

**PRELIMINARY GEOTECHNICAL
EVALUATION AND SLOPE STABILITY
ANALYSIS**

**SOUTHWEST VILLAGE VTM-2
(BORROW/FILL SITE)
SAN DIEGO, CALIFORNIA**



GEOCON
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GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

**TRI POINTE HOMES
SAN DIEGO, CALIFORNIA**

**JULY 2, 2021
PROJECT NO. 06847-42-04**



Project No. 06847-42-04
July 2, 2021

Tri Pointe Homes
13400 Sabre Springs Parkway, Suite 200
San Diego, California 92128

Attention: Ms. April Tornillo

Subject: PRELIMINARY GEOTECHNICAL EVALUATION
AND SLOPE STABILITY ANALYSIS
SOUTHWEST VILLAGE VTM-2 (BORROW/FILL SITE)
SAN DIEGO, CALIFORNIA

Dear Ms. Tornillo:

In accordance with your authorization, we have performed a preliminary geotechnical evaluation and slope stability analysis for VTM-2 of the proposed Southwest Village project in the San Ysidro area of San Diego, California. The intent of the study was to provide preliminary information regarding slope stability as it relates to the San Ysidro Landslide Complex that borders the south margin of the proposed project. The information provided herein supplements previous geotechnical reports and will be augmented with a future geotechnical field investigation.

Based on previous geotechnical studies and the preliminary results of this investigation, it is our opinion that the proposed project can be developed as planned provided the conclusions presented in this report are confirmed during future studies.

If you have 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

Rodney C. Mikesell
GE 2533

RCM:DBE:arm

(e-mail) Addressee
(e-mail) Rick Engineering Company
Attention: Mr. Tim Gabrielson



David B. Evans
CEG 1860

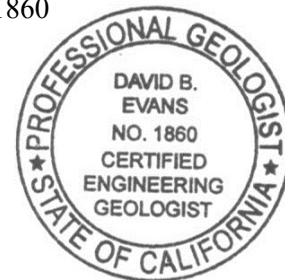


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PRELIMINARY GEOTECHNICAL EVALUATION AND SLOPE STABILITY ANALYSIS

1. PURPOSE AND SCOPE

This report presents the findings of a preliminary geotechnical evaluation for the Southwest Village Vesting Tentative Map 2 (VTM-2, Borrow/Fill Site) project located in South Otay Mesa, San Diego, California (see Vicinity Map, Figure 1). There are two other phases of the overall project which consists of VTM-1 and the eastward extension of Beyer Boulevard into VTM-1 (see Vicinity Map, Figure 1). We prepared a supplemental study for VTM-1 entitled *Supplemental Geotechnical Investigation and Slope Stability Analysis, Southwest Village VTM-1, San Diego, California*, dated June 25, 2021. The geotechnical aspects of the extension of Beyer Boulevard will be addressed in a forthcoming study.

The purpose of this study was to evaluate the stability of the mesa top and adjacent San Ysidro landslide complex that borders the southern margin of VTM-2. We understand that the VTM-2 area will initially be used as a borrow/fill site to support the grading of VTM-1 with respect to site balancing.

A geotechnical investigation associated with VTM-2, including exploratory borings and the placement of groundwater monitoring wells is commencing this summer which will be the basis for future geotechnical analyses and confirmation of this study. In the mean time we have performed this preliminary study to evaluate the proposed project based on a hypothetical model using information obtained during several prior geotechnical studies (Reference Nos. 7, 9 and 10) and an assumed development plan. As development concepts progress, update studies will be prepared to address the new plans.

Since this report is a supplement to previous studies (Reference Nos. 7 and 9), we did not attempt to re-present information contained in the referenced study but rather provide the salient information which focuses on a hypothetical evaluation of the potential impact of the proposed development, if any, on the current landslide stability and vice versa. In this regard, a discussion of faulting, stratigraphy and other geologic information can be found in the referenced geotechnical reports.

The scope of the preliminary geotechnical evaluation included a review of previous geotechnical reports and published geologic literature with respect to the landslide complex (see list of references), preparing a geologic map and cross section of the study area and evaluating the stability of the hillside adjacent to the VTM-2 project site based on hypothetical conditions. We also used infiltration and laboratory test results, as well as groundwater level information obtained during our previous studies to formulate our geotechnical opinions regarding the proposed development.

Laboratory test results from selected samples obtained from the borings during our December 2020/January 2021 field investigation (June 25, 2021 report) are provided in Appendix A. Infiltration test results from the same study are provided in Appendix B. Slope stability figures relating to VTM-2 are provided in Appendix C. A hypothetical geologic cross section, which was the basis for our slope stability analysis, is presented on Figure 11. The letter designation (CC-CC') was selected to differentiate the current cross section from those presented in previous reports.

As part of the referenced June 25, 2021 study, Dudek & Associates was retained to perform a groundwater evaluation of Landslide A and the surrounding area. Their study was based on a site reconnaissance, our bore-hole and infiltration data and published documents. The intent of their study was to assess the current groundwater elevations in the VTM-1 area and comment on the potential impacts project development on the mesa may have on the regional groundwater system, specifically the landslides. The Dudek report is contained in Appendix D. Their report will also be updated once the proposed geotechnical investigation for VTM-2 and monitoring period is complete.

Rick Engineering Company also performed a hydrology analysis of the Southwest Village VTM-1 project and surrounding landslide areas as part of our June 25, 2021 study (Reference No. 14). They evaluated the pre-project and post-project conditions with respect to infiltration of storm water and irrigation. The Rick Engineering report is contained in Appendix E.

In addition to Dudek and Rick Engineering's study, the groundwater elevation in each boring performed during our December 2020/January 2021 field investigation was measured by Geovision Geophysical Services using bore-hole geophysical techniques. This information was used in the analysis presented in Reference No. 10.

2. BACKGROUND

The overall proposed Southwest Village development is located adjacent to the San Ysidro Landslide Complex which is one of the largest landslide features in San Diego County (See Figures 1 through 6). Although studied relatively extensively by prominent geologists and geotechnical firms, to our knowledge, prior to our December 2020/January 2021 field investigation (June 25, 2021 report), the base of the landslide complex had only been identified once during an investigation by Geocon Incorporated for the Intermodal Transportation Center located southwest of the mesa (see Reference No. 6).

With the exception of our December 2020/January 2021 investigation, the primary focus of previous geotechnical studies performed by Geocon Incorporated was to define the headscarp of the landslide adjacent to the proposed development to establish the building setback limit along the edge of the mesa (see Reference No. 7). Large-diameter borings were advanced along the proposed development

limits to demonstrate that beyond the landslide headscarp, intact sedimentary bedrock units exist (i.e. stable conditions). In addition, during the referenced investigation, the headscarp was mapped in detail and surveyed to record its location. A 50-foot setback from the surveyed location of the headscarp was established.

3. GEOLOGIC CONDITIONS AND GEOMORPHIC FEATURES

The following discussion presents general observations made during this study and our interpretation of the boring logs from our December 2020/January 2021 field investigation, stereographic photographs (anaglyphs; Figures 4 and 8, note: color anaglyphic glasses needed for viewing), color/reflectance terrain models generated from Lidar information (Figures 9 and 10), geomorphic features and our experience with similar mass movements. Future studies will further evaluate the geologic conditions in the VTM-2/borrow/fill site area as well the eastern extension of Beyer Boulevard into the project.

The results of our December 2020/January 2021 study indicates that the northern portion of the San Ysidro Landslide Complex is approximately 350 to 400-feet-thick near its head scarp southwest of VTM-1. It is suspected that a slightly less thickness is present along the southern landslide apron since the adjacent Spring Canyon drainage/toe of the landside is approximately 100 feet higher in elevation than the toe of the complex to the west, and the mesa above the entire slide complex is relatively level. The difference in elevation of the base of the slides suggest that the causative bedding plane shear within the Otay Formation for the southern slide complex may occur approximately 100 feet above that of the failure to the west.

Characteristic landslide morphology of steep back-scarps and bulging, hummocky topography, as well as deflected drainages and closed surface depressions are evident within the hillsides that surround the entire mesa. Based on surface topography, we have separated the landslide complex into three components based on observed geomorphological differences between areas (Landslides A, B and C, see Figures 2, 3, 5, and 6).

Landslide A appears to be the most developed feature with respect to past horizontal displacement as evidenced by its more subdued/relaxed topography, especially along its distal portion. It is postulated/hypothesized that the Landslide A mass has moved down dip along its slip surface in “glacier-like” fashion with progressive failure occurring northeastward. The upper, steeper part of this slide appears to be comprised of detached blocks of cemented sandstone/siltstone and terrace-derived conglomerate suspended in a matrix of clay and silt. The head scarp of this feature is well expressed and is curvilinear.

In contrast, Landslide B expresses robust topography and appears to be less developed with respect to horizontal displacement. Its apparent limited detachment from the mesa top suggests that portions of this slide are incipient consisting of a relatively minor block-glide type movement with less horizontal displacement than Landslide A. The maximum head scarp differential elevation of this feature is approximately 50 feet below the mesa compared to Landslide A which is approximately 100 feet below the mesa. The topography within the slide mass consists of elevated promontories and prominent lobate-shaped ridges.

With respect to geomorphic expression, it appears that the Landslide C area, the focus of this preliminary study, is intermediate between Landslide A and B. The terrain exhibits a robust profile with some similar morphologies as Landslide A suggesting that a series of detached blocks have relaxed in a progressive fashion sliding southward from the mesa top. The amount of horizontal displacement also appears to be intermediate between Landslide A and B and the westernmost feature exhibits a well expressed curvilinear head scarp (see Figures 7 through 10). Down-cutting of the natural slopes by the Spring Canyon drainage along the toe of the hillside appears to be the likely mechanism which triggered landsliding on both sides of the canyon.

With respect to the composition of the slide mass, the cores obtained from our Landslide A study revealed that the main body of the slide mass at the location studied consists of a mixture of sandstone, siltstone, claystone and gravel/cobble conglomerate derived from the Otay and San Diego Formations, and overlying Terrace Deposits. Sheared bentonitic claystone and sections of disturbed Otay gritstone were noted in several of the borings. Abundant highly fractured and blocky textures were also observed.

The cores also revealed that the basal shear zone of Landslide A consists of plastic/viscous deformation features ranging from sheared bentonite and remolded clay planes to disturbed mixtures of sand, clay and gravel. The underlying Otay Formation consisted of thinly bedded micaceous sandstone with an apparent relatively low angle. We suspect that the slide composition and basal shear zone of Landslide C may be similar to that of Landslide A.

The landside geometry and basal slip surface modeled on our geologic cross section was interpreted based on geomorphology and the projection of information from our June 25, 2021 report. The dip of the basal surface used in our slope stability analysis was modeled at 1.5 degrees along section to simulate conditions encountered during our December 2020/January 2021 study. The source for the ground surface topography was a combination of relatively recent flown topo for the project and 1999 SANGIS. Since the slide mass is heterogeneous, we did not attempt to model separate geologic/soil materials on the cross section and in our slope stability analysis.

4. SLOPE STABILITY EVALUATION

4.1 General

A cross section was analyzed to make a preliminary assessment regarding the stability of Landslide C (Section CC-CC'). The location of the cross section is considered a worst-case location. The geology and basal slide surface was determined from geomorphic interpretation and application of features observed during our December 2020/January 2021 field investigation. The groundwater elevation used in the analysis was based on a similar saturation model as encountered during the aforementioned study.

The computer program SLOPE/W distributed by Geo-Slope International was utilized to perform the slope stability analyses. This program uses conventional slope stability equations and a two-dimensional limit-equilibrium method to calculate the factor of safety against deep-seated failure. For our analysis, Spencer's Method with a block failure mode was used for failure along landslide basal surface. Spencer's Method satisfies both moment and force equilibrium.

The computer program searches for the critical failure surface based on parameters inputted, including the location of the "left" and "right" sliding blocks. The output files and calculated factor of safety for the cross-sections analyzed are presented in Appendix C, Figures C-1 through C-9. The critical failure surface for each analysis is shown on computer-generated output. The factor of safety is shown on each figure directly above the failure surface.

4.2 Shear Strength Parameters

The shear strength parameters used in the analyses are based on laboratory direct shear testing performed on samples obtained from borings during our December 2020/January 2021 study and our experience with similar soil conditions. Where direct shear tests were not performed in a soil or geologic unit, assumed strength values were used. Table 4.2.1 summarizes the shear strength tests performed by Geocon Incorporated during our previous geotechnical investigations on the property. Table 4.2.2 summarize residual shear strength values. The residual shear strength values were determined following the procedure presented in the *Journal of Geotechnical and Geoenvironmental Engineering, Drained Shear Strength Parameters for Analysis of Landslides (Stark, Choi, McCone, 2005)*. However, for conservatism, we used a friction angle of 8 degrees for the basal slip surface, which is less than the values determined using the Stark, Choi, McCone (2005) procedure. Shear strength values used in our analyses are shown on Table 4.2.3.

**TABLE 4.2.1
SUMMARY OF DIRECT SHEAR STRENGTH TEST RESULTS**

Soil/Geologic Unit	Sample No.	Angle of Shear Resistance (degrees)	Unit Cohesion (psf)
Landslide Debris	LB1-3**	31	135
Otay Formation	*LB3-3†	32	500
	B1@215 feet	45 (peak) 39 (ultimate)	3,260 (peak) 960 (ultimate)
	B2@289 feet	38 (peak) 29 (ultimate)	1,720 (peak) 600 (ultimate)
	B3@394 feet	49 (peak) 37 (ultimate)	1,550 (peak) 1,000 (ultimate)
Remolded Shear Plane	LB4-9**	27	180
Basal Shear Plane (Residual)	B3 @ 328 – 330 feet	20	160

*Sample remolded to approximately 90 percent of maximum dry density near optimum moisture content.

†From Geocon October 2004

**From Geocon May 2006

**TABLE 4.2.2
RESIDUAL SHEAR STRENGTH VALUES FOR BASAL SLIDE PLANE
BASED ON STARK, CHOI, MCCONE (2005)**

Sample No.	Liquid Limit	Percent Clay	Angle of Internal Friction (degrees)	Cohesion (psf)
B1@161 – 164 feet	66	27	11	50
B2@263 feet	40	10	24	20
B3@324 feet	51	22	15	60
B3@328-330 feet	35	14	22	60

**TABLE 4.2.3
SHEAR STRENGTH USED IN SLOPE STABILITY ANALYSES**

Soil Type	Angle of Internal Friction (degrees)	Cohesion (psf)
Qcf (Compacted Fill)	30	300
Qal (Alluvium)	28	100
Qls (Landslide Debris)	31	135
To (Otay Formation)	34	450
Basal Slide Plane	8	50

4.3 Slope Stability Analysis

We analyzed three failure locations. The first location was along the basal slide plane and up the assumed landslide headscarp. The strength parameters used for the basal surface was also used along the landslide headscarp. The result of this analysis is shown on Figure C-1 which indicates a factor of safety of 1.21. For the second location we allowed the computer to search for the failure surface with the lowest factor of safety assuming that a bedding plane shear with the same strength parameters as the basal shear zone extends behind the landslide headscarp and beneath the mesa. The results of this analysis is shown on Figure C-2 and indicates a factor of safety greater than 1.5. The third failure location was set at the edge of the borrow/fill disposal limits (see Figure C-3). The factor of safety at the edge of the borrow/disposal limits is 1.5.

We also analyzed the cross section assuming landslide movement causes the ground surface in front of the landslide headscarp to drop thereby creating a higher exposed headscarp slope. Assuming a 50-foot elevation change in front of the headscarp, a factor of safety of at least 1.5 exists at or in front of the edge of the borrow/disposal limit (see Figure C-4).

4.4 Seismic Slope Stability

In accordance with Special Publication 117 guidelines, site-specific seismic slope stability analyses are required for sites located within mapped hazard zones. Seismic Hazard Zone maps published by CDMG, including landslide hazard zones, have not been published for San Diego County due to the relatively low seismic risk compared with other jurisdictions in Southern California. Therefore, it is our opinion that seismic slope stability analyses are not required in San Diego County. However, we performed a seismic slope stability analysis in accordance with *Recommended Procedures for Implementation of DMG Special Publication 117A: Guidelines for Analyzing and Mitigating Landslide Hazards in California*, prepared by the Southern California Earthquake Center (SCEC), dated 2008.

The seismic slope stability analysis was performed for the headscarp slope using an unweighted acceleration of 0.21g, corresponding to a 10 percent probability of exceedance in 50 years. In addition, a deaggregation analysis was performed on the 0.21g value for the site. A modal magnitude and modal distance of 6.12 and 11.5 kilometers, was determined from the deaggregation analysis. A printout of the deaggregation analysis is provided in Appendix C.

Using the parameters discussed herein, an equivalent site acceleration, k_{EQ} , of 0.101g was calculated to perform the screening analysis, as shown on Figure C-5. This equivalent site acceleration resulted in a factor of safety less than 1.0 (see Figure C-6). A slope is considered acceptable by the screening analysis if the calculated factor of safety is greater than 1.0 using k_{EQ} ; therefore, the section analyzed

did not pass the screening analysis for seismic slope stability. We then performed a deformation analysis utilizing procedures outlined in Special Publication 117A.

The yield acceleration used in the deformation analysis was determined by establishing the horizontal seismic coefficient necessary to achieve a factor of safety of 1.0 (see Figure C-7). Using a yield acceleration of 0.05, an estimated slope deformation of 0 centimeters is calculated for the overall landslide slope (see Figure C-8). When we use the height of the headscarp slope (approximately 80 feet), the estimated deformation is 12 cm (see Figure C-9). Using the headscarp slope height rather than the overall slope height is conservative. According to Special Publication 117A, displacements up to 15 centimeters are unlikely to correspond to serious landside movement and damage. Additionally, the 12 centimeters deformation would occur over the length of the slide area (2,000 lineal feet) resulting in negligible deformations throughout the slide area.

4.5 Summary

The results of our preliminary analysis indicates that the existing slope along the southern boundary of VTM-2 has a factor of safety of 1.5, or greater under static conditions assuming a bedding plane shear extends behind the landslide headscarp and beneath the mesa. With respect to seismic slope stability, our analyses indicates that the expected deformation under seismic loading is not likely to cause serious landslide movement. Table 4.5 summarizes the results of the slope stability analyses. Based on our preliminary analysis, the existing slopes along the southern perimeter of VTM-2 have an acceptable factor of safety and deformation with respect to both static and seismic conditions.

**TABLE 4.5
SUMMARY OF STABILITY ANALYSES**

Condition Analyzed	Cross Section	Factor-of-Safety	Estimated Deformation Under Seismic Loading
Along Headscarp	CC-CC'	1.21	--
Extended Bedding Plane Shear	CC-CC'	1.50	--
At Edge of Development	CC-CC'	1.50	--
Higher Exposed Headscarp	CC-CC'	2.15 (at edge of borrow/fill limits)	--
Seismic Analysis	CC-CC'	--	0 to 12 cm

5. CONCLUSIONS

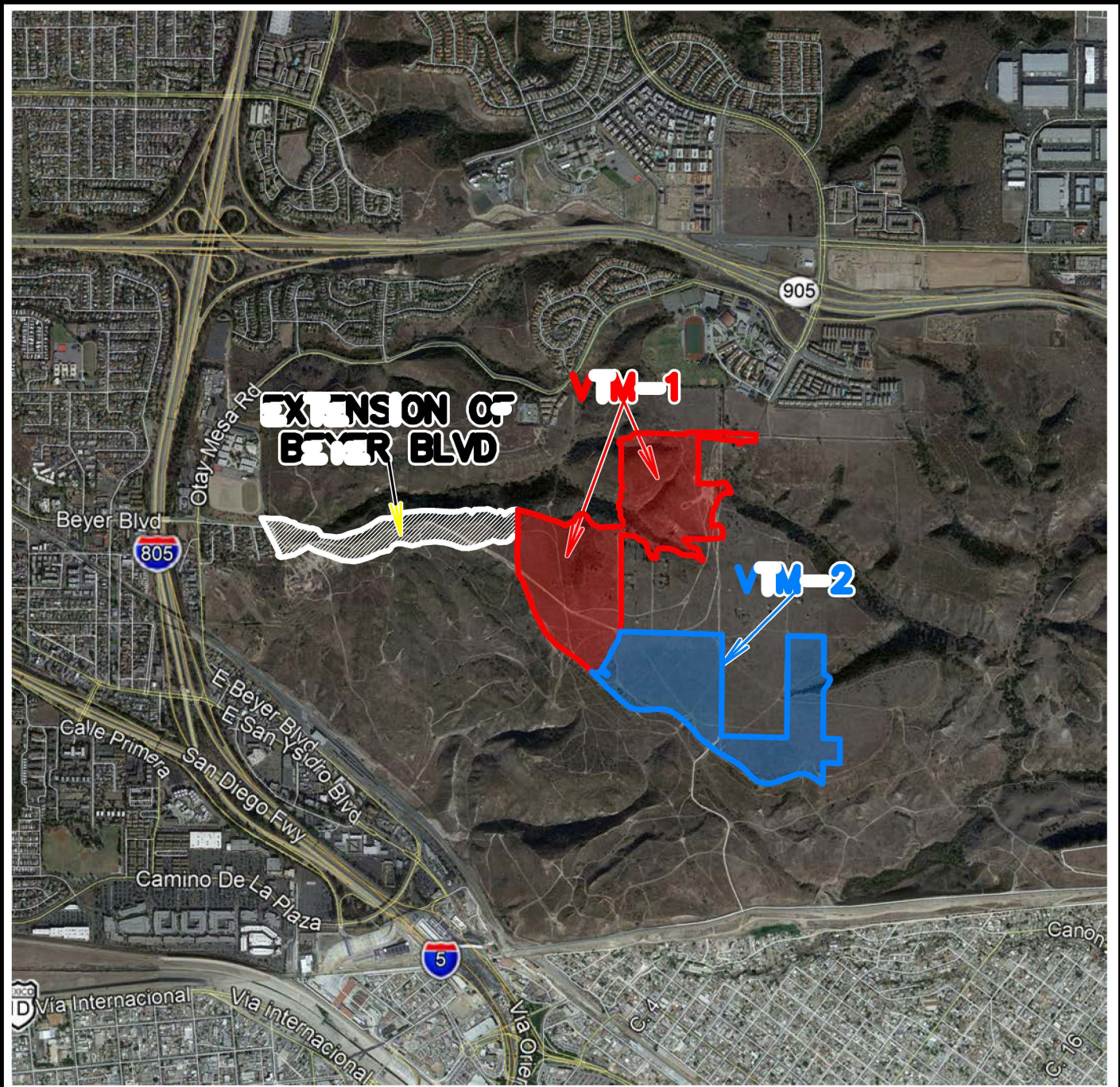
- 5.1 Southwest Village VTM-2 is proposed on the mesa adjacent to the southern extent of the San Ysidro Landslide Complex (Landslide C). This geotechnical evaluation was performed as a preliminary assessment of the stability of the mesa and adjacent slope for use in planning a borrow/fill site associated with the development of Southwest Village VTM-1. Our analysis is hypothetical based on an interpretation of the existing geologic conditions and uses information obtained during a recent supplemental geotechnical investigation for VTM-1. This study should be updated subsequent to a field investigation which is planned for this summer.
- 5.2 The Landslide C geometry was modeled based on information from previous studies as well as a geomorphic analysis of various sources (i.e. Lidar terrain, anaglyphic stereo, etc.). A cross section was developed for use in geologic characterization and performing a slope stability analysis (Cross Section CC-CC').
- 5.3 The results of our stability analysis indicates that the existing static factor of safety of Landslide C is 1.21. The factor of safety at the edge of the borrow/disposal site closest to the headscarp is 1.5. The factor of safety along the most critical surface is also 1.5 assuming a bedding plane shear extends beneath the mesa behind the landslide basal shear surface. The minimum factor of safety occurs approximately 240 feet northward from the landslide margin. A graphic representation of the factors of safety described above is presented on Figure 12.
- 5.4 With respect to seismic slope stability, the section analyzed did not pass the screening evaluation, therefore, we performed a deformation analysis utilizing procedures in Special Publication 117A. Using the overall landslide slope height (336 feet), our analysis indicates 0 cm of deformation. If we use the landslide headscarp slope height (approximately 80 feet), our analysis indicates a deformation of 12 cm. According to Special Publication 117A, displacements up to 15 centimeters are unlikely to correspond to serious landside movement and damage. Using the steeper landslide headscarp slope height in the seismic analysis rather than the overall more gentle landslide slope is a conservative approach. Additionally, the 12 centimeters deformation would occur over the length of the slide area (2,000 lineal feet) resulting in negligible deformations throughout the slide area.
- 5.5 The following is a list of conservative assumptions used during our slope stability analysis that were also used in our June 25, 2021 *Supplemental Investigation and Slope Stability Analysis*:
1. We used a lower phi angle for the basal slide zone than the laboratory testing during our VTM-1 study yielded (8 degrees versus an average of 18 degrees based on Stark, Choi, Mccone, 2005);

2. We used a lower shear strength for the Otay Formation than the previous laboratory testing indicated (34 degrees and 450 psf versus an average ultimate value of 35 degrees and 800 psf and average peak value of 43 degrees and 2,200 psf);
 3. We assumed that a sheared bentonite bed projects behind the slide and beneath the mesa at the elevation of the basal shear zone;
 4. We assumed the basal slip surface is uniformly sloping and not undulatory which is likely the actual geometry. The actual condition, if undulatory, would increase the sliding friction; and
 5. We used the same groundwater saturation model as our VTM-1 study which assumes the slide is saturated below the first occurrence of seepage. The groundwater observed during our previous study is likely a perched condition rather than full saturation of the landslide mass and bedrock unit.
- 5.6 To address a “what if” scenario, we performed a hypothetical analysis along the cross section to evaluate the potential impact on the proposed development assuming that a significant seismically triggered horizontal displacement of the slide mass had occurred. In this exercise we lowered the elevation of the headscarp region adjacent to the development to simulate a smaller resisting landslide mass out in front of the bedrock block that is present beneath the development. Our analysis revealed that the slide mass south of the development margin would have to drop at least 50 vertical feet before lowering the factor of safety within the development area below 1.5.
- 5.7 A groundwater profile from the borings during our June 25, 2021 study and a nearby agricultural well on the mesa was the basis for the phreatic surface used in our slope stability analysis. We retained Dudek & Associates to evaluate the information in the June 25, 2021 study and comment on the potential for seasonal fluctuations, and any future impacts that the proposed development may have on the regional groundwater system. Specifically, they studied the existing storm water infiltration into the undeveloped mesa and surrounding area and compared it to the condition that would be present post-development considering irrigation and storm water infiltration.
- 5.8 Dudek concluded that the post-development vertical infiltration of storm water into the substrate would be less than the existing condition which is already relatively low as evidenced by our permeability testing, a review of existing soil survey maps and the presence of vernal pools on the mesa. This opinion is supported by the fact that the development will eventually result in a net increase in impervious surface area due to the construction of structures, pavements, etc., and the collection and conveyance of storm water into the project storm drain system that would normally soak into the exposed soils on the mesa.

