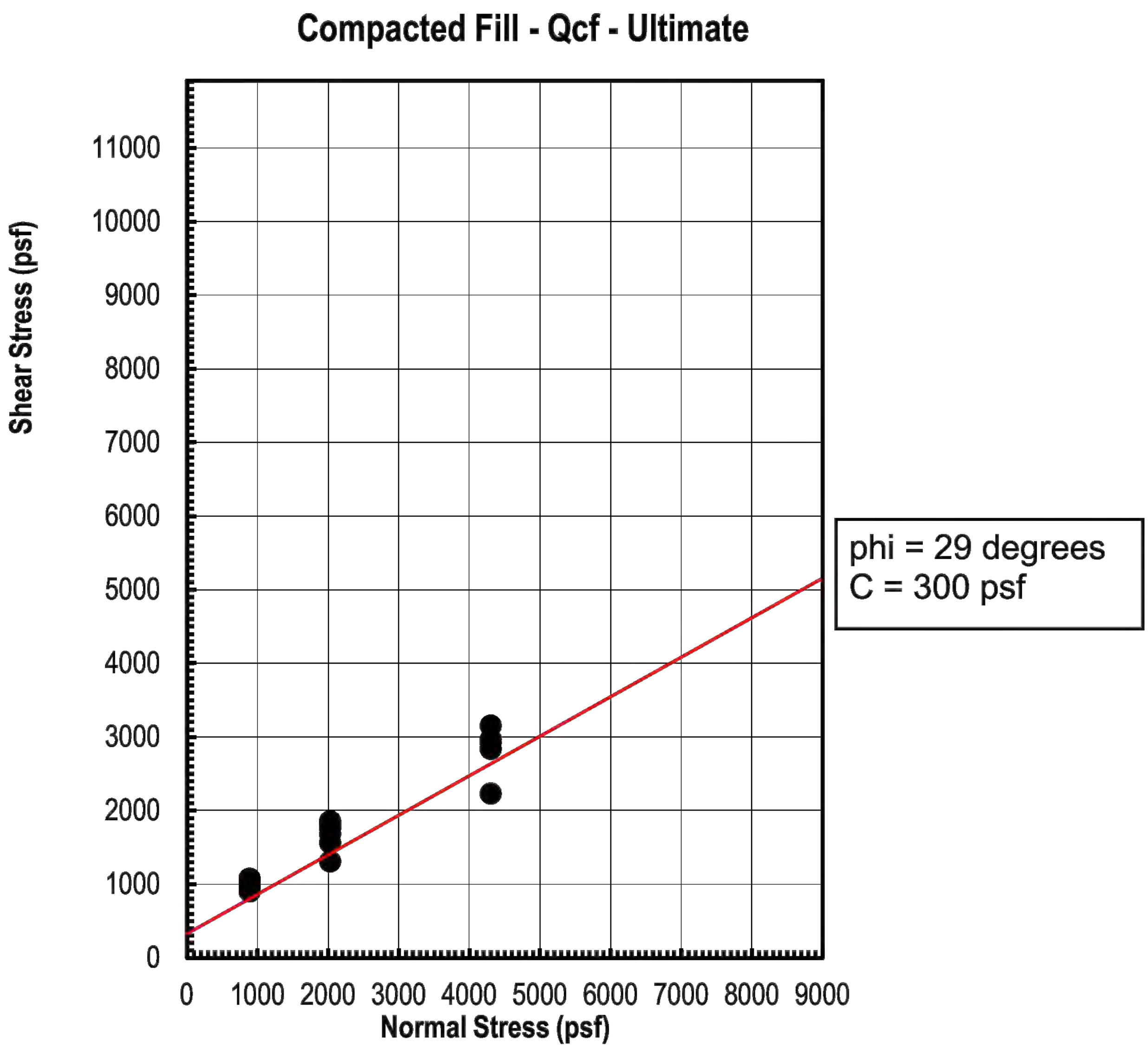


	SAMPLE	DEPTH (ft)	CLASSIFICATION	NAT WC	LL	PL	PI
●	LB2-10A	38.2	MH - Elastic SILT		122	52	70
⊠	LB3-23	103.0	MH - Elastic SILT		103	50	53
▲	LB5-12	95.5	MH - Elastic SILT		128	57	71

GRADATION CURVE

SUNBOW II, PHASE 3

CHULA VISTA, CALIFORNIA

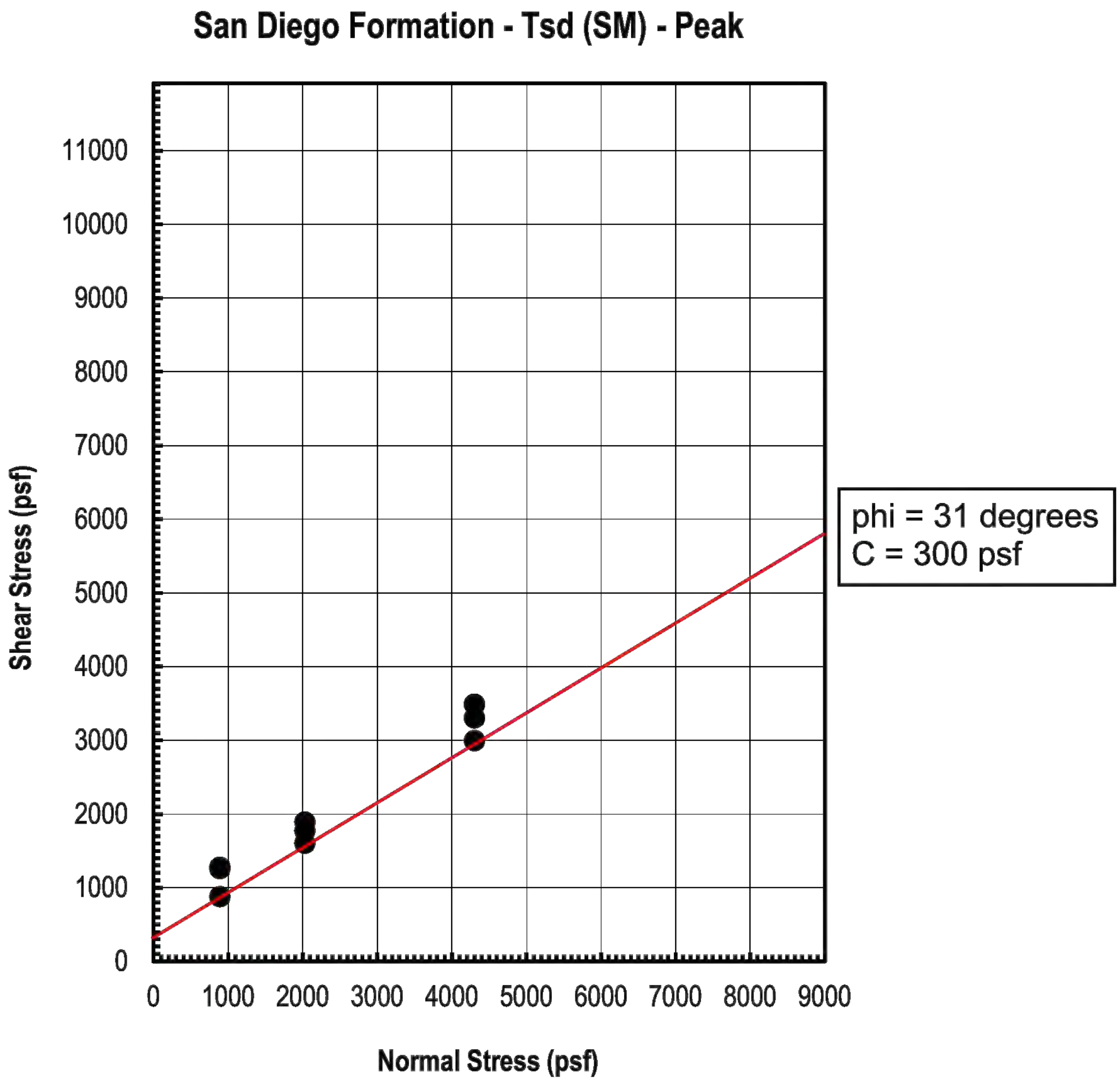


COMPOSITE DIRECT SHEAR TEST RESULTS

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. B-2

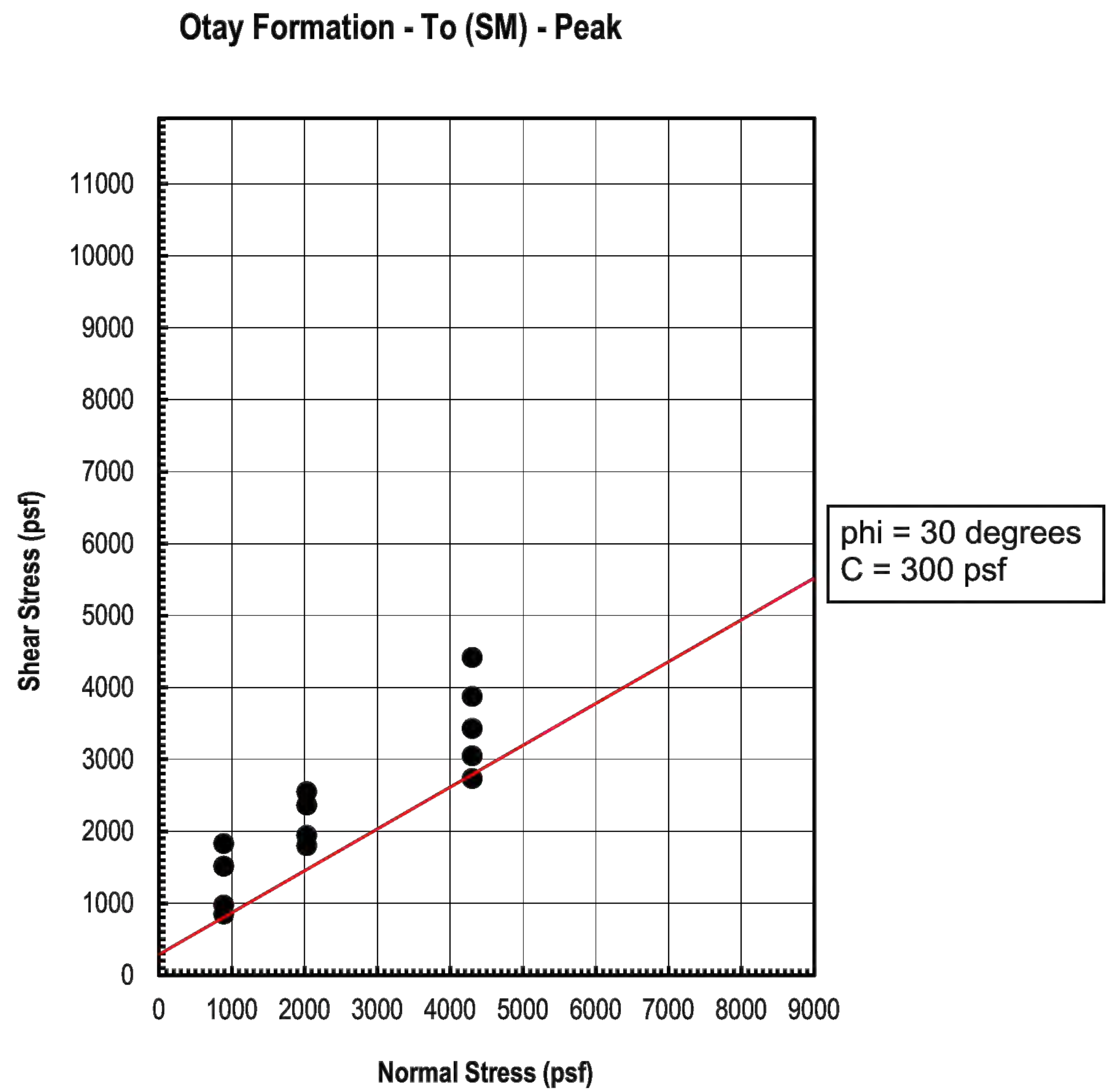


COMPOSITE DIRECT SHEAR TEST RESULTS

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. B-3



COMPOSITE DIRECT SHEAR TEST RESULTS

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PHONE 858 558-6900 - FAX 858 558-6159

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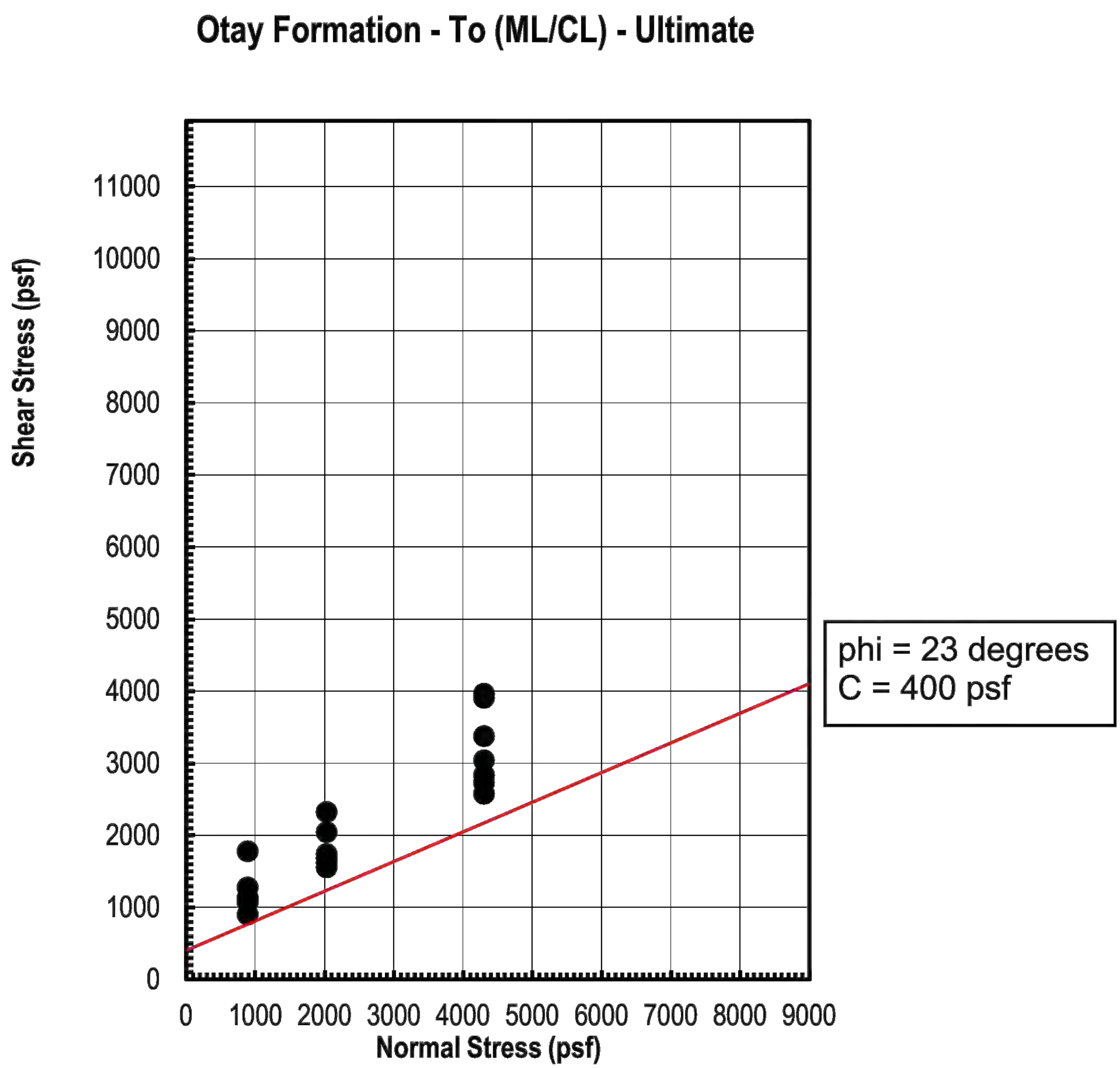
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. B-4



COMPOSITE DIRECT SHEAR TEST RESULTS

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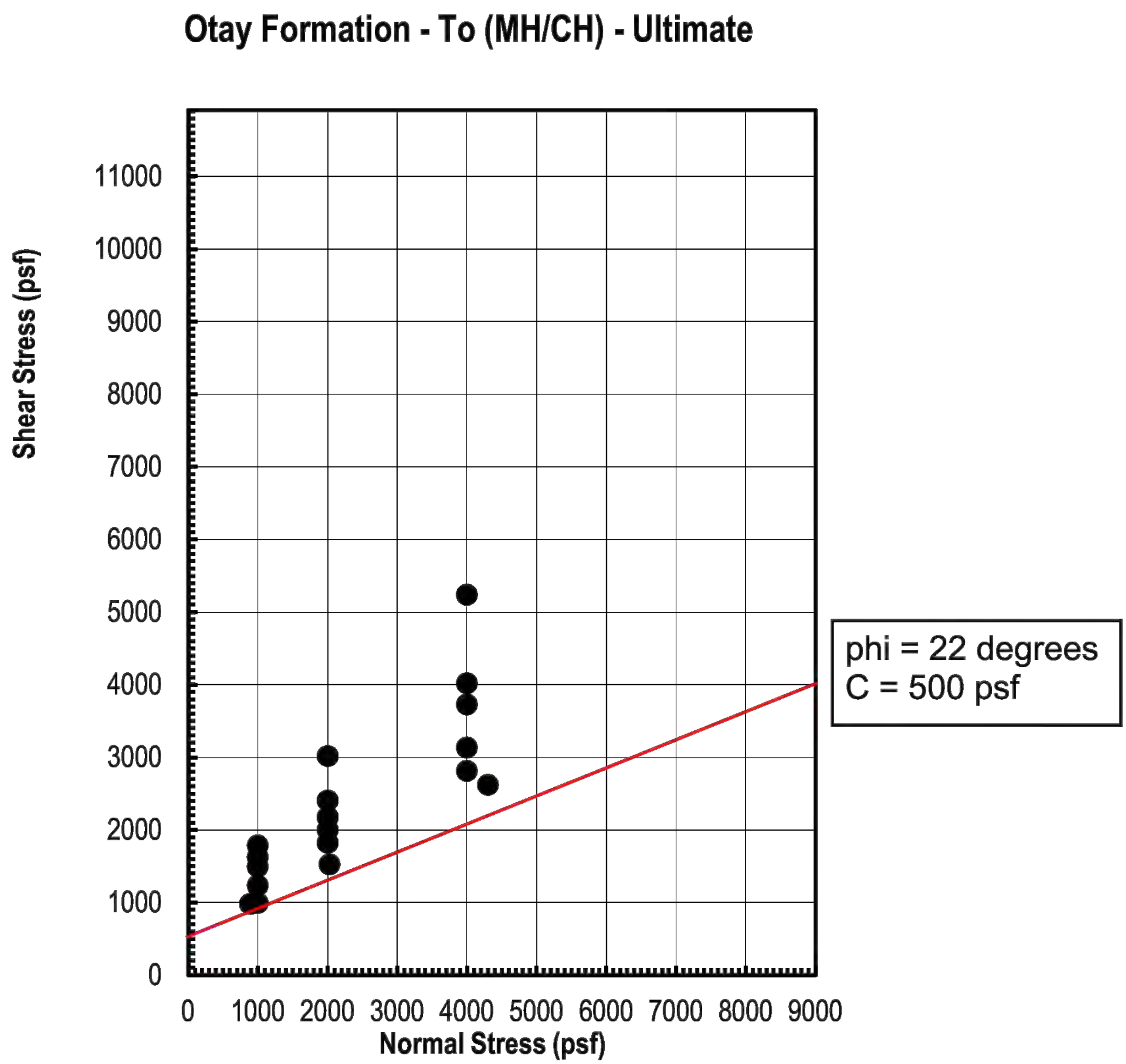
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. B-5



COMPOSITE DIRECT SHEAR TEST RESULTS

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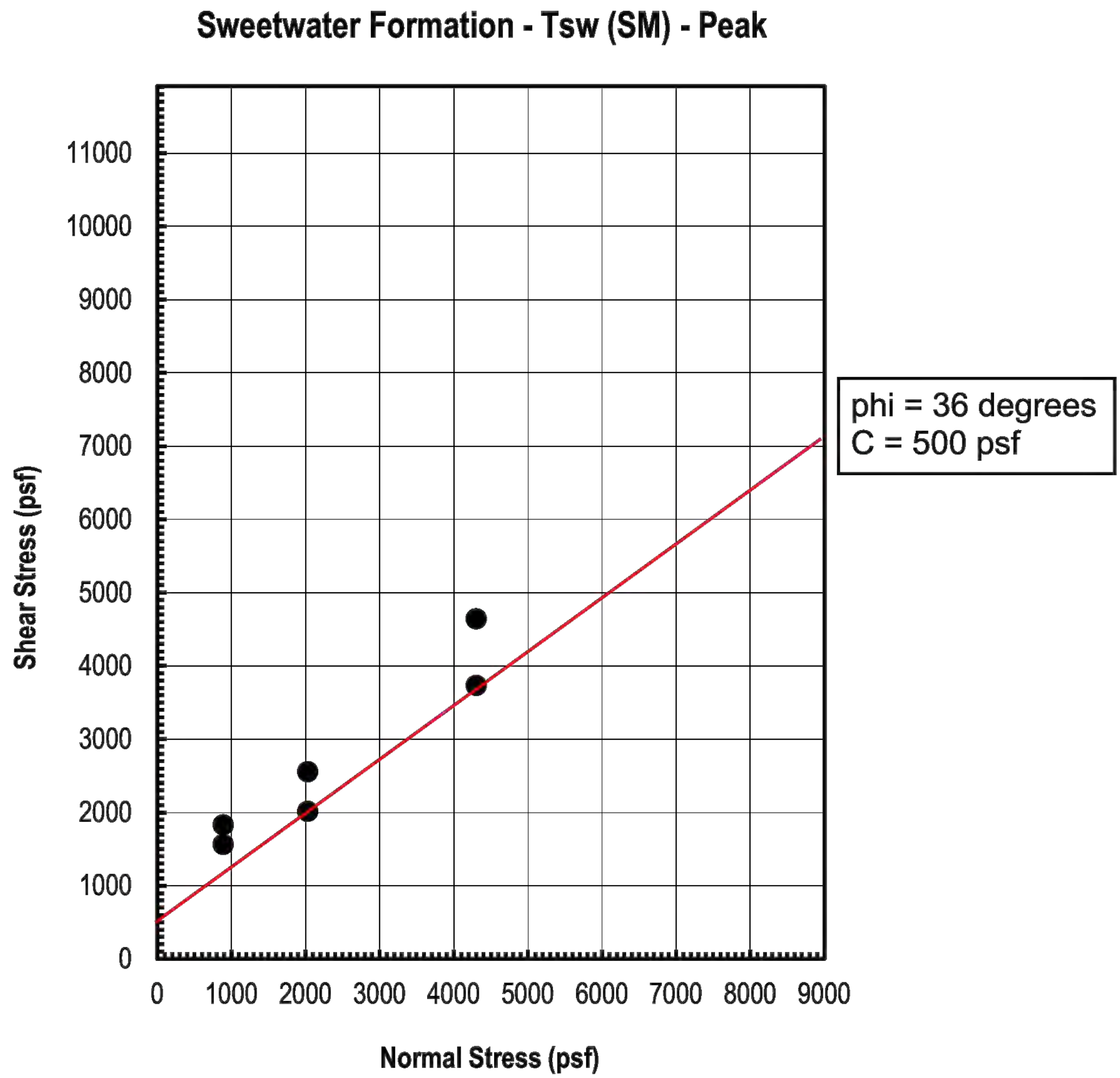
CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. B-6



COMPOSITE DIRECT SHEAR TEST RESULTS

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CHULA VISTA, CALIFORNIA

TR / RA		DSK/GTYPD	DATE 04 - 10 - 2020	PROJECT NO. G2452 - 32 - 02	FIG. B-7

APPENDIX C

APPENDIX C

SLOPE STABILITY ANALYSES

The slope stability analyses utilized the computer software program *Geostudio 2018* to calculate the factor of safety with respect to deep-seated instability. This program uses conventional slope stability equations and a two-dimensional, limit-equilibrium method. For our analyses, Spencer's Method with a block-failure mode was used to analyze the slope stability along assumed continuous weak clay beds. Circular failure surfaces were also utilized to evaluate cut and fill slopes. Shear strength parameters were assigned using average shear strength parameters for sandstone, siltstone, and claystone and engineering judgment. Residual shear strengths were used for bedding plane shears and were determined from the *Journal of Geotechnical and Geoenvironmental Engineering, Drained Shear Strength Parameters for Analysis of Landslides (Stark, Choi, McCone, 2005)* and engineering judgment.

Based on our experience, we have observed that bedding plane shears can undulate with orientations varying up to 15 degrees over tens of feet, however, when averaged over a greater distance they are generally horizontal or dipping only a few degrees. Therefore, projection or modeling the orientation of these features on the *Geologic Cross Sections* was based on piercing points and/or graphical methods (i.e., 3-point solutions) between the exploratory borings in lieu of projection along strike measured in the borings. In addition, to be conservative, bedding plane shears that dipped into slope were conservatively modeled flat, and those dipping out of slope were modeled out of slope in our slope stability analysis.

The results of the slope stability analyses performed on Cross-Sections A-A' through K-K' are presented in Figures C-1 through C-29.