- 5.9 Dudek also concluded that the groundwater levels measured/assumed during the June 25, 2021 study were reasonable for use in that analysis, however, additional groundwater wells would improve characterization of the phreatic surface immediately outside and within the slide mass, and would facilitate recording of the groundwater level in response to seasonal rainfall. A supplemental groundwater monitoring program is currently planned in conjunction with our geotechnical investigation to confirm the measurements obtained during our study of Landslides A and C.
- 5.10 As part of our June 25, 2021 study, Rick Engineering Company also performed a hydrology analysis of the project area and concluded that “considering both the infiltration of storm water, and the application of irrigation, the average infiltration volume has decreased in the post-project condition compared to the pre-project condition”.
- 5.11 Several storm water outfall locations were contemplated during the original project design. These features were proposed to discharge storm runoff collected from the project into pronounced drainages within the landslide complex. Although the infiltration data collected from the discharge locations supported a short-term discharge without adverse effects, the potential for scour and injection of storm water into the slide mass during extreme storm events resulted in a requirement to redesign the storm drain system to discharge outside landslide areas. It is understood that one outfall is still contemplated in the Landslide C area. This storm drain system will be extended to the south to discharge into Spring Canyon.

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 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 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 be 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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NO SCALE

VICINITY MAP

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SOUTHWEST VILLAGE
VESTING TENTATIVE MAP 1 AND 2,
BEYER BOULEVARD
SAN DIEGO, CALIFORNIA

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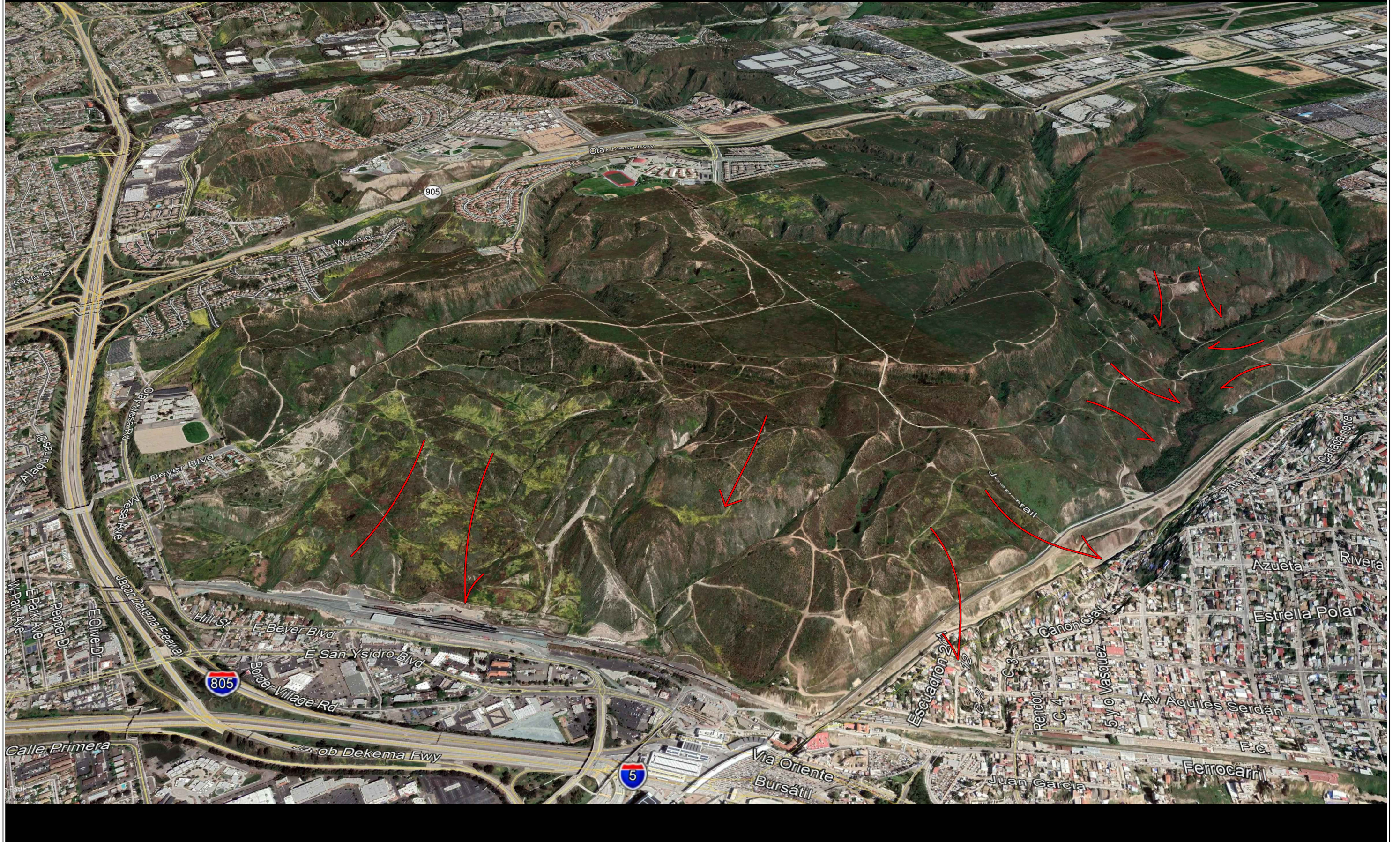
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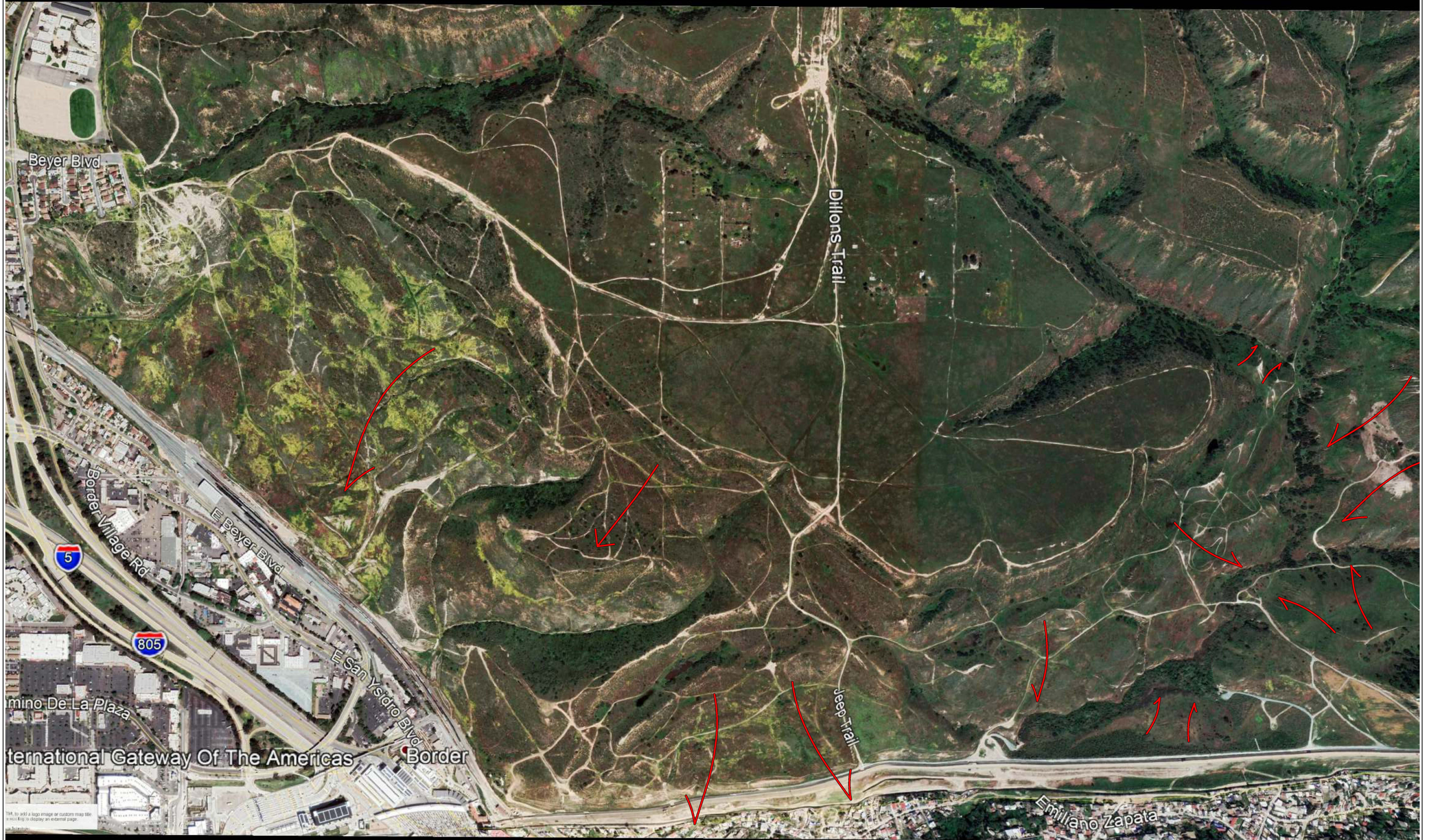
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FIG. 1

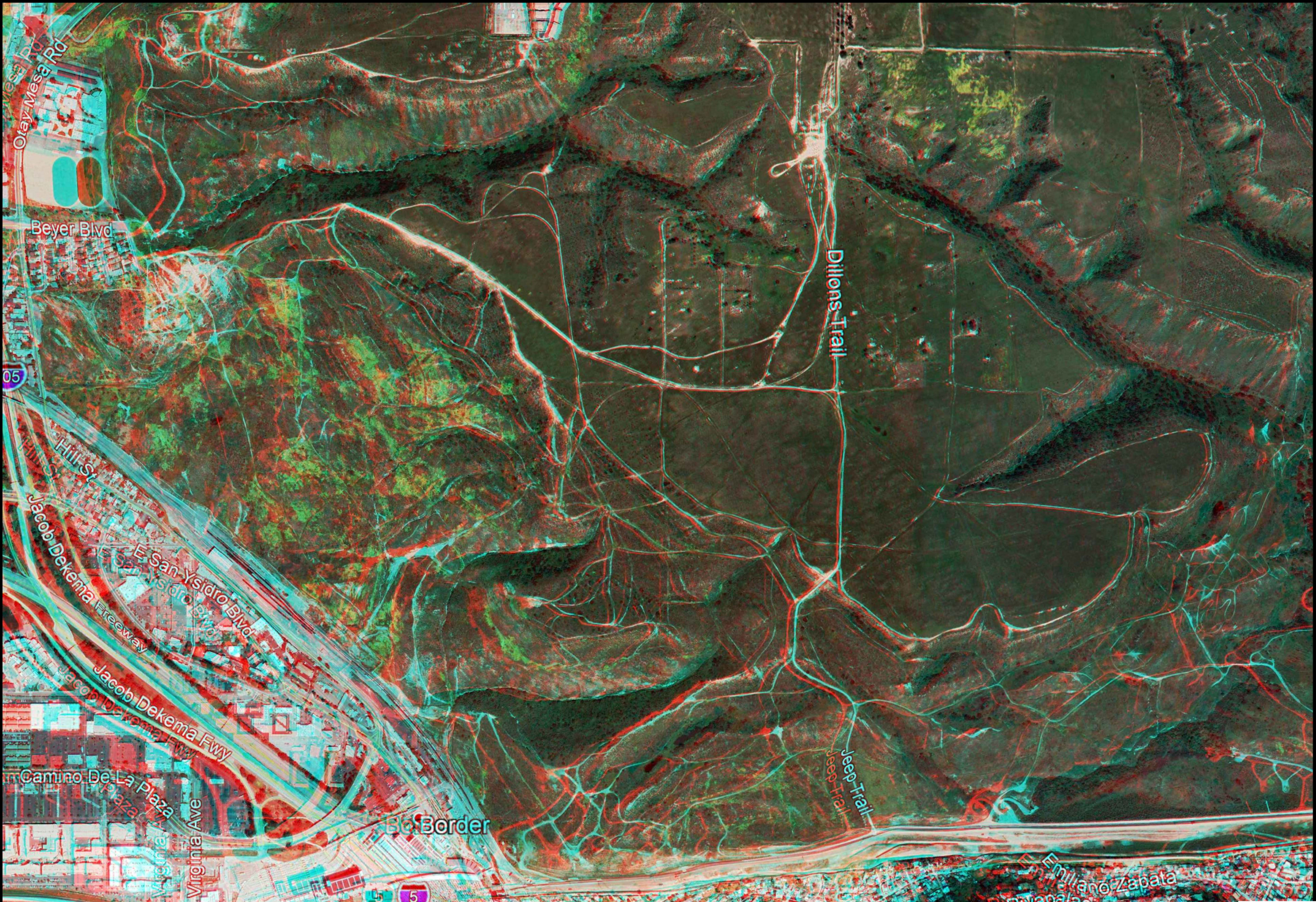
OBLIQUE VIEW OF THE SAN YSIDRO LANDSLIDE COMPLEX



MAP VIEW OF THE SAN YSIDRO LANDSLIDE COMPLEX

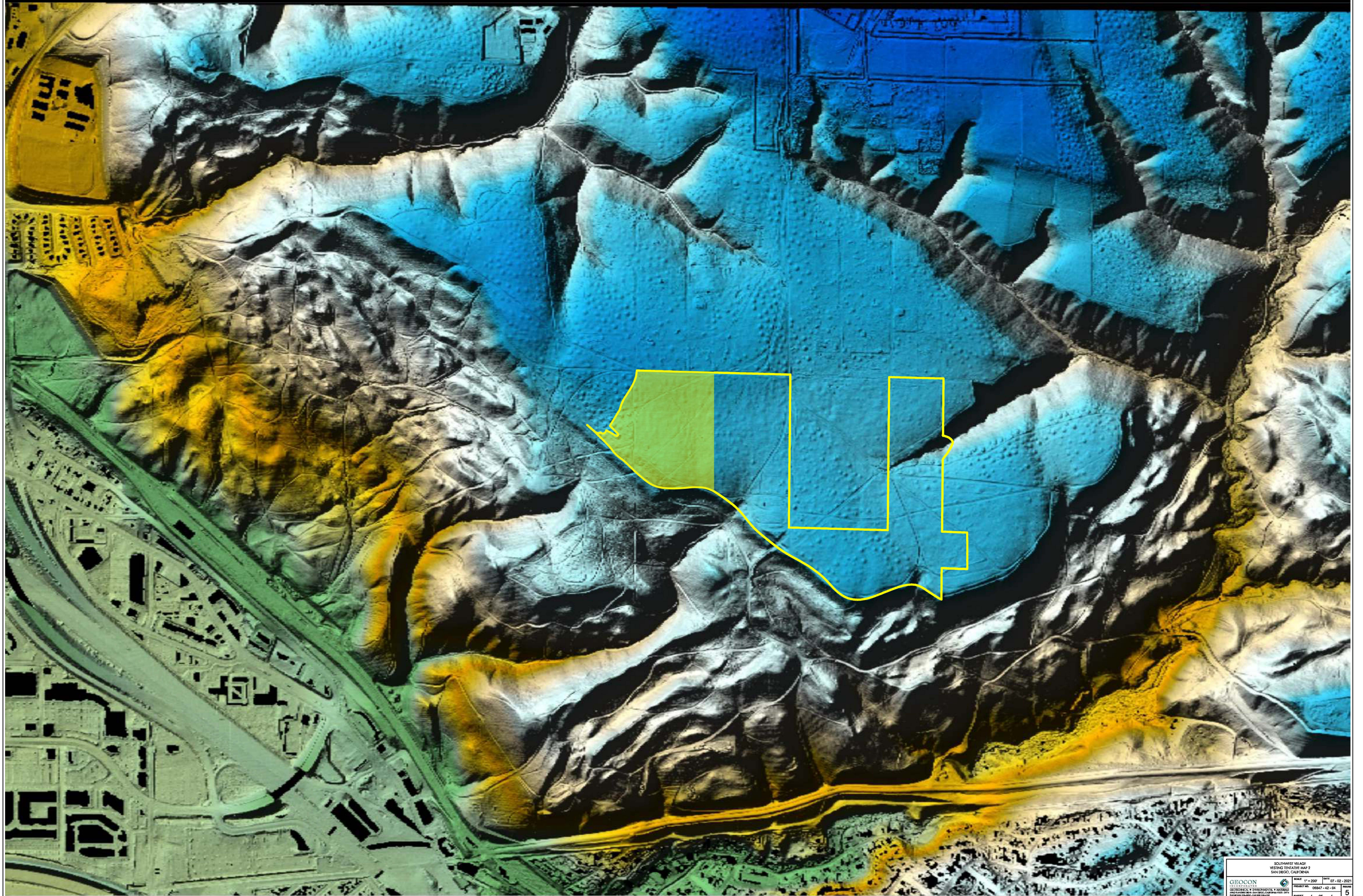


TM, to add a logo image or custom map title
a new map to display an external page.



Click this HTML to view a large image or custom map tile.
USGS National Wetlands Inventory (NWI) to display an external page.

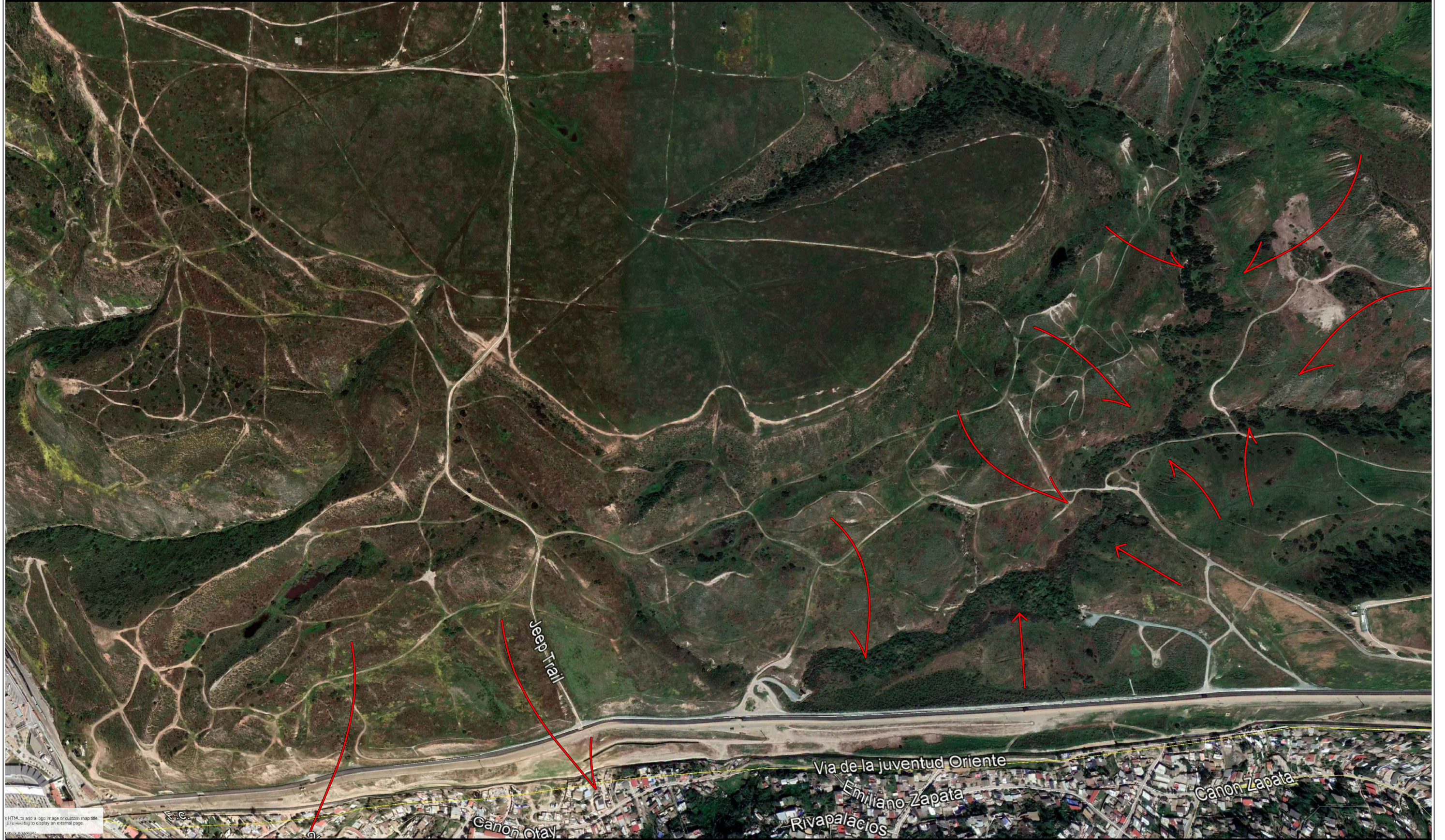
VTM-2 DEVELOPMENT FOOTPRINT; COLOR TERRAIN MAP



VTM-2 DEVELOPMENT FOOTPRINT; TERRAIN
REFLECTANCE MAP



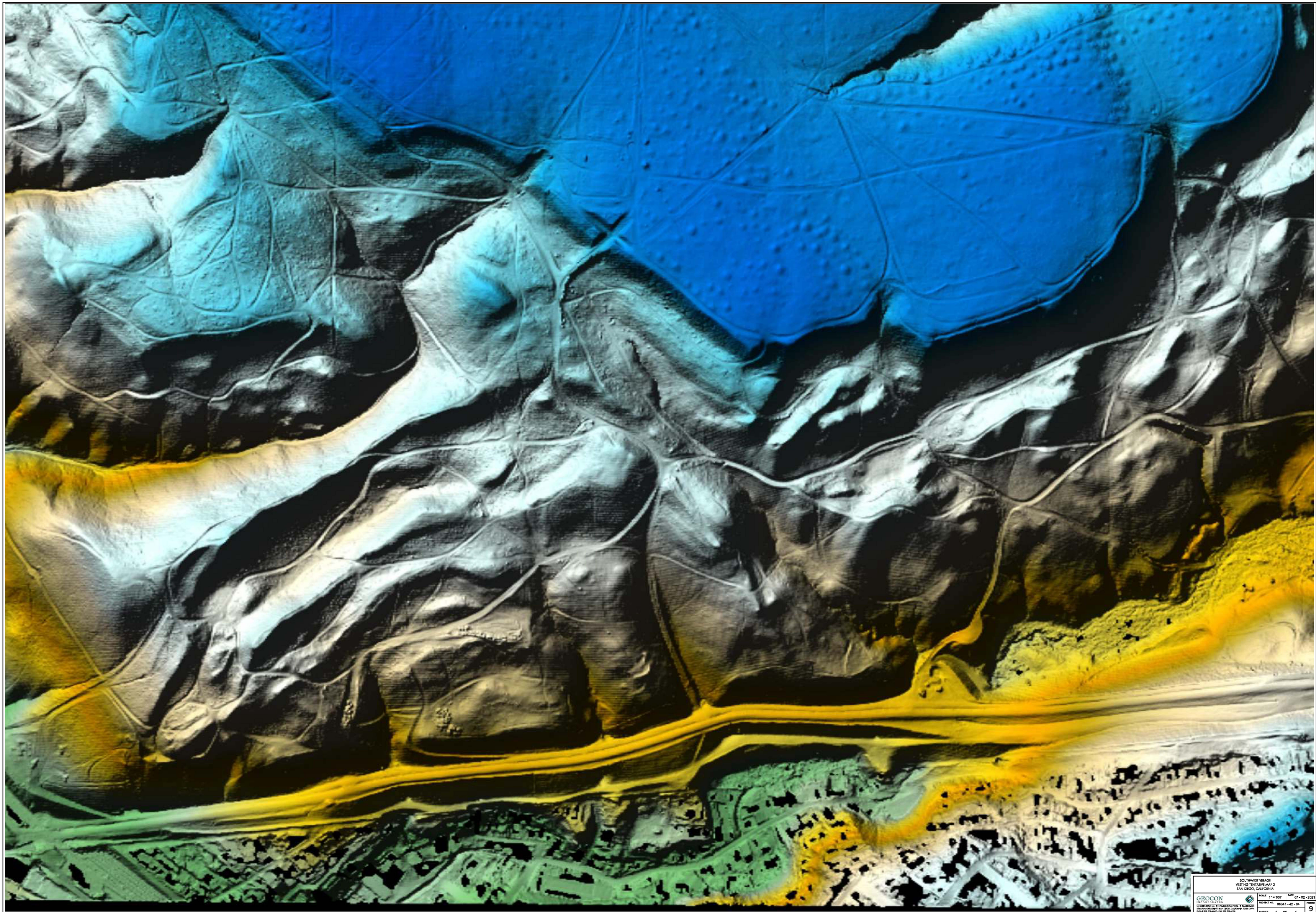
MAP VIEW IMAGE OF LANDSLIDE C



HTML to add a logo image or custom map title
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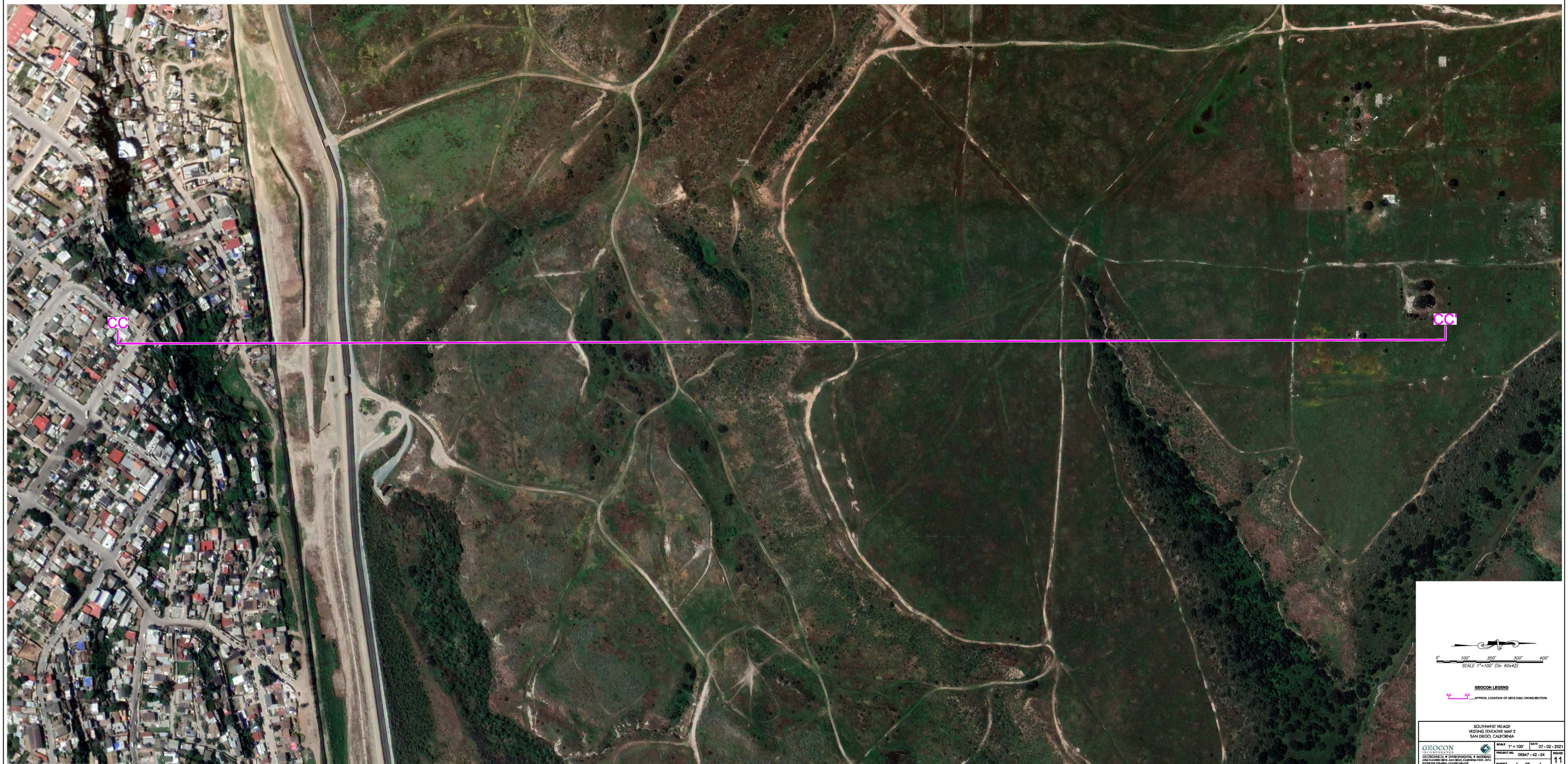
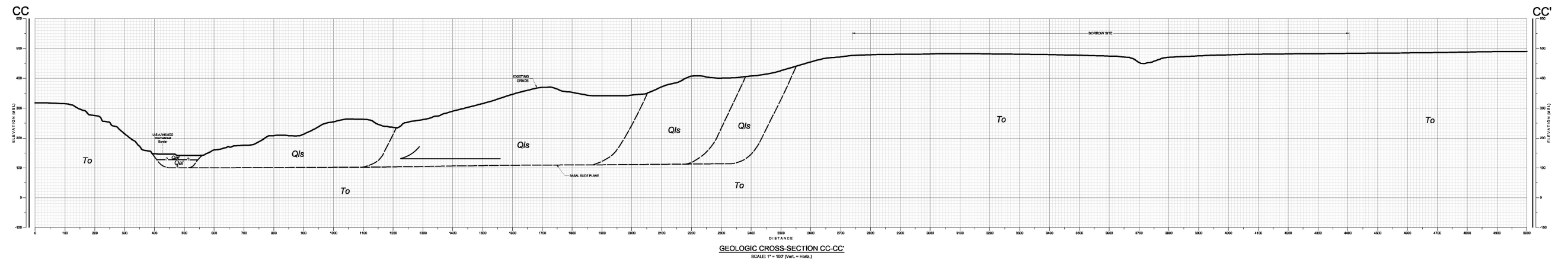
ANAGLYPHIC STEREOSCOPIC IMAGE OF LANDSLIDE C







GEOLOGIC CROSS - SECTION CC-CC'



0' 100' 200' 300' 400'

SCALE 1"=100' (ON 60x42)

GEOCON LEGEND

APPROX. LOCATION OF GEOLOGIC CROSS-SECTION

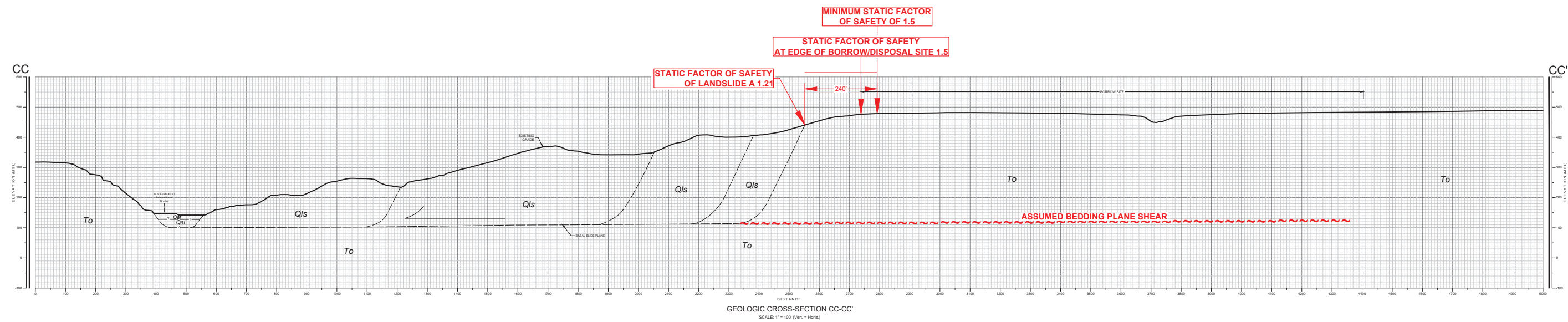
SOUTHWEST VILLAGE
VESTING TENTATIVE MAP 2
SAN DIEGO, CALIFORNIA

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CONSULTING ENGINEERS

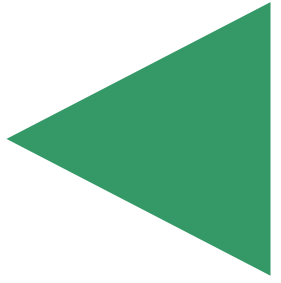
DATE: 11-13-2021 SHEET: 07-02-2021
PROJECT NO: 08047-42-04
SHEET 1 OF 1

11

SLOPE STABILITY SUMMARY



APPENDIX



APPENDIX A

LABORATORY TESTING

As part of our June 25, 2021 study we performed laboratory tests in general accordance with the test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. We tested selected samples to evaluate in-place dry density and moisture content, direct shear strength, Atterberg limits, maximum dry density and optimum moisture content, gradation, and permeability. The results of the laboratory tests are presented in the following tables and graphs.

**TABLE A-I
SUMMARY OF DIRECT SHEAR TEST RESULTS
(ASTM D 3080)**

Sample No.	Geologic Unit	Dry Density (pcf)	Moisture Content (%)	Angle of Shear Resistance (degrees)	Unit Cohesion (psf)
LB3-3 ^{†*}	Otay Formation	93.4	19.0	32	500
LB1-3 ^{**}	Landslide Debris	101.0	25.9	31	135
LB4-9 ^{†**}	Remolded Shear Plane	--	--	27	180
B1@215 ft	Otay Formation	121.2	6.1	45 (peak) 39 (ultimate)	3,260 (peak) 960 (ultimate)
B2@289 ft	Otay Formation	116.4	6.4	38 (peak) 29 (ultimate)	1,720 (peak) 600 (ultimate)
B3@394 ft	Otay Formation	113.5	8.9	49 (peak) 37 (ultimate)	1,550 (peak) 1,000 (ultimate)
B3@328-330 ft	Basal Shear Zone (Remolded)	107.4	18.3	21 (peak) 20 (ultimate)	150 (peak) 160 (ultimate)

[†]Sample remolded to approximately 90 percent of relative compaction near optimum moisture content.

*From Geocon October 2004

**From Geocon May 2006

**TABLE A-II
SUMMARY OF LABORATORY ATTERBERG LIMITS TEST RESULTS
ASTM D 4318**

Sample No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index
B1@161-164 ft	66	27	39
B2@263 ft	40	21	19
B3@324 ft	51	23	28
B3@328-330 ft	35	18	17

**TABLE A-III
RESIDUAL SHEAR STRENGTH VALUES FOR BASAL SLIDE PLANE
BASED ON STARK, CHOI, MCCONE (2005)**

Sample No.	Liquid Limit	Percent Clay	Angle of Internal Friction (degrees)	Cohesion (psf)
B1@161 – 164 feet	66	27	11	50
B2@263 feet	40	10	24	20
B3@324 feet	51	22	15	60
B3@328-330 feet	35	14	22	60

**TABLE A-IV
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY
AND OPTIMUM MOISTURE CONTENT TEST RESULTS
(ASTM D 1557)**

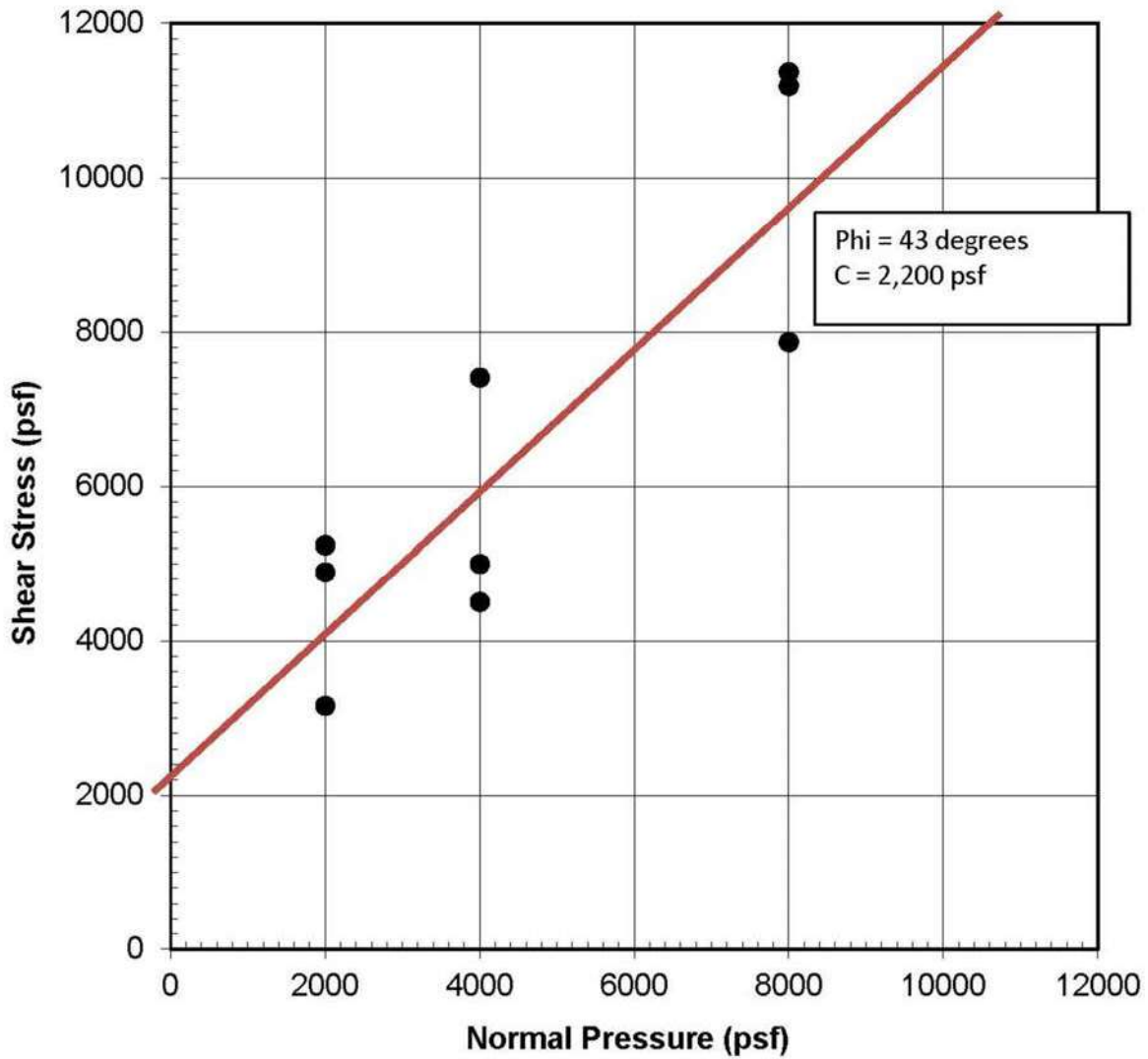
Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
Perm - 1	Reddish brown, Silty, fine to coarse SAND with trace gravel	126.9	9.9

**TABLE A-V
SUMMARY OF LABORATORY REMOLDED PERMEABILITY TEST
(ASTM D5084)**

Sample No.	Moisture Content (%)		Dry Density (pcf)	Permeability (cm/s)
	Before Test	After Test		
*Perm - 1	10.3	17.6	111.9	6.38 x 10 ⁻⁴

*Sample remolded to approximately 90 percent relative compaction near optimum moisture content

To (PEAK)



SHEAR PLOTS - PEAK

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SOUTHWEST VILLAGE
SAN DIEGO, CALIFORNIA

RM / AML

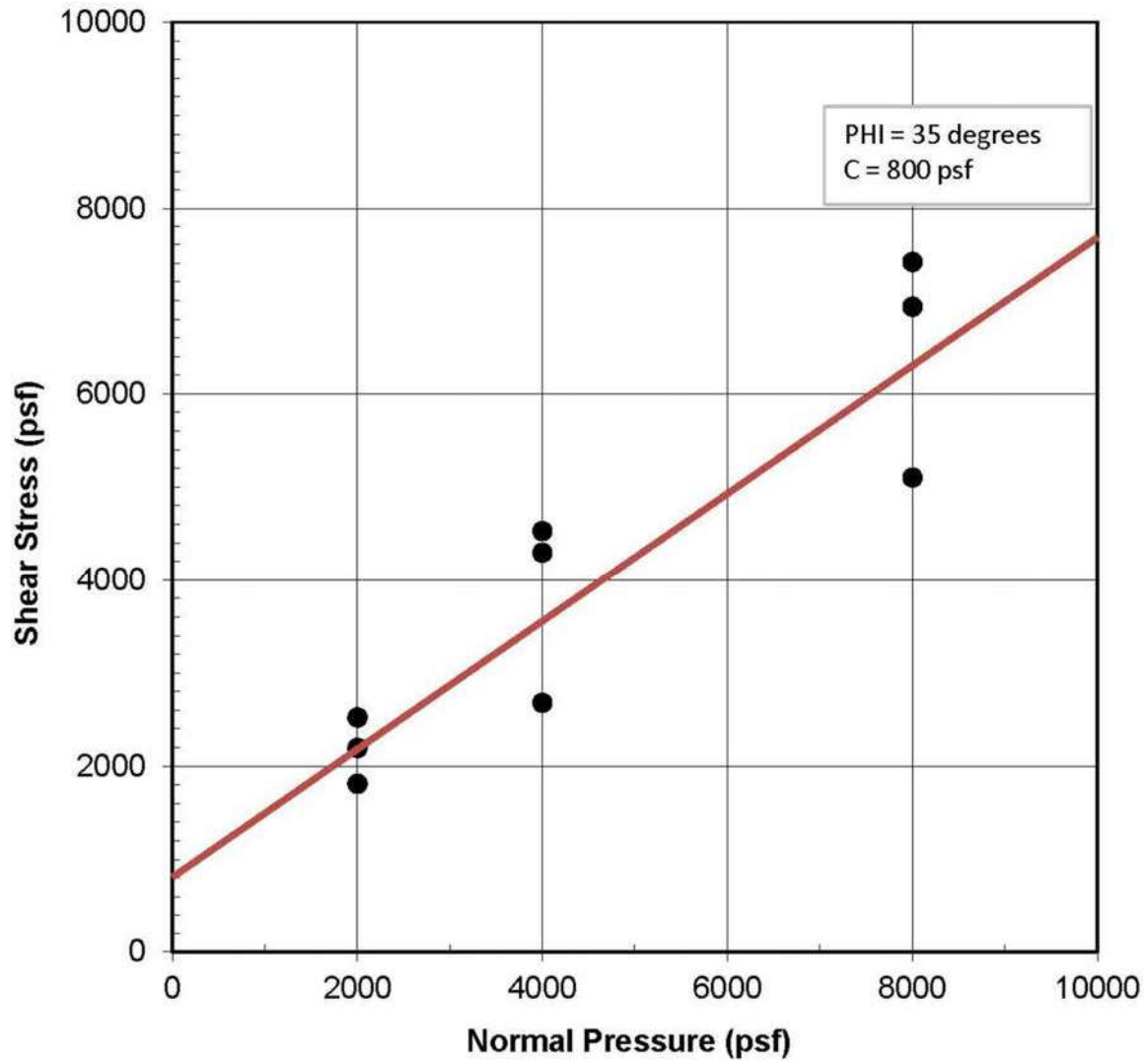
DSK/GTYPD

DATE 06 - 21 - 2021

PROJECT NO. 06847 - 42 - 04

FIG.

To (ULTIMATE)



SHEAR PLOTS - ULTIMATE

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RM / AML

DSK/GTYPD

DATE 06 - 21 - 2021

PROJECT NO. 06847 - 42 - 04

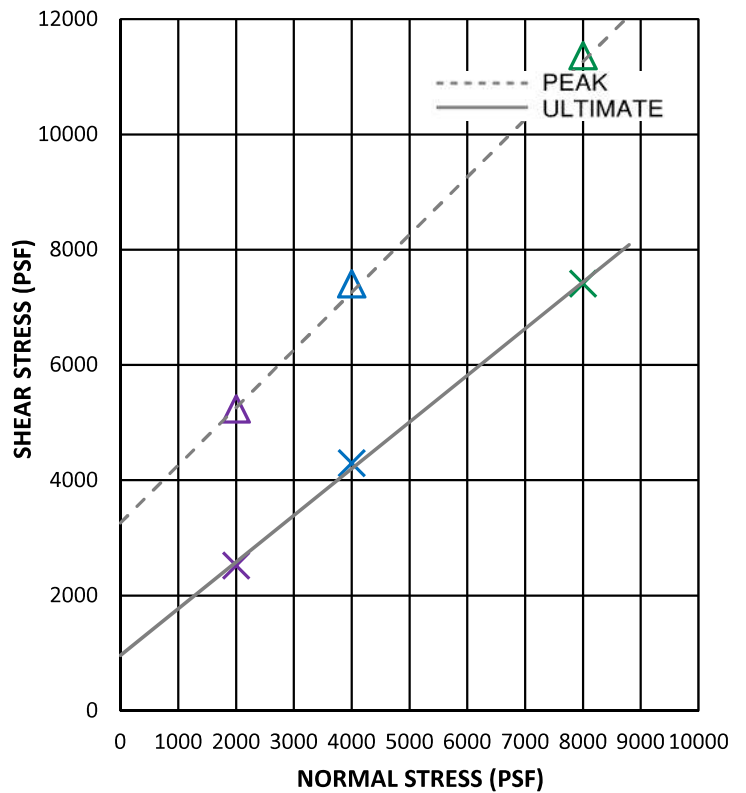
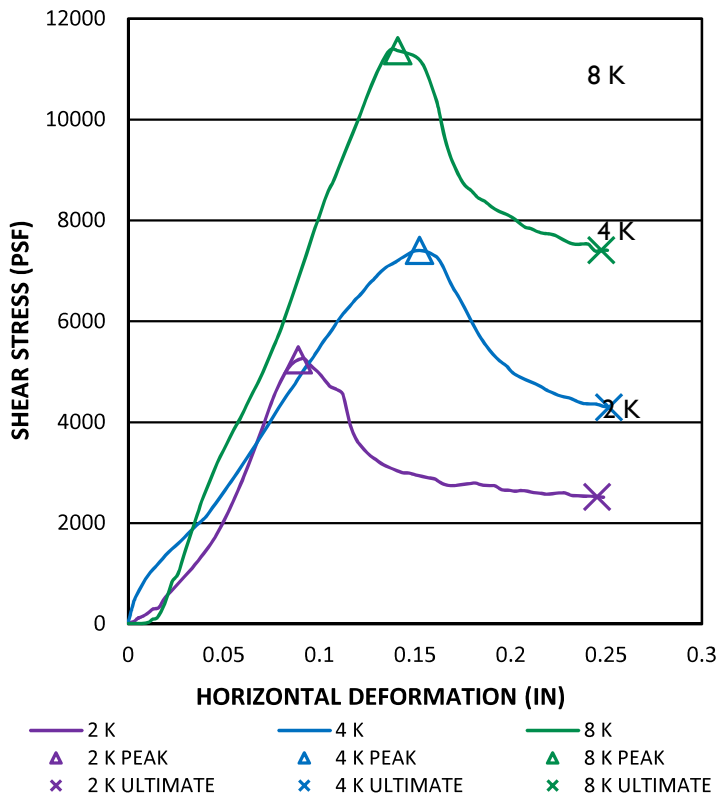
FIG.