Sunbow II, Phase 3
Project No. G2452-32-02
Section A-A'
Name: AA-Case1.gsz
Date: 04/07/2020 Time: 05:05:28 PM

Proposed Condition

Block Analysis

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (SM)	130	300	30
	San Diego Formation (SM)	120	300	31
	Sweetwater Formation (SM)	130	500	36

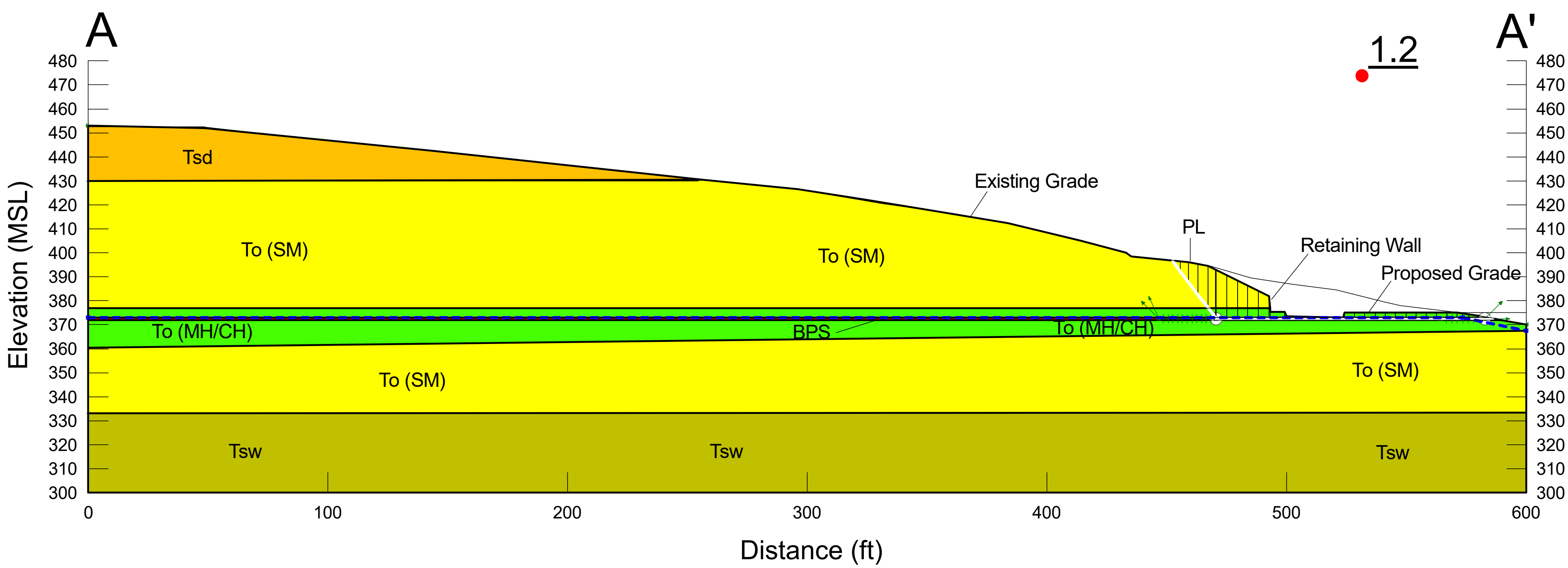

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Figure C-1

Sunbow II, Phase 3
Project No. G2452-32-02
Section A-A'
Name: AA-Case3.gsz
Date: 04/08/2020 Time: 11:50:07 AM

Proposed Condition with Buttress

Block Analysis Thru BPS

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
(red)	Bedding Plane Shear (BPS)	120	0	7
(orange)	Compacted Fill (Qcf)	120	300	29
(green)	Otay Formation (MH/CH)	120	500	22
(yellow)	Otay Formation (SM)	130	300	30
(light orange)	San Diego Formation (SM)	120	300	31
(olive)	Sweetwater Formation (SM)	130	500	36

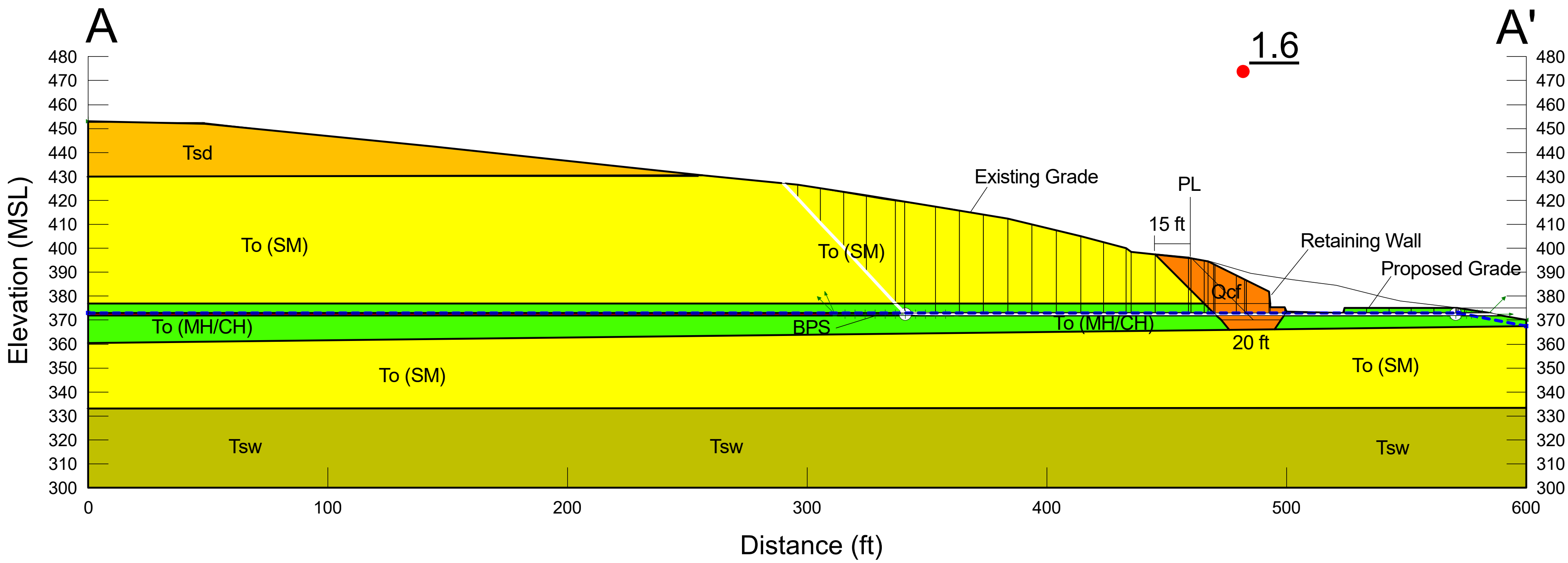

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Figure C-2

Sunbow II, Phase 3
Project No. G2452-32-02
Section A-A'
Name: AA-Case4.gsz
Date: 04/08/2020 Time: 12:22:33 PM

Proposed Condition with Buttress

Block Analysis Thru To (MH/CH)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	300	29
Green	Otay Formation (MH/CH)	120	500	22
Yellow	Otay Formation (SM)	130	300	30
Light orange	San Diego Formation (SM)	120	300	31
Olive	Sweetwater Formation (SM)	130	500	36

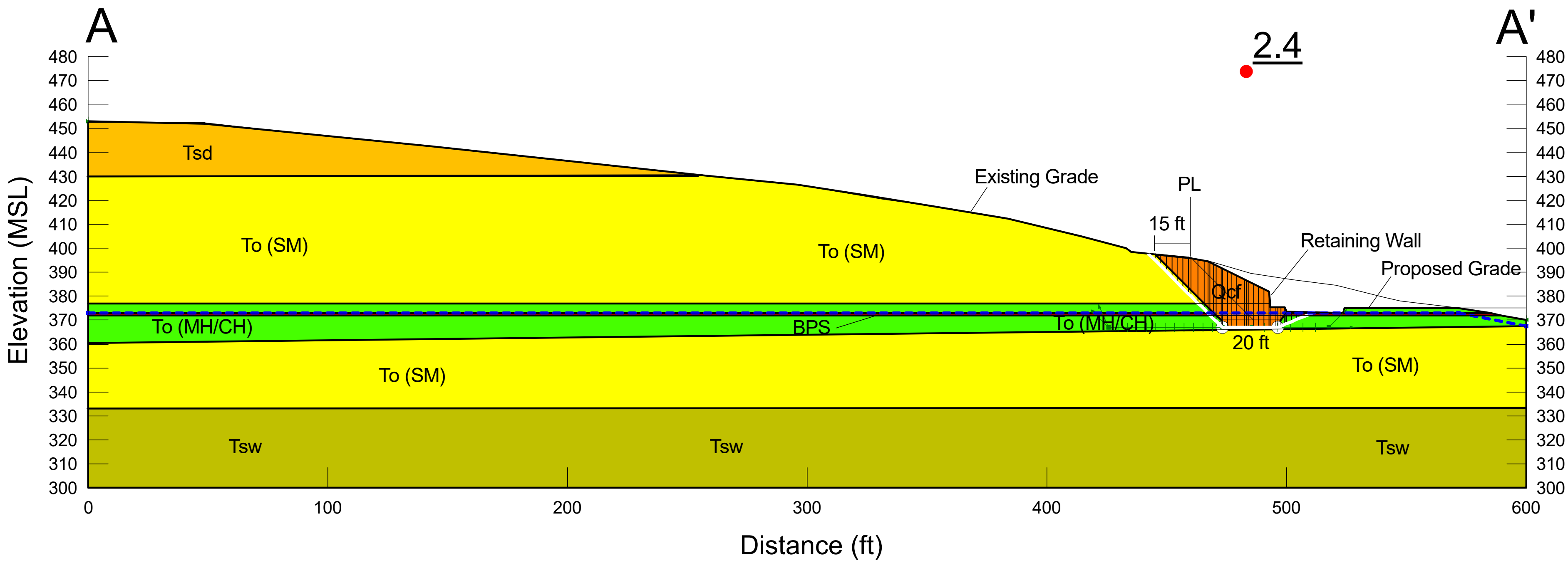

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Figure C-3

Sunbow II, Phase 3
Project No. G2452-32-02
Section B-B'
Name: BB-Case1.gsz
Date: 04/07/2020 Time: 05:14:02 PM

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (ML/CL)	125	400	23
	Otay Formation (SM)	130	300	30
	San Diego Formation (SM)	120	300	31
	Sweetwater Formation (SM)	130	500	36

Proposed Condition

Block Analysis Thru BPS

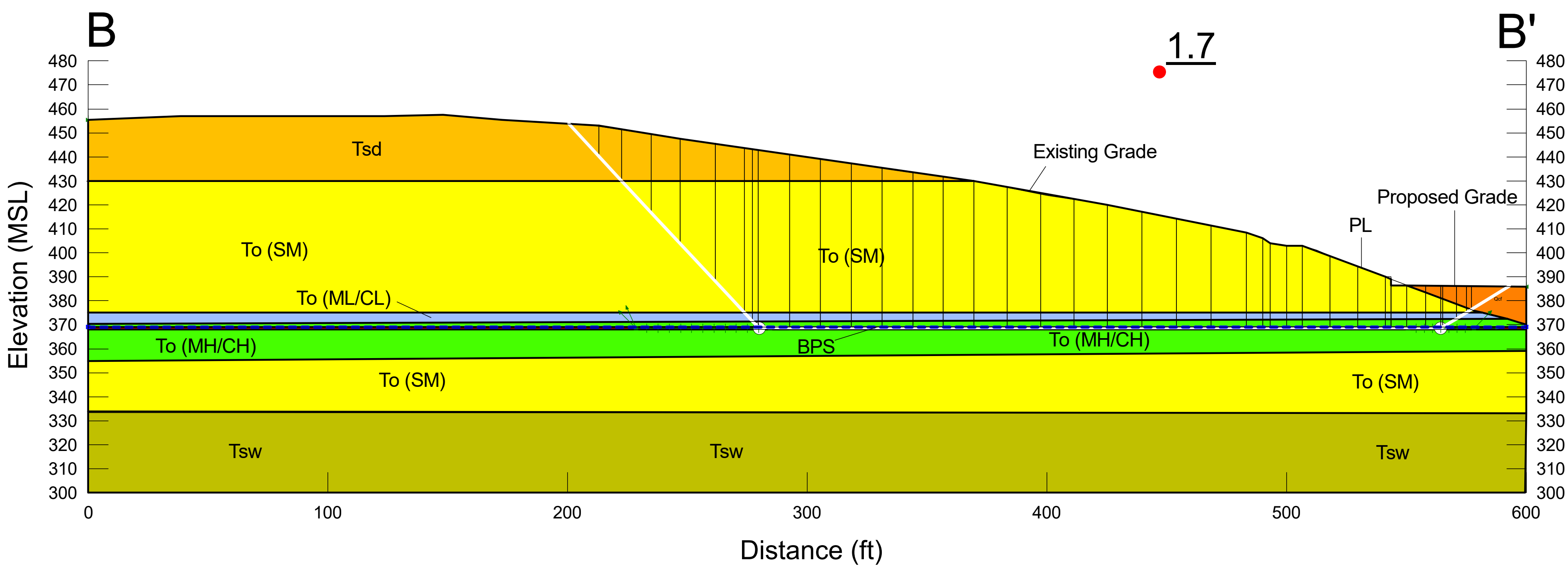

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Figure C-4

Sunbow II, Phase 3
Project No. G2452-32-02
Section B-B'
Name: BB-Case3.gsz
Date: 04/08/2020 Time: 12:32:09 PM

Proposed Condition

Block Analysis Thru To (MH/CH)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (ML/CL)	125	400	23
	Otay Formation (SM)	130	300	30
	San Diego Formation (SM)	120	300	31
	Sweetwater Formation (SM)	130	500	36

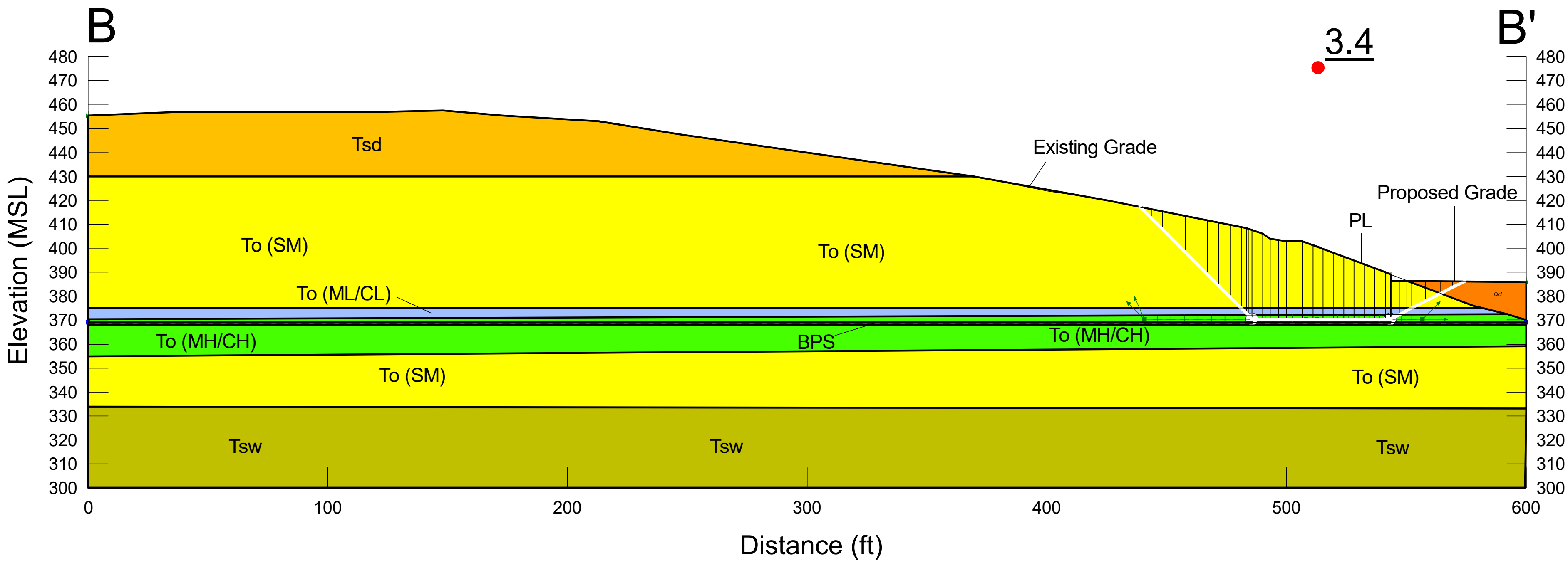

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Figure C-5

Sunbow II, Phase 3
Project No. G2452-32-02
Section B-B'
Name: BB-Case2.gsz
Date: 04/07/2020 Time: 05:18:48 PM

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	300	29
Green	Otay Formation (MH/CH)	120	500	22
Light blue	Otay Formation (ML/CL)	125	400	23
Yellow	Otay Formation (SM)	130	300	30
Light orange	San Diego Formation (SM)	120	300	31
Olive	Sweetwater Formation (SM)	130	500	36

Proposed Condition

Circular Analysis

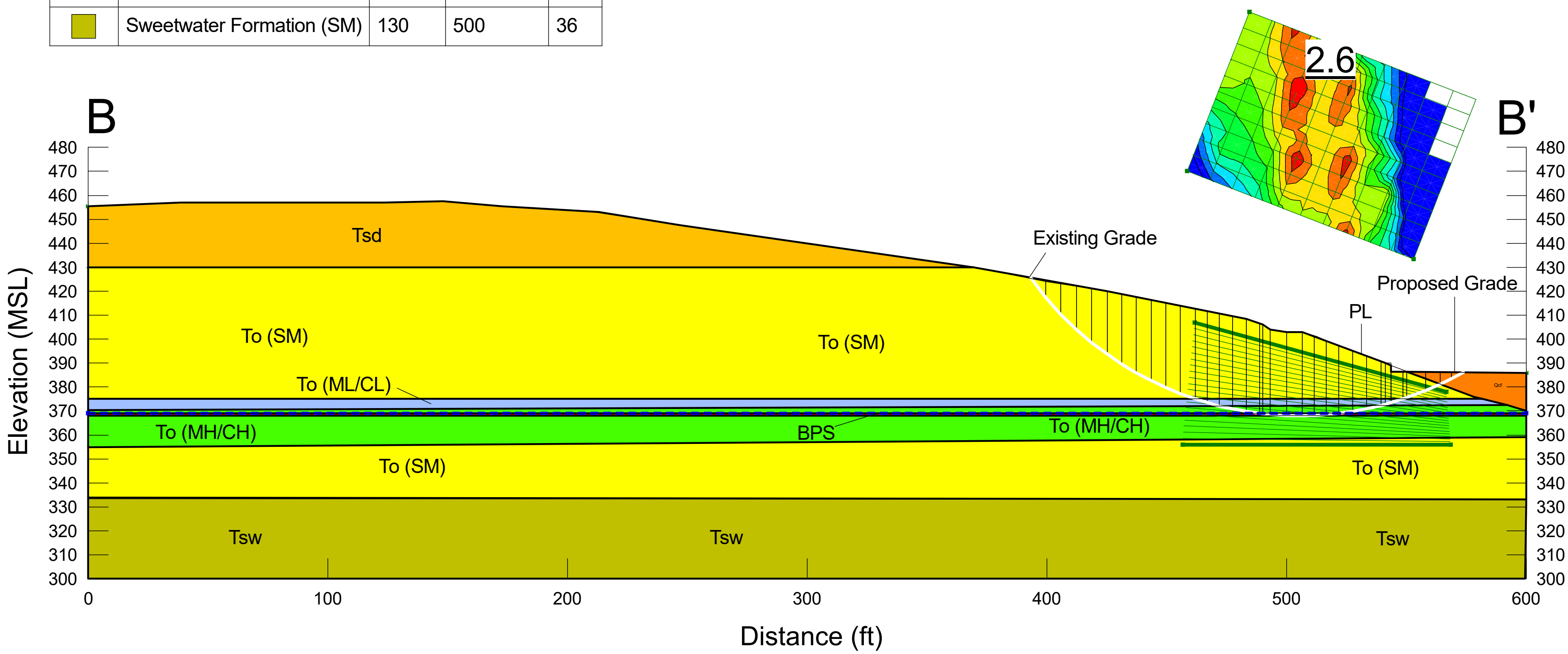

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Figure C-6

Sunbow II, Phase 3
Project No. G2452-32-02
Section C-C'
Name: CC-Case0 - Block Failure.gsz
Date: 04/08/2020 Time: 12:39:12 PM

Proposed Condition

Block Analysis Thru To (MH/CH)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Green	Otay Formation (MH/CH)	120	500	22
Yellow	Otay Formation (SM)	130	300	30
Orange	San Diego Formation (SM)	120	300	31

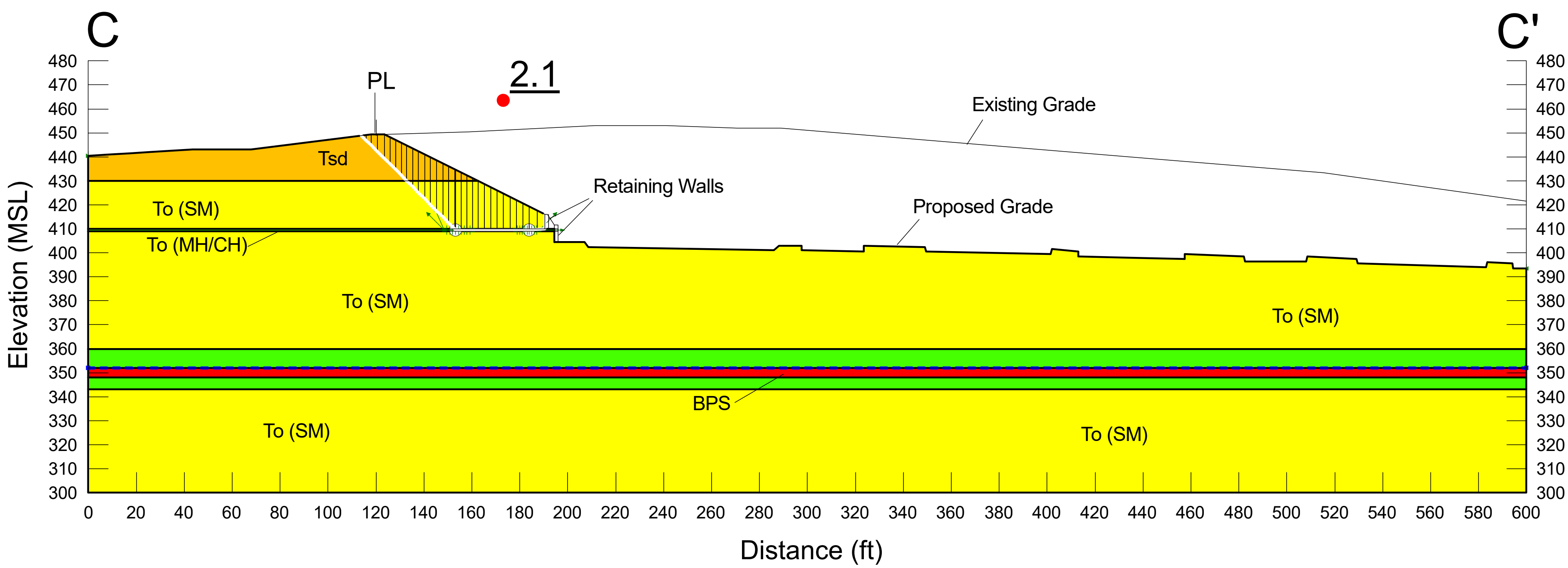

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Figure C-7

Sunbow II, Phase 3
Project No. G2452-32-02
Section C-C'
Name: CC-Case1.gsz
Date: 04/08/2020 Time: 12:56:59 PM

Proposed Condition with Stability Fill

Block Analysis Thru To (MH/CH)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (SM)	130	300	30
	San Diego Formation (SM)	120	300	31

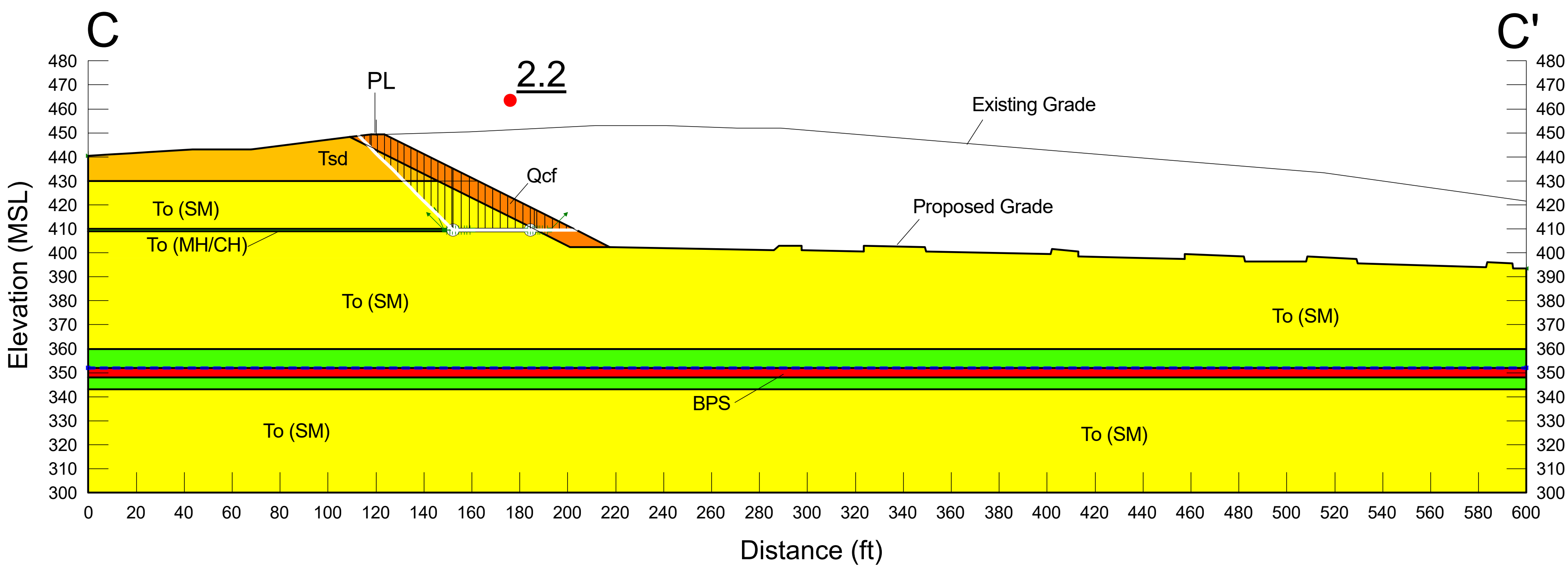

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Figure C-8

Sunbow II, Phase 3
Project No. G2452-32-02
Section C-C'
Name: CC-Case2.gsz
Date: 04/08/2020 Time: 01:05:26 PM

Proposed Condition with Stability Fill

Circular Analysis

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
(red)	Bedding Plane Shear (BPS)	120	0	7
(orange)	Compacted Fill (Qcf)	120	300	29
(green)	Otay Formation (MH/CH)	120	500	22
(yellow)	Otay Formation (SM)	130	300	30
(gold)	San Diego Formation (SM)	120	300	31

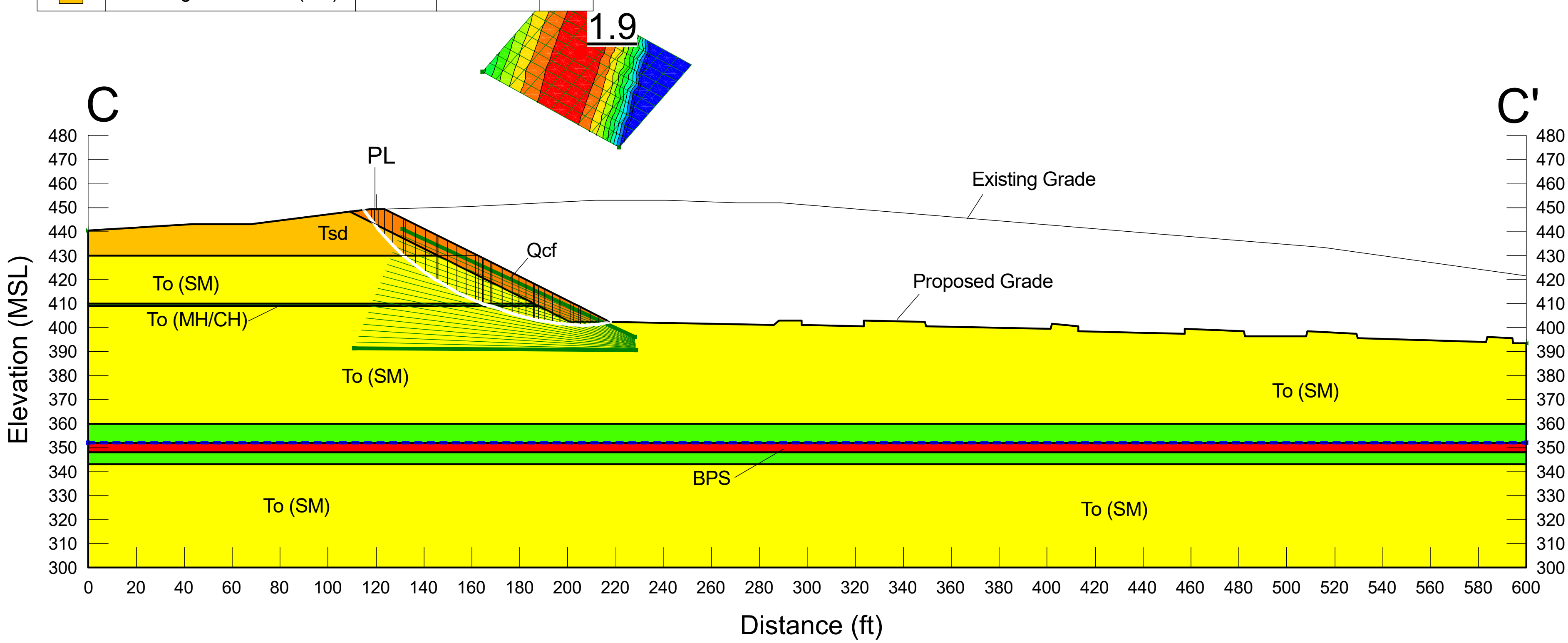

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Figure C-9

Sunbow II, Phase 3
Project No. G2452-32-02
Section D-D'
Name: DD-Case1.gsz
Date: 04/08/2020 Time: 01:18:56 PM

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	400	29
Green	Otay Formation (MH/CH)	120	500	25
Light blue	Otay Formation (ML/CL)	125	500	28
Yellow	Otay Formation (SM)	130	300	30
Gold	San Diego Formation (SM)	120	300	31

Proposed Condition with Stability Fill

Block Analysis Thru To (ML/CL)

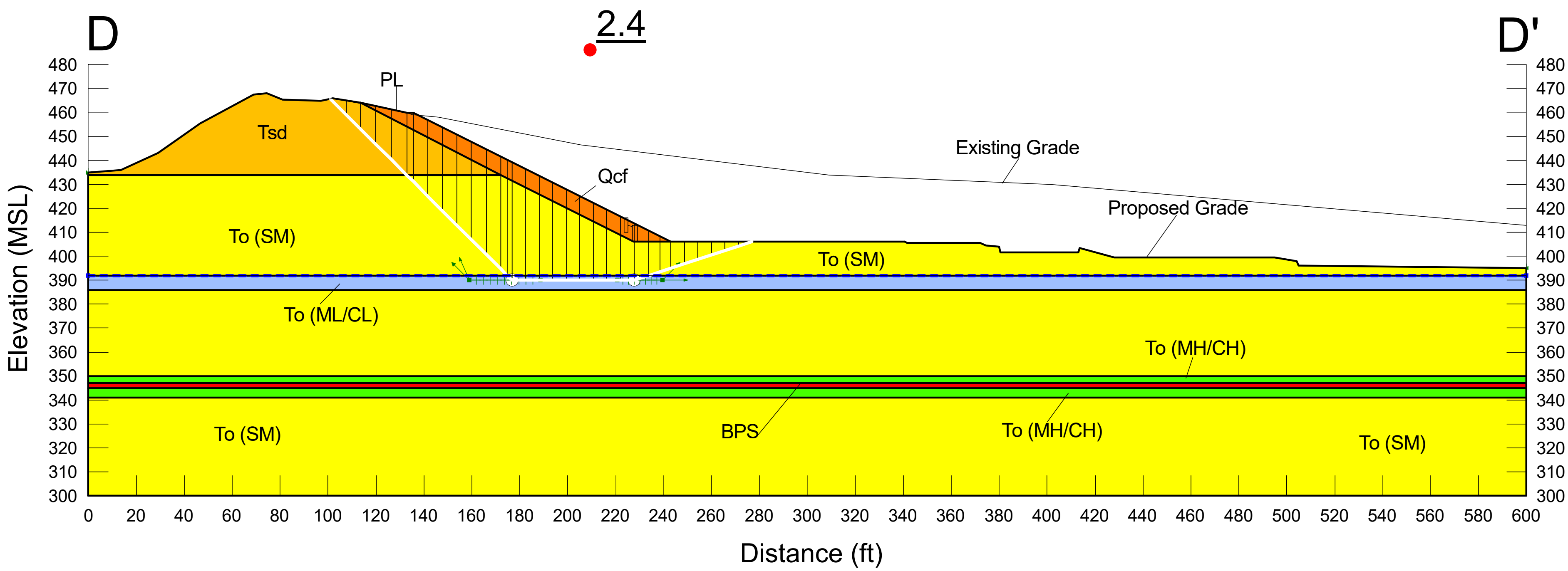

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Figure C-10

Sunbow II, Phase 3
Project No. G2452-32-02
Section D-D'
Name: DD-Case0.gsz
Date: 04/08/2020 Time: 01:22:26 PM

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	400	29
Green	Otay Formation (MH/CH)	120	500	25
Light blue	Otay Formation (ML/CL)	125	500	28
Yellow	Otay Formation (SM)	130	300	30
Light orange	San Diego Formation (SM)	120	300	31

Proposed Condition with Stability Fill

Circular Analysis

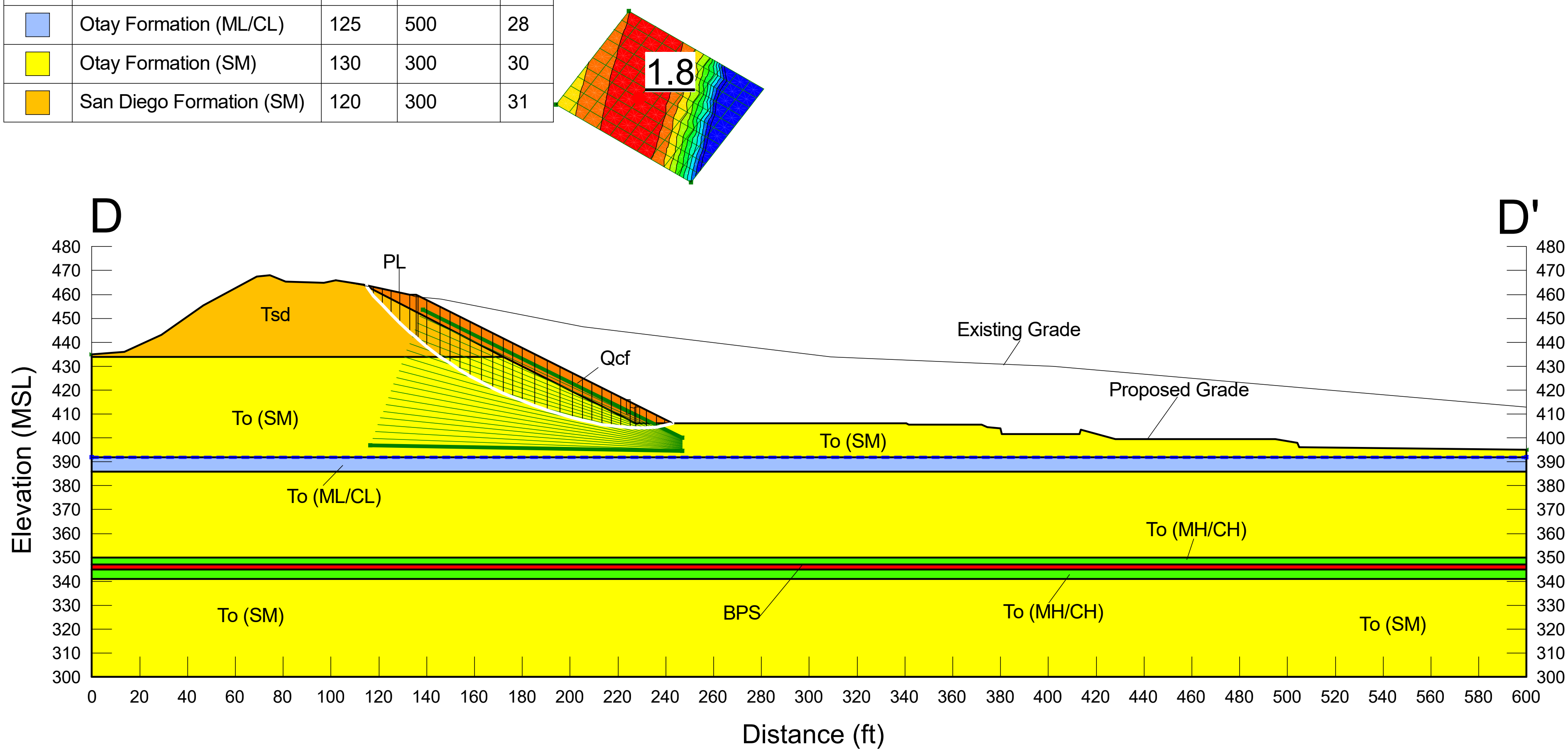

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Figure C-11

Sunbow II, Phase 3
Project No. G2452-32-02
Section E-E'
Name: EE-Case0.gsz
Date: 04/09/2020 Time: 09:56:46 AM

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	300	29
Green	Otay Formation (MH/CH)	120	500	22
Light blue	Otay Formation (ML/CL)	125	400	23
Yellow	Otay Formation (SM)	130	300	30
Light orange	San Diego Formation (SM)	120	300	31

Proposed Condition with Stability Fill

Block Analysis Thru To (ML/CL)

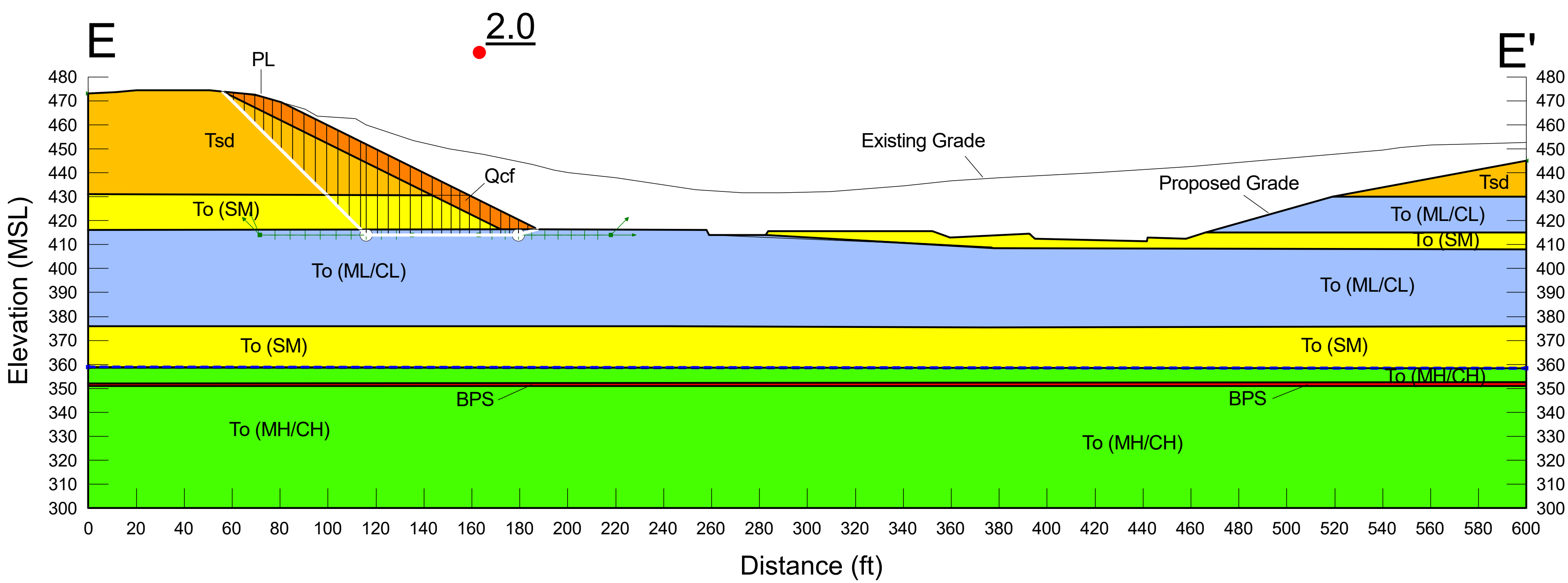

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Figure C-12

Sunbow II, Phase 3
Project No. G2452-32-02
Section E-E'
Name: EE-Case1.gsz
Date: 04/09/2020 Time: 10:00:26 AM

Proposed Condition with Stability Fill

Circular Analysis

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (ML/CL)	125	400	23
	Otay Formation (SM)	130	300	30
	San Diego Formation (SM)	120	300	31

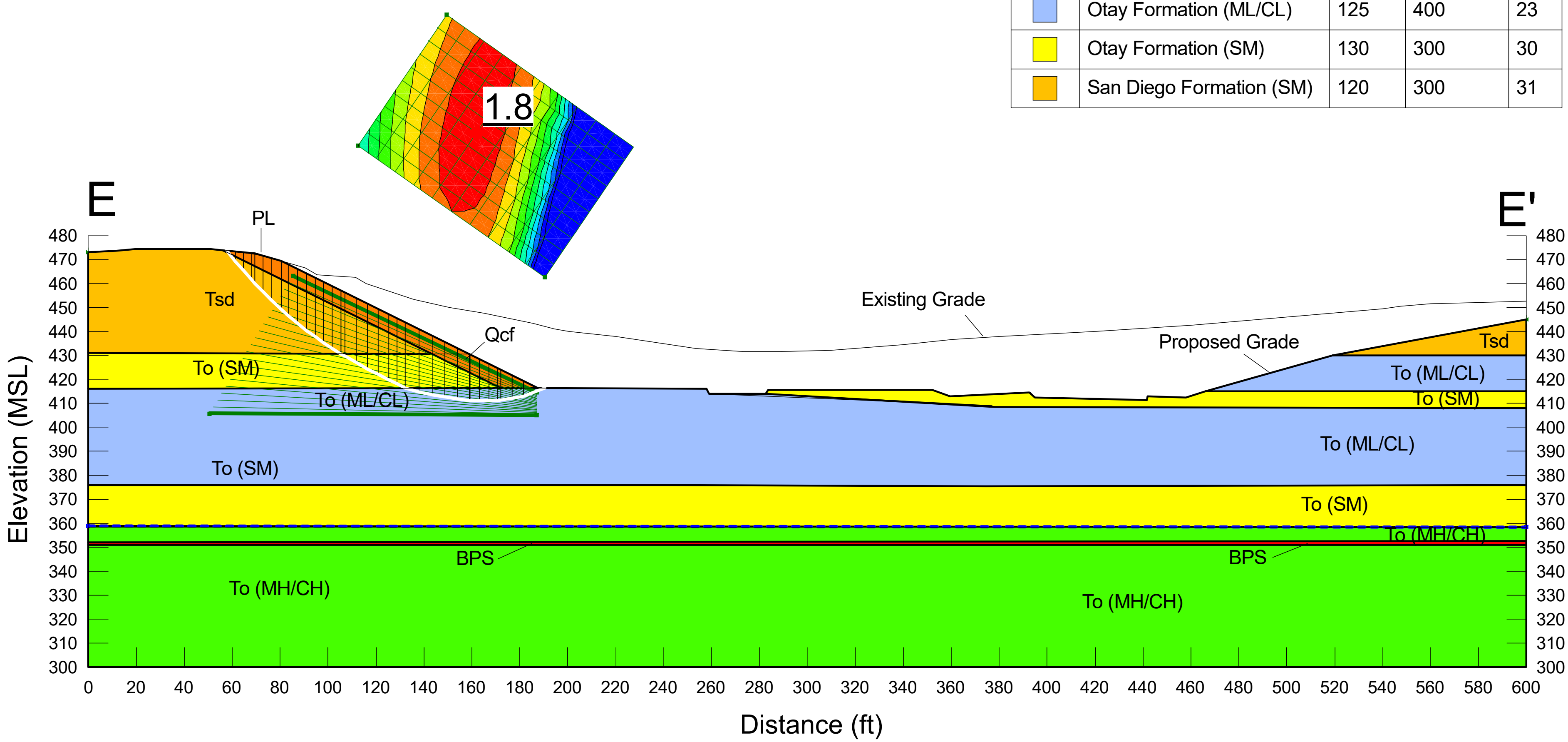

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Figure C-13

Sunbow II, Phase 3
Project No. G2452-32-02
Section F-F'
Name: FF-Case0.gsz
Date: 04/08/2020 Time: 01:37:24 PM

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	300	29
Green	Otay Formation (MH/CH)	120	500	22
Light blue	Otay Formation (ML/CL)	125	400	23
Yellow	Otay Formation (SM)	130	300	30
Gold	San Diego Formation (SM)	120	300	31

Proposed Condition with Stability Fill

Block Analysis Thru Lower To (ML/CL)

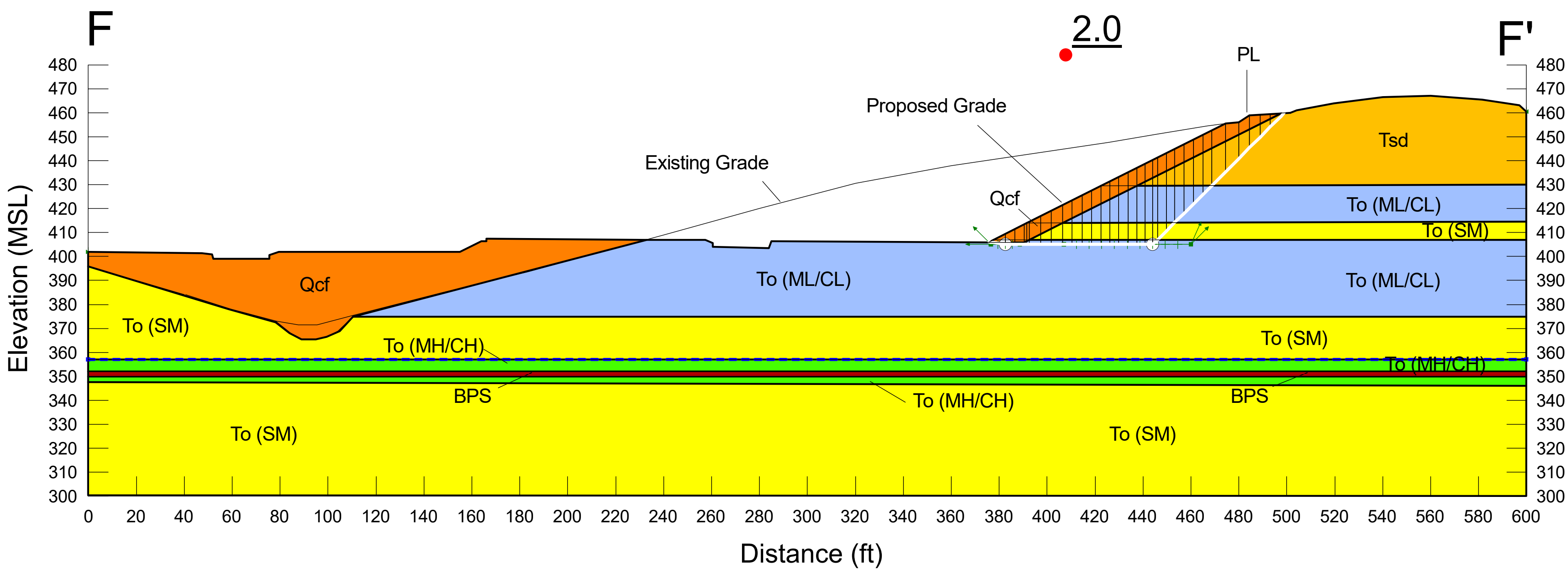

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Figure C-14

Sunbow II, Phase 3
Project No. G2452-32-02
Section F-F'
Name: FF-Case2.gsz
Date: 04/08/2020 Time: 01:40:18 PM

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (ML/CL)	125	400	23
	Otay Formation (SM)	130	300	30
	San Diego Formation (SM)	120	300	31

Proposed Condition with Stability Fill

Block Analysis Thru Upper To (ML/CL)

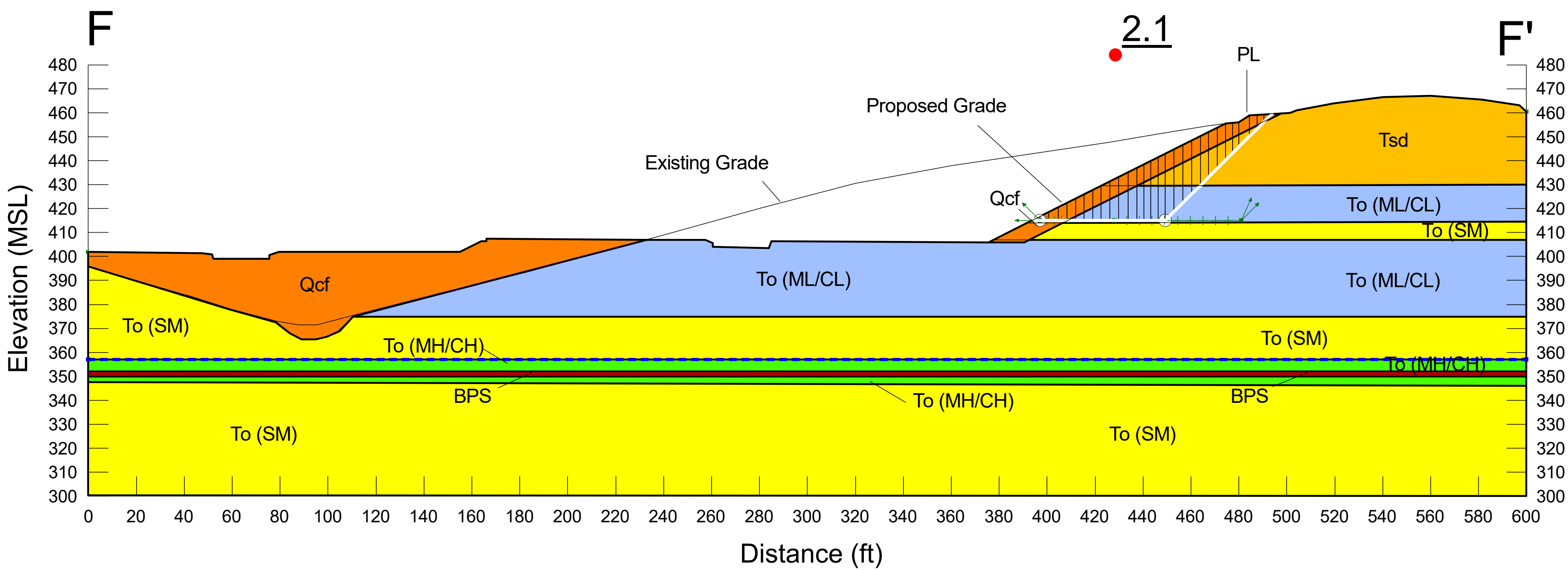

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Figure C-15

Sunbow II, Phase 3
Project No. G2452-32-02
Section F-F'
Name: FF-Case1.gsz
Date: 04/08/2020 Time: 01:45:54 PM