SAMPLE NO.: **B-1** GEOLOGIC UNIT: **Otay Formation**
 SAMPLE DEPTH (FT): **215'** NATURAL/REMOVED: **N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	2 K	4 K	8 K	AVERAGE
ACTUAL NORMAL STRESS (PSF):	2000	4000	8000	--
WATER CONTENT (%):	6.1	6.5	5.7	6.1
DRY DENSITY (PCF):	121.2	119.4	123.0	121.2

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	2 K	4 K	8 K	AVERAGE
WATER CONTENT (%):	12.6	13.5	12.2	12.8
PEAK SHEAR STRESS (PSF):	5236	7406	11365	--
ULT.-E.O.T. SHEAR STRESS (PSF):	2522	4294	7412	--

RESULTS		
PEAK	COHESION, C (PSF)	3260
	FRICTION ANGLE (DEGREES)	45
ULTIMATE	COHESION, C (PSF)	960
	FRICTION ANGLE (DEGREES)	39



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DIRECT SHEAR - ASTM D 3080

SOUTHWEST VILLAGE

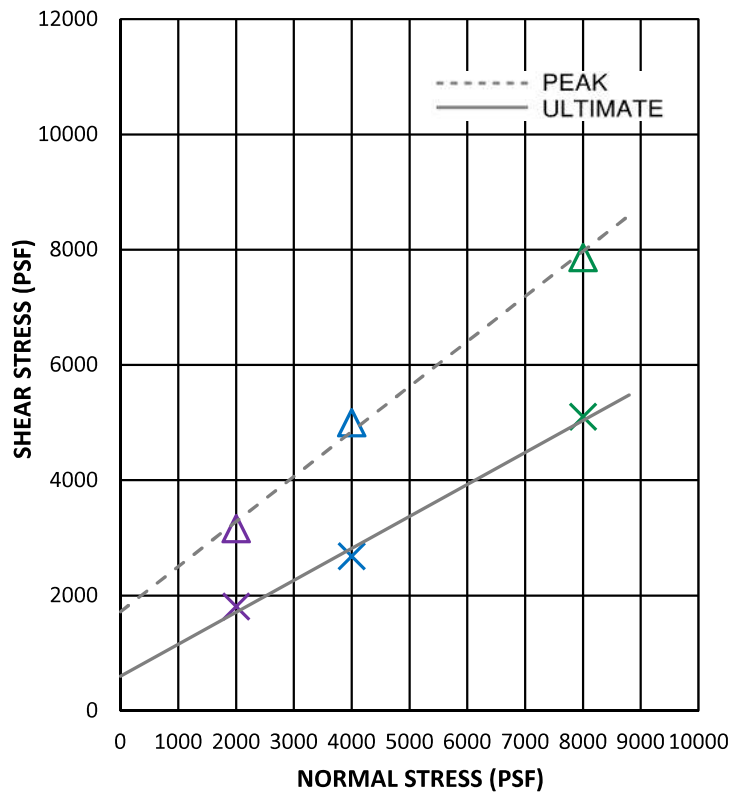
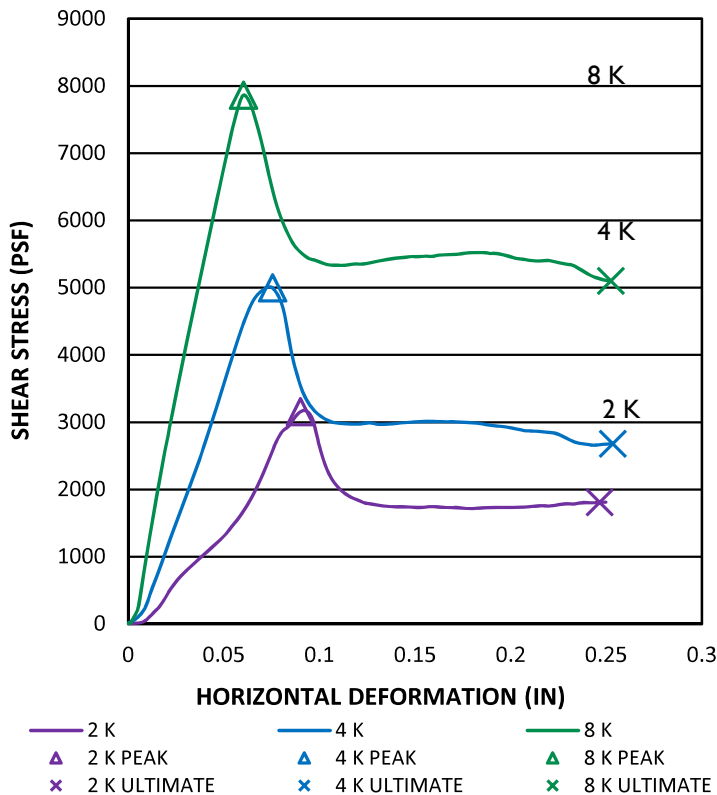
PROJECT NO.: 06847-42-04

SAMPLE NO.: **B-2** GEOLOGIC UNIT: **Otay Formation**
 SAMPLE DEPTH (FT): **289'** NATURAL/REMOLDED: **N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	2 K	4 K	8 K	AVERAGE
ACTUAL NORMAL STRESS (PSF):	2000	4000	8000	--
WATER CONTENT (%):	6.2	6.4	6.5	6.4
DRY DENSITY (PCF):	116.5	115.6	117.0	116.4

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	2 K	4 K	8 K	AVERAGE
WATER CONTENT (%):	13.4	13.8	13.5	13.6
PEAK SHEAR STRESS (PSF):	3156	4996	7863	--
ULT.-E.O.T. SHEAR STRESS (PSF):	1811	2678	5100	--

RESULTS		
PEAK	COHESION, C (PSF)	1720
	FRICTION ANGLE (DEGREES)	38
ULTIMATE	COHESION, C (PSF)	600
	FRICTION ANGLE (DEGREES)	29



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DIRECT SHEAR - ASTM D 3080

SOUTHWEST VILLAGE

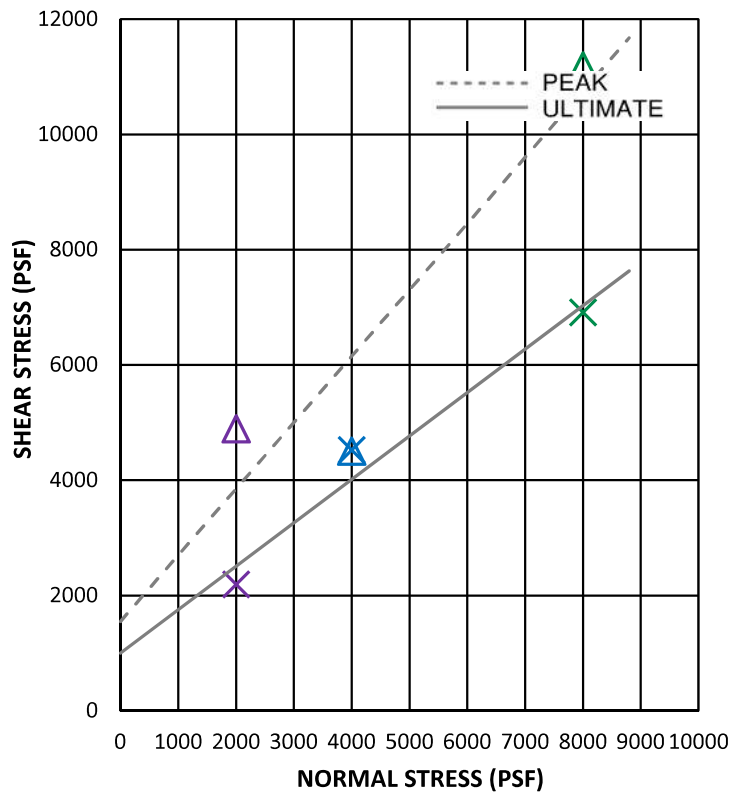
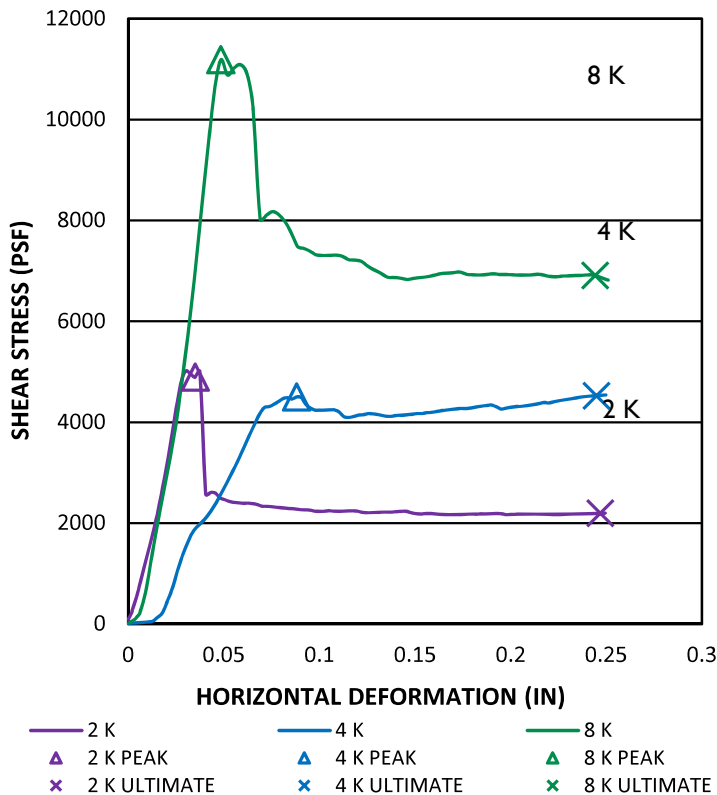
PROJECT NO.: 06847-42-04

SAMPLE NO.: **B-3** GEOLOGIC UNIT: **Otay Formation**
 SAMPLE DEPTH (FT): **394'** NATURAL/REMOVED: **N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	2 K	4 K	8 K	AVERAGE
ACTUAL NORMAL STRESS (PSF):	2000	4000	8000	--
WATER CONTENT (%):	8.0	9.7	9.1	8.9
DRY DENSITY (PCF):	113.4	113.2	113.9	113.5

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	2 K	4 K	8 K	AVERAGE
WATER CONTENT (%):	15.5	16.0	15.5	15.7
PEAK SHEAR STRESS (PSF):	4892	4502	11186	--
ULT.-E.O.T. SHEAR STRESS (PSF):	2194	4525	6913	--

RESULTS		
PEAK	COHESION, C (PSF)	1550
	FRICTION ANGLE (DEGREES)	49
ULTIMATE	COHESION, C (PSF)	1000
	FRICTION ANGLE (DEGREES)	37



DIRECT SHEAR - ASTM D 3080

SOUTHWEST VILLAGE

PROJECT NO.: 06847-42-04

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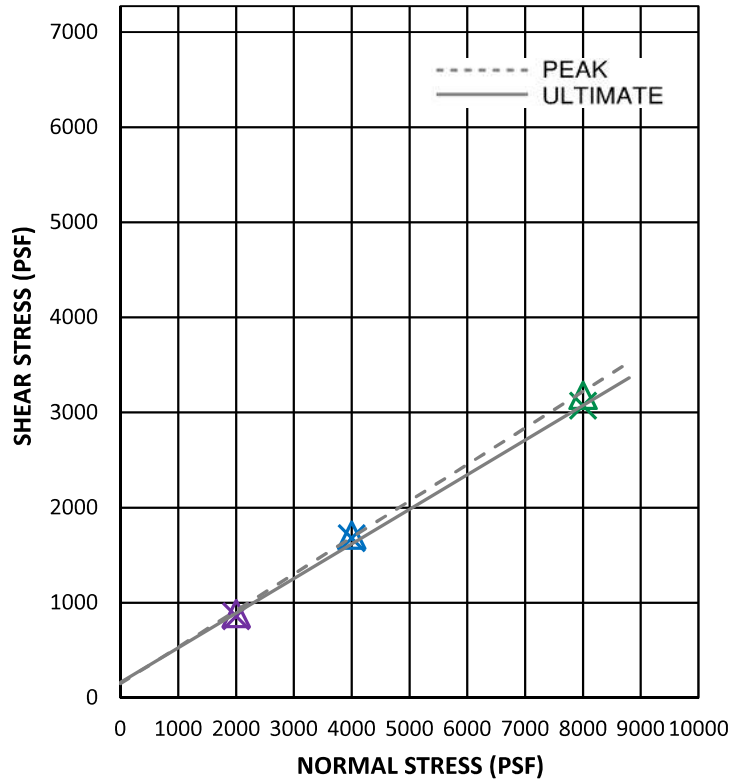
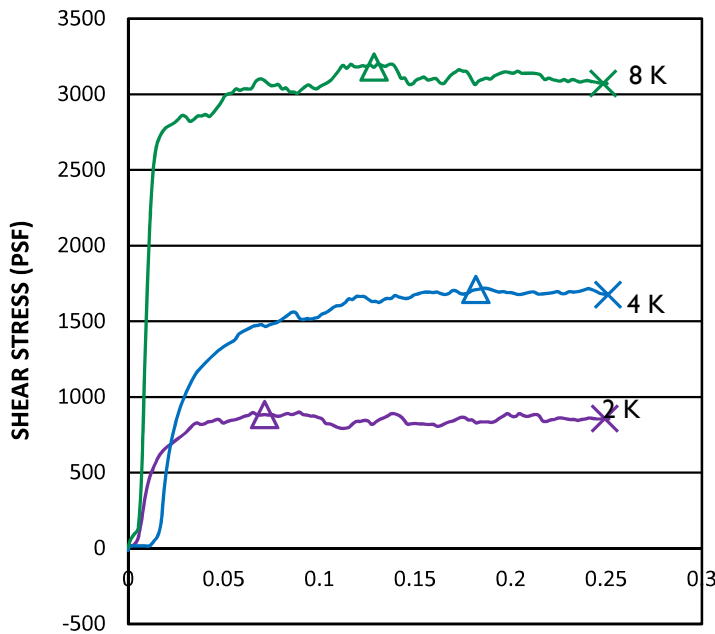
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SAMPLE NO.: **B3 @ 328-330** GEOLOGIC UNIT: **Shear Zone**
 SAMPLE DEPTH (FT): _____ NATURAL/REMOLDED: **N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	2 K	4 K	8 K	AVERAGE
ACTUAL NORMAL STRESS (PSF):	2000	4000	8000	--
WATER CONTENT (%):	18.3	18.3	18.3	18.3
DRY DENSITY (PCF):	107.4	107.4	107.4	107.4

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	2 K	4 K	8 K	AVERAGE
WATER CONTENT (%):	23.3	23.3	23.3	23.3
PEAK SHEAR STRESS (PSF):	884	1710	3179	--
ULT.-E.O.T. SHEAR STRESS (PSF):	858	1677	3072	--

RESULTS		
PEAK	COHESION, C (PSF)	150
	FRICTION ANGLE (DEGREES)	21
ULTIMATE	COHESION, C (PSF)	160
	FRICTION ANGLE (DEGREES)	20



HORIZONTAL DEFORMATION (IN)

— 2 K — 4 K — 8 K
 ▲ 2 K PEAK ▲ 4 K PEAK ▲ 8 K PEAK
 × 2 K ULTIMATE × 4 K ULTIMATE × 8 K ULTIMATE

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RESIDUAL SHEAR - ASTM D 3080

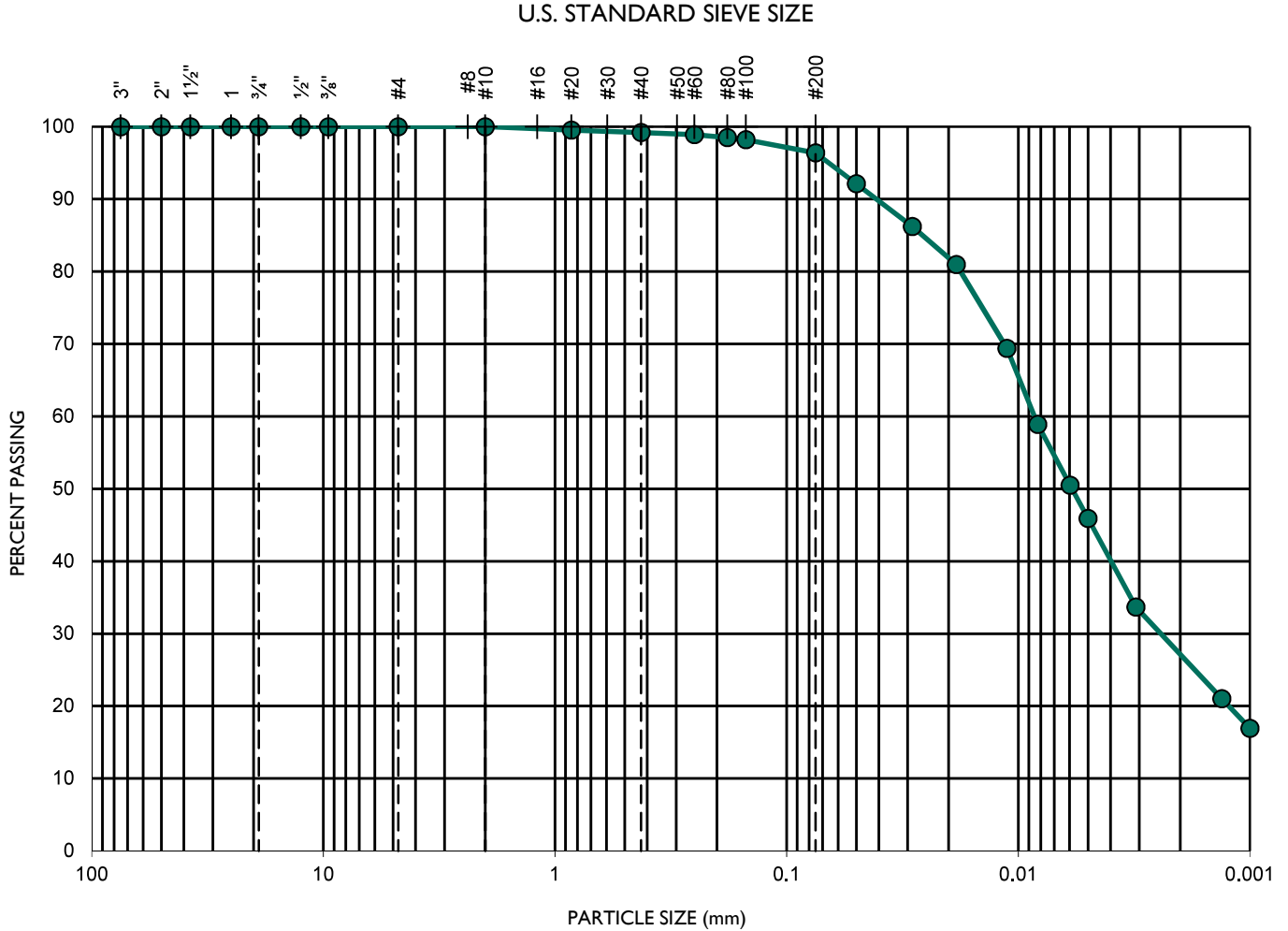
SOUTHWEST VILLAGE

PROJECT NO.: 06847-42-04

SAMPLE NO.: **BI @ 161-164**
 SAMPLE DEPTH (FT.): **161-164**

GEOLOGIC UNIT: **Shear Zone**

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



TEST DATA					
D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _c	C _u	SOIL DESCRIPTION
0.00046	0.00259	0.00854	1.7	18.6	Silty CLAY

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SIEVE ANALYSES - ASTM D 135 & D 422

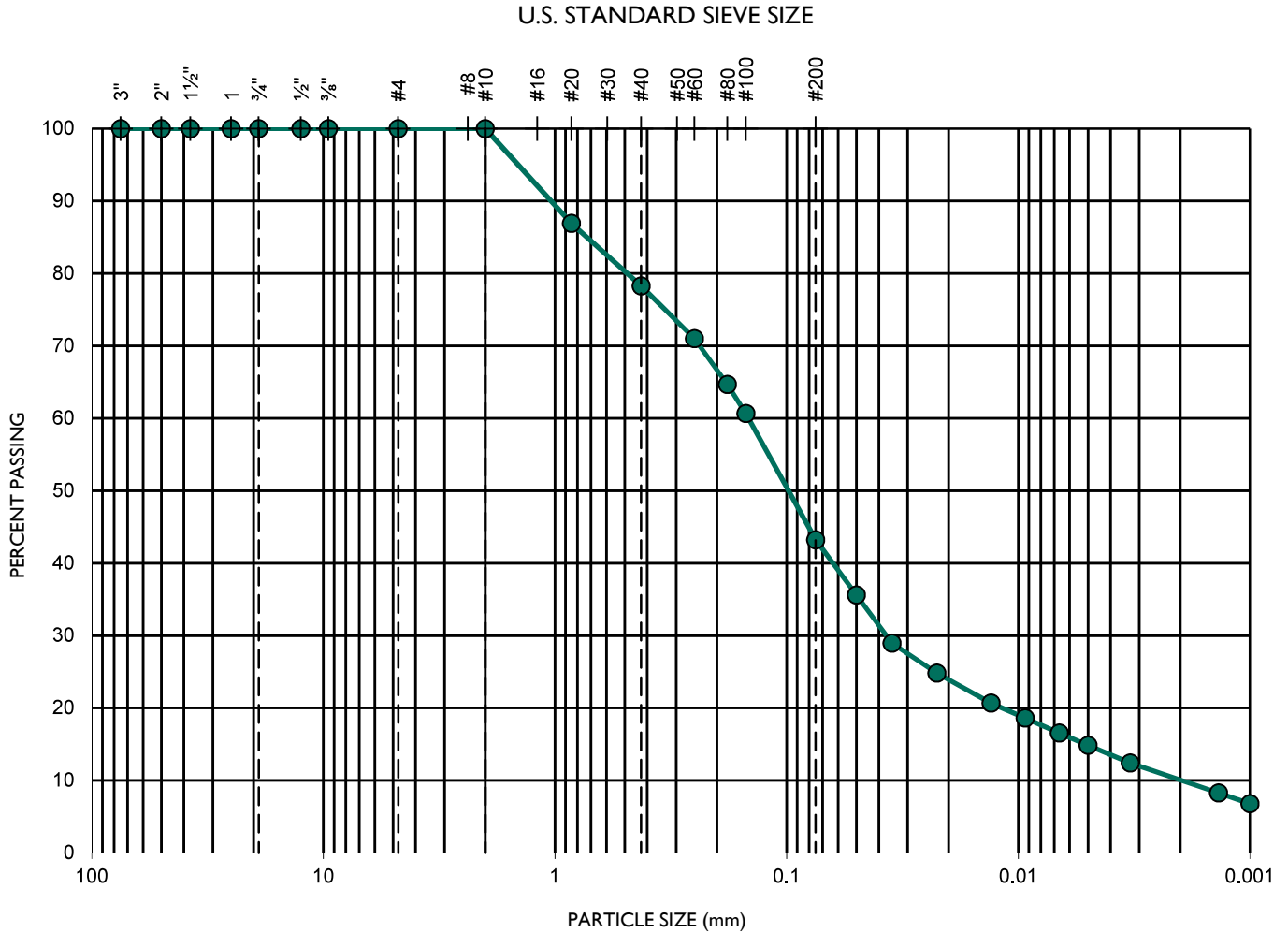
SOUTHWEST VILLAGE

PROJECT NO.: 06847-42-04

SAMPLE NO.: **B2 @ 263**
 SAMPLE DEPTH (FT.): **263**

GEOLOGIC UNIT: **Shear Zone**

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



TEST DATA					
D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _c	C _u	SOIL DESCRIPTION
0.00217	0.03745	0.14714	4.4	67.8	Silty SAND