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (ML/CL)	125	400	23
	Otay Formation (SM)	130	300	30
	San Diego Formation (SM)	120	300	31

Proposed Condition with Stability Fill

Circular Analysis

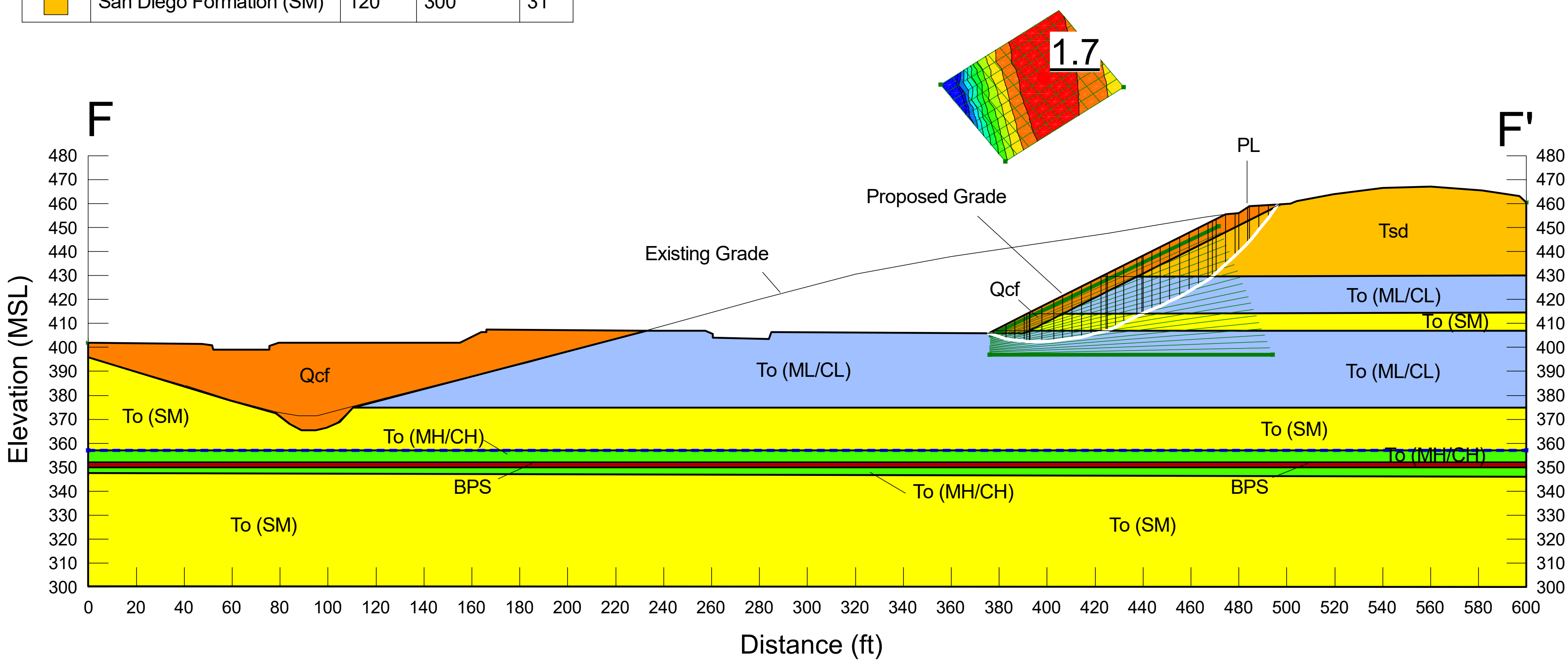

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Figure C-16

Sunbow II, Phase 3
Project No. G2452-32-02
Section G-G'
Name: GG-Case0.gsz
Date: 04/08/2020 Time: 12:59:50 AM

Proposed Condition

Block Analysis Thru To (ML/CL)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (ML/CL)	125	400	23
	Otay Formation (SM)	130	300	30
	Sweetwater Formation (SM)	130	500	36

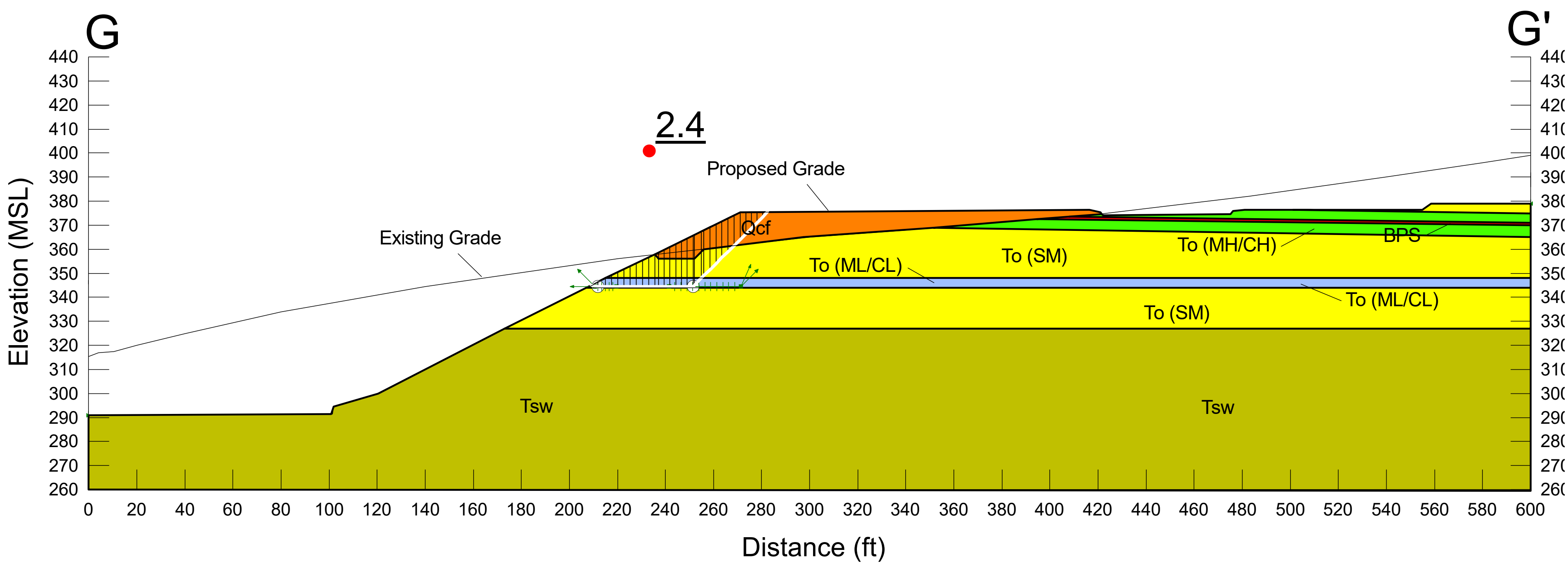

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Figure C-17

Sunbow II, Phase 3
Project No. G2452-32-02
Section G-G'
Name: GG-Case1.gsz
Date: 04/08/2020 Time: 12:55:18 AM

Proposed Condition

Circular Analysis

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (ML/CL)	125	400	23
	Otay Formation (SM)	130	300	30
	Sweetwater Formation (SM)	130	500	36

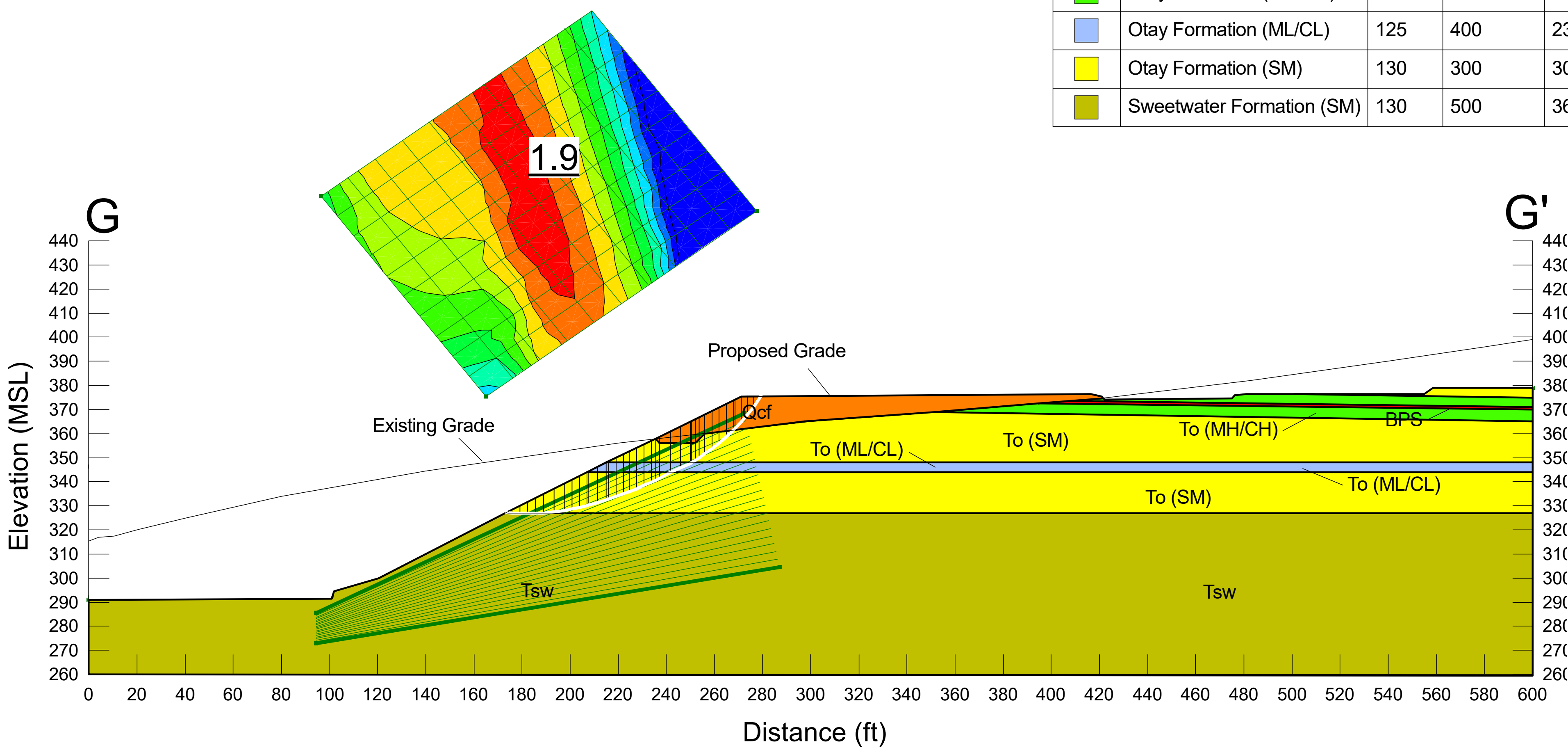

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Figure C-18

Sunbow II, Phase 3
Project No. G2452-32-02
Section H-H'
Name: HH-Case0.gsz
Date: 04/08/2020 Time: 01:47:54 AM

Proposed Condition

Circular Analysis

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
(red)	Bedding Plane Shear (BPS)	120	0	7
(orange)	Compacted Fill (Qcf)	120	300	29
(green)	Otay Formation (MH/CH)	120	500	22
(yellow)	Otay Formation (SM)	130	300	30
(olive)	Sweetwater Formation (SM)	130	500	36

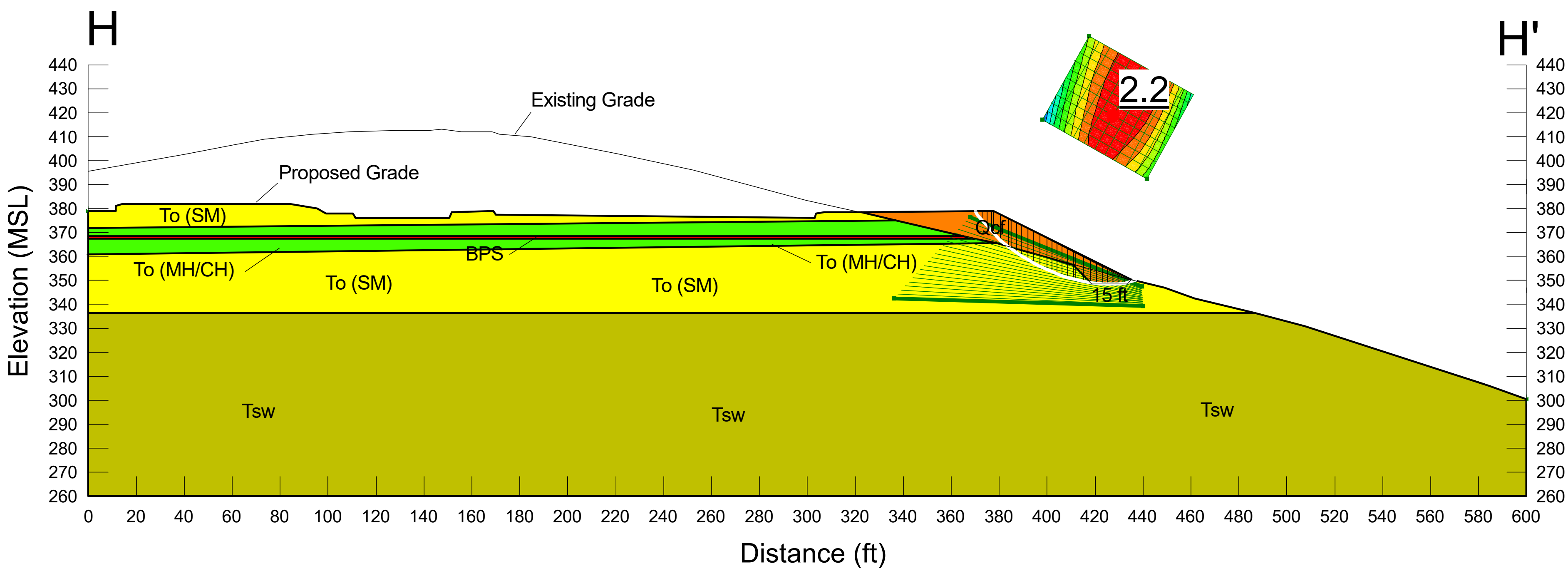

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Figure C-19

Sunbow II, Phase 3
Project No. G2452-32-02
Section I-I'
Name: II-Case1.gsz
Date: 04/08/2020 Time: 02:06:47 PM

Proposed Condition

Block Analysis Thru BPS

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (SM)	130	300	30
	Sweetwater Formation (SM)	130	500	36

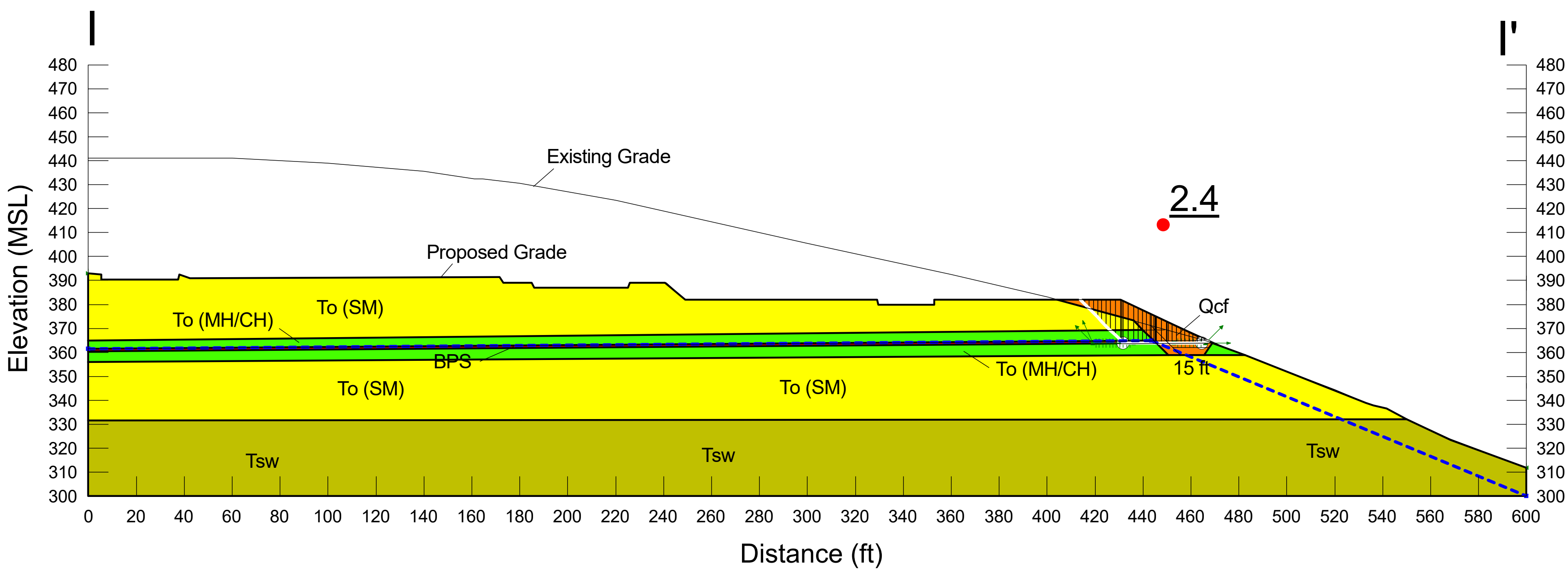

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Figure C-20

Sunbow II, Phase 3
Project No. G2452-32-02
Section I-I'
Name: II-Case3.gsz
Date: 04/08/2020 Time: 02:10:41 PM

Proposed Condition

Block Analysis Thru To (MH/CH)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	300	29
Green	Otay Formation (MH/CH)	120	500	22
Yellow	Otay Formation (SM)	130	300	30
Olive	Sweetwater Formation (SM)	130	500	36

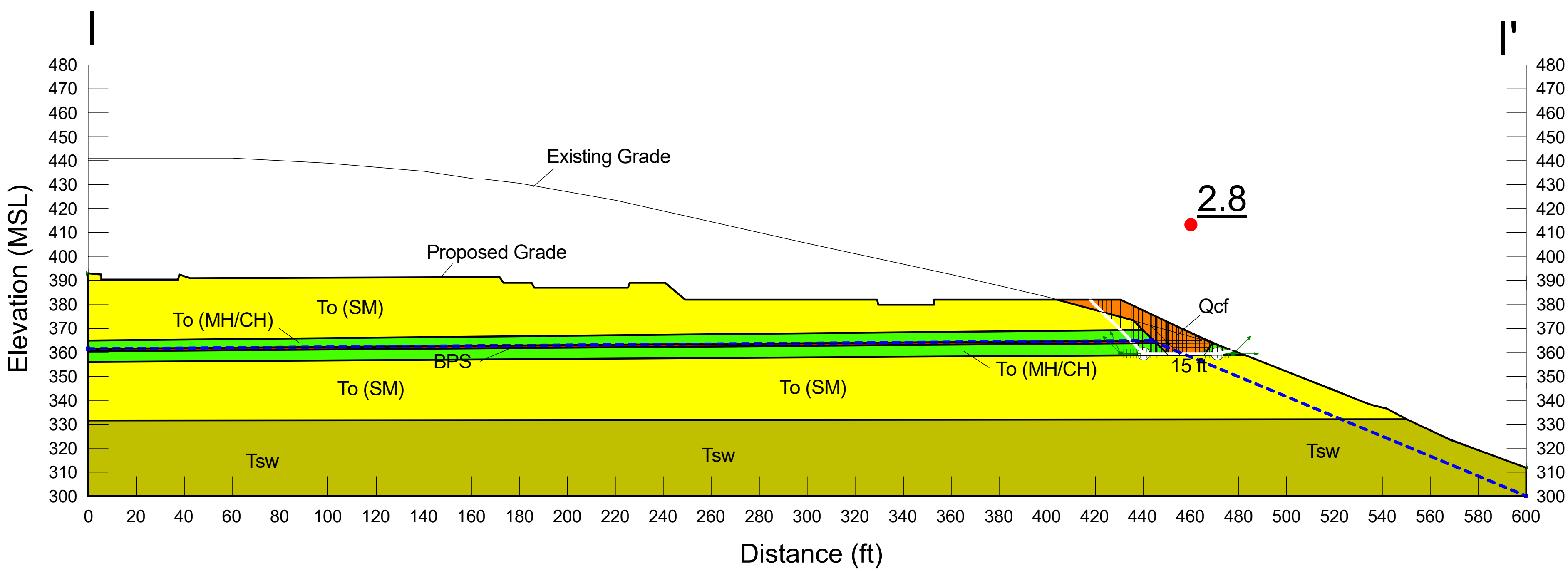

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Figure C-21

Sunbow II, Phase 3
Project No. G2452-32-02
Section I-I'
Name: II-Case2.gsz
Date: 04/08/2020 Time: 02:17:17 PM

Proposed Condition

Circular Analysis

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	300	29
Green	Otay Formation (MH/CH)	120	500	22
Yellow	Otay Formation (SM)	130	300	30
Olive	Sweetwater Formation (SM)	130	500	36

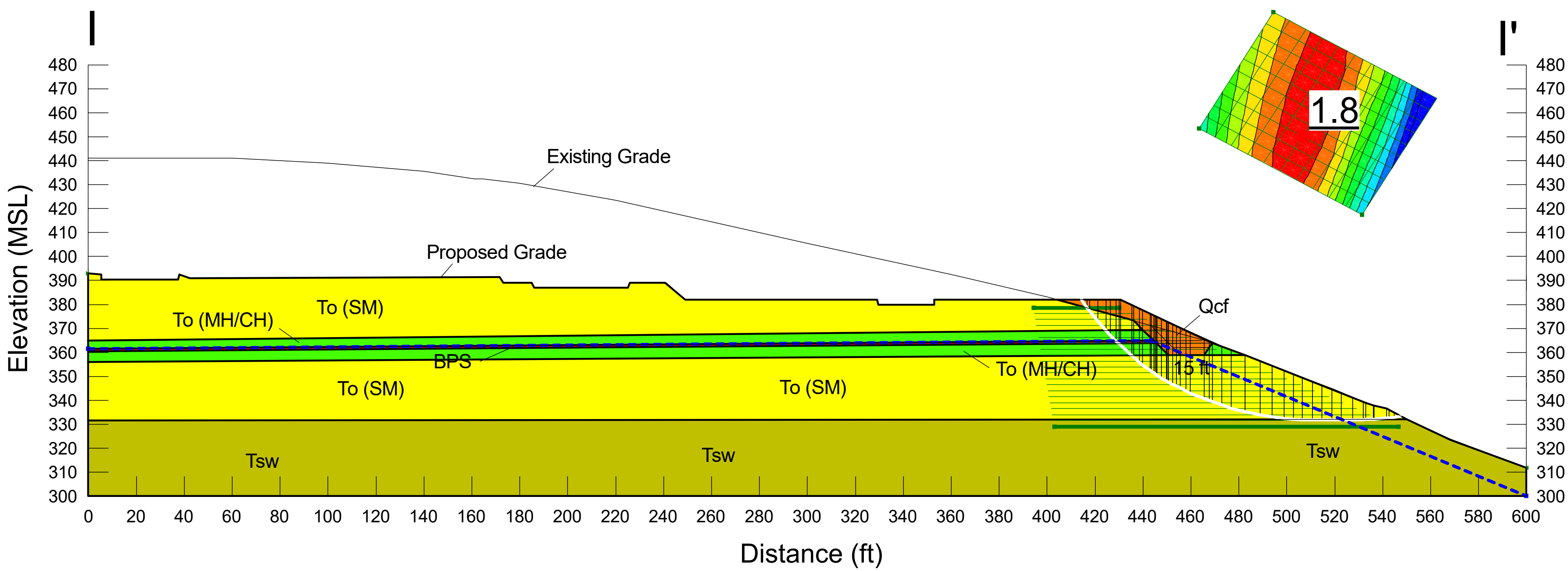

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Figure C-22

Sunbow II, Phase 3
Project No. G2452-32-02
Section J-J'
Name: JJ-Case0.gsz
Date: 04/07/2020 Time: 10:35:09 PM

Proposed Condition

Block Analysis Thru To (MH/CH)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
(red)	Bedding Plane Shear (BPS)	120	0	7
(orange)	Compacted Fill (Qcf)	120	300	29
(green)	Otay Formation (MH/CH)	120	500	22
(light blue)	Otay Formation (ML/CL)	125	400	23
(yellow)	Otay Formation (SM)	130	300	30
(olive)	Sweetwater Formation (SM)	130	500	36

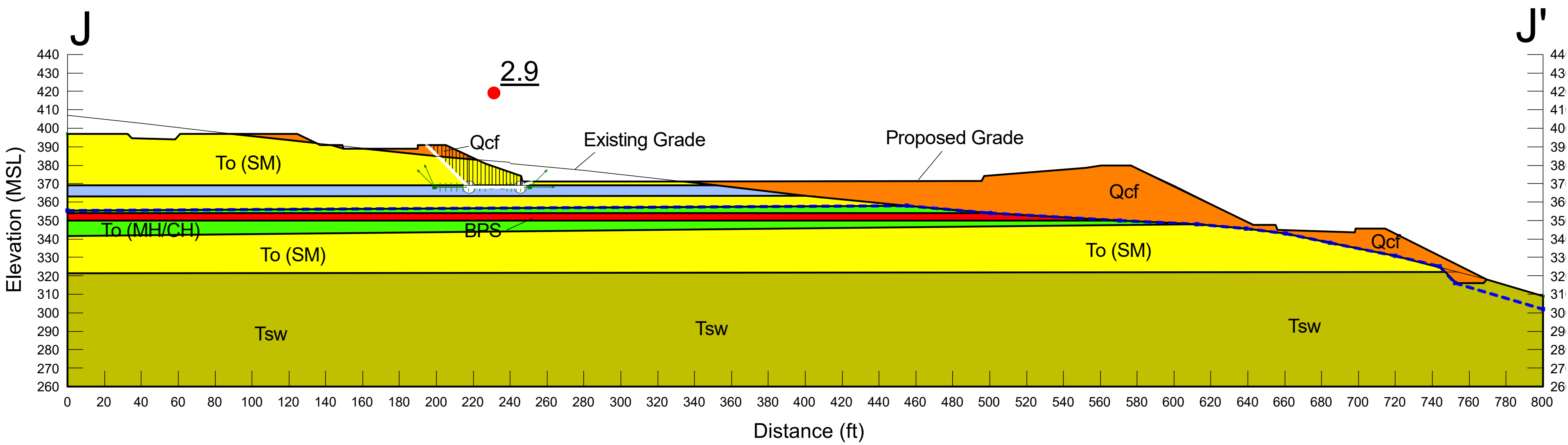

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Figure C-23

Sunbow II, Phase 3
Project No. G2452-32-02
Section J-J'
Name: JJ-Case1.gsz
Date: 04/07/2020 Time: 10:37:43 PM

Proposed Condition

Circular Analysis Thru To (MH/CH)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
(red)	Bedding Plane Shear (BPS)	120	0	7
(orange)	Compacted Fill (Qcf)	120	300	29
(green)	Otay Formation (MH/CH)	120	500	22
(light blue)	Otay Formation (ML/CL)	125	400	23
(yellow)	Otay Formation (SM)	130	300	30
(olive)	Sweetwater Formation (SM)	130	500	36

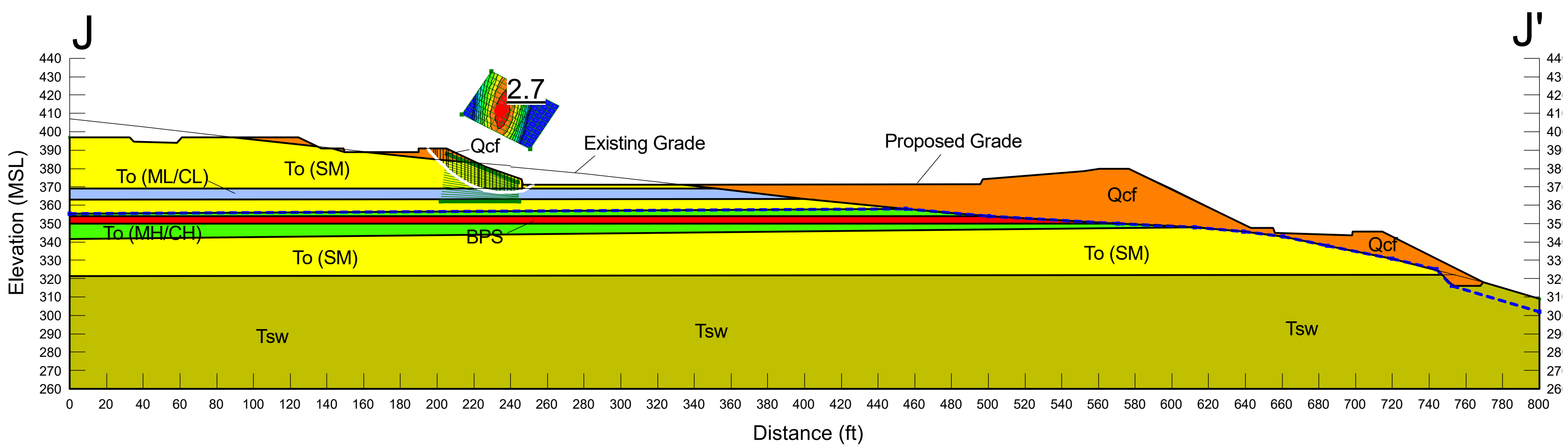

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Figure C-24

Sunbow II, Phase 3
Project No. G2452-32-02
Section J-J'
Name: JJ-Case2.gsz
Date: 04/07/2020 Time: 10:46:51 PM

Proposed Condition

Circular Analysis Thru BPS

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	300	29
Green	Otay Formation (MH/CH)	120	500	22
Light blue	Otay Formation (ML/CL)	125	400	23
Yellow	Otay Formation (SM)	130	300	30
Olive	Sweetwater Formation (SM)	130	500	36

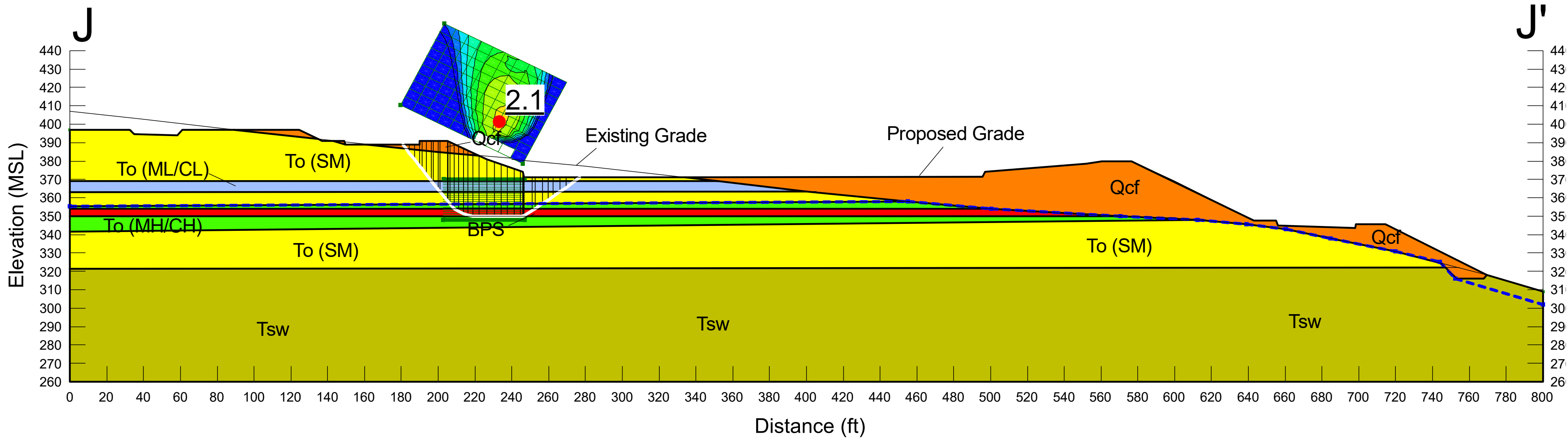

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Figure C-25

Sunbow II, Phase 3
Project No. G2452-32-02
Section J-J'
Name: JJ-Case5.gsz
Date: 04/07/2020 Time: 11:00:10 PM

Proposed Condition

Circular Analysis

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (ML/CL)	125	400	23
	Otay Formation (SM)	130	300	30
	Sweetwater Formation (SM)	130	500	36

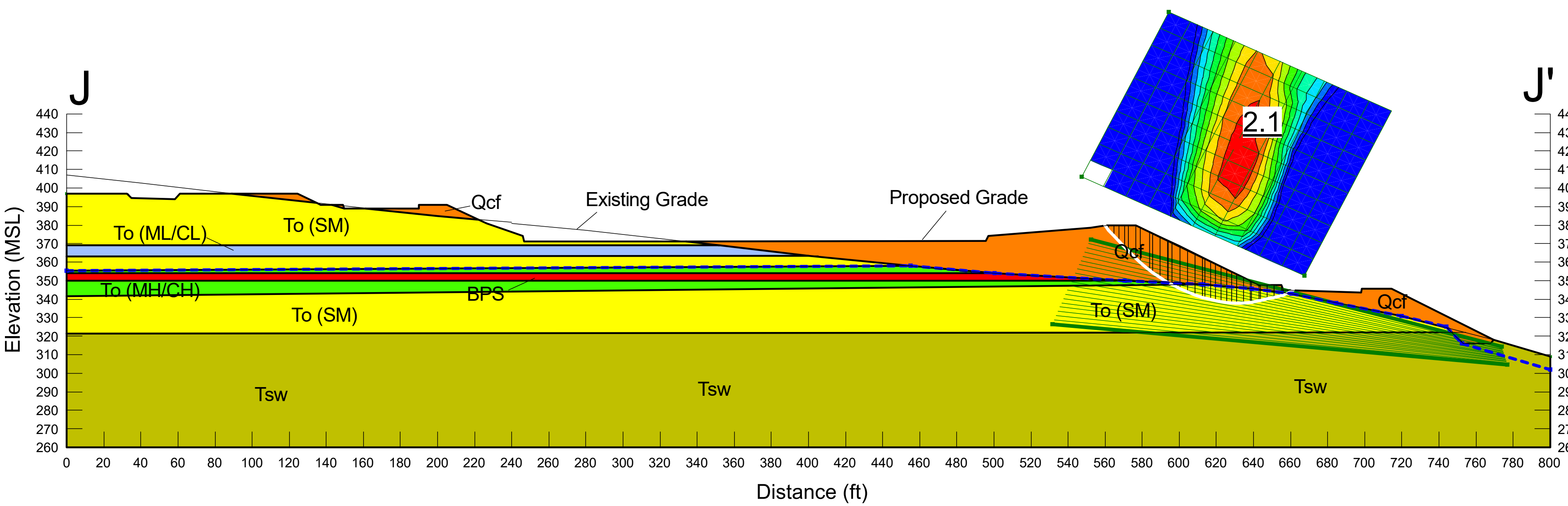

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Figure C-26

Sunbow II, Phase 3
Project No. G2452-32-02
Section K-K'
Name: KK-Case0.gsz
Date: 04/08/2020 Time: 03:01:16 PM

Proposed Condition

Block Analysis Thru BPS

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (SM)	130	300	30
	Sweetwater Formation (SM)	130	500	36

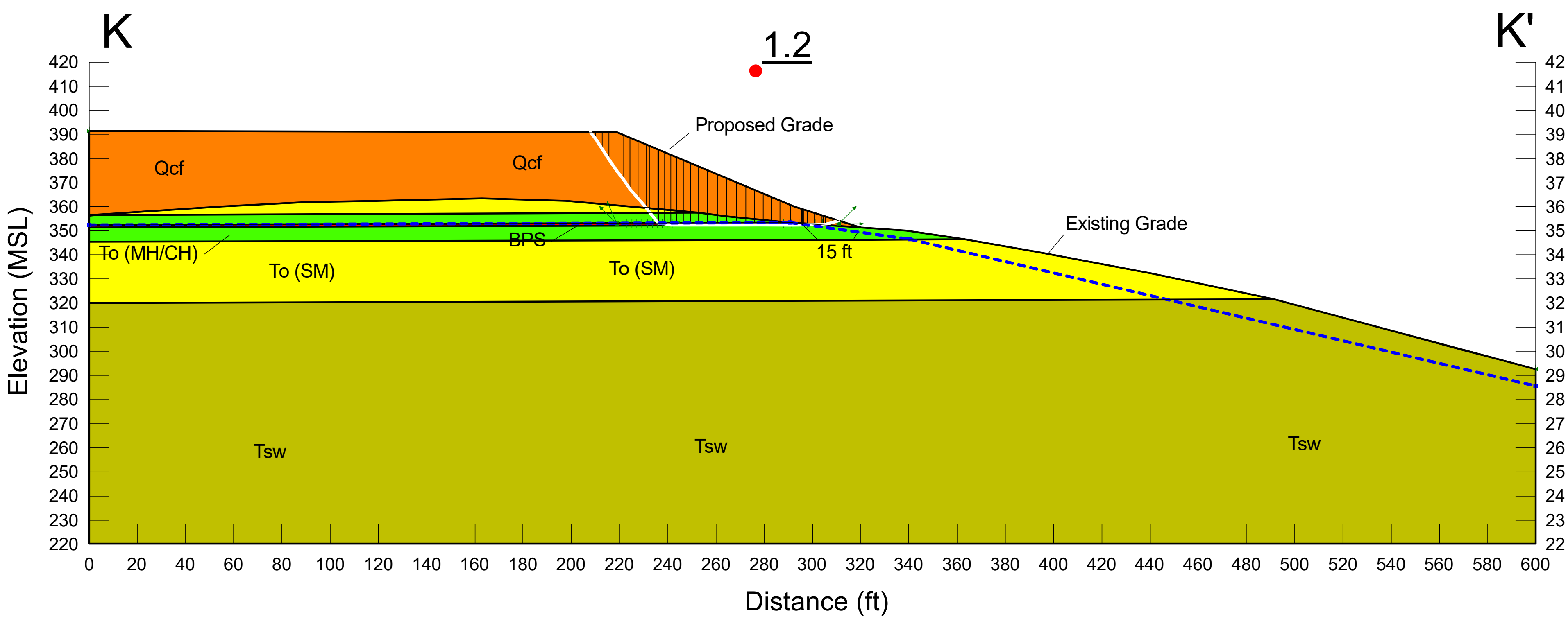

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Figure C-27

Sunbow II, Phase 3
Project No. G2452-32-02
Section K-K'
Name: KK-Case1.gsz
Date: 04/08/2020 Time: 02:41:31 PM

Proposed Condition with Shear Key

Block Analysis Thru BPS

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Red	Bedding Plane Shear (BPS)	120	0	7
Orange	Compacted Fill (Qcf)	120	300	29
Green	Otay Formation (MH/CH)	120	500	22
Yellow	Otay Formation (SM)	130	300	30
Olive	Sweetwater Formation (SM)	130	500	36

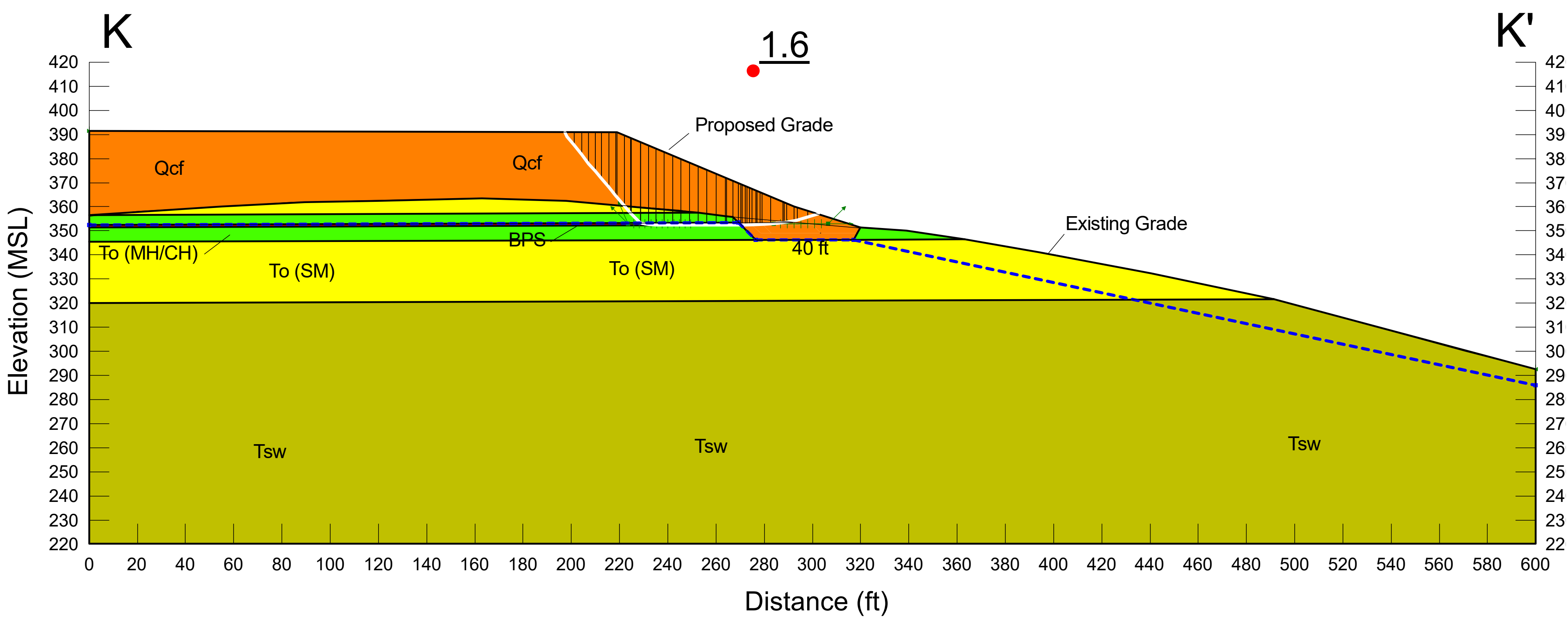

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Figure C-28

Sunbow II, Phase 3
Project No. G2452-32-02
Section K-K'
Name: KK-Case2.gsz
Date: 04/08/2020 Time: 02:47:44 PM

Proposed Condition with Shear Key

Circular Analysis

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedding Plane Shear (BPS)	120	0	7
	Compacted Fill (Qcf)	120	300	29
	Otay Formation (MH/CH)	120	500	22
	Otay Formation (SM)	130	300	30
	Sweetwater Formation (SM)	130	500	36

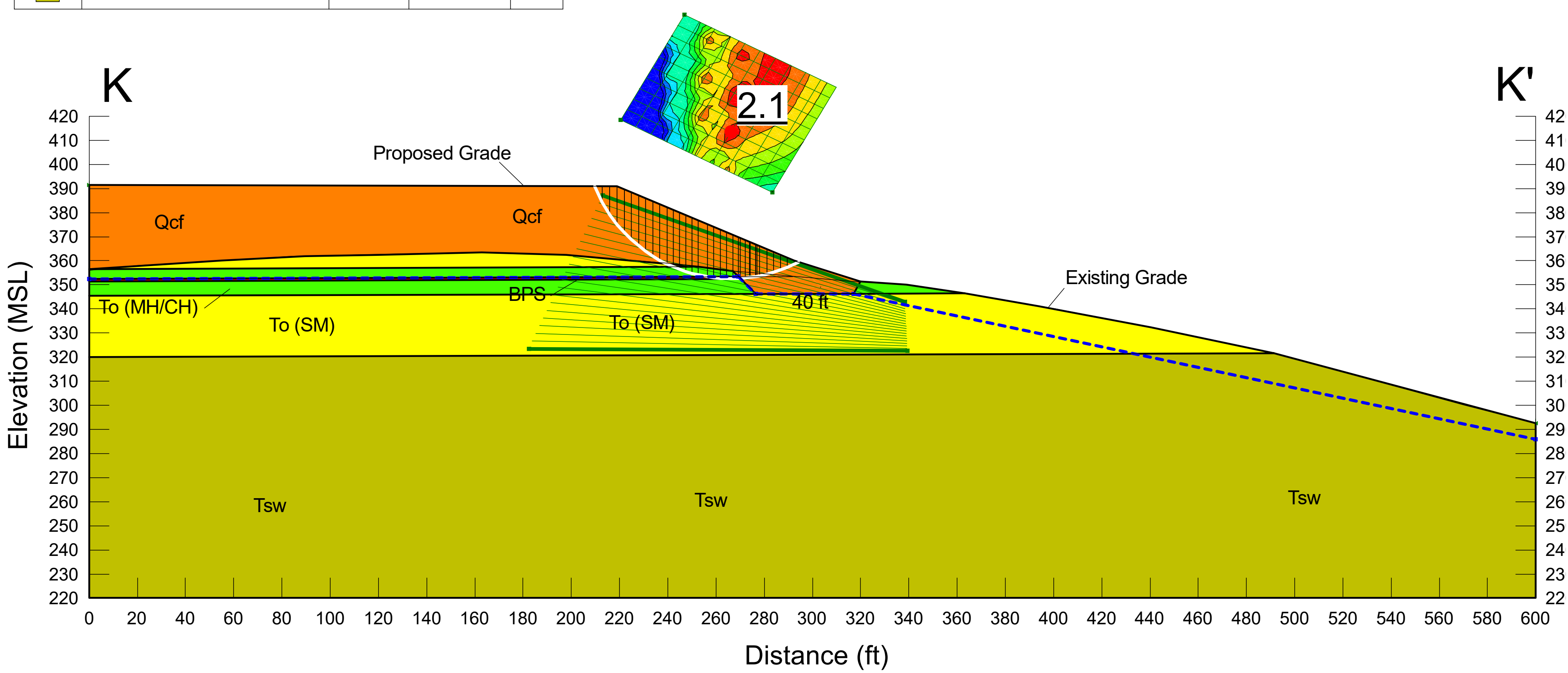

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Figure C-29

APPENDIX D

APPENDIX D

STORM WATER MANAGEMENT I-8A (WORKSHEET C.4-1) FORMS

FOR

SUNBOW II
PHASE 3
CHULA VISTA, CALIFORNIA

PROJECT NO. G2452-32-02

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)
Part 1 - Full Infiltration Feasibility Screening Criteria		
DMA(s) Being Analyzed:		**Project Phase:**
Criteria 1: Infiltration Rate Screening		
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[2]? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ☐ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ☐ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ☐ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).	
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ☐ Yes; Continue to Step 1C. ☐ No; Skip to Step 1D.	
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ☐ No; full infiltration is not required. Answer "No" to Criteria 1 Result.	
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ☐ Yes; continue to Step 1E. ☐ No; select an appropriate infiltration testing method.	
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ☐ Yes; continue to Step 1F. ☐ No; conduct appropriate number of tests.	

[1] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.
[2] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ☐ Yes; continue to Step 1G. ☐ No; select appropriate factor of safety.	
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ☐ Yes; answer "Yes" to Criteria 1 Result. ☐ No; answer "No" to Criteria 1 Result.	
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ☐ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ☐ No; full infiltration is not required. Skip to Part 1 Result.	
Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report.		
Criteria 2: Geologic/Geotechnical Screening		
2A	**If all questions in Step 2A are answered "Yes," continue to Step 2B.** For any "No" answer in Step 2A answer "No" to Criteria 2 and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.	

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	☐ Yes	☐ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	☐ Yes	☐ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No
Summarize findings and basis; provide references to related reports or exhibits.			

Part 1 Result – Full Infiltration Geotechnical Screening [3]	**Result**
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	☐ **Full infiltration Condition** ☐ **Complete Part 2**

[3] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria		
DMA(s) Being Analyzed:		**Project Phase:**
Criteria 3 : Infiltration Rate Screening		
3A	**NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data? ☐ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☐ Yes; the site is mapped as D soils or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☐ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.	
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ☐ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result. ☐ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result.	
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ☐ Yes; Continue to Criteria 4. ☐ No: Skip to Part 2 Result.	
Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).		

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	☐ Yes	☐ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	☐ Yes	☐ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Summarize findings and basis; provide references to related reports or exhibits.	
Part 2 – Partial Infiltration Geotechnical Screening Result[4]	**Result**
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	☐ **Partial Infiltration Condition** ☐ **No Infiltration Condition**

[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

San Diego County Area, California

Sunbow II, Phase 3 Western Basin

February 14, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

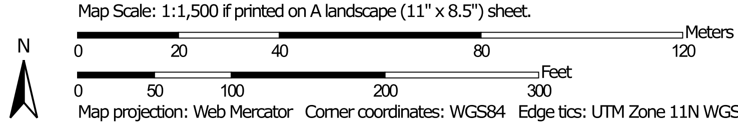
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:1,500 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DaF	Diablo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	2.0	77.7%
LsE	Linne clay loam, 9 to 30 percent slopes	0.6	22.3%
Totals for Area of Interest		**2.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

DaF—Diablo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20

Map Unit Setting

National map unit symbol: 2w638
Elevation: 20 to 2,530 feet
Mean annual precipitation: 1 to 30 inches
Mean annual air temperature: 60 to 65 degrees F
Frost-free period: 290 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Diablo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Diablo

Setting

Landform: Hillslopes, mountain slopes
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Residuum weathered from calcareous shale

Typical profile

A - 0 to 15 inches: clay
Bkss1 - 15 to 28 inches: clay
Bkss2 - 28 to 40 inches: clay loam
Cr - 40 to 79 inches: bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 39 to 79 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Altamont

Percent of map unit: 7 percent
Landform: Hillslopes
Down-slope shape: Convex

Across-slope shape: Convex
Hydric soil rating: No

Gazos

Percent of map unit: 2 percent
Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Linne

Percent of map unit: 2 percent
Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

San benito

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Ecological site: Fine Loamy 9-13 (R015XE020CA)
Hydric soil rating: No

Oliventain

Percent of map unit: 2 percent
Landform: Terraces
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

LsE—Linne clay loam, 9 to 30 percent slopes

Map Unit Setting

National map unit symbol: hbdt
Elevation: 100 to 2,000 feet
Mean annual precipitation: 12 to 20 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 200 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition

Linne and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Linne

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from calcareous sandstone and shale

Typical profile

H1 - 0 to 15 inches: clay loam
H2 - 15 to 37 inches: clay loam, loam
H2 - 15 to 37 inches: weathered bedrock
H3 - 37 to 41 inches:

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Diablo

Percent of map unit: 5 percent
Hydric soil rating: No

Huerhuero

Percent of map unit: 5 percent
Hydric soil rating: No

Altamont

Percent of map unit: 5 percent
Hydric soil rating: No

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Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Part 1 - Full Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	**Project Phase:**
Criteria 1: Infiltration Rate Screening	

1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[2]? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ☐ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ☐ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ☐ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ☐ Yes; Continue to Step 1C. ☐ No; Skip to Step 1D.
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ☐ No; full infiltration is not required. Answer "No" to Criteria 1 Result.
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ☐ Yes; continue to Step 1E. ☐ No; select an appropriate infiltration testing method.
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ☐ Yes; continue to Step 1F. ☐ No; conduct appropriate number of tests.