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SIEVE ANALYSES - ASTM D 135 & D 422

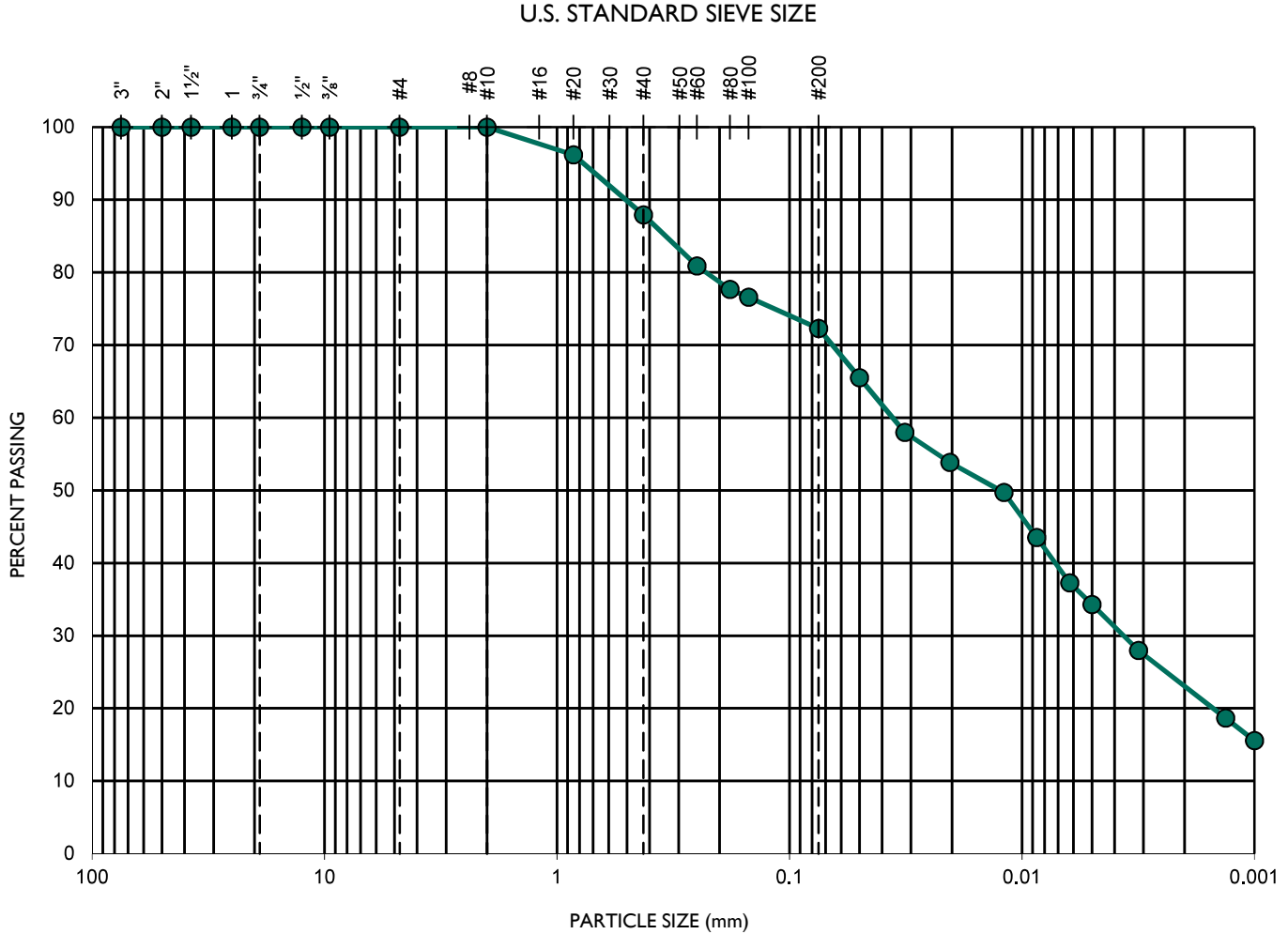
SOUTHWEST VILLAGE

PROJECT NO.: 06847-42-04

SAMPLE NO.: **B3 @ 324**
 SAMPLE DEPTH (FT.): **324**

GEOLOGIC UNIT: **Shear Zone**

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



TEST DATA					
D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _c	C _u	SOIL DESCRIPTION
0.00040	0.00375	0.03673	0.9	90.8	Silty CLAY with sand

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SIEVE ANALYSES - ASTM D 135 & D 422

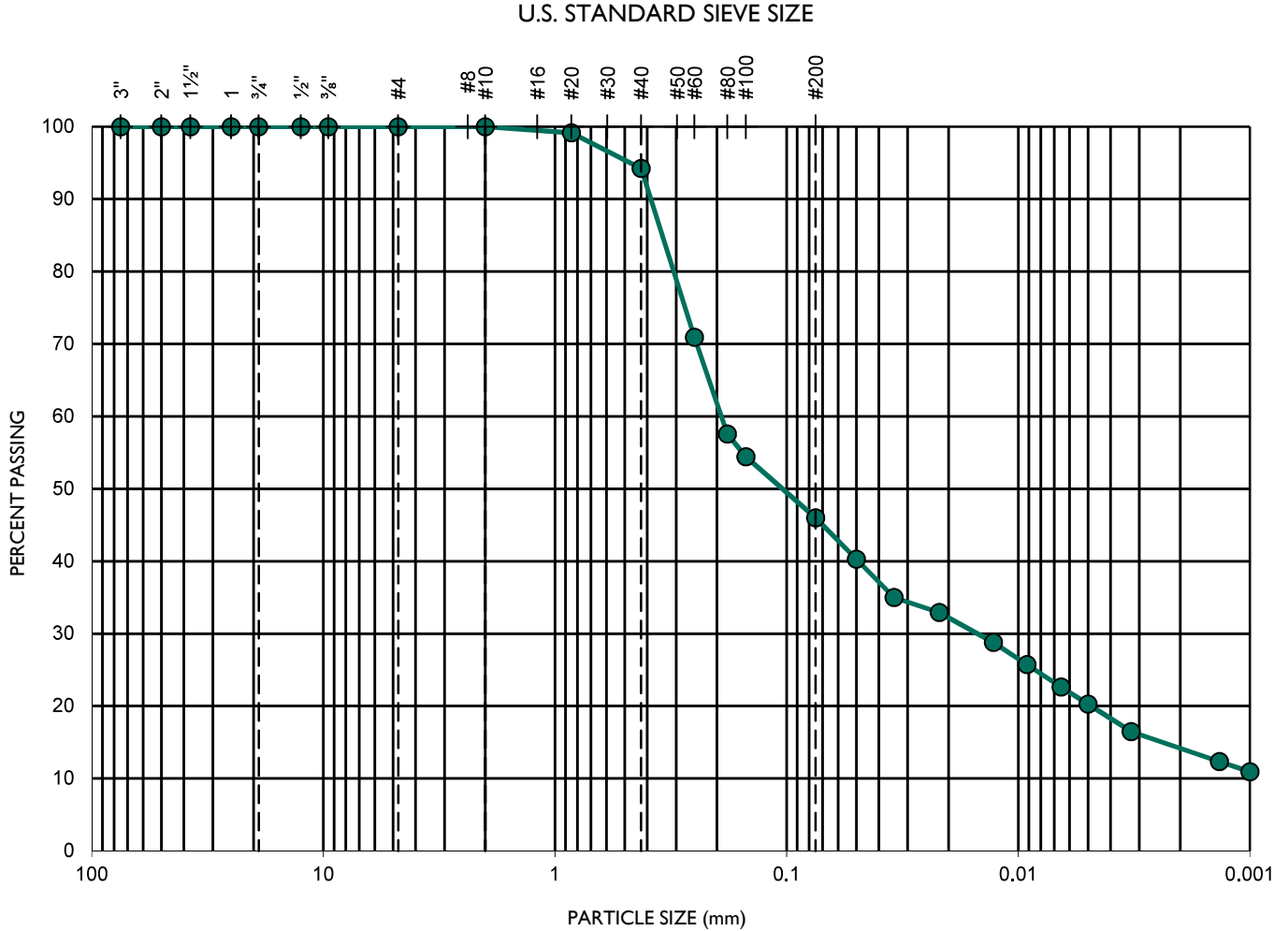
SOUTHWEST VILLAGE

PROJECT NO.: 06847-42-04

SAMPLE NO.: **B3 @ 328-330**
 SAMPLE DEPTH (FT.): **328-330**

GEOLOGIC UNIT: **Shear Zone**

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



TEST DATA					
D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _c	C _u	SOIL DESCRIPTION
0.00077	0.01546	0.19277	1.6	250.6	Silty Clayey SAND

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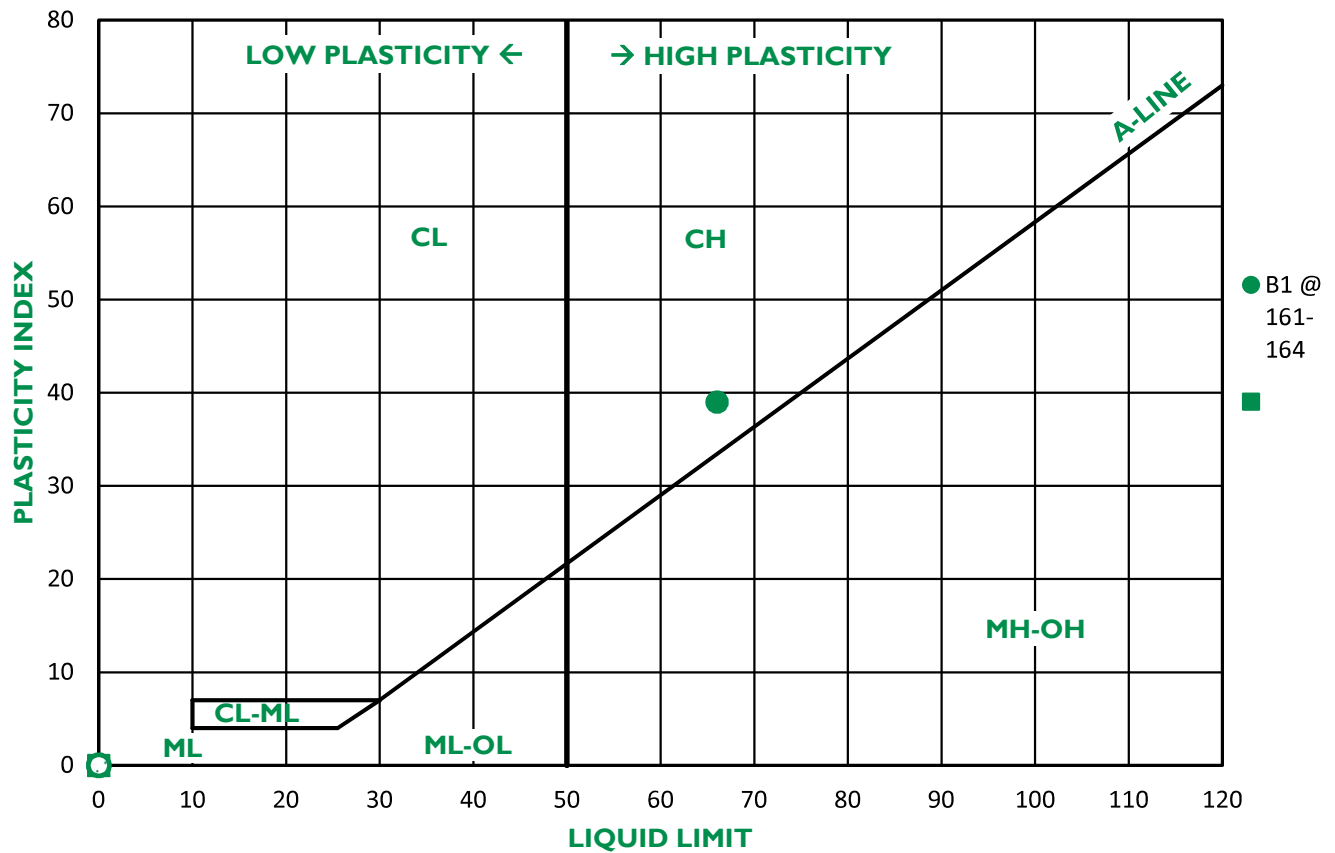
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SOUTHWEST VILLAGE

PROJECT NO.: 06847-42-04

TEST RESULTS					
SAMPLE NO.	GEOLOGIC UNIT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
B1 @ 161-164	Shear Zone	66	27	39	CH



SOIL TYPE DESCRIPTION	
CH	High-Plasticity Clay
CL	Low-Plasticity Clay
ML	Low-Plasticity Silt
CL-ML	Low-Plasticity Clay to Low-Plasticity Silt
MH-OH	High-Plasticity Silt to High-Plasticity, Organic Silt
ML-OL	Low-Plasticity Silt to Low-Plasticity, Organic Silt

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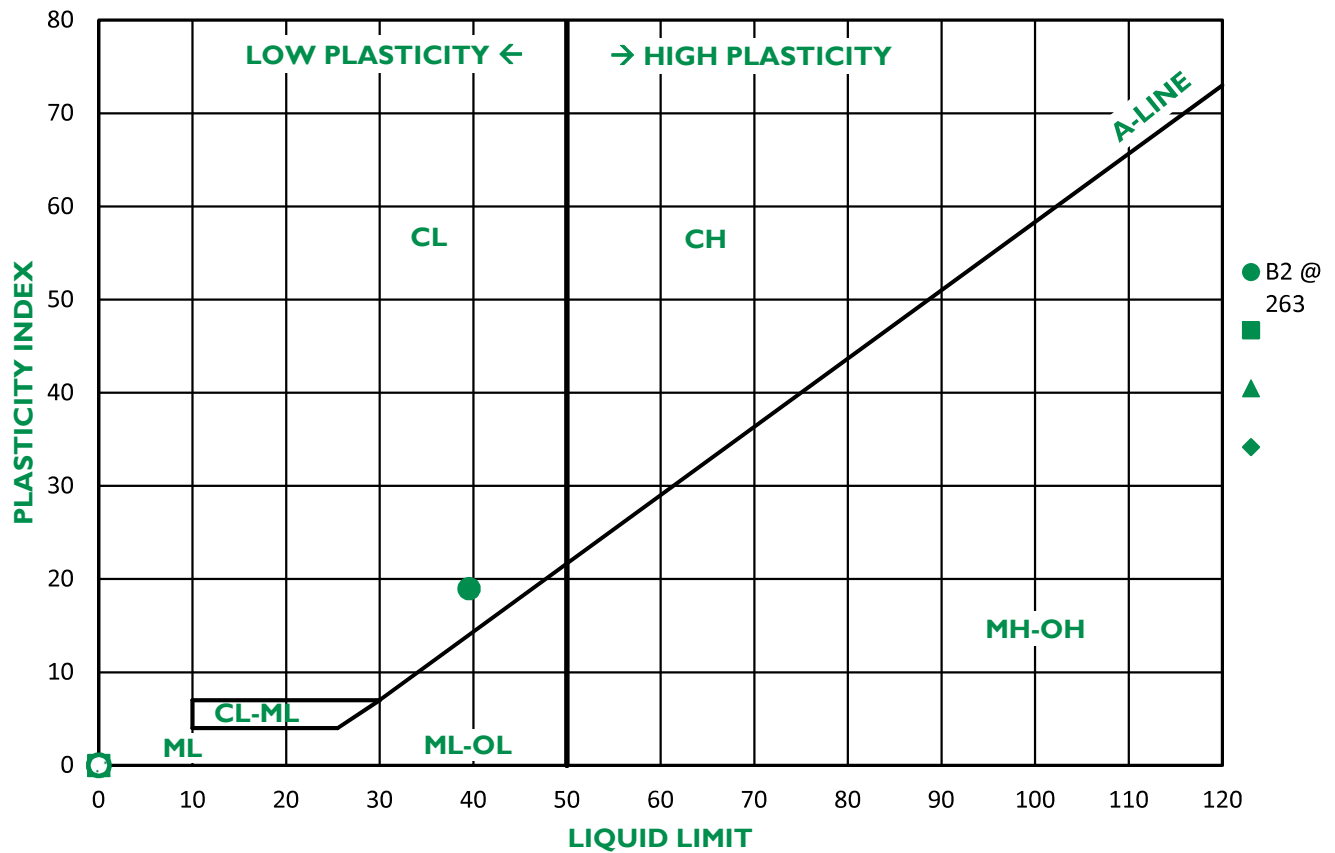


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PLASTICITY INDEX - ASTM D 4318

Southwest Village
PROJECT NO.: 06847-42-04

TEST RESULTS					
SAMPLE NO.	GEOLOGIC UNIT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
B2 @ 263	Shear Zone	40	21	19	CL



SOIL TYPE DESCRIPTION	
CH	High-Plasticity Clay
CL	Low-Plasticity Clay
ML	Low-Plasticity Silt
CL-ML	Low-Plasticity Clay to Low-Plasticity Silt
MH-OH	High-Plasticity Silt to High-Plasticity, Organic Silt
ML-OL	Low-Plasticity Silt to Low-Plasticity, Organic Silt

GEOCON
INCORPORATED

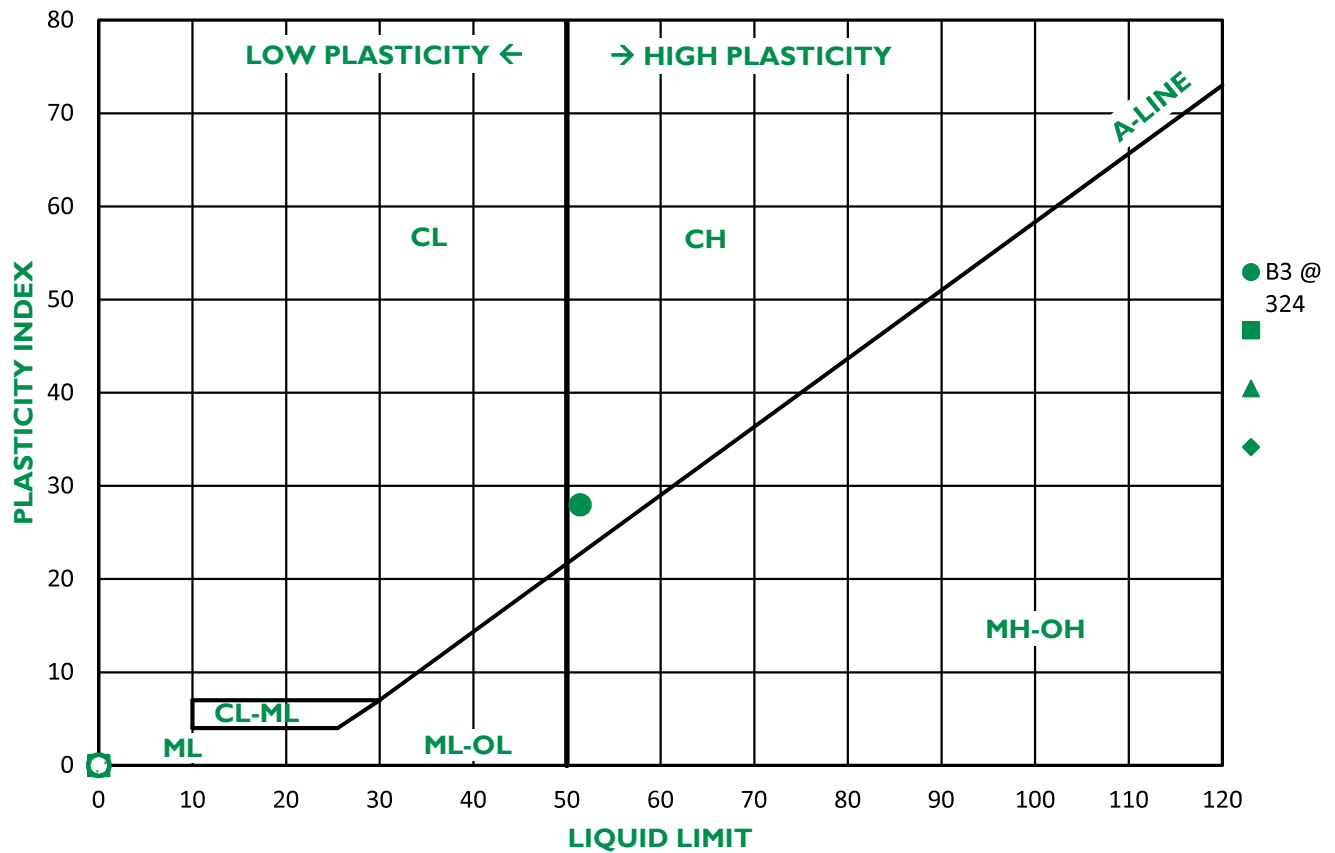


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PLASTICITY INDEX - ASTM D 4318

SOUTHWEST VILLAGE
PROJECT NO.: 06847-42-04

TEST RESULTS					
SAMPLE NO.	GEOLOGIC UNIT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
B3 @ 324	SHEAR ZONE	51	23	28	CH



SOIL TYPE DESCRIPTION	
CH	High-Plasticity Clay
CL	Low-Plasticity Clay
ML	Low-Plasticity Silt
CL-ML	Low-Plasticity Clay to Low-Plasticity Silt
MH-OH	High-Plasticity Silt to High-Plasticity, Organic Silt
ML-OL	Low-Plasticity Silt to Low-Plasticity, Organic Silt

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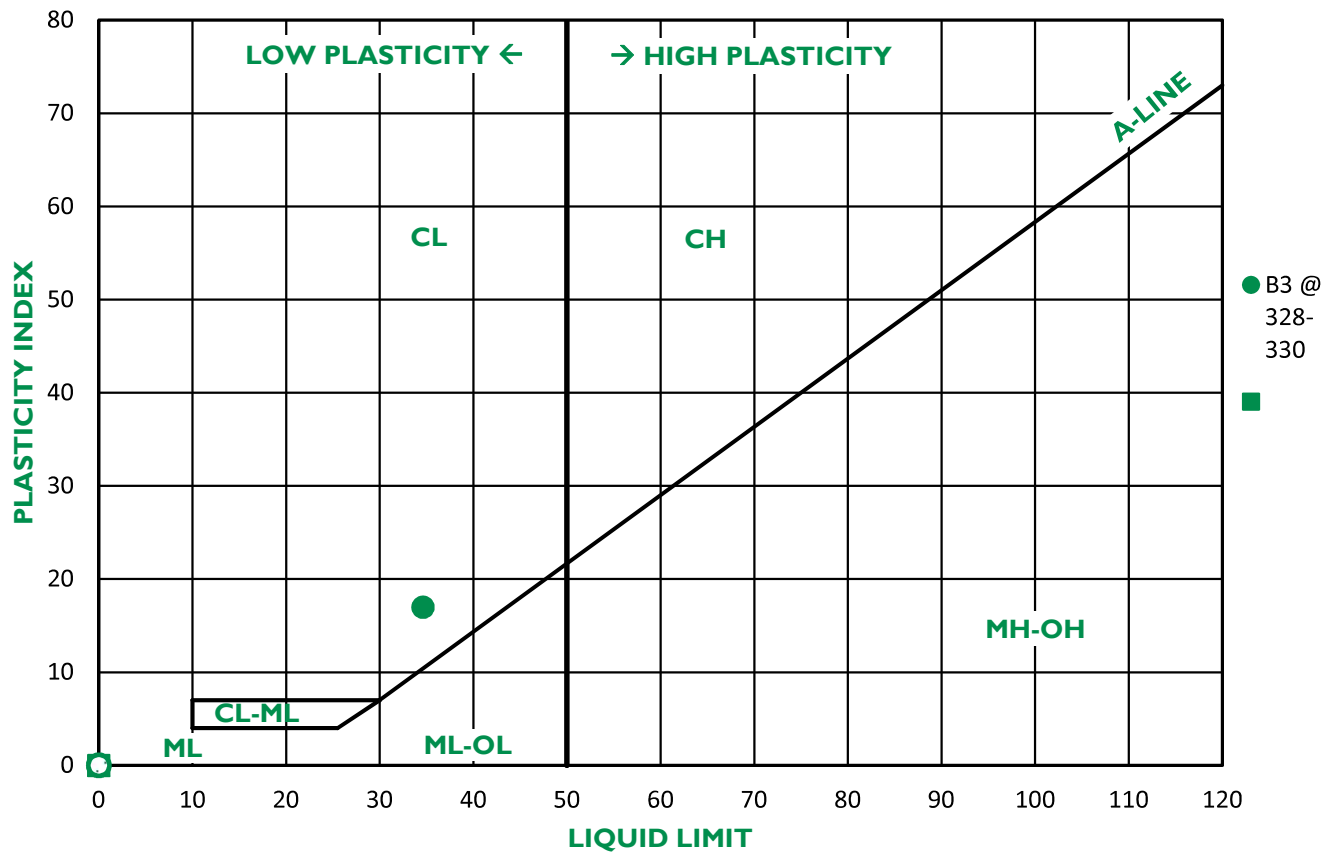