[1] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.
[2] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)
1F	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ☐ Yes; continue to Step 1G. ☐ No; select appropriate factor of safety.	
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ☐ Yes; answer "Yes" to Criteria 1 Result. ☐ No; answer "No" to Criteria 1 Result.	
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ☐ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ☐ No; full infiltration is not required. Skip to Part 1 Result.	
Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report.		
Criteria 2: Geologic/Geotechnical Screening		
2A	**If all questions in Step 2A are answered "Yes," continue to Step 2B.** For any "No" answer in Step 2A answer "No" to Criteria 2 and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.	

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	☐ Yes	☐ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	☐ Yes	☐ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No
Summarize findings and basis; provide references to related reports or exhibits.			

Part 1 Result – Full Infiltration Geotechnical Screening [3]	**Result**
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	☐ **Full infiltration Condition** ☐ **Complete Part 2**

[3] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Project Name: ____

<table>
<tr><td colspan="2">Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions</td><td>Form I-8A[1]
(Worksheet C.4-1)</td></tr>
<tr><td colspan="3">Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria</td></tr>
<tr><td colspan="2">DMA(s) Being Analyzed:</td><td>Project Phase:</td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td colspan="3">Criteria 3 : Infiltration Rate Screening</td></tr>
<tr><td>3A</td><td colspan="2">NRCS Type C, D, or “urban/unclassified”: Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or “urban/unclassified” and corroborated by available site soil data?
☐ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer “Yes” to Criteria 3 Result.
☐ Yes; the site is mapped as D soils or “urban/unclassified” and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer “Yes” to Criteria 3 Result.
☐ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.</td></tr>
<tr><td>3B</td><td colspan="2">Infiltration Testing Result: Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr?
☐ Yes; the site may support partial infiltration. Answer “Yes” to Criteria 3 Result.
☐ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer “No” to Criteria 3 Result.</td></tr>
<tr><td>Criteria 3 Result</td><td colspan="2">Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP?
☐ Yes; Continue to Criteria 4.
☐ No: Skip to Part 2 Result.</td></tr>
<tr><td colspan="3">Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).</td></tr>
</table>

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	☐ Yes	☐ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	☐ Yes	☐ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Summarize findings and basis; provide references to related reports or exhibits.	
Part 2 – Partial Infiltration Geotechnical Screening Result[4]	**Result**
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	☐ **Partial Infiltration Condition** ☐ **No Infiltration Condition**

[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
San Diego County Area, California

Sunbow II, Phase 3 Eastern Basin

February 14, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:3,000 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 40, 80, 160, 240

Feet: 0, 100, 200, 400, 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DaE	Diablo clay, 15 to 30 percent slopes	4.1	100.0%
Totals for Area of Interest		**4.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

DaE—Diablo clay, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: hbbb
Elevation: 200 to 3,250 feet
Mean annual precipitation: 9 to 25 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 310 days
Farmland classification: Not prime farmland

Map Unit Composition

Diablo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Diablo

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous sandstone and shale

Typical profile

H1 - 0 to 15 inches: clay
H2 - 15 to 32 inches: clay, silty clay loam
H2 - 15 to 32 inches: weathered bedrock
H3 - 32 to 36 inches:

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 24 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Altamont

Percent of map unit: 10 percent
Hydric soil rating: No

Linne

Percent of map unit: 3 percent
Hydric soil rating: No

Oliventain

Percent of map unit: 2 percent
Hydric soil rating: No

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APPENDIX E

APPENDIX E

PREVIOUSLY REPORTED TRENCH AND BORING LOGS
PREPARED BY GEOCON INCORPORATED

FOR

SUNBOW II
PHASE 3
CHULA VISTA, CALIFORNIA

PROJECT NO. G2452-32-02

File No. D-3763-M01
September 22, 1986

BORING 2
ELEVATION 450 DATE DRILLED 8/19/86
EQUIPMENT

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
0					TOPSOIL Soft, moist, dark brown, Silty CLAY scattered Lindavista cobbles, near contact			
2								
4					SAN DIEGO FORMATION Medium dense, moist, light brown, very silty very fine SANDSTONE; laminated, micaceous			
6								
8					--becomes yellow-orange-brown; mottled			
10								
12								
14								
					-- becomes yellowish-gray; mottled			
16								
18					-- pebble layer			
20					OTAY FORMATION Hard, moist, greenish gray, very Silty CLAYSTONE; weathered Otay			
22	B2-1					9	119.0	12.2
24								
26					Dense, moist, tan - lt. brown, medium silty fine to medium SANDSTONE			
28								
30								

Figure A-3 Log of Test Boring 2

Continued next page

SAMPLE SYMBOLS
☐ — SAMPLING UNSUCCESSFUL
☒ — DISTURBED OR BAG SAMPLE
STANDARD PENETRATION TEST
CHUNK SAMPLE
DRIVE SAMPLE (UNDISTURBED)
WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3763-M01
September 22, 1986

BORING 2 CONTINUED

ELEVATION ________ DATE DRILLED ________

EQUIPMENT ________

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
32					OTAY FORMATION			
34					Hard, moist, medium to light, greenish-gray, very silty CLAYSTONE			
36								
38					Dense, moist, very light tan - gray, medium silty fine to medium SANDSTONE			
40								
42	B2-2					9*	113.5	14.7
44	B2-3				OTAY FORMATION BENTONITE Hard, moist, waxy, light gray/pink, silty CLAYSTONE		109.8	18.7
46					Dense, moist, light tan-green-gray mottled Clayey SANDSTONE			
48					Hard, moist, light greensih gray very Silty CLAYSTONE			
50								
51					BORING TERMINATED AT 51.0 FEET			

* Minus one Kelley Weight

Figure A-4 Log of Test Boring 2

SAMPLE SYMBOLS			
	☐ — SAMPLING UNSUCCESSFUL	— STANDARD PENETRATION TEST	— DRIVE SAMPLE (UNDISTURBED)
	☒ — DISTURBED OR BAG SAMPLE	— CHUNK SAMPLE	— WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3763-M01
September 22, 1986

BORING 3

ELEVATION 362 DATE DRILLED 8/19/86

EQUIPMENT

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
0								
2					COLLUVIUM Soft, moist, dark grayish brown with white mottling, very silty CLAY			
4					OTAY FORMATION Dense, moist, light greenish gray - light gray, very silty fine SANDSTONE			
6								
8								
	B3-1					6		
10	B3-2						BULK SAMPLE	
12								
14					Hard, moist, medium greenish gray, silty-sandy CLAYSTONE			
16								
18					Dense, moist, light green-gray-white Silty SANDSTONE			
20								
22					Hard, moist, medium greenish gray very Silty CLAYSTONE			
24					Dense, moist, very light greenish gray-white silty SANDSTONE			
26								
28					clay stringer			
30								

Figure A-5 Log of Test Boring 3

Continued next page

SAMPLE SYMBOLS

- SAMPLING UNSUCCESSFUL
- DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3763-M01
September 22 , 1986

BORING 3 CONTINUED

ELEVATION ________ DATE DRILLED ________

EQUIPMENT ________

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
32								
34					contact horizontal, or less than 3°			
36					SWEETWATER FORMATION Dense, moist, yellowish brown, very clayey-silty fine to coarse SANDSTONE			
38					angular chert/metavolcanic fragments			
40								
42								
	B3-3						BULK	SAMPLE
44	B3-4					21	102.2	21.8
46					BORINGS TERMINATED AT 45.0 FEET			

Figure A-6 Log of Test Boring 3

SAMPLE SYMBOLS
- ☐ — SAMPLING UNSUCCESSFUL
- ☒ — DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3763-M01
September 22, 1986

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 6 ELEVATION ~~342~~ 339 DATE DRILLED 8/20/86 EQUIPMENT	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
0	B6-1				TOPSOIL Hard, slighly moist, dark brownish gray Sandy CLAY with much carbonate			
2	B6-2				—becomes brown	push		
4					OTAY FORMATION Dense, slightly moist, grey-white, silty medium to fine SANDSTONE			
6	B6-3					4		
8					— carbonate in subhorizontal layers -N20W 10N general strike and dip			
10	B6-4				— becomes fine to coarse	5		
12								
14								
16					— 6" thick cemented layer with gravel continuous — N53E7N: contact			
18					SWEETWATER Dense, slightly moist to moist, light brown silty fine to coarse SANDSTONE, moderately to strongly cemented			
20	B6-5					14		
22								
24					— strongly cemented			
26								
28					— strongly cemented and with gravel			
30								

Figure A-11 Log of Test Boring 6

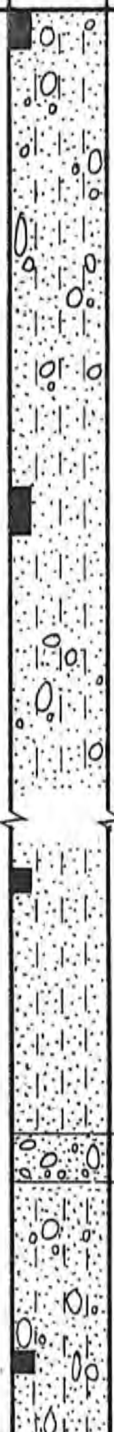
Continued next page

SAMPLE SYMBOLS			
	☐ — SAMPLING UNSUCCESSFUL	STANDARD PENETRATION TEST	DRIVE SAMPLE (UNDISTURBED)
	☒ — DISTURBED OR BAG SAMPLE	CHUNK SAMPLE	WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

File No. D-3763-M01
September 22, 1986

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (U.S.C.S.)	BORING 6 CONTINUED ELEVATION ____ DATE DRILLED ____ EQUIPMENT ____	PENETRATION RESISTANCE BLOWS/FT.	DRY DENSITY P.C.F.	MOISTURE CONTENT, %
					MATERIAL DESCRIPTION			
30	B6-6					12/ 7"		
32								
34					strongly cemented with quartzite GRAVEL			
36								
38					very strongly cemented with GRAVEL			
40	B6-7					20/ 11"		
42								
44					very strongly cemented with GRAVEL			
46					lightly cemented			
50	B6-8					35/ 6"		
52								
54								
56					Dense, slightly moist, tan, sandy GRAVEL strongly cemented			
58					Dense, slightly moist, tan, silty fine to coarse SANDSTONE, moderately cemented with much quartzite gravel			
60	B6-9					25/ 6"		
62								



BORING TERMINATED AT 62.0 FEET

Figure A-12 Log of Test Boring 6

SAMPLE SYMBOLS
- ☐ — SAMPLING UNSUCCESSFUL
- ☒ — DISTURBED OR BAG SAMPLE
- STANDARD PENETRATION TEST
- CHUNK SAMPLE
- DRIVE SAMPLE (UNDISTURBED)
- WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. V 1 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD)

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, dry, brownish-red, Silty fine SAND (SM)		
2						
3				**SAN DIEGO FORMATION** Medium dense, moist, tan to light brown, Silty, very fine SANDSTONE (SM)		
4						
5						0
6						
7				Medium dense, moist, brownish-yellow, fine SANDSTONE (SP)		
8						
9				Medium dense to dense, moist, grayish-green, Silty, fine SANDSTONE (SM)		
10						
11				Pebble to cobble layer at 10 to 12 feet		
12						
13				**OTAY FORMATION** Hard, moist, greenish-gray, very Silty CLAYSTONE (CL)		
14						0
15				Hard moist, greenish-brown, Silty fine SANDSTONE (SM)		
16						
17						
18						
19						
20						
21						
22						2
23						
24						

Figure B-1, Log of Boring V 1 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 436 ± 2 FT.	QUANTITY OF FILTER MATERIAL: 12 SACKS
DIAMETER & TYPE OF CASING: 2 IN. SCH 40 PVC	WELL SEAL & INTERVAL: CEMENT 0-5 FT.
CASING INTERVAL: 0-6, 36-41 FT.	WELL SEAL QUANTITY:
WELL SCREEN: 2 IN. PVC, 0.020 IN.	ANNULUS SEAL/INTERVAL: GRANULAR BENTONITE
SCREEN INTERVAL: 6-36 FT.	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 42 FT.
FILTERPACK/INTERVAL: CRYSTAL SILICA #16	ENGINEER/GEOLOGIST: PETER STANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. V 1 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
26				**OTAY FORMATION** (CONTINUED) Hard moist, greenish-brown, Silty fine <u>SANDSTONE</u> (SM)		
27						
28				Dense, moist, grayish-green, Silty, Sandy <u>CLAYSTONE</u> (CL)		
29						
30						
31						2
32				Dense, moist, greenish-gray, Clayey fine <u>SANDSTONE</u> (SC)		
33						
34						
35				Hard, moist, tan to white, somewhat cemented, silty, medium <u>SANDSTONE</u> (SM)		
36						2
37						
38				Hard, moist, tan to pinkish-gray Sandy <u>CLAYSTONE</u> (CL)		
39						
40						
41						8
42						
43				BORING TERMINATED AT 43 FEET		
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						

Figure B-2, Log of Boring V 1 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. V 2 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, damp reddish-brown, Silty fine SAND (SM)		
2						
3				**SAN DIEGO FORMATION** Medium dense, damp, brownish-red, Silty fine to medium SANDSTONE (SM)		
4						
5				Pebble and cobble (1 inch to 4 inch) layer at 5 to 7 feet		
6						
7				**OTAY FORMATION** Hard, moist yellowish-green, Silty, Sandy CLAYSTONE (CL)		
8						
9						0
10				Hard, moist, greenish-yellow, slightly sandy, very Silty CLAYSTONE (CL)		
11						
12						
13				Dense, moist, grayish-green, Clayey, fine SANDSTONE (SC)		
14						
15						
16						
17						
18						
19						0
20						
21						
22						
23						
24						

Figure B-1, Log of Boring V 2 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 435 ± 2 FT.	QUANTITY OF FILTER MATERIAL: 12 SACKS
DIAMETER & TYPE OF CASING: 2 IN.SCH. 40 PVC	WELL SEAL & INTERVAL: CEMENT 0-46 FT.
CASING INTERVAL: 0-49, 79-84 FT.	WELL SEAL QUANTITY:
WELL SCREEN: 2 IN. PVC	ANNULUS SEAL/INTERVAL:
SCREEN INTERVAL: 49-79 FT.	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 84 FT.
FILTERPACK/INTERVAL: CRYSTAL SIL.#16 47-80FT	ENGINEER/GEOLOGIST: PETER STANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. V 2 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
26				**OTAY FORMATION** (CONTINUED) Hard, moist, tan to pinkish-gray, Sandy CLAYSTONE (CL)		
27						
28						
29				Hard, moist, grayish-green, Silty CLAYSTONE (CL)		1
30						
31						
32				Hard, moist, grayish-green, very Clayey fine SANDSTONE (SC)		0
33						
34						
35						
36						
37						
38						
39						0
40						
41						
42				Hard, moist, brownish-green, Sandy, very Silty CLAYSTONE (CL)		
43						
44						
45						
46						
47						
48						
49						
50						
51						2
52				Hard, moist, greenish-brown, Silty CLAYSTONE (CL)		
53						
54						

Figure B-2, Log of Boring V 2 /WELL

Continued Next Page

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. V 2 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
56				**OTAY FORMATION** (CONTINUED) Hard, moist, light tan, cemented, fine to medium SANDSTONE (SW)		
57						
58				Dense, moist, brownish-green, Sandy SILTSTONE (ML)		
59						2
60				Hard, moist, light tan, cemented, fine to medium SANDSTONE (SW)		
61						
62				Hard, damp, brown to red-brown, Sandy CLAYSTONE (CL)		
63						
64						
65						
66						
67						
68						
69						5
70						
71						
72						
73						
74						5
75						
76						
77				Hard, moist, white Silty fine to medium SANDSTONE (SM)		6
78						
79						
80				Hard, moist, reddish-brown, Sandy CLAYSTONE (CL)		
81						
82						7
83						
84						

Figure B-3, Log of Boring V 2 /WELL

Continued Next Page

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	BORING/WELL NO. V 2 /WELL DATE DRILLED 12/19/89 WATER LEVEL (ATD) EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC. SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
86				**OTAY FORMATION (CONTINUED)** Hard, moist, reddish-brown Sandy CLAYSTONE (CL)		7
87						
88				BORING TERMINATED AT 87 FEET		
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						

Figure B-4, Log of Boring V 2 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. V 3 /WELL

DATE DRILLED 12/20/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, damp, reddish-brown, Silty fine SAND (SM)		
2						
3				**SAN DIEGO FORMATION** Dense, damp, brownish-yellowish, Silty fine SANDSTONE (SM)		
4						
5						
6						
7						
8						
9						
10				Becomes yellow-orange at 10 feet		0
11						
12				**OTAY FORMATION** Dense, damp, medium greenish-gray, Silty-Sandy CLAYSTONE (CL)		
13						
14						
15						
16						
17				Dense, damp, tan to light brown, Silty, fine to medium SANDSTONE (SM)		
18						
19						
20						0
21						
22				Hard, damp, dark brown CLAYSTONE (CH)		
23						
24				Dense, damp, light brown SANDSTONE		

Figure B-1, Log of Boring V 3 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 438 ± 2 FT.	QUANTITY OF FILTER MATERIAL: 12 SACKS
DIAMETER & TYPE OF CASING: 2IN. SCH 40 PVC	WELL SEAL & INTERVAL: CEMENT 0-39 FT.
CASING INTERVAL: 0-41, 72-78 FT.	WELL SEAL QUANTITY:
WELL SCREEN: 2 IN. PVC	ANNULUS SEAL/INTERVAL:
SCREEN INTERVAL: 41-72 FT.	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 72 FT.
FILTERPACK/INTERVAL: CRYSTAL SILICA #16	ENGINEER/GEOLOGIST: PETER STANG

FILE NO. D-8080-602

BORING/WELL NO. V 3 /WELL

DATE DRILLED 12/20/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
				(SP)		
26				**OTAY FORMATION** (CONTINUED)		
				Dense, damp, light brown SANDSTONE (SP)		
27						
28				Hard, damp, greenish-gray, very Silty CLAYSTONE (CL)		
29						
30						0
31						
32						
33				Hard, moist, brownish-red bentonitic CLAYSTONE (CH)		
34						
35				Hard, damp, greenish-gray, Silty CLAYSTONE (CL)		
36						
37				Dense, damp, light brown to gray, Silty, fine to medium SANDSTONE (SM)		
38						
39						
40						0
41						
42				Hard, moist, light grayish-pink, Silty CLAYSTONE (CL)		
43						
44						
45						
46						
47				Dense, damp, light tan to greenish-gray Clayey SANDSTONE (SC)		
48						
49						
50						0
51				Very dense, damp, greenish-gray, Silty CLAYSTONE (CL)		
52						
53						
54						

Figure B-2, Log of Boring V 3 /WELL

Continued Next Page

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. V 3 /WELL

DATE DRILLED 12/20/89 WATER LEVEL (ATD)

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
56				**OTAY FORMATION** (CONTINUED) Very dense, damp greenish-gray Silty CLAYSTONE (CL)		
57						
58						
59						0
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						0
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82				BORING TERMINATED AT 82 FEET		
83						
84						

Figure B-3, Log of Boring V 3 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 1 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, dry, reddish orange, Silty fine SAND (SM)		0
2						
3				**SAN DIEGO FORMATION** Medium dense, moist, yellowish gray Silty fine SANDSTONE (SM)		
4–10						
11				**OTAY FORMATION** Hard, moist, brown to greenish gray, very Silty SANDSTONE (SM)		0
12–15						
16				Hard, moist, brown, Silty, fine to medium SANDSTONE (SM)		0
17–20						
21				Very hard, dry, gray, very silty cemented SANDSTONE (SM)		0
22						
23				Hard, moist, brown, silty, fine to medium SANDSTONE (SM)		
24						

Figure B-1, Log of Boring G 1 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 438 ± 2 FT.	QUANTITY OF FILTER MATERIAL:
DIAMETER & TYPE OF CASING: 1/4" POLYPROPYLENE	WELL SEAL & INTERVAL: CEMENT
CASING INTERVAL:	WELL SEAL QUANTITY:
WELL SCREEN: 1"x3'& 1"x5' GAS PROBES	ANNULUS SEAL/INTERVAL: CEMENT
SCREEN INTERVAL: 17-20, 33-36, 59-64 FT.	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 65 FT.
FILTERPACK/INTERVAL: 3/8 IN. GRAVEL	ENGINEER/GEOLOGIST: PETER STANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 1 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
26				**OTAY FORMATION** (CONTINUED) Hard, moist, brown, Silty, fine to medium SANDSTONE (SM)		
27						0
28				Hard, moist, light grayish brown, very Silty CLAYSTONE (CL)		
29						
30						
31						
32						
33						
34						
35				Hard, moist, gray, Silty fine to medium SANDSTONE (SM)		
36						
37						0
38				Hard, moist, grayish brown Silty CLAYSTONE (CL)		
39						
40						
41						
42						
43						
44						
45						
46						0
47						
48						
49						0
50						
51				**OTAY FORMATION** Hard, moist, light greenish gray Silty CLAYSTONE (CL)		
52						
53						
54						

Figure B-2, Log of Boring G 1 /WELL

Continued Next Page

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 1 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
56				**OTAY FORMATION** (CONTINUED)		
				Hard, moist, light greenish gray		
57				Silty CLAYSTONE (CL)		
58						
59						
60						
61						0
62				Becomes very silty at 62 feet		
63						
64						
65						
66						
67						
68						
69						
70						
71						0
72						
73				BORING TERMINATED AT 72 FEET		
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						

Figure B-3, Log of Boring G 1 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 2 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD)

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, dry, brownish red, Silty fine SANDSTONE (SM)		
2						
3				**SAN DIEGO FORMATION** Medium dense, moist, orange-red very Silty, fine SANDSTONE (SM)		
4						
5						0
6						
7						
8				Becomes light tan at 8 feet		
9						
10						
11						
12						
13						
14						0
15				Becomes yellowish-green silty fine sandstone at 15 feet		
16						
17						
18						
19						
20						
21				Light yellowish-green, Silty fine SANDSTONE with 1 inch to 2 inch pebbles (GM)		
22						
23						0
24				**OTAY FORMATION**		

Figure B-1, Log of Boring G 2 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 455 ± 2 FT.	QUANTITY OF FILTER MATERIAL:
DIAMETER & TYPE OF CASING: 1/4" POLYPROPYLENE	WELL SEAL & INTERVAL: CMT.(3%BENT) 0-9FT.
CASING INTERVAL:	WELL SEAL QUANTITY:
WELL SCREEN: 1'x3'& 1"x5' GAS PROBES	ANNULUS SEAL/INTERVAL: CEMENT
SCREEN INTERVAL: 11-14, 28-31, 59-64	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL COVER	WELL DEPTH: 65 FT.
FILTERPACK/INTERVAL: 3/8 IN. GRAVEL	ENGINEER/GEOLOGIST: PETER STANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 2 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
26				**OTAY FORMATION** (CONTINUED) Hard, damp, greenish-gray, Silty-Sandy CLAYSTONE (CL)		
27						
28				Dense, damp, grayish-green Silty, fine to medium SANDSTONE (SM)		
29						
30						
31						
32						
33						
34						0
35						
36				Becomes silty-clayey fine sandstone at 35 to 38 feet		
37						
38						
39						
40						
41				Dense, moist, brownish-gray, Silty Sandy CLAYSTONE (CL)		
42						0
43						
44						
45						
46						
47						
48						
49						
50						
51				**OTAY FORMATION** Hard, damp, light gray to tan somewhat cemented, fine to medium SANDSTONE (SM)		
52						
53						
54						

Figure B-2, Log of Boring G 2 /WELL

Continued Next Page

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 2 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

<table>
<tr><th>DEPTH IN FEET</th><th>PENETRAT. RESIST. BLWS/FT.</th><th>SAMPLE NO.</th><th>LITHOLOGY</th><th>SOIL DESCRIPTION</th><th>WELL CONSTRUCTION</th><th>FID HEADSPACE (PPM)</th></tr>
<tr><td>56–57</td><td></td><td></td><td></td><td>OTAY FORMATION (CONTINUED)
Hard, moist, waxy, reddish-pink Silty <u>SANDSTONE</u> (SM)</td><td></td><td>2</td></tr>
<tr><td>58–65</td><td></td><td></td><td></td><td>Dense, moist, gray-brown, Sandy <u>SILTSTONE</u> (ML)</td><td></td><td>2</td></tr>
<tr><td>66–70</td><td></td><td></td><td></td><td>Dense, moist, brown to grayish brown, Sandy, Silty <u>CLAYSTONE</u> (CL)</td><td></td><td>1</td></tr>
<tr><td>71–84</td><td></td><td></td><td></td><td>BORING TERMINATED AT 70 FEET</td><td></td><td></td></tr>
</table>

Figure B-3, Log of Boring G 2 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 3 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, damp, light brown, Silty SAND with trace gravel (GC)		
2						
3				**SAN DIEGO FORMATION** Medium dense, damp, olive brown Clayey SILTSTONE (CL)		
4						
5						
6						
7						
8						
9						
10						
11						0
12				Becomes olive-gray at 12 feet		
13						
14						
15						
16						
17						
18				**OTAY FORMATION** Hard, moist, yellowish tan very Silty CLAYSTONE (CL)		
19						
20						
21						
22						0
23				Dense, moist, tan to light brown Silty, fine to medium SANDSTONE (SM)		
24						

Figure B-1, Log of Boring G 3 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 436 ± 2 FT.	QUANTITY OF FILTER MATERIAL:
DIAMETER & TYPE OF CASING: 1/4" POLYPROPYLENE	WELL SEAL & INTERVAL: CEMENT
CASING INTERVAL:	WELL SEAL QUANTITY:
WELL SCREEN: 1"x3'& 1"x5' GAS PROBES	ANNULUS SEAL/INTERVAL: CEMENT
SCREEN INTERVAL: 12-15, 36-39, 64-69	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 70 FT.
FILTERPACK/INTERVAL: 3/8 IN. GRAVEL	ENGINEER/GEOLOGIST: PETER STANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 3 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
26						
27				**OTAY FORMATION** (CONTINUED) Dense, moist, tan to light brown Silty, fine to medium SANDSTONE (SM)		
28						
29						
30				Hard, moist, olive brown, very Silty CLAYSTONE (CL)		
31						
32						
33						
34						
35						
36						0
37						
38				Dense, moist, tan to gray, Silty, fine to medium SANDSTONE (SM)		
39						
40						
41						
42						
43						
44						
45						
46						0
47						
48						
49						
50						
51						
52						
53						
54						

Figure B-2, Log of Boring G 3 /WELL

Continued Next Page

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 3 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ____

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
56				**OTAY FORMATION** (CONTINUED) Dense, moist, tan to gray Silty fine to medium SANDSTONE (SM) Trace clay at 57 feet		0
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67				Cemented tan to gray sandstone at 66 to 68 feet		
68						
69						
70						
71				BORING TERMINATED AT 70 FEET		
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						

Figure B-3, Log of Boring G 3 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 4 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD)

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, dry, orange red, Silty fine SAND (SM)		
2						
3				**SAN DIEGO FORMATION** Medium dense, moist, yellowish orange, Silty, fine to medium SANDSTONE (SM)		
4						
5						
6						
7						
8						
9						
10						
11						0
12						
13						
14						
15						
16				Medium dense, moist, greenish yellow, very Silty, fine SANDSTONE (SM)		
17						
18						
19						
20				Becomes grayish yellow; mottled at 20 feet		
21						0
22						
23						
24						

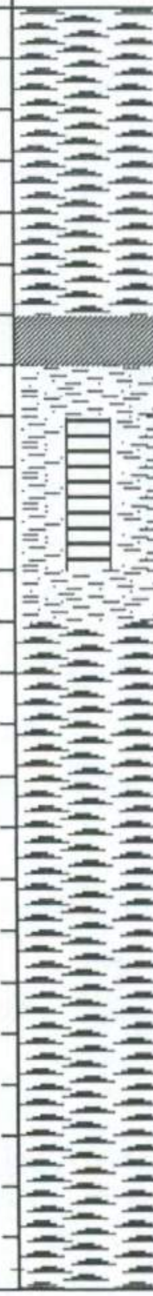


Figure B-1, Log of Boring G 4 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 460 ± 2 FT.	QUANTITY OF FILTER MATERIAL:
DIAMETER & TYPE OF CASING: 1/4" POLYPROPYLENE	WELL SEAL & INTERVAL: CEMENT
CASING INTERVAL:	WELL SEAL QUANTITY:
WELL SCREEN: 1"x3'& 1"x5' GAS PROBES	ANNULUS SEAL/INTERVAL: CEMENT
SCREEN INTERVAL: 8-11, 34-47, 64-69	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 70 FT.
FILTERPACK/INTERVAL: 3/8 IN. GRAVEL	ENGINEER/GEOLOGIST: PETER STANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 4 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
26				**SAN DIEGO FORMATION** (CONTINUED) Dense, moist, brownish red, Silty,		
27				fine to medium SANDSTONE (SM)		
28				Pebble layer at 28 to 29 feet		
29						
30						
31				**OTAY FORMATION** Hard, moist, greenish-gray, Silty		0
32				CLAYSTONE (CL)		
33						
34						
35						
36						
37				Hard, moist, brownish-red, very Silty, fine SANDSTONE (ML)		
38						
39						
40						
41				Hard, moist, brownish-red, very Silty Sandy CLAYSTONE (CL)		0
42						
43						
44						
45						
46				Very hard, moist, gray to tan cemented, fine to medium SANDSTONE		
47				(SM)		
48				Hard, moist, brownish-red Sandy		
49				CLAYSTONE (CL)		
50						
51						0
52				Hard, moist, light tan, Silty, fine SANDSTONE (ML)		
53						
54				Hard, moist, dark brown, slightly silty CLAYSTONE (CL)		

Figure B-2, Log of Boring G 4 /WELL

Continued Next Page

FILE NO. D-8080-602

BORING/WELL NO. G 4 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD)

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
56				**OTAY FORMATION** (CONTINUED)		
57				Hard, damp, waxy, pink CLAYSTONE (CH)		
58						
59				Hard, moist, light tan, silty, fine to medium SANDSTONE (SM)		0
60						
61				Hard, moist, reddish-brown silty CLAYSTONE (CL)		
62						
63						
64						
65						
66						
67						
68						
69						0
70						
71				BORING TERMINATED AT 70 FEET		
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						

Figure B-3, Log of Boring G 4 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 5 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD)

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, dry, brownish-red, Silty, fine SANDSTONE (SM)		
2						
3						
4				**SAN DIEGO FORMATION** Medium dense, moist, light brown, very Silty, fine SANDSTONE (ML)		
5						0
6						
7				Medium dense, moist, yellowish-brown, fine SANDSTONE (SM)		
8						
9				Dense, moist, greenish-yellow Silty fine SANDSTONE (SM)		
10						
11				Pebble to cobble layer at 10 to 12 feet		
12						
13				**OTAY FORMATION** Hard, moist, greenish-gray, very Silty CLAYSTONE (CL)		
14						
15				Hard, moist, brownish-gray, silty, fine to medium SANDSTONE (SM)		0
16						
17						
18						
19						
20						
21						
22						
23						
24				Becomes reddish-brown at 24 feet		

Figure B-1, Log of Boring G 5 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 435 ± 2 FT.	QUANTITY OF FILTER MATERIAL:
DIAMETER & TYPE OF CASING: 1/4" POLYPROPYLENE	WELL SEAL & INTERVAL: CEMENT
CASING INTERVAL:	WELL SEAL QUANTITY:
WELL SCREEN: 1"x3'& 1"x5' GAS PROBES	ANNULUS SEAL/INTERVAL: CEMENT
SCREEN INTERVAL: 16-19, 31-36 FT.	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 37 FT.
FILTERPACK/INTERVAL: 3/8 IN. GRAVEL	ENGINEER/GEOLOGIST: PETER STANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 5 /WELL

DATE DRILLED 12/18/89 WATER LEVEL (ATD)

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
						0
26						
27				**OTAY FORMATION** (CONTINUED) Hard, moist, tan to light brown, Silty, Sandy CLAYSTONE (CL)		
28						
29						
30						
31						4
32						
33				Hard, moist, greenish-gray, Clayey fine SANDSTONE (SC)		2
34						
35				Very hard, moist, gray-green Sandy CLAYSTONE (CL)		
36						1
37						
38				BORING TERMINATED AT 37 FEET		
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						

Figure B-2, Log of Boring G 5 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 6 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, dry, brown Silty SAND (SM)		
2						
3				**SAN DIEGO FORMATION** Dense, moist, orangish-brown, very fine SANDSTONE (SW)		
4						1
5				**OTAY FORMATION** Hard, moist, greenish-gray, very Silty CLAYSTONE (CL)		
6						
7						
8				Trace gravels at 8 feet		
9				Becomes olive-brown, mottled at 9 feet		
10						
11						
12						2
13				Gravel layer at 12 to 13 feet		
14						
15						
16						
17						
18						
19						
20						
21						2
22						
23						
24						

Figure B-1, Log of Boring G 6 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 433 ± 2 FT.	QUANTITY OF FILTER MATERIAL:
DIAMETER & TYPE OF CASING: 1/4" POLYPROPYLENE	WELL SEAL & INTERVAL: CEMENT
CASING INTERVAL:	WELL SEAL QUANTITY:
WELL SCREEN: 1"x3'& 1"x5' GAS PROBES	ANNULUS SEAL/INTERVAL: CEMENT
SCREEN INTERVAL: 11-14, 27-30, 54-59 FT.	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 60 FT.
FILTERPACK/INTERVAL: 3/8 IN. GRAVEL	ENGINEER/GEOLOGIST: PETER STANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 6 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
26				**OTAY FORMATION** (CONTINUED)		
27				Hard, moist, greenish-gray very Silty SANDSTONE (SM)		
28				Gravel layer at 27 to 28 feet		
29				Dense, damp, tan to light brown, medium Silty, fine to medium SANDSTONE (SM)		
30						
31						
32						
33						
34						
35						6
36						
37						
38				Very dense, damp, dark brown, very Silty CLAYSTONE (CL)		
39						7
40						
41						
42						
43						5
44						
45						
46						7
47						
48						
49						2
50						
51						
52						
53				Very dense, moist, brownish-gray Silty CLAYSTONE (CL)		
54						

Figure B-2, Log of Boring G 6 /WELL

Continued Next Page

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 6 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
56				**OTAY FORMATION** (CONTINUED) Very dense, moist, brownish-gray Silty CLAYSTONE (CL)		15
57						
58						
59						
60						
61						
62						
63						
64						3
65						
66						
67						
68						
69						
70						8
71						
72						
73				BORING TERMINATED AT 72 FEET		
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						

Figure B-3, Log of Boring G 6 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 7 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD)

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
1				**TOPSOIL** Soft, dry, dark brown, Silty SAND (SM)		
2						
3						
4				**SAN DIEGO FORMATION** Dense, damp, yellowish-brown, fine SANDSTONE (SO)		
5						1
6				Hard, moist, greenish-yellow, Clayey SILTSTONE (ML)		
7						
8				Becomes light olive brown at 8 feet		
9						
10				Trace gravels at 10 feet		
11						
12						
13				Gravel and cobble layer at 12 to 15 feet		
14						
15						1
16				**OTAY FORMATION** Dense, damp, tan to light brown, Silty, fine to medium SANDSTONE (SM)		
17						
18						
19				Hard, damp, greenish-gray, Sandy CLAYSTONE (CL)		
20						
21						
22						
23				Hard, damp, brownish-gray Silty, fine SANDSTONE (SM)		
24						

Figure B-1, Log of Boring G 7 /WELL

Continued Next Page

RDSP2

CASING ELEVATION: 440 ± 2 FT.	QUANTITY OF FILTER MATERIAL:
DIAMETER & TYPE OF CASING: 1/4" POLYPROPYLEN	WELL SEAL & INTERVAL: CEMENT
CASING INTERVAL:	WELL SEAL QUANTITY:
WELL SCREEN: 1"x3'& 1"x5' GAS PROBES	ANNULUS SEAL/INTERVAL: CEMENT
SCREEN INTERVAL: 12-15, 31-34, 54-59 FT.	ADDITIVES: 3% BENTONITE
WELL COVER: 8 IN. STEEL CASING	WELL DEPTH: 61 FT.
FILTERPACK/INTERVAL: 3/8 IN. GRAVEL	ENGINEER/GEOLOGIST: PETER STANG

FILE NO. D-8080-602

BORING/WELL NO. G 7 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
26				**OTAY FORMATION** (CONTINUED) Hard, damp, brownish-gray, silty fine SANDSTONE (SM)		
27						
28						
29						0
30						
31						
32				Hard, damp, greenish-gray CLAYSTONE (CL)		
33						
34						
35						
36						
37						
38						
39						0
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						2
50						
51						
52						
53						
54						

Figure B-2, Log of Boring G 7 /WELL

Continued Next Page

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

FILE NO. D-8080-602

BORING/WELL NO. G 7 /WELL

DATE DRILLED 12/19/89 WATER LEVEL (ATD) ______

EQUIPMENT MOBILE B-61 DRILL RIG DRILLER F & C INC.

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	FID HEADSPACE (PPM)
56				**OTAY FORMATION** (CONTINUED) Hard, damp, greenish-gray CLAYSTONE (CL)		
57						
58						
59						
60						
61						
62						
63				BORING TERMINATED AT 63 FEET		
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						

Figure B-3, Log of Boring G 7 /WELL

RDSP2

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 1

DATE DRILLED 3/24/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
1				**OTAY FORMATION** Medium, moist, brown to yellowish-brown, Silty, very fine to fine SAND with trace clay (SM)		
2						
3						
4						
5						
6						
7						
8						
9						
10						
11				Dense, damp, light yellowish-brown, Silty, very fine Sandstone (SM)		
12						
13						
14						
15						
16						
17		9:25				
18						
19						
20						
21						
22						
23						
24				Dense, damp, Silty, fine to medium Sandstone (SM)		

Figure A-1, log of Boring MW 1

Continued Next Page

RDS1

CASING ELEVATION: 2.7 FT ABOVE GRADE	QUANTITY OF FILTER MATERIAL: 4 BAGS
DIAMETER & TYPE OF CASING: 2" SHED. 40 PVC	WELL SEAL & INTERVAL: 5'X 5' TO 6", 0-2 FT WELL
CASING INTERVAL: 2.7 FT TO 162 FT	WELL SEAL QUANTITY: 10 BAGS
WELL SCREEN: 0.02 INCH	ANNULUS SEAL/INTERVAL: BENTONITE GROUT, 8 BAGS,
SCREEN INTERVAL: -162 FT TO -177 FT	ADDITIVES: TAP WATER
WELL COVER: STAND PIPE	WELL DEPTH: 177 FT BGS
FILTERPACK/INTERVAL: LONESTAR #3, 157'-177'	ENGINEER/GEOLOGIST: DENNIS SULLIVAN

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 1

DATE DRILLED 3/24/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
		9:32				
26				Hard, damp, light brown, Sandy CLAYSTONE (CL)		
27						
28		9:34				
29						
30				Dense, damp, light yellowish-brown, fine to medium SANDSTONE (SM)		
31						
32						
33				Hard, damp, brown to olive-brown, fine Sandy CLAYSTONE (CL)		
34						
35		9:53				
36		9:59		Dense, damp, light yellowish-brown, Clayey fine SANDSTONE (SC)		
37		10:05				
38						
39						
40						
41		10:12				
42				-Becomes light grayish-brown, Silty fine to medium SANDSTONE with some clay (SM)		
43						
44						
45						
46		10:16				
47				-Becomes light yellowish-brown		
48						
49				Hard, damp, olive-brown, fine Sandy CLAYSTONE (CL)		
50						
51				Hard, damp, light yellowish to grayish-brown, Silty, fine to medium Sandy CLAYSTONE (CL)		
52						
53						
54						

Figure A-2, log of Boring MW 1

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 1

DATE DRILLED 3/24/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
56		10:30				
57		10:37				
58						
59						
60						
61						
62						
63		10:45				
64						
65						
66						
67		10:49				
68						
69						
70						
71						
72						
73						
74						
75						
76		11:00				
77		11:09				
78				Hard, damp, olive-brown to brown, fine Sandy CLAYSTONE (CL)		
79						
80						
81						
82		11:14				
83				Dense, damp, light yellowish-brown to grayish-brown, Silty, fine to medium SANDSTONE with some clay (SM)		
84						

Figure A-3, log of Boring MW 1

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 1

DATE DRILLED 3/24/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
86		11:23				
87						
88						
89						
90		11:28		Hard, damp to moist, white to light gray and pinkish-white bentonite (CL)		
91						
92						
93						
94						
95						
96		11:37				
97		12:00				
98						
99						
100				Dense, damp, light yellowish-brown, Silty to Clayey fine to medium SANDSTONE (SC/SM)		
101						
102						
103						
104						
105						
106						
107						
108						
109						
110						
111						
112		12:12				
113						
114						

Figure A-4, log of Boring MW 1

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 1

DATE DRILLED 3/24/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
116		12:17		Hard, damp, dark brown to olive-brown, CLAYSTONE (CL)		
117		12:23				
118						
119						
120						
121				Dense, light yellowish-brown, Silty, fine to coarse SANDSTONE with some gravel (SM)		
122		12:30				
123						
124						
125				Hard, damp, light yellowish-brown, fine to medium Sandy CLAYSTONE (CL)		
126						
127						
128		12:35				
129				Dense, damp, light yellowish-brown, Clayey, fine to medium SANDSTONE (SC)		
130						
131						
132		12:43		Dense, damp, Silty, fine to coarse SANDSTONE with some clay (SM)		
133						
134						
135						
136		12:50				
137		12:55				
138						
139						
140						
141						
142						
143						
144						
145						

Figure A-5, log of Boring MW 1

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 1

DATE DRILLED 3/24/94 WATER LEVEL (ATD)

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
146						
147						
148						
149						
150						
151						
152		13:12		-With gravel at 152 feet		
153						
154						
155						
156		13:21				
157	50/6"	MW1-1 15:00		Very dense, damp, light yellowish-brown to yellowish-brown, Silty to Clayey, fine to coarse SANDSTONE with gravels (SM/SC)		
158						
159						
160						
161						
162		15:07				
163						
164	62/6"	MW1-2 15:15		-Becomes moist at 164 feet		
165				-Water level = 165.43 3/28/94		
166						
167						
168						
169						
170	70/6"	MW1-3 16:40		-Becomes wet (TD=170 feet on 3/24/94)		
171						
172				-Resume drilling (9:15 A.M. on 3/25/94)		
173						
174						
175						

Figure A-6, log of Boring MW 1

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	BORING/WELL NO. MW 1 DATE DRILLED 3/24/94 WATER LEVEL (ATD) EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY	WELL CONSTRUCTION	HEADSPACE (PPM)
				SOIL DESCRIPTION		
176						
177						
178				TERMINATED AT 177 FEET AT 10:00 A.M. Water level: 3/28/94, 8:45 A.M.=167.34 feet T.O.C 3/29/94, 9:33 A.M.=167.38 feet T.O.C.		
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						

Figure A-7, log of Boring MW 1

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD)

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
0		9:48		**OTAY FORMATION** Medium, moist, brown to yellowish-brown, Silty, very fine to fine SAND with trace clay (SM)		
10				Dense, damp, light yellowish-brown, Silty, very fine SANDSTONE (SM)		
17		10:15				
24				Dense, damp, Silty, fine to medium SANDSTONE (SM)		

Figure A-8, log of Boring MW 2

Continued Next Page

RDS1

CASING ELEVATION: 2.7 FT ABOVE GRADE	QUANTITY OF FILTER MATERIAL: 30 BAGS
DIAMETER & TYPE OF CASING: 2" SHED. 40 PVC	WELL SEAL & INTERVAL: 5'X 5' TO 6", 0-2 FT WELL
CASING INTERVAL: 2.7 FT TO 265 FT	WELL SEAL QUANTITY: 10 BAGS
WELL SCREEN: 0.02 INCH	ANNULUS SEAL/INTERVAL: 2-263 FT; 285-337 FT
SCREEN INTERVAL: 265 FT TO 285 FT	ADDITIVES: TAP WATER
WELL COVER: STAND PIPE	WELL DEPTH: 285 FT
FILTERPACK/INTERVAL: LONESTAR #3, 157'-177'	ENGINEER/GEOLOGIST: DENNIS SULLIVAN

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	SOIL DESCRIPTION	HEADSPACE (PPM)
26				
27			Hard, damp, light brown, CLAYSTONE (CL)	
28				
29				
30				
31				
32			Dense, damp, light yellowish-brown, Silty fine to medium SANDSTONE with trace clay (SM)	
33				
34			Hard, damp, brown to olive-brown, Sandy CLAYSTONE (CL)	
35				
36				
37				
38				
39				
40			Dense, damp, yellowish-brown to light grayish-brown, Silty fine SAND with some clay (SM)	
41				
42				
43				
44				
45				
46			Hard, damp, light olive-brown, Silty to fine Sandy CLAYSTONE (CL)	
47				
48				
49				
50				
51				
52		11:23	-Light yellowish-brown	
53				
54				

Figure A-9, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
56		11:34				
57						
58						
59						
60						
61						
62						
63						
64				-More sand at 64 feet		
65						
66						
67		11:58				
68				-Brown to olive-brown at 68 feet (1 foot thick)		
69				-Clayey fine to medium sand at 69 feet (1 foot thick)		
70						
71						
72		12:07				
73						
74				-Some gravel at 74 feet		
75						
76						
77						
78						
79						
80						
81						
82						
83				Dense, damp, light olive-brown, Clayey, fine to medium SANDSTONE (SC)		
84						

Figure A-10, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
86					
87			-Sandy clay at 87 feet		
88					
89			Hard, damp, light grayish-brown to white, bentonite (CL)		
90					
91					
92		12:53			
93					
94					
95					
96			-Reddish-brown at 96 feet		
97		13:15			
98					
99					
100			Hard, Damp, olive-brown, Silty CLAYSTONE (CL)		
101					
102		13:25	Dense, damp, Light yellowish to grayish-brown, fine Sandy, Clayey SILTSTONE (ML) (micaceous)		
103					
104					
105					
106			Hard, damp, Light brown to olive-brown, Silty CLAYSTONE (CL)		
107		13:36			
108			Dense, damp, Light yellowish-brown, fine Sandy, Clayey SILTSTONE (ML)		
109					
110		13:42	-Becomes light olive-brown at 110 feet		
111					
112					
113					
114					

Figure A-11, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD) ______

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
116		13:58				
117						
118						
119				Dense, damp, Light yellow-brown, Clayey, fine to coarse Sandy SILTSTONE to CLAYSTONE (ML/CL)		
120						
121						
122				Dense, damp, Light yellow-brown, Silty and Clayey fine to coarse SANDSTONE with gravels (SM/SC)		
123						
124				Hard, damp, light olive-brown fine to coarse Sandy CLAYSTONE(CL) to dense Clayey fine to coarse SANDSTONE (SC)		
125						
126						
127		14:24				
128		14:29				
129						
130						
131						
132		14:31		Dense, damp, light olive-brown, Clayey, fine to coarse SANDSTONE, with gravels (SC)		
133						
134						
135						
136		14:39				
137		14:44				
138						
139						
140						
141						
142						
143						
144						
145						

Figure A-12, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD)

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
146						
147						
148		14:49		-More gravels - coarse sand		
149						
150						
151						
152						
153						
154						
155						
156		15:12				
157				-TD at 157 feet on 3/28/94		
158				-Begin drilling 9:15, 3/29/94		
159						
160						
161						
162	65/6"	MW2-1 9:45		Very dense, damp, light yellowish to reddish-brown, Clayey, fine-coarse SANDSTONE (SC)		
163						
164						
165						
166						
167	55/6"	MW2-2 10:15		-Becomes light yellowish-brown		
168						
169						
170						
171				Very dense, moist, Silty to Clayey, light yellowish-brown, fine to coarse SANDSTONE with gravels (SM/SC)		
172						
173						
174						
175						

Figure A-13, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD) ____

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
176		11:35				
177		11:45		-Becomes wet		
178						
179						
180				Water produced from hole - cuttings in slurry; no change in color or texture		
181						
182						
183						
184						
185						
186						
187						
188						
189						
190						
191						
192						
193						
194				Now adding 2 to 3 gpm water to hole to keep cuttings flowing to surface		
195						
196						
197						
198						
199						
200						
201						
202						
203						
204						
205						

Figure A-14, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD)

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
206				Adding Poly-Vis to water		
207		13:55				
208						
209						
210						
211						
212						
213						
214				Sand coarse,more gravels		
215						
216		14:15				
217		14:23				
218				Cuttings in slurry - still light yellowish-brown, Clayey, fine to coarse SAND with gravels (SC) -At 218 feet - bit pluged, pulled up 20 feet and cleaned bit, cleaning out hole		
219						
220						
221						
222						
223						
224						
225						
226						
227						
228				**SWEETWATER FORMATION** Very moist, dense, reddish-brown, Silty CLAYSTONE (CL) with minor gravel (interbedded with gritstone)		
229						
230						
231						
232						
233						
234						
235						

Figure A-15, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD)

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
236		12:30				
237		12:35				
238						
239						
240				Very dense, very moist, reddish-green, fine gravelly, fine to coarse SAND 1/4 to 1/2 inch gravel (interbedded with reddish claystone)		
241						
242						
243						
244						
245						
246						
247						
248						
249						
250						
251						
252						
253						
254						
255						
256						
257						
258						
259						
260						
261						
262				Very dense, moist, reddish-brown, fine gravelly CLAYSTONE (1/4 inch gravel 15 %) (CL)		
263						
264		MW2-3				
265						

Figure A-16, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD)

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
266						
267						
268						
269						
270						
271						
272						
273						
274				-Become less gravelly (3%-5%)		
275				-Water level at 10:40 on 4/15/94		
276						
277						
278						
279						
280				-Water level at 13:20 on 4/19/94		
281						
282						
283						
284						
285						
286						
287	60/8"	MW2-4				
288						
289						
290				2 - 3 feet gravel/ claystone layer/ seepage 285 - 290 feet		
291						
292						
293						
294						
295						

Figure A-17, log of Boring MW 2

Continued Next Page

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD)

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
296						
297	58/6"	MW2-5				
298		3:40				
299						
300		4:20				
301						
302		4:50		Dense, moist, reddish-brown, CLAYSTONE with trace 1/4 gravel (5 %)		
303						
304						
305						
306						
307						
308						
309						
310		5:30				
311				-TD at 312 feet BGS, 4/1/94		
312		1:35		-Resume drilling at 13:35, 4/2/94		
313						
314						
315						
316		1:45				
317						
318						
319						
320						
321				-Gravels at 321 feet		
322						
323						
324				-Gravels at 324 feet		
325						