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PLASTICITY INDEX - ASTM D 4318

SOUTHWEST VILLAGE
PROJECT NO.: 06847-42-04

TEST RESULTS					
SAMPLE NO.	GEOLOGIC UNIT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
B3 @ 328-330	Shear Zone	35	18	17	CL



SOIL TYPE DESCRIPTION	
CH	High-Plasticity Clay
CL	Low-Plasticity Clay
ML	Low-Plasticity Silt
CL-ML	Low-Plasticity Clay to Low-Plasticity Silt
MH-OH	High-Plasticity Silt to High-Plasticity, Organic Silt
ML-OL	Low-Plasticity Silt to Low-Plasticity, Organic Silt

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PLASTICITY INDEX - ASTM D 4318

SOUTHWEST VILLAGE

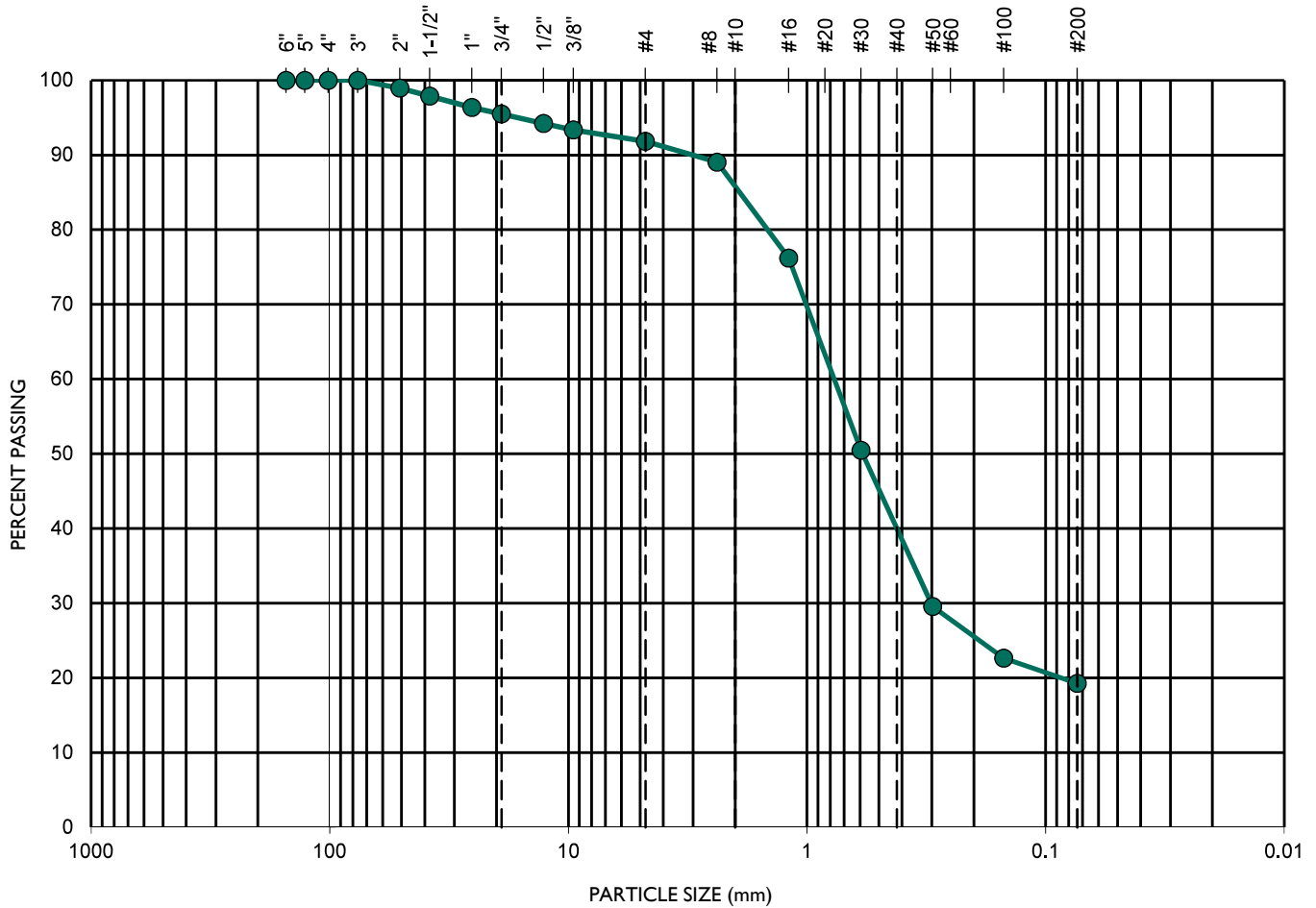
PROJECT NO.: 06847-42-04

SAMPLE NO.: Perm-1
 SAMPLE DEPTH (FT.): 0

GEOLOGIC UNIT: Qt

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

U.S. STANDARD SIEVE SIZE



TEST DATA					SOIL DESCRIPTION
D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _c	C _u	
0.038	0.303	0.816	2.9	21.3	SM - Silty SAND

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SIEVE ANALYSES - ASTM D 135

SOUTHWEST VILLAGE

PROJECT NO.: 06847-42-04

APPENDIX



APPENDIX B

HYDRAULIC CONDUCTIVITY TESTING

We performed hydraulic conductivity testing on the mesa in the development area and at each of the proposed storm water outfalls. The tests were performed in 4- and 6-inch-diameter, drilled boreholes. We also performed a laboratory permeability test on a remolded sample of soil obtained from the mesa. Tables B-1 and B-2 presents the results of the testing. Figure B-1 shows the locations of the tests.

**TABLE B-1
HYDRAULIC CONDUCTIVITY TEST RESULTS PERFORMED ON THE MESA**

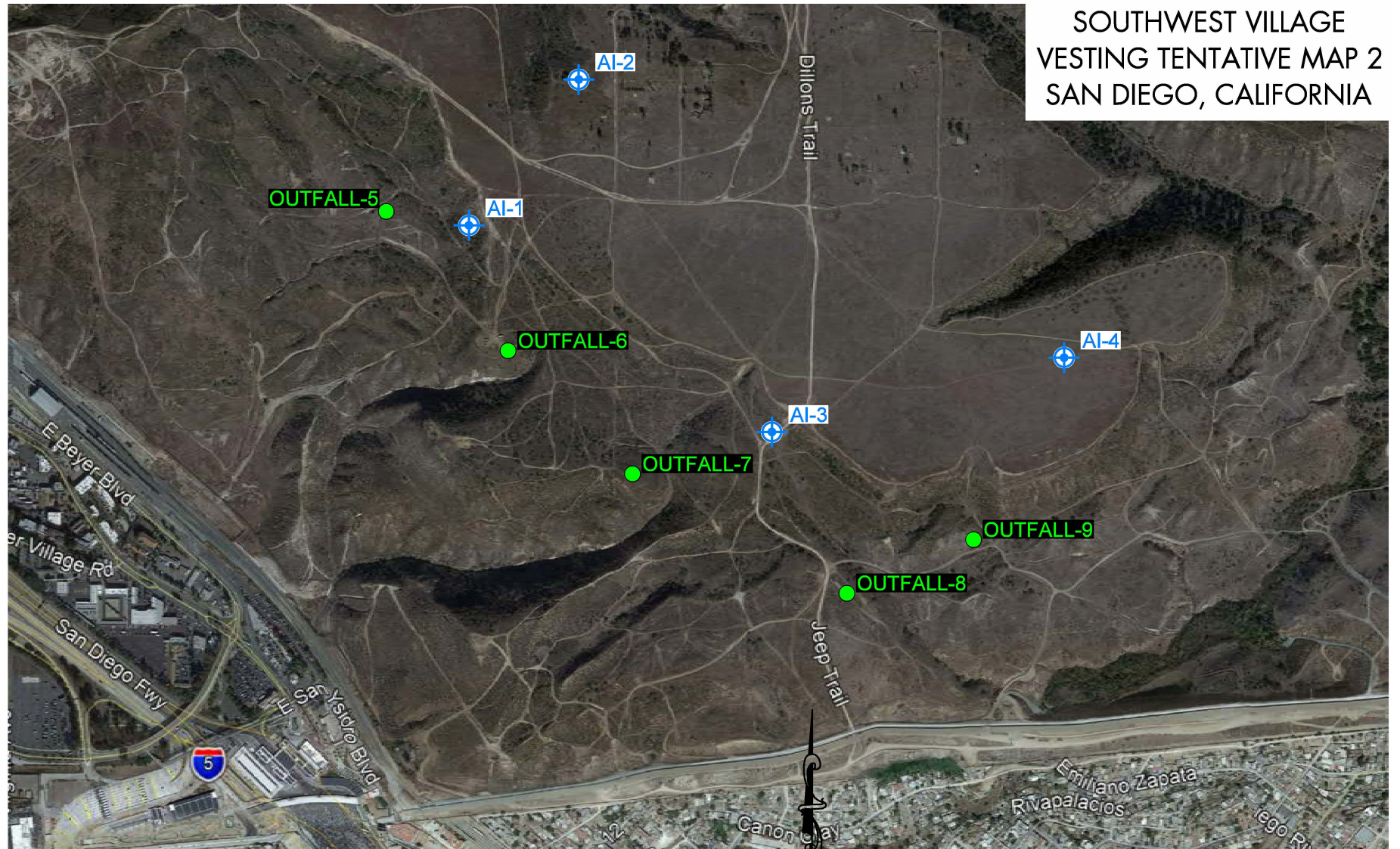
Location	Depth (feet)	Geologic Unit	Hydraulic Conductivity k (in/hr)
A-1	5	Topsoil/Qt	0.007
A-2	5	Qt	0.049
A-3	5	Qt	0.018
A-4	5	Qt	0.004
Lab Permeability	--	Remolded Sample	0.86

**TABLE B-2
HYDRAULIC CONDUCTIVITY TEST RESULTS PERFORMED AT OUTFALLS**

Location	Depth (feet)	Geologic Unit	Hydraulic Conductivity k (in/hr)
Outfall 5	5	Qls	0.011
Outfall 6	5	Qls	0.0009
Outfall 7*	3.3	Qls	0.0004
Outfall 8	4	Qls	0.008
Outfall 9	4.5	Qls	0.004

* Actual Location Slightly West of Outfall 7

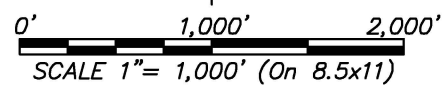
SOUTHWEST VILLAGE
VESTING TENTATIVE MAP 2
SAN DIEGO, CALIFORNIA



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GEOCON LEGEND

AI-4 APPROX. LOCATION OF INFILTRATION TEST

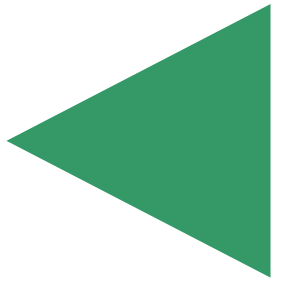


INFILTRATION TEST LOCATION MAP

GEOCON
INCORPORATED
GEO TECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159
PROJECT NO. 06847 - 42 - 04
FIGURE B-1
DATE 07 - 02 - 2021



APPENDIX



APPENDIX C

SLOPE STABILITY ANALYSIS

FOR

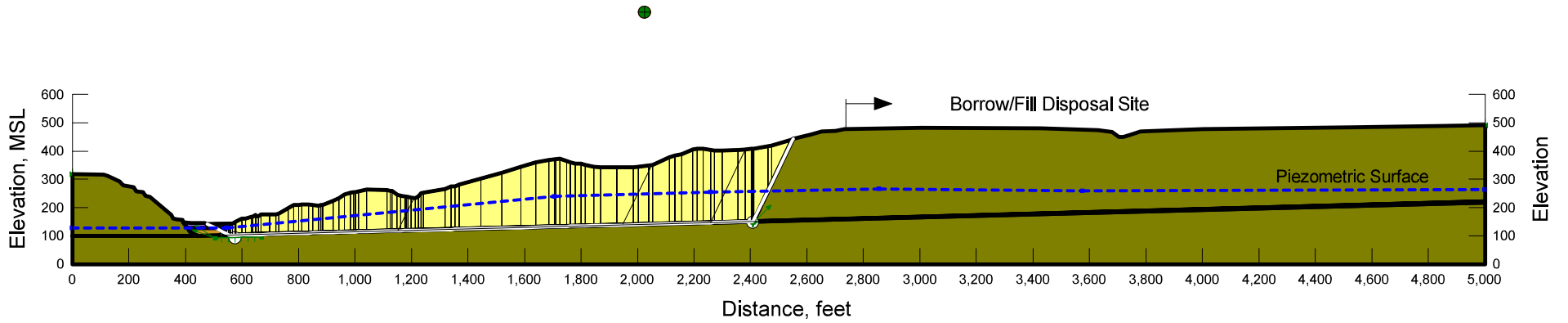
SOUTHWEST VILLAGE VTM-2
SAN DIEGO, CALIFORNIA

PROJECT NO. 06847-42-04

Southwest Village
 Project No. 06847-42-04
 Cross Section: CC-CC'

Analysis:
 – Failure Up Headscarp

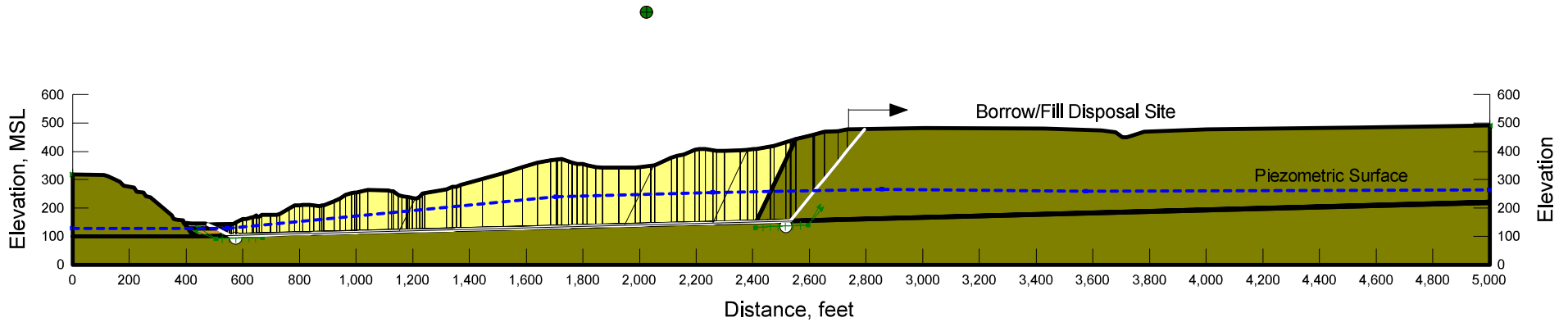
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
Orange	Qal	125	100	28	1
Purple	Qcf	130	300	30	1
Yellow	Qls	130	300	30	1
Red	Shear Zone	120	50	8	1
Olive Green	To	130	450	34	1
Olive Green	To (2)				1



Southwest Village
 Project No. 06847-42-04
 Cross Section: CC-CC'

Analysis:
 – Failure along Extended Shear Plane

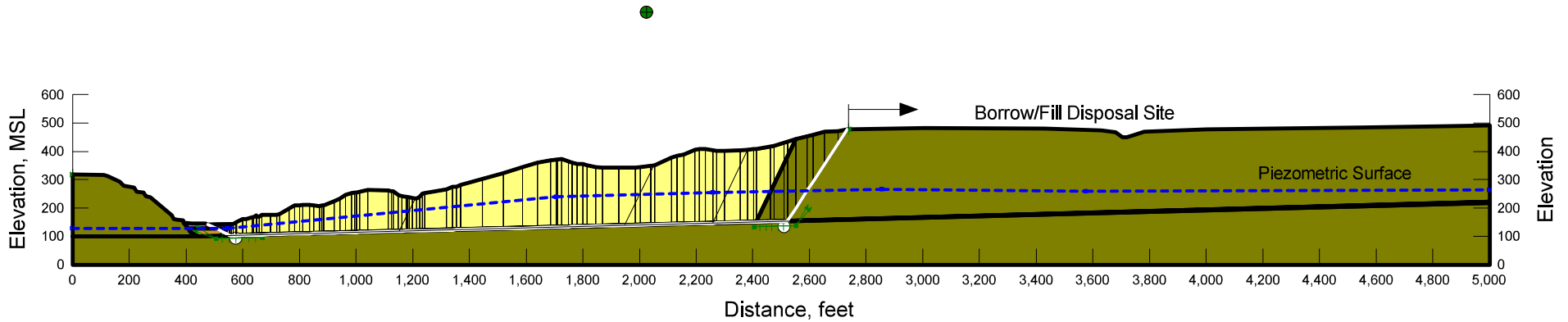
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
Orange	Qal	125	100	28	1
Purple	Qcf	130	300	30	1
Yellow	Qls	130	300	30	1
Red	Shear Zone	120	50	8	1
Olive Green	To	130	450	34	1
Olive Green	To (2)				1



Southwest Village
 Project No. 06847-42-04
 Cross Section: CC-CC'

Analysis:
 – Failure at Edge of Borrow/Disposal Site

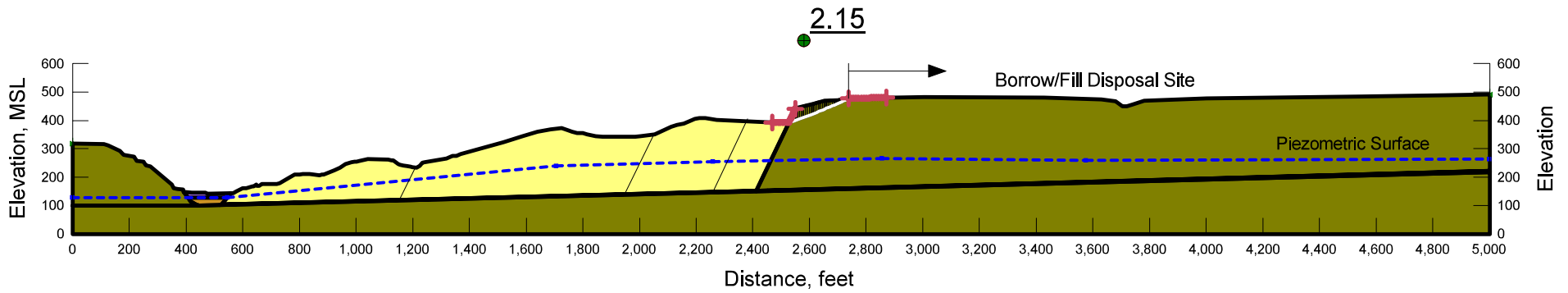
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
Orange	Qal	125	100	28	1
Purple	Qcf	130	300	30	1
Yellow	Qls	130	300	30	1
Red	Shear Zone	120	50	8	1
Olive Green	To	130	450	34	1
Olive Green	To (2)				1



Southwest Village
 Project No. 06847-42-04
 Cross Section: CC-CC'

Analysis:
 – 50 foot drop in landslide

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
Orange	Qal	125	100	28	1
Purple	Qcf	130	300	30	1
Yellow	Qls	130	300	30	1
Red	Shear Zone	120	50	8	1
Olive Green	To	130	450	34	1
Olive Green	To (2)				1





Seismic Slope Stability Evaluation

Input Data in Shaded Areas

Project Southwest Village
Project Number 06847-42-04
Date 07/02/21

Computed By RCM

Peak Ground Acceleration (Firm Rock), MHA_r , g	0.21	10% in 50 years
Modal Magnitude, M	6.12	
Modal Distance, r, km	11.5	
Site Condition, S (0 for rock, 1 for soil)	0	
Yield Acceleration, k_y/g	NA	<-- Enter Value or NA for Screening Analysis
Shear Wave Velocity, V_s (ft/sec)	1500	<--
Max Vertical Distance, H (Feet)	336	<--
Is Slide X-Area > 25,000ft ² (Y/N)	Y	<-- Use "N" for Buttress Fills
Correction for horizontal incoherence	0.8	
Duration, D_{5-95} med, sec	6.730	
Coefficient, C_1	0.4110	
Coefficient, C_2	0.0837	
Coefficient, C_3	0.0021	
Standard Error, ϵ_T	0.437	
Mean Square Period, T_m , sec	0.445	

Initial Screening with $MHEA = MHA = k_{max}g$

k_y/MHA	NA
$f_{EQ}(u=5cm) = (NRF/3.477) * (1.87 - \log(u / ((MHA_r/g) * NRF * D_{5-95})))$	0.4811
$k_{EQ} = feq(MHA_r)/g$	0.101
Factor of Safety in Slope Analysis Using k_{EQ}	0.77

Fails Initial Screening Analysis

Approximation of Seismic Demand

Period of Sliding Mass, $T_s = 4H/V_s$, sec	0.896
T_s/T_m	2.01
$MHEA/(MHA * NRF)$	0.248
$NRF = 0.6225 + 0.9196 \exp(-2.25 * MHA_r/g)$	1.20
MHEA/g	0.06
$k_y/MHEA = k_y/k_{max}$	NA
Normalized Displacement, Normu	NA

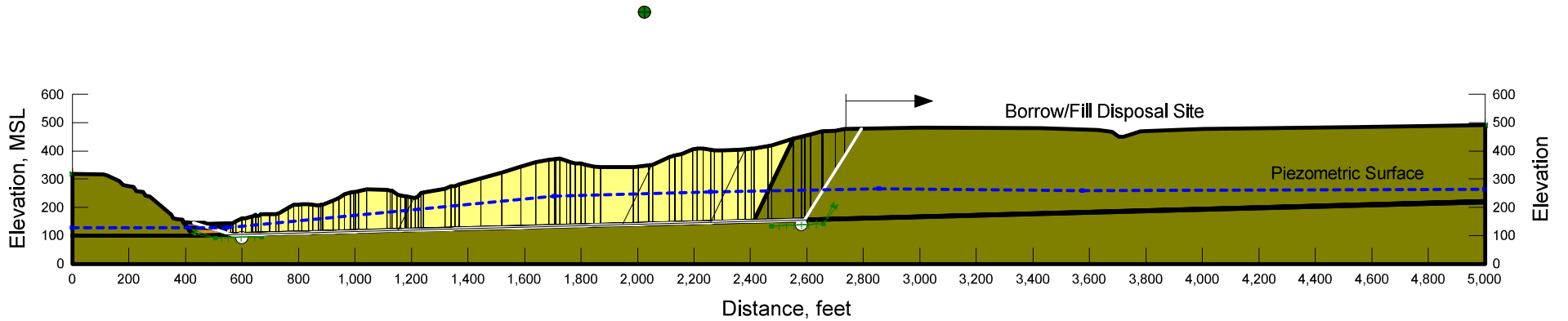
Estimated Displacement, u (cm) NA

FIGURE C-5

Southwest Village
 Project No. 06847-42-04
 Cross Section: CC-CC'

Analysis:
 – Seismic Analysis: Horz Seismic Coef.: 0.101

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
Orange	Qal	125	100	28	1
Purple	Qcf	130	300	30	1
Yellow	Qls	130	300	30	1
Red	Shear Zone	120	50	8	1
Olive Green	To	130	450	34	1
Olive Green	To (2)				1

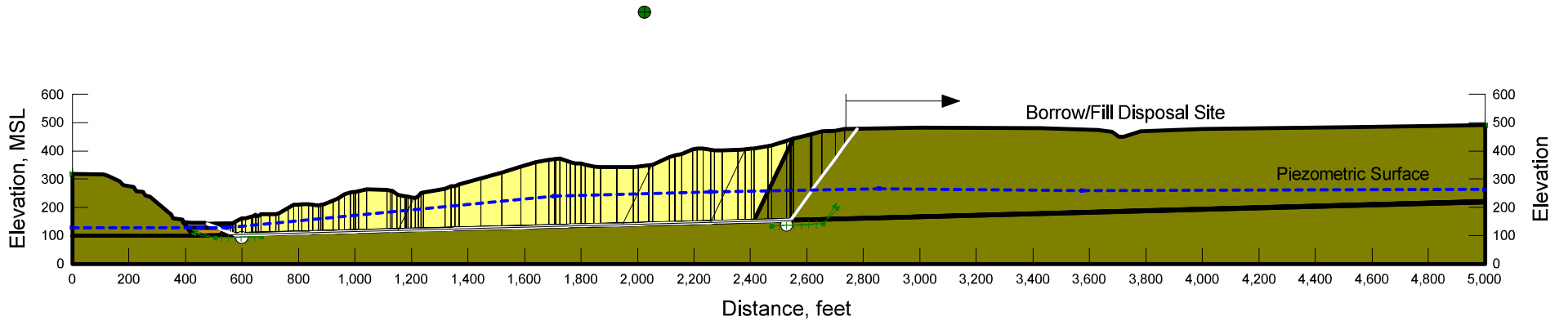


Southwest Village
 Project No. 06847-42-04
 Cross Section: CC-CC'

Analysis:

- Seismic for FS=1.0
- Horz Seismic Coef.: 0.05

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
Orange	Qal	125	100	28	1
Purple	Qcf	130	300	30	1
Yellow	Qls	130	300	30	1
Red	Shear Zone	120	50	8	1
Olive Green	To	130	450	34	1
Olive Green	To (2)				1





Seismic Slope Stability Evaluation

Input Data in Shaded Areas

Project	Southwest Village	Computed By	RCM
Project Number	06847-42-04		
Date	07/02/21		
Filename	Seismic		

Peak Ground Acceleration (Firm Rock), MHA_r , g	0.21	10% in 50 years
Modal Magnitude, M	6.12	
Modal Distance, r, km	11.5	
Site Condition, S (0 for rock, 1 for soil)	0	
Yield Acceleration, k_y/g	0.05	<-- Enter Value or NA for Screening Analysis
Shear Wave Velocity, V_s (ft/sec)	1500	<--
Max Vertical Distance, H (Feet)	336	<--
Is Slide X-Area > 25,000ft ² (Y/N)	Y	<-- Use "N" for Buttress Fills
Correction for horizontal incoherence	0.8	
Duration, $D_{5-95 med}$, sec	6.730	
Coefficient, C_1	0.4110	
Coefficient, C_2	0.0837	
Coefficient, C_3	0.0021	
Standard Error, ϵ_T	0.437	
Mean Square Period, T_m , sec	0.445	

Initial Screening with $MHEA = MHA = k_{max}g$

k_y/MHA	0.2381
$f_{EQ}(u=5cm) = (NRF/3.477) * (1.87 - \log(u / ((MHA_r/g) * NRF * D_{5-95})))$	0.4811
$k_{EQ} = feq(MHA_r)/g$	0.101
Factor of Safety in Slope Analysis Using k_{EQ}	0.77

Fails Initial Screening Analysis

Approximation of Seismic Demand

Period of Sliding Mass, $T_s = 4H/V_s$, sec	0.896
T_s/T_m	2.01
$MHEA/(MHA * NRF)$	0.248
$NRF = 0.6225 + 0.9196 \text{EXP}(-2.25 * MHA_r/g)$	1.20
$MHEA/g$	0.06
$k_y/MHEA = k_y/k_{max}$	0.80
Normalized Displacement, Normu	0.1

Estimated Displacement, u (cm)

0

FIGURE C-8



Seismic Slope Stability Evaluation

Input Data in Shaded Areas

Project	Southwest Village	Computed By	RCM
Project Number	06847-42-04		
Date	07/02/21		
Filename	Seismic		

Peak Ground Acceleration (Firm Rock), MHA_r , g	0.21	10% in 50 years
Modal Magnitude, M	6.12	
Modal Distance, r, km	11.5	
Site Condition, S (0 for rock, 1 for soil)	0	
Yield Acceleration, k_y /g	0.05	<-- Enter Value or NA for Screening Analysis
Shear Wave Velocity, V_s (ft/sec)	1500	<--
Max Vertical Distance, H (Feet)	80	<--
Is Slide X-Area > 25,000ft ² (Y/N)	Y	<-- Use "N" for Buttress Fills
Correction for horizontal incoherence	0.8	
Duration, $D_{5-95 med}$, sec	6.730	
Coefficient, C_1	0.4110	
Coefficient, C_2	0.0837	
Coefficient, C_3	0.0021	
Standard Error, ϵ_T	0.437	
Mean Square Period, T_m , sec	0.445	

Initial Screening with $MHEA = MHA = k_{max}g$

k_y/MHA	0.2381
$f_{EQ}(u=5cm) = (NRF/3.477) * (1.87 - \log(u / ((MHA_r/g) * NRF * D_{5-95})))$	0.4811
$k_{EQ} = feq(MHA_r)/g$	0.101
Factor of Safety in Slope Analysis Using k_{EQ}	0.77

Fails Initial Screening Analysis

Approximation of Seismic Demand

Period of Sliding Mass, $T_s = 4H/V_s$, sec	0.213
T_s/T_m	0.48
$MHEA/(MHA * NRF)$	0.762
$NRF = 0.6225 + 0.9196 \exp(-2.25 * MHA_r/g)$	1.20
$MHEA/g$	0.19
$k_y/MHEA = k_y/k_{max}$	0.26
Normalized Displacement, Normu	9.2

Estimated Displacement, u (cm) 12

FIGURE C-9

- Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

32.5545

Time Horizon

Return period in years

475

Longitude

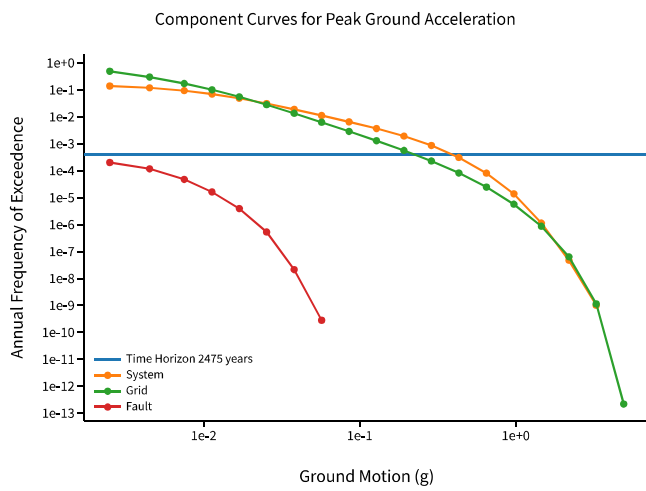
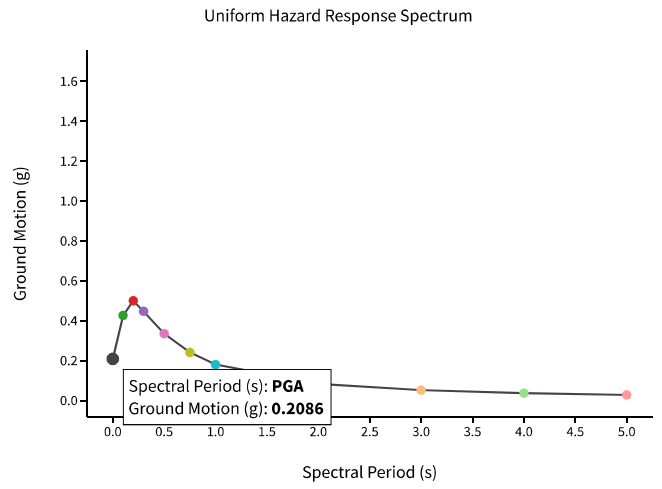
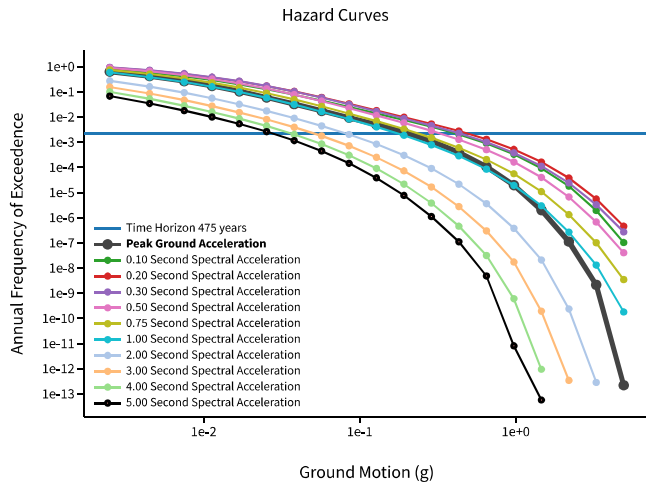
Decimal degrees, negative values for western longitudes

-117.0258

Site Class

537 m/s (Site class C)

^ Hazard Curve

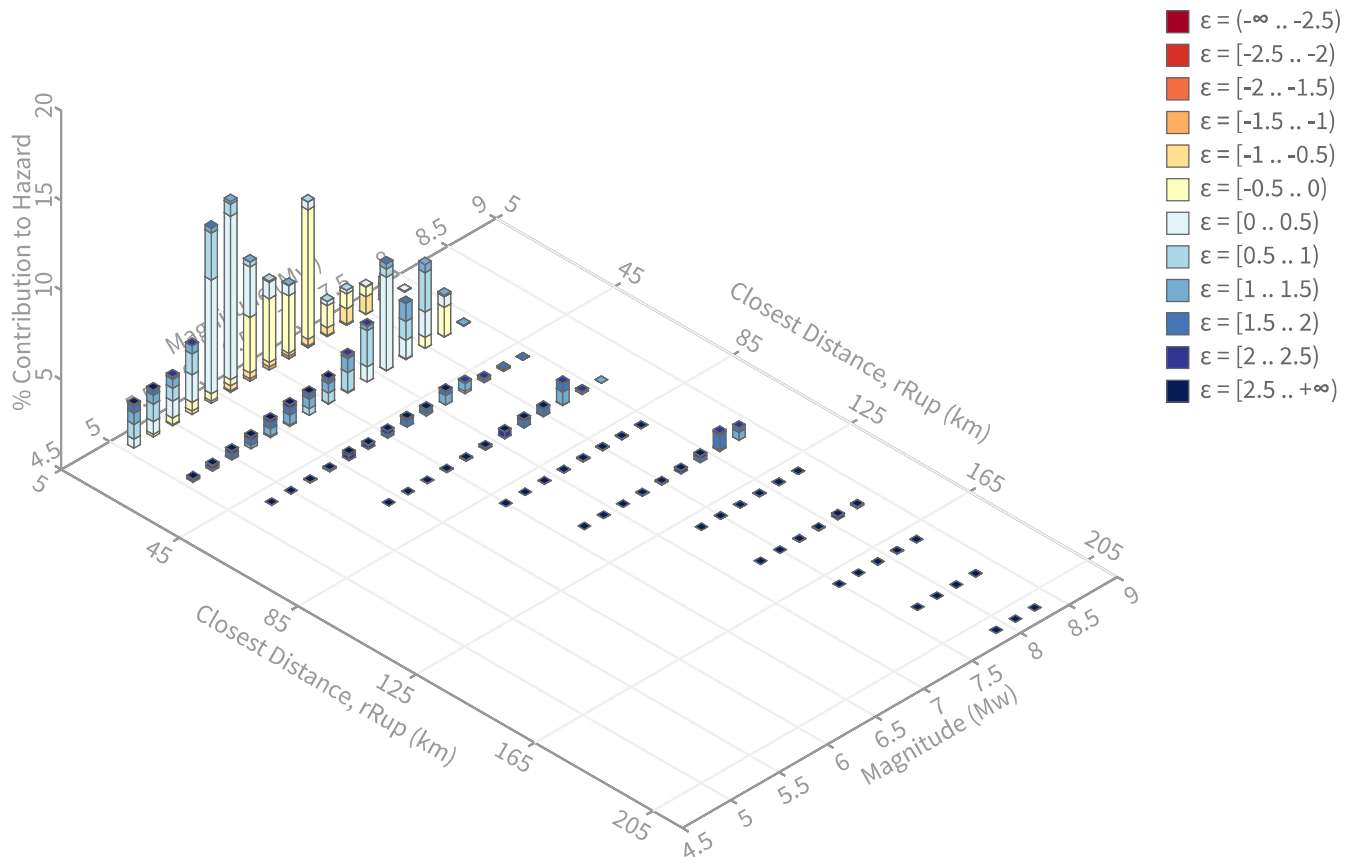


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.20861892 g

Recovered targets

Return period: 487.51271 yrs
Exceedance rate: 0.0020512286 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.23 %

Mean (over all sources)

m: 6.58
r: 22.27 km
ε₀: 0.43 σ

Mode (largest m-r bin)

m: 6.12
r: 11.76 km
ε₀: 0.2 σ
Contribution: 10.64 %

Mode (largest m-r-ε₀ bin)

m: 6.12
r: 11.53 km
ε₀: 0.2 σ
Contribution: 9.11 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

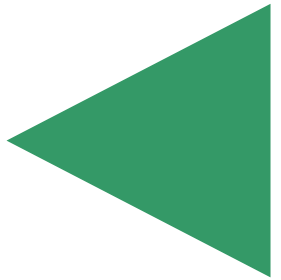
Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↴ Source	Type	r	m	ϵ_0	lon	lat	az	%
UC33brAvg_FM31	System							39.80
Rose Canyon [0]		11.42	6.36	0.01	117.147°W	32.551°N	267.92	18.70
Coronado Bank alt1 [13]		22.75	7.08	0.41	117.234°W	32.450°N	239.35	6.39
San Diego Trough south [1]		39.15	7.33	0.99	117.397°W	32.395°N	243.08	2.37
Rose Canyon [3]		15.45	6.50	0.33	117.161°W	32.634°N	304.97	1.34
Rose Canyon [1]		11.60	6.97	-0.41	117.148°W	32.568°N	277.27	1.21
Rose Canyon [2]		12.81	6.85	-0.19	117.150°W	32.601°N	294.08	1.01
UC33brAvg_FM32	System							38.23
Rose Canyon [0]		11.42	6.39	-0.02	117.147°W	32.551°N	267.92	17.62
Coronado Bank alt2 [25]		22.75	7.39	0.18	117.233°W	32.448°N	238.72	5.03
San Diego Trough south [1]		39.15	7.33	1.00	117.397°W	32.395°N	243.08	2.33
Oceanside alt2 [0]		19.58	7.39	-0.21	117.357°W	32.560°N	271.13	1.66
Rose Canyon [1]		11.60	6.91	-0.36	117.148°W	32.568°N	277.27	1.25
Rose Canyon [3]		15.45	6.58	0.27	117.161°W	32.634°N	304.97	1.10
UC33brAvg_FM32 (opt)	Grid							10.89
PointSourceFinite: -117.026, 32.604		7.42	5.63	-0.12	117.026°W	32.604°N	0.00	1.15
PointSourceFinite: -117.026, 32.604		7.42	5.63	-0.12	117.026°W	32.604°N	0.00	1.13
UC33brAvg_FM31 (opt)	Grid							10.76
PointSourceFinite: -117.026, 32.604		7.43	5.63	-0.12	117.026°W	32.604°N	0.00	1.16
PointSourceFinite: -117.026, 32.604		7.43	5.63	-0.12	117.026°W	32.604°N	0.00	1.14

APPENDIX



APPENDIX D

GROUNDWATER EVALUATION BY DUDEK & ASSOCIATES

FOR

**SOUTHWEST VILLAGE VTM-2
SAN DIEGO, CALIFORNIA**

PROJECT NO. 06847-42-04

June 22, 2021

13330

David Evans
Vice President/Senior Geologist
Geocon Incorporated
6990 Flanders Drive
San Diego, CA 92127

Subject: *Initial Assessment of Groundwater Conditions at the Southwest Village Site, Otay Mesa and Surrounding Areas, San Diego County*

Dear Mr. Evans:

This report is prepared at Geocon's request to address groundwater conditions that relate to slope stability calculations and evaluation of landslide topography for the proposed Southwest Village Project (Project, or VTM-1). The Project site occupies a large mesa situated east of highway 805, south of highway 905, and north of the US-Mexico border (Figure 1). The study area includes the Project site and adjacent slopes southwest, south, and southeast of the mesa. These slopes include a known complex of landslides.

Geocon has conducted, and continues geotechnical investigation including mapping, drilling, trenching, soil sampling, permeameter testing, groundwater measurements, and laboratory soils testing for the project. This includes geotechnical characterization and slope stability assessment for the landslides adjacent to the Project. Figure 1 shows Geocon's delineation of three landslide complex groups adjacent to the proposed development site. These are Landslides A, B, and C. The principal area addressed to date by Geocon's work is Landslide A. The findings of this initial groundwater assessment are summarized as follows:

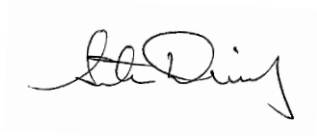
- Few data points exist at present to characterize Otay Mesa groundwater conditions. The groundwater observations found for this report are summarized in Table 1. These data include a wide time span of observations from 1955 to present, and include some wells which no longer exist. An area with more groundwater level detail is Landslide A, due to Geocon's geotechnical investigations in 2001 and current work of 2020 and 2021.
- Groundwater is present under the Mesa, and as expected is present at shallow depths at the base of slope at the west edge of the Mesa, where the older rocks that form the Mesa contact more porous alluvial deposits of the Tijuana River valley which extend west to the ocean. A profile of three core borings drilled in Landslide A by Geocon documents the groundwater slope in the Otay Formation rising from approximately 40 feet below terrain (elev 52', NAVD88) near base of slope gradually to 193 feet below terrain (elev 170') west of the Landslide A headscarp. Depth to groundwater under the Mesa surface in the Project area is not clearly delineated, but may occur at approximately 300 foot depth (elev 184 ft) based on "first water" encountered when an agricultural well was drilled in the Project area in 1961. This well is presently filled with debris, and because of its 1245 foot depth may blend groundwater pressures from several depth zones.

- The undisturbed sedimentary strata east and north of the landslide masses identified in Figure 1 consist of generally horizontal rocks lying beneath marine terrace deposits and associated well developed soil horizons that cap the Mesa. Beneath the terrace deposits and associated soils are San Diego formation and Otay formation (oldest). The Otay formation rocks, as encountered within Landslide A in Geocon coreholes 1, 2, and 3 are predominantly fractured sandstone, siltstone, and claystone. Where undisturbed outside of the slide complexes, it is expected that the strong horizontal layering inhibits vertical infiltration of groundwater. Such layering can cause development of pockets of groundwater perched above the regional water table.
- At present, there are insufficient monitoring points within and bordering the landslide complexes surrounding the Project to create a groundwater elevation contour map to accurately determine flow directions and groundwater slope, or to determine vertical groundwater pressure gradients which may be important to assessing landslide mass stability.
- A groundwater monitoring well (Corehole 3) which was constructed within Landslide A terminates above the basal shear zone which occurs at Elevation 29-33 (NAVD88). Because of the thickness and apparent continuity of the basal shear as found in Coreholes 1, 2, and 3, and at the Intermodal Transportation Center (Geocon, 2001) it should not be assumed that Corehole 3 is in close continuity with groundwater levels and pressures beneath and upslope of the well, which may respond somewhat differently to seasonal rain than groundwater levels within the landslide masses.
- We recommend additional groundwater monitoring wells to improve characterization and monitoring of groundwater levels within, outside, and under the slide masses adjacent to the proposed development. Determination of the groundwater level response of the landslide affected hillside areas to heavy seasonal rainfall events is recommended as part of the geotechnical assessment. The rate and magnitude of hillside groundwater level changes to seasonal rainfall is of primary importance to causation and/or re-activation of landslide movements.
- Use of the bare soil and rock gullies to conduct stormwater from outfalls 5 through 9 to the base of the slope is not recommended, especially for outfalls 5 and 7. Permeameter tests on the soil in the gully bottoms indicates infiltration through the intact soil of the gully bottoms into the subsurface during moderate storm flow events will not be sufficient to affect stability. However, elevated storm flow velocities such as may occur below outfall 7 during extreme storms within the natural channels could pose the risk of severe soil erosion and expose landslide tension cracks between landslide blocks in the channel bottoms, which could cause rapid stormwater infiltration into deeper levels of the slide masses. Outfall 5 discharges immediately into a closed depression near the headscarp created by previous landslide movements, and is not recommended for direct stormwater disposal.
- The stormwater routing design by Rick Engineering incorporates sufficient retention basin capacity to largely mitigate peak flows and velocities from the proposed Project development areas of the Mesa to pre-project levels or less.
- The process of grading and construction for the Project will reduce vertical infiltration of storm and irrigation water into the subsurface from the Mesa mostly due to the creation of impervious surfaces and to some degree the compaction required to create finished the finished grade and lot pads.

Mr. Evans

Subject: *Initial Assessment of Groundwater Conditions at the Southwest Village Site, Otay Mesa and Surrounding Areas, San Diego County*

Sincerely,

A handwritten signature in black ink, appearing to read "Steve Dickey", is centered on the page.

Steve Dickey
CEG 1070, CHG 386
Senior Hydrogeologist

Mr. Evans

Subject: *Initial Assessment of Groundwater Conditions at the Southwest Village Site, Otay Mesa and Surrounding Areas, San Diego County*

1 Scope of Work

Dudek has provided the following services under this project:

1. Review of existing geotechnical reports and documents
2. Assist with casing installation, well development, and monitoring of Corehole 3, which was drilled into Landslide A, along with Coreholes 2 and 3.
3. Review of borehole seismic data and report prepared by Geovision, Inc. in the three Geocon coreholes.
4. Review historic documents and air photos to provide groundwater data additional to that developed directly for geotechnical reports for the Southwest Village and Intermodal Transfer Station projects. The largest source of this data is the CA Department of Water Resources Well Driller's Completion Reports, which have recently become publicly available.
5. Review April 21, 2021 Rick Engineering Report, Landslide Hydrology Analysis for Southwest Village, Rick Engineering Job Number 15013-C.
6. Provide field staff to assist Geocon in conducting near surface permeameter measurements of soils at several proposed stormwater outfall sites located within the landslide complex area.
7. Assemble the historic and the recently acquired groundwater information into this assessment of groundwater conditions beneath the mesa and the landslide complexes.

2 Geologic Setting and History

The mesa top is a relatively flat, ancient marine terrace at an elevation of approximately 500 feet. Long term, uniform and continuous uplift of approximately 14-16 cm/1000 years has placed the Mesa at its present elevation (Kern and Rockwell, 1992). The Mesa surface at the Southwest Village site consists of well developed terrace clay surficial soils which overly a thick layer of terrace gravel, cobbles, and boulders. Beneath the Terrace deposits are San Diego formation which overlies Otay formation. Geocon's borings at the mesa top demonstrated erosional contacts between the terrace gravels, San Diego formation, and Otay formation. The Quaternary terrace clay soil and gravel, the San Diego formation and Otay formation rocks are involved in the Landslide A head scarp at the west and beyond to the west of the Mesa.

The appearance of the landslide slope below the Mesa indicates a complex and progressive series of deep seated downslope block movements, which include components of block rotation. A major landslide feature evident in the three deep coreholes drilled by Geocon in the landslide complex west of the mesa top are thick, apparently continuous zones of sheared and deformed bentonite, lying almost horizontal slightly at elevation 29-33 ft (NAVD88) in Corehole 3. The bentonite units occur intermittently and may be an important feature restricting vertical groundwater movement, and could locally cause "perched" conditions, affecting groundwater elevation heads above and/or below the bentonite units.

The deformed bentonite beds found in the Geocon Otay Mesa Landslide A coreholes and in the Intermodal Transportation Center geotechnical borings may be the same or similar as described by Vanderhurst, Hart, and Owen, 2011. Development of the present terrain was influenced by a different Pleistocene climate for extended time with greater precipitation on the order of 30-40 inches annual compared to present day 10 inches average annual for San Ysidro, and a Pleistocene sea level as much as 345 feet below present level starting 20,000 years BP.