Figure A-18, log of Boring MW 2

Continued Next Page

PROJECT NO. 8080-06-05

BORING/WELL NO. MW 2

DATE DRILLED 3/28/94 WATER LEVEL (ATD)

EQUIPMENT CANTERA CT 450 DRILLER TRI COUNTY

DEPTH IN FEET	PENETRAT. RESIST. BLWS/FT.	SAMPLE NO.	LITHOLOGY	SOIL DESCRIPTION	WELL CONSTRUCTION	HEADSPACE (PPM)
326–329				-Fine to coarse sands		
330	60/6"	MW2-6		**MISSION VALLEY FORMATION** Dense, moist, light yellowish-brown, SILTSTONE with trace of very fine sand and trace clay (ML)		
331–336						
337	60/6"	MW2-7		BOTTOM OF BORING AT 337 FEET		
338–355						

Figure A-19, log of Boring MW 2

RDS1

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 167 ELEV. (MSL.) 388' DATE COMPLETED 08-25-2006 EQUIPMENT TRACKED BACKHOE W/24" BUCKET BY: N. ASH	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**TOPSOIL** Very stiff, damp, dark brown, Silty CLAY; roots and porosity; blocky texture; few gravel			
2				SM	**OTAY FORMATION** Medium dense to dense, damp, grayish brown to light olive gray, Silty, fine- to medium-grained SANDSTONE; intensely weathered with carbonate mineralization in upper 18" of unit; decreasing weathering with depth; moderately cemented			
4								
6								
8								
					TRENCH TERMINATED AT 8½ FEET No groundwater encountered			

Figure A-56,
Log of Trench T 167, Page 1 of 1

06862-52-09(FIGS A24-A75 & A90-A104).GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 06862-52-09

TRENCH T 168

ELEV. (MSL.) 363' DATE COMPLETED 08-24-2006

EQUIPMENT TRACKED BACKHOE W/24" BUCKET BY: N. ASH

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**TOPSOIL** Loose, damp, grayish brown, Clayey, fine to medium SAND; porous with roots; carbonate mineralization			
2				SM	**OTAY FORMATION** Medium dense, damp, light gray, Silty, fine- to medium-grained SANDSTONE; moderately weathered; carbonate-filled fractures			
4								
6								
8				CH	Very stiff, moist, olive gray, pink, and white, bentonite CLAYSTONE; chaotic structure with sandstone blocks in claystone; sheared and pulverized surfaces -Becomes hard and less sheared at bottom of bed			
10				SM	Dense, damp, light gray, Silty, fine- to medium-grained SANDSTONE; moderately cemented			

TRENCH TERMINATED AT 11 FEET
No groundwater encountered

Figure A-57,
Log of Trench T 168, Page 1 of 1

06862-52-09(FIGS.A24-A75 & A90-A104).GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 06862-52-09

TRENCH T 169

ELEV. (MSL.) **340'** DATE COMPLETED **08-25-2006**

EQUIPMENT **TRACKED BACKHOE W/24" BUCKET** BY: **N. ASH**

DEPTH IN FEET	SAMPLE NO	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2				CL	**TOPSOIL** Very stiff, damp, dark brown, Sandy CLAY; porous with thin roots; blocky texture			
2 – 4				CL	**OTAY FORMATION** Very stiff, damp, reddish brown, Silty CLAYSTONE; weathered and fractured; carbonate mineralization; krotovina			
4 – 6				SM	Dense, damp, light gray, Silty, fine to medium-grained SANDSTONE; moderately cemented; thin fractures with roots			

TRENCH TERMINATED AT 7½ FEET
No groundwater encountered

Figure A-58,
Log of Trench T 169, Page 1 of 1

06862-52-09(FIGS.A24-A75 & A90-A104).GPJ

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 06862-52-09

BORING B 77

ELEV. (MSL.) 390' DATE COMPLETED 08-31-2006

EQUIPMENT 30" BUCKET RIG BY: J. WASHBURN

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**OTAY FORMATION** Loose, dry, dark brown, Clayey, fine- to medium-grained SANDSTONE; roots and gravel; weathered			
2				SM	Dense, damp, light gray to white, Silty, fine- to medium-grained SANDSTONE; massive and micaceous with small clay-filled fractures; moderately cemented			
4								
6	B77-1					6		
8	B77-3							
10	B77-2					4	112.5	16.7
12				ML	Dense, damp, olive, fine-grained Sandy SILTSTONE; some fractures present in unit with local clay infilling			
14								
16	B77-4					4		
				SM	Dense, damp, light gray to white, Silty, fine- to medium-grained SANDSTONE; massive, micaceous with small clay-filled fractures; moderately cemented			
18								
20	B77-5					5	119.1	9.1
22					-At 22 feet; olive-colored bed 6" thick, continuous around boring			
24				CH	Very stiff, damp, pink, bentonite CLAYSTONE; seam continuous around boring; no shearing or offset			
26	B77-6			SM	Dense, damp, light gray, Silty, fine- to medium-grained SANDSTONE; micaceous and massive with some small fractures and claystone clasts within the matrix; moderately cemented	4		
28								
					-At 30 feet; thin bed continuous around hole and horizontal			

Figure A-104,
Log of Boring B 77, Page 1 of 2

06862-52-09(FIGS A24-A75 & A90-A104).GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING B 77

ELEV. (MSL.) **390'** DATE COMPLETED **08-31-2006**

EQUIPMENT **30" BUCKET RIG** BY: **J. WASHBURN**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B77-7			SM		7		
32				SM-ML	Dense, damp, olive, fine-grained Sandy SILTSTONE with interbeds of Silty, fine- to medium-grained SANDSTONE			
35	B77-8					5	98.4	23.4
36				CH	Very stiff, damp, white to pink, bentonite CLAYSTONE; highly fractured from 37 to 38 feet; some internal shearing			
40	B77-9				-At 41 feet; becomes more pink; locally remolded	4		
					-Generally flat-lying; undulating contact			
43				ML	Dense, damp, olive, fine-grained Sandy SILTSTONE; unit continuous around boring			
45	B77-10			SM	Dense, damp, gray, Silty, fine- to medium-grained SANDSTONE; massive, micaceous and with strongly cemented lenses	12		

BORING TERMINATED AT 45 FEET
No groundwater encountered
Backfilled on 08-31-2006 with bentonite and cuttings

Figure A-104,
Log of Boring B 77, Page 2 of 2

06862-52-09(FIGS.A24-A75 & A90-A104).GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

APPENDIX F

APPENDIX F

RECOMMENDED GRADING SPECIFICATIONS

FOR

SUNBOW II
PHASE 3
CHULA VISTA, CALIFORNIA

PROJECT NO. G2452-32-02

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition.

4. CLEARING AND PREPARING AREAS TO BE FILLED

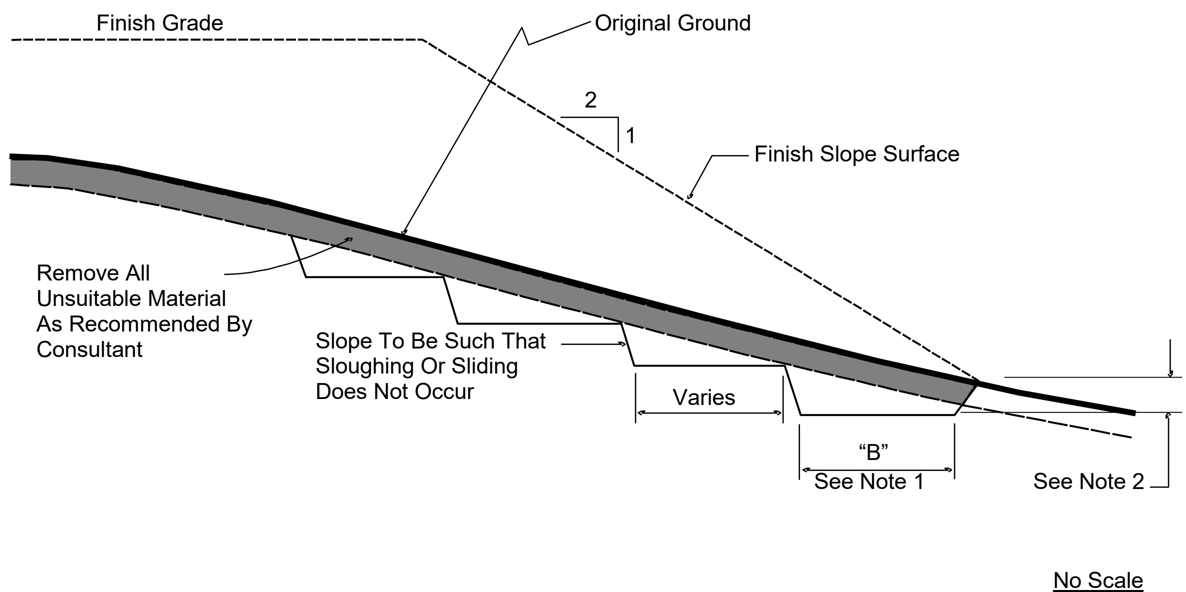
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

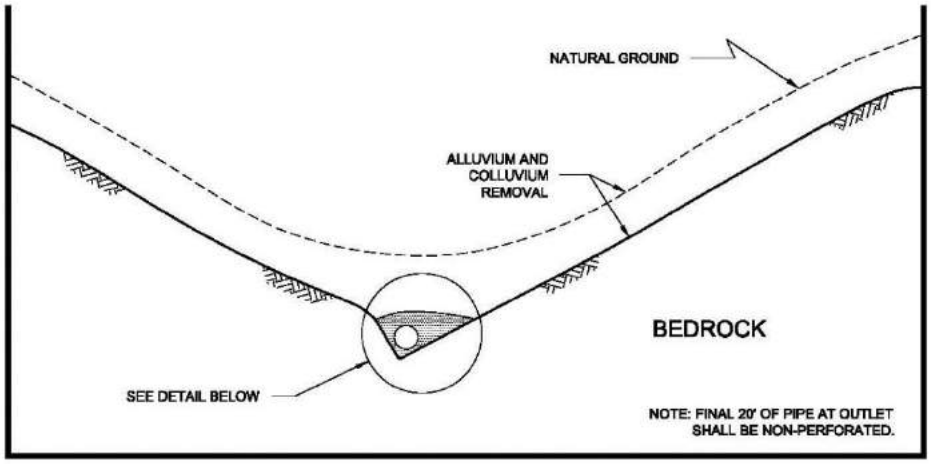
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

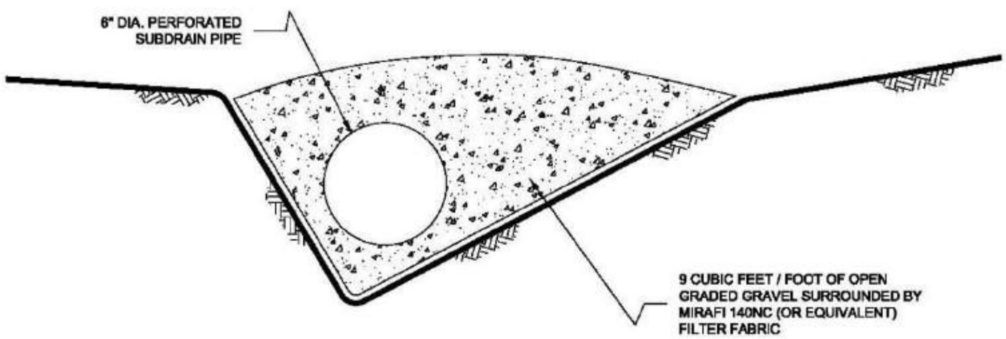
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

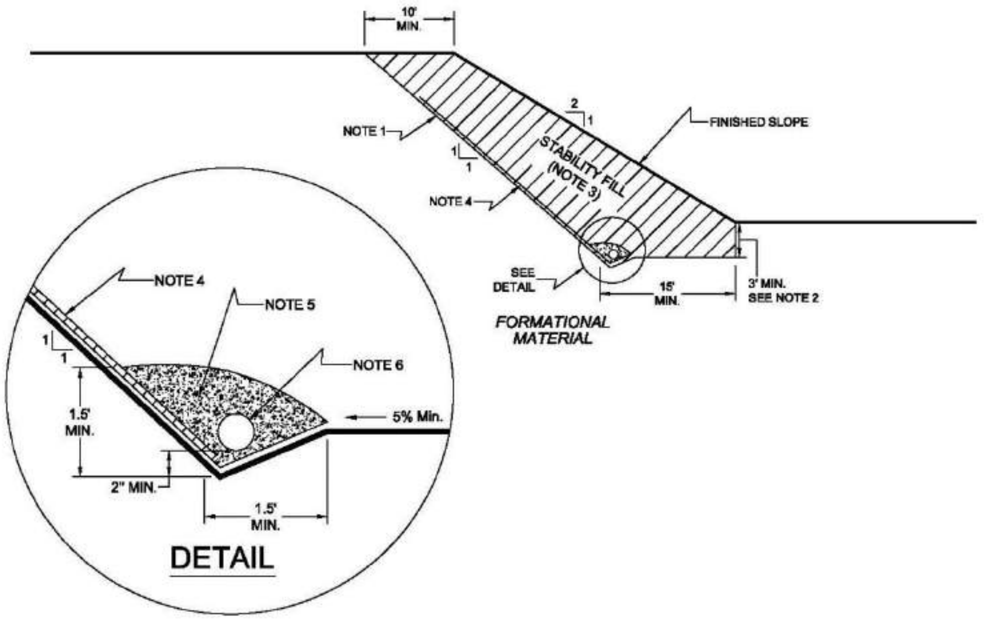
1......6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

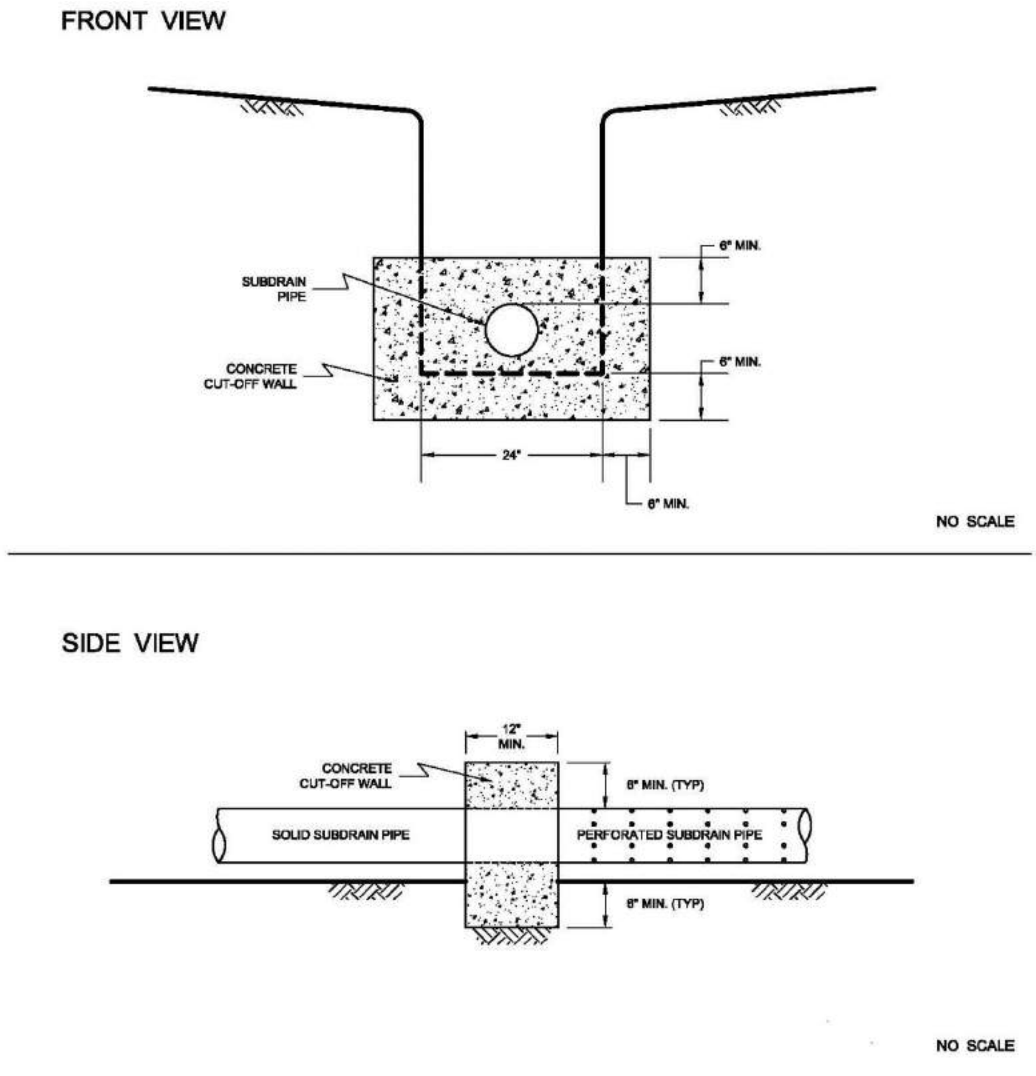
NO SCALE

7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

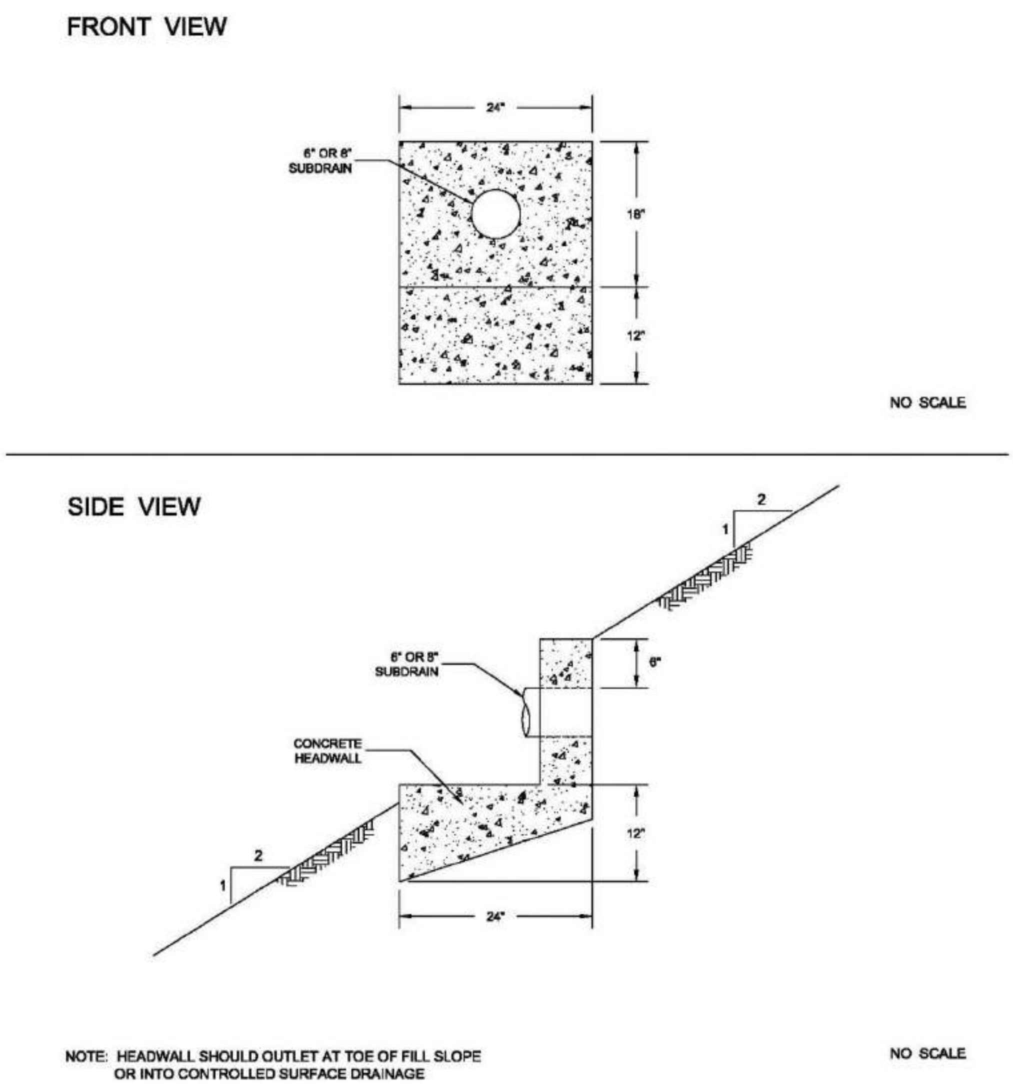
7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

TYPICAL CUT OFF WALL DETAIL



7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL



7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop.*

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

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2. Boore, D. M., and G. M Atkinson (2008), *Ground-Motion Prediction for the Average Horizontal Component of PGA, PGV, and 5%-Damped PSA at Spectral Periods Between 0.01 and 10.0 S*, Earthquake Spectra, Volume 24, Issue 1, pages 99-138, February 2008.

3. California Department of Conservation, Division of Mines and Geology, *Probabilistic Seismic Hazard Assessment for the State of California,* Open File Report 96-08, 1996.

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5. California Geological Survey, *Seismic Shaking Hazards in California,* Based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003). 10% probability of being exceeded in 50 years. http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html

6. Campbell, K. W. and Y. Bozorgnia, *NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s*, Preprint of version submitted for publication in the NGA Special Volume of Earthquake Spectra, Volume 24, Issue 1, pages 139-171, February 2008.

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8. Geocon Incorporated, *Final Consolidated Environmental Assessment Including Remedial Cost Estimates for Rancho Del Sur Phase II, Chula Vista, California*, dated October 13, 1994 (Project No. 08080-06-07).

9. Geocon Incorporated, *Final Report of Testing and Observation Services During Installation of Vertical Wick Drains, Site Grading, and Crib Wall Construction, Olympic Parkway 43 to 131, Chula Vista, California*, dated November 29, 2000 (Project No. 06217-52-02).

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11. Geocon Incorporated, *Geologic Reconnaissance, Sunbow Planning Area 23, Chula Vista, California*, dated November 14, 2019 (Project No. G2452-32-01).

12. Geocon Incorporated, *Geotechnical Investigation, Otay Ranch Village 2 West, Chula Vista, California*, dated October 20, 2006 (Project No. 06862-52-09).

13. Geocon Incorporated, *Rancho Del Sur, 600 Acre Parcel, San Diego County, California*, dated September 22, 1986 (Project No. D-3763-M01).

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14. Geocon Incorporated, *Rancho Del Sur Phase II, Land Adjacent to the Otay Landfill, San Diego County, California*, dated December 13, 1989 (Project No. D-8080-602).

15. Hart, Michael, *Radiocarbon Ages of Alluvium Overlying La Nacion Fault, San Diego*, in Geological Society of America Bulletin, v. 85, p. 1329-1332, dated August 1974.

16. Jennings, C. W., 1994, California Division of Mines and Geology, *Fault Activity Map of California and Adjacent Areas,* California Geologic Data Map Series Map No. 6.

17. Kahle, James, A Geomorphic Analysis of the Rose Canyon, La Nacion and Related Faults in the San Diego Area, California, dated June 30, 1988.

18. Kennedy, M. P. *et al.*, *Character and Recency of Faulting, San Diego Metropolitan Area, California*, California Division of Mines and Geology Special Report 123, 1975.

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Project No. G2452-32-02
March 10, 2021

Lennar Homes
16465 Via Esprillo, Suite 150
San Diego, California 92127

Attention: Mr. David Shepherd

Subject: RESPONSE TO CITY OF CHULA VISTA GEOTECHNICAL REVIEW COMMENTS
SUNBOW II, PHASE 3
CHULA VISTA, CALIFORNIA

Reference: *Geotechnical Investigation, Sunbow II, Phase 3, Chula Vista, California,* prepared by Geocon Incorporated, dated April 10, 2020 (Project No. G2452-32-02).

Dear Mr. Shepherd:

This correspondence has been prepared to respond to geotechnical review comments contained in the City of Chula Vista 4th Submittal Issues Matrix (MPA20-0006) dated March 4, 2021. Specifically, we are addressing Geotechnical Comments 1 and 2. The comments along with our responses are presented below.

Comment 1: *Provide recommendations for off-site grading to the east. Specifically, if proposed shear key onsite is to be extended offsite.*

Response: At the time of our report, the off-site area to the east had not been designed. Geologic Cross-Section K-K' was prepared to depict this area. As stated in Section 9.1.5, we recognize the shear key will need to wrap around the knoll beneath the offsite embankment. Final geotechnical design of this feature should be done as plans progress to 40-scale. We do not anticipate any issues with constructing this mitigation feature.

Comment 2: *Provide recommendations for fill settlement to eliminate potential 3" settlement as stated in Section 9.2.1. Add notes to grading plans for contractor to eliminate this settlement. We cannot have 3" of settlement for public infrastructure.*

Response: Based on a review of the grading plans, the thickest fill embankments that will support public improvements occur along Street A, Stations 33+50 through 34+80 and 39+00 through 39+50. The fill in these areas has a maximum thickness of approximately 47 feet.

Assuming 0.3 percent hydro-compression over time, the total estimated settlement beneath improvements along the referenced areas is approximately 1.7 inches. The magnitude of settlement would gradually diminish laterally and is expected to occur over a relatively extended period. It should be noted that this empirical estimate assumes that the entire fill column will become saturated over time.

Based on the discussion above, it is our opinion the recommendations presented in our geotechnical report remain applicable and no additional measures are necessary to address potential settlement beneath proposed public improvements.

If there are any questions regarding this correspondence, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Trevor E. Myers
RCE 63773

David B. Evans
CEG 1860

TEM:DBE:arm

(e-mail) Addressee