The greater precipitation and lower sea levels during the Pleistocene epoch deepened incision of the ravines that are present at the Mesa, and may also have caused larger and more frequent storm flows, resulting in possible meanders of the Tijuana River which undercut the west and southwest edges of Otay Mesa. The greater Pleistocene precipitation during the Younger Dryas period also contributed to the deeply weathered, well-developed soil profiles that cap the Mesa.

Figure 2 provides a cross section constructed from the Mesa and Carvajal driller's logs, along with Geocon boring and corehole logs. The Carvajal well log indicates "pinkish gray mud" from depth 435-460 ft, at elevation slightly higher than the basal shear bentonite bed encountered on the Project side of the Mesa in Geocon Corehole 3.

Figure 3 provides an estimated sea level curve from 20,000 years BP to present, along with a summary graph of ocean core pollen analyses indicating a prolonged wet climate interval during the Pleistocene epoch from 12,000 to 20,000 years BP for the California Borderland at latitude 32.3 degrees north.

3 Groundwater Elevation Data

Plate 1 is a map summarizing the groundwater depth/elevation information that was found for the proposed project the surrounding area. The data are from CA DWR Well Drillers Completion Reports, the CA DWR groundwater information GIS system, wells constructed for groundwater regulatory cleanup investigations such as gas stations, USGS groundwater multi-port monitoring wells, and geotechnical reports generated by Geocon, Inc. This data is summarized in Table 1. The data also includes groundwater levels from three core holes drilled into Landslide A for the current Southwest Village geotechnical investigation. Figure 1 is a map showing Geocon's designation of the landslide areas at the Mesa edges as Landslides "A", "B", and "C", as well as a conceptual footprint of the initial phase of the proposed development.

Because of the scarcity of water well data available for the Mesa area, the Plate 1 includes groundwater observations date from 1955 (Carvajal agricultural well) to the present (depth to groundwater measured in Geocon Corehole 3 and in Mesa agricultural well). Because the available data is very widely spaced and taken over a 66 year time span, Plate 1 should be regarded as reconnaissance level information, especially for the Mesa itself. Several of the groundwater elevations shown in Plate 1 are previous reported levels for wells that no longer exist.

Two deep agricultural wells are located on the Mesa, constructed in 1955 and 1961, which are no longer in service; Attempts to sound the Mesa well, located immediately uphill of the Landslide A complex headscarp were not repeatable because of debris in the well. However, the logs of these wells are included because they were drilled with cable tool equipment, which allows construction of somewhat detailed drilling logs, as well as detailed observations regarding occurrence of first water or perched groundwater.

Plate 2 is a cropped portion of Plate 1, which enlarges the proposed Southwest Village development area. A cross section line through Landslide A is presented in Figure 4. The groundwater depth/elevation cross section shows depth to water and elevation from the three Geocon core holes, the Mesa irrigation well (depth to "first water" in 1960), and Boring SB-3 drilled at the Intermodal Transportation Center in 2001. Groundwater levels for the Mesa Well and the SB-3 exploration boring have been projected northwest into the Figure 4 cross section.

As part of this investigation, Corehole 3 was equipped with a PVC casing and well screen extending to 270 foot depth, and equipped with a water level recording pressure transducer. The groundwater levels shown in Figure 4 for Coreholes 1 and 2 were measured very shortly after drilling with a borehole seismic survey conducted by Geovision, and the borings have since been abandoned. Boring SB-3 was abandoned in 2001 shortly after logging.

It should not be assumed that the groundwater conditions shown in Figure 4 and Plate 2 are static and invariant with respect to seasonal storms or unusual series of precipitation events, should they occur. Because the core borings indicate the bulk of the Otay formation slide mass is composed of claystone, siltstone, and sandstone, a conservative assumption would be that groundwater flow within Landslide A occurs primarily via fracture flow, and a much lesser degree porous media flow. Therefore groundwater level response of the slope to heavy rainfall could be greater and also more rapid than would occur in more porous, unconsolidated basin aquifer sediments such as sand.

Additional monitor wells with water level recording capability are needed to measure water level and fluctuations uphill of the Landslide A headscarp, and also within the slide mass to measure the groundwater level response to heavy rainfall events. In addition, an observation well should be constructed with a screen isolated beneath the basal shear zone bentonite bed to assess the degree it may function to restrict vertical groundwater flow, and measure the hydraulic pressure acting beneath the basal shear layer.

4 Assessment of Groundwater Conditions

4.1 Groundwater Conditions at Base of Slope, Landslides A and B

Groundwater levels in Geocon boreholes near the base of slope (Plates 1 and 2) in the Landslide A and B area indicate that there is very likely continuous saturation above and beneath the basal slide surface and that these levels are slightly above but on a downwards slope consistent with gas station monitor well groundwater elevations measured recently west of the slide area near the Tijuana River, and northwards adjacent/west of Otay Mesa and northwards to the Otay River area. The groundwater levels within the toe area of Landslides A and B were determined in 2001 by exploration borings advanced for the Intermodal Transfer project area, at the west downhill portion of Landslide A, and adjacent to Landslide B, as shown in the Figure 4 cross section. If property access allows, one or more monitor wells should be re-established at the base of slope, and equipped with a recording groundwater level transducer to determine the groundwater level response, if any of the landslide mass in this area to significant rainfall events.

4.2 Surfacing Groundwater, South Edge of Otay Mesa

Surfacing Groundwater is present in Spring Canyon, at the south edge of Otay Mesa, at the US-Mexico international border. Examination of a multi year sequence of aerial photos as early as November 1981 indicates persistent presence of riparian trees, surface water flow, and riparian vegetation that begins approximately 2800 feet east-northeast and upstream of a newly constructed concrete culvert structure at the International Border that takes the water under the border into Tijuana. The 1981 air photo pre-dates the extensive bulk grading and road construction conducted along this section of the border, which included the construction of a concrete culvert and other works to convey the Spring Canyon surface flow across the border.

Plate 1 and Plate 2 show this location, with a 2014 surface water elevation of 164 feet at the border, located at the southwest corner of Landslide C. This elevation is roughly comparable with nearby groundwater elevations measured in CH-2, CH-3, and the Mesa Well. This location is interpreted as discharging groundwater that has been exposed and released by downcutting of Spring Canyon. The source of the surface water is from older rocks assumed to be Otay Formation, with the groundwater source within the adjacent Otay Mesa hillside, and assumed to be higher than the surface flow at Elevation 164, in order to sustain the flow. A short distance upstream of this location, the canyon bottom surface water ends and the vegetation transitions from riparian to upland species, as visible in aerial mapping photos. Although the relationship of the Spring Canyon perennial surface water to the

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regionally extensive bentonite bed at the base of Landslides A, B, and C is unknown, the landslide area core boring logs suggest that this water is perched above the basal shear bentonite bed .

4.3 Groundwater Beneath Top of Mesa, Project Area

The Mesa Well, shown near the west edge of the Mesa in Plates 1 and 2 provides the only data available for groundwater level beneath the Project area, outside of the landslide areas. In 1960 the driller noted “first water” at 298 feet below ground surface (DWR drillers log and completion report provided in Appendix A). The borehole was continued by casing advance to a total depth of 1245 feet. When deep perforations were cut at the completion of the well, the final water level is listed in the report as 565 feet.

While the final water level noted may not have reached equilibrium when measured, it suggests a final water level near or below sea level (ground surface elevation at the Mesa well is 482 feet). This deep level after casing perforation is interpreted to indicate a downwards hydraulic pressure gradient within the Otay Formation with depth.

Although not current or the most reliable data, we regard the “first water” notation on the Mesa Well driller’s log as the best available indication of groundwater depth beneath the Project area, subject to verification. The Mesa Well driller’s log is presented in the Figure 2 cross section.

5.0 Influence of Proposed Stormwater Outfalls on Groundwater

5.1 Landslide Surface

The project as proposed includes five outfalls to manage the Project stormwater flows. Figure 5 shows the location of proposed stormwater outlet structures which are intended to convey project stormwater and excess irrigation water to existing bare earth drainages which will then convey the stormwater to the base of the slope and existing San Ysidro stormwater infrastructure. The outfalls are numbered 5, 6, 7, and 8 as indicated in Figure 4.

The existing drainage pathways that traverse from the proposed outfalls through the slide areas are shown in Figure 5 as yellow lines. The drainage pathways were digitized and are graphed as profiles in Figure 6. The cross sections for these bare earth drainages have been unfolded from their curved path routes into the flat plane of Figure 6. Thus the true drainage path lengths and slopes are retained in the figure.

The downhill drainage pathway for outfall 5 traverses downslope through Landslide A, while the pathways issuing from outfalls 6 and 7 traverse the slope of Landslide B. The drainage pathways from outfalls 8 and 9 traverse more steeply downhill over the Landslide C slope.

The Figure 6 outfall drainage profiles indicate the channel downhill from Outfall 9 is steepest at 20%, while the drainage gully from Outfall 7 has the least downhill slope at 10%. Outfalls 5, 6, and 8 drop downhill at slopes of 14, 16, and 17% respectively.

None of the current drainage profiles exhibit sharp concave nicks in their profiles indicating excessive “nick point” erosion, such as would indicate wallowing out of a structural weak spots such as tension cracks or soft sedimentary beds. The drainages flowing down from Outfalls 6 and 7 are the most deeply incised into what appears to be a soft, erodible portion of the composite landslide slope.

Based on peak stormwater flows calculated by Rick Engineering, the post development flow velocities could be especially elevated in the bare earth channel of Outfall 7, which Rick proposes to substantially mitigate to pre-project levels with retention of stormwater at the Mesa.

The drainage dropping out of Outfall 5 begins almost immediately in a shallow closed depression that occupies a sag immediately beneath the Landslide A headscarp, and is recommended for re-routing or modification to prevent infiltration of stormwater into the Landslide A headscarp.

Based on the stormflow durations calculated by Rick Engineering, and soil permeameter infiltration measurements at each outfall location measured by Geocon, it is calculated that infiltration through the soil bottoms of the existing channels into the slide mass during moderate rainfall events will not be excessive, as it is expected that the soil layer covering the channels will remain intact. After such events it is expected that the infiltrated stormwater will be held in the soils at shallow depth by capillary forces and will come back out as evapotranspiration. Only during extended series of multiple closely spaced rainstorms would infiltration to groundwater be expected to occur, and

it would occur at very slow rates, with of the stormwater continuing downhill as surface flow . The outfall infiltration test results are displayed in Table 2 below.

TABLE 2

Outfall 5	32.55425	-117.027	1.09E-2
Outfall 6	32.55183	-117.0243	9.05E-4
Outfall 7A	32.55078	-117.0229	4.13E-4
Outfall 8	32.54762	-117.0173	8.22E-3
Outfall 9	32.548613	-117.01489	3.92E-3

Notes: Data and calculations for K values provided by Geocon.

However, it is possible that periods of sustained high flow in these drainages, such as might occur during an “atmospheric river” type series of rains could generate erosive stormflows that remove enough soil to expose landslide-generated tension cracks in the channels beneath the soil layer, leading to significant injection of stormwater directly into the subsurface through the cracks in rock, and tension fracture zones between the landslide blocks. Rapid introduction of significant volume stormwater into fractures between slide blocks could raise the water table within portions of the composite slide mass rapidly and sufficiently above the basal shear zone clay surface to affect local slide mass stability.

Analysis of aerial photos and shaded relief topographic images of the landslide complex indicates that such cracks are very likely present. Groups of native palm trees present in catchments within Landslide Component A also suggest that significant trapping of stormwater within the composite landslide surface has occurred in previous rainfall events.

Without detailed knowledge of the slide mass groundwater surface in Landslide A, B, and C, and knowledge of the response of slide mass groundwater levels to significant rain events, it is suggested that routing of stormwater from the proposed development onto the bare earth existing channels on the landslides be avoided.

Draft stormwater calculations by Rick Engineering for proposed flows to Outfalls 1 through 5 indicate that any increase in total volume of stormwater created by development of Southwest Village will be mitigated to pre-project levels by stormwater retention to reduce peak flows leaving the project area through the proposed outfalls 1 through 5. Therefore it can be said that the project, as currently proposed will not cause a change the overall landslide stability situation of the slopes surrounding it to the west, southwest, and south, due to stormwater flows. This is not the same as stating that with the present level of knowledge that Landslide A, B, and C slopes are known to be stable under all future rainfall event sequences.

5.2 Groundwater Infiltration Impact of Developing the Mesa Surface

The existing natural surface of the Mesa is characterized by relatively low infiltration of rainfall, as evidenced by presence of vernal pools. The uppermost natural terrace deposits are predominantly clay soils., classified by USDA as Huerhuero loam (HrC). Compared to the existing natural Mesa surface, the proposed development will reduce the areas open to stormwater infiltration due to the construction of impervious surfaces consisting of streets, sidewalks, roofs, and driveway pavement.

The infiltration capacity of the soil horizons capping the Mesa is limited by the presence of low vertical conductivity layers that restrict downwards water flow. The soil profile of the Mesa top is characterized by USDA as being in runoff class “Very High”, and with the infiltration capacity of the limiting soil profile layers as very low to moderately low, with Ksat of 0.00 to .06 inches per hour.

Geocon conducted permeater testing of undisturbed surface soils in the proposed development area of the Mesa, with resulting vertical conductivities as follows:

TABLE 3

GEOCON HYDRAULIC CONDUCTIVITY TEST RESULTS, DEVELOPMENT AREA, MESA SURFACE

Location	Depth, ft	Geologic Unit	Hydraulic Conductivity K (in/hr)
A-1	5	Qt, Topsoil	.007
A-2	5	Qt	.049
A-3	5	Qt	.018
A-4	5	Qt	.004

These results are consistent with the USDA published soil map for the Mesa. Therefore, given the strong layering of horizontal strata under the Mesa surface, the low hydraulic conductivity of the site surface, and the replacement of exposed soil surface with impervious areas by the proposed development plan, we believe the net impact will be a reduction of stormwater infiltration into the Mesa surface. Therefore, the net long term impact of the proposed development of the Mesa surface will be to reduce infiltration of rainwater to groundwater, resulting in a long term, net decrease in groundwater levels beneath the development.

6.0 Conclusions

A thorough search for historic groundwater data was conducted to support this assessment, which is summarized on Table 1 and Plates 1 and 2. The data spans dates from 1955 to the present. In addition measurements of present groundwater levels within Landslide A were conducted. Conclusions are as follows:

1. There is solid evidence that the groundwater surface within the project portion of Otay Mesa rises above the surrounding areas at the flanks and base of the Mesa. The maximum groundwater elevation under the Southwest Village project area of the Mesa could not be determined with available data.
2. The driller's logs from the deep Carvajal and Mesa wells, although very old are detailed and generally meaningful for this initial assessment. They indicate that due to the persistent layering of clay and silt bearing strata, there was perched water within the sedimentary stack, above the main water table when drilled. The perched water occurrences started at approximately 300 foot depth below the Mesa surface when drilled in 1961. It is reasonable to assume that this condition may persist in general today, although exact details may differ.
3. The groundwater depths indicated by Landslide A Coreholes CH-1, CH-2, and CH-3 are considered to be generally representative of groundwater levels for the adjacent portions of the hillside, but specific groundwater depths and elevations in adjacent areas should be confirmed by drilling.
4. Geocon Coreholes 1, 2, and 3 indicate that the aquifer in the landslide area, above the basal shear zone is characterized by fracture flow in claystone, siltstone, and sandstone which probably dominates compared to porous media groundwater flow. The practical impact of this aquifer characteristic is groundwater fluctuations within the slope are likely to be greater and more sudden/abrupt than for a system dominated by porous flow, such as groundwater flow in sand.
5. Given #4 above, we recommend additional monitor wells be installed in the Southwest Village project area, and downslope landslide areas with recording transducers to determine the sensitivity of landslide mass groundwater levels in several locations to seasonal precipitation. Corehole 3 is presently equipped with such a transducer/datalogger.
6. The assumed groundwater elevation above 164 feet that sustains the surface water flow at the south edge of Otay Mesa at the International border (Landslide C area) is generally consistent with the level found in corehole CH-3 to the northwest, and is likely to be approximately representative of groundwater level in the Otay Formation beneath the Mesa north of the scarp above Landslide A. Due to the lack of sufficient wells, the exact shape and elevation contours of the groundwater surface beneath the Mesa is unknown.

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7. It is our opinion that a significant cause for development of the extensive landslide apron surrounding the southwest, south, and southeast slopes of Otay Mesa was significantly wetter climate conditions in the late Pleistocene (Younger Dryas event), and also the significantly lower of sea level to minus 345 feet MSL, thus increasing the topographic relief of the Mesa.

8 We recommend the routing of stormwater from the Project outfalls over the bare earth drainages to bottom of slope be re-considered and avoided. Piping the water with storm drains across or around the slide mass is our recommendation.

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TABLE 1 Well Data								
FEATURE	Feature, Short Name	Grd Surf Elev	GW Depth, Ft	GW Elev, Ft	Dec Latitude	Dec Longitude	SP N, US ft	SP E, US ft
				NAVD88			CA Zone 6	CA Zone 6
Corehole 1 Surveyed	CH1	184	70	114	32.5515527	-117.0307686	1781361.4	6321066.9
Corehole 2 Surveyed	CH2	279	125	154	32.5525594	-117.0291278	1781723.9	6321575.3
Corehole 3 Surveyed	CH 3	360	189.87	170	32.5534973	-117.0274925	1782061.4	6322081.7
Mesa Well, 1245', 1961	Mesa	482	385 , 298	97, 184	32.5507160	-117.0187320	1781029.4	6324773.8
Carvajal Well, 1215', 1955	Carvajal	507	347	160	32.5655240	-117.0057070	1,786,387.80	6,328,826.54
Spring Canyon Surface Flow At Border	Spr Cyn Surf			164	32.5448820	-117.0131950	1,778,894.22	6,326,464.49
Geocon SB-7, Transfer Station	SB-7	101	54.5	47	32.5444880	-117.0280300	1,778,784.66	6,321,891.64
Geocon SB-3, Transfer Station	SB-3	98	46	52	32.5460550	-117.0295270	1,779,358.24	6,321,434.56
Geocon SB-1, Transfer Station	SB-1	89	54	35	32.5454390	-117.0293270	1,779,133.65	6,321,494.52
Geocon SB-2, Transfer Station	SB-2	78	47.5	31	32.5442580	-117.0285470	1,778,702.16	6,321,731.69
Otay River Surface Water 1	OT Riv Surf1			115	32.5904380	-117.0132720	1,795,469.48	6,326,562.10
Otay Rock Quarry Pit Lake	OT Pit Lake			184	32.5925350	-116.9872470	1,796,174.77	6,334,583.63
Mon Well	Mon Well			45	32.5854460	-117.0350820	1,793,703.08	6,319,830.59
Otay River Surface Water 2	OT Riv Surf2			36	32.5886940	-117.0568320	1,794,935.97	6,313,140.01
Mon Well 314 E San Ysidro	Mon Well 314 ESY			40	32.5513010	-117.0397970	1,781,290.76	6,318,284.10
USGS Boundary Waters Mon Well	USGS Mon Well			27	32.5536320	-117.0616060	1,782,190.48	6,311,570.21
2004 Dairy Mart Road Mon Well	2004 Dairy Mart			31	32.5615550	-117.0627450	1,785,075.91	6,311,241.71
USGS Otay River Mon Well	SDOR			45	32.5912140	-117.0539560	1,795,846.00	6,314,032.95
Section 33 Ag Well Deep	33S1W33 73	512	440	72	32.5601530	-116.9880660	1,784,394.68	6,334,247.97
SD County Park Well	SD County	32	11	21	32.5567410	-117.0757790	1,783,355.95	6,307,211.85
Note: Applied Dave Evans edits to GW Elev, Coreholes 1,2,3.								

APPENDIX A

CA DWR WELL COMPLETION REPORTS

12996

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

Do Not Fill In

State Well No.
 Other Well No.
 Region

(5) Well log (continued):
 Total depth of well ft.

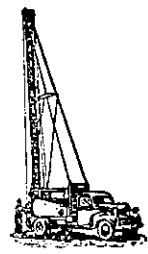
Give details of formations penetrated, such as silt, peat, muck, sand, gravel, clay, shale, sandstone, hardpan, rock. Include size of gravel (diameter) and sand (fine, medium, coarse), color of material, structure (loose, packed, cemented, soft, hard, brittle).

Depth From Ground Surface		
ft.	to	ft.
676	ft. to	677
678	" "	679
680	" "	681
682	" "	683
684	" "	685
686	" "	687
688	" "	689
690	" "	691
692	" "	693
694	" "	695
696	" "	697
698	" "	699
700	" "	701
702	" "	703
704	" "	705
706	" "	707
708	" "	709
710	" "	711
712	" "	713
714	" "	715
716	" "	717
718	" "	719
720	" "	721
722	" "	723
724	" "	725
726	" "	727
728	" "	729
730	" "	731
732	" "	733
734	" "	735
736	" "	737
738	" "	739
740	" "	741
742	" "	743
744	" "	745
746	" "	747
748	" "	749
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754	" "	755
756	" "	757
758	" "	759
760	" "	761
762	" "	763
764	" "	765
766	" "	767
768	" "	769
770	" "	771
772	" "	773
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804	" "	805
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808	" "	809
810	" "	811
812	" "	813
814	" "	815
816	" "	817
818	" "	819
820	" "	821
822	" "	823
824	" "	825
826	" "	827
828	" "	829
830	" "	831
832	" "	833
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838	" "	839
840	" "	841
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926	" "	927
928	" "	929
930	" "	931
932	" "	933
934	" "	935
936	" "	937
938	" "	939
940	" "	941
942	" "	943
944	" "	945
946	" "	947
948	" "	949
950	" "	951
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980	" "	981
982	" "	983
984	" "	985
986	" "	987
988	" "	989
990	" "	991
992	" "	993
994	" "	995
996	" "	997
998	" "	999
1000	" "	1001

CONFIDENTIAL - NOT FOR PUBLIC RELEASE

MICROFILMED

If additional space is required continue on DWR Form No. 246—Supplement, and attach to respective report copies.



SAN DIEGO PUMP & WELL DRILLERS

STATE LICENSED DRILLING CONTRACTORS
PUMP SALES AND SERVICE
POST OFFICE BOX 438
CHULA VISTA, CALIFORNIA

Water test on Ray Carvajal well Otay Mesa

505'	865'	PPM
597	650	"
660	1058	"
710	935	"
771	605	"
830	715	"
875	1255	"
1014	1320	"
1085	1640	"
1180	1380	"
1200	1010	"

MICROFILMED

32 32 58.322, -117 1 16.439

MVR 12/23/11

DUPLICATE
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. _____
(if appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

Do Not Fill In

No. 28842

State Well No. 195/1W-660015

Other Well No. _____

(11) WELL LOG:

Total depth 1245 ft. Depth of completed well 1245 ft.

Formation: Describe by color, character, size of material, and structure.

ft. to	ft.	Formation
0	11	Grey sticky clay & rocks
11	32	Brown sandy clay & lg. rocks
32	49	Grey sandy clay & " "
49	105	Grey sticky sandy clay
105	252	Grey sandstone
252	257	Sandstone & bentonite
257	295	Grey sandstone
295	298	Sand & gravel
298	351	Brown sandstone
351	400	Hard brown sandstone
400	452	Brown clay & rocks
452	470	Brown clay
470	481	Brown clay & rocks
481	490	Soft brown sandstone
490	494	Brown sticky clay
494	567	Brown sandstone
567	701	Grey sandstone
701	727	Brown shale
727	798	Brown sandstone
798	810	Brown shale
810	825	Grey sandstone
825	830	Grey sandstone & small gravel
830	880	Light grey sandstone
880	898	Dark grey sandstone (soft)
898	1042	Dark grey sandstone (hard)
1042	1141	Dark grey shale
1141	1164	Grey sandstone (hard)
1164	1245	Black shale

(2) LOCATION OF WELL:

County _____ Owner's number, if any— _____
R. F. D. or Street No. _____

SE cor W 1/2, NE 1/4, Sec 6, T 19S/1W

(3) TYPE OF WORK (check):

New well Deepening Reconditioning Abandon

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic Industrial Municipal Rotary
Irrigation Test Well Other Cable
Dug Well

(5) EQUIPMENT:

(6) CASING INSTALLED:

From	ft. to	ft.	Diam.	Gage or Wall	Diameter of Bore	from ft.	to ft.
0	1245	12	1/4				

If gravel packed _____
Type and size of shoe or well ring _____
Describe joint _____

(7) PERFORATIONS:

Type of perforator used M-11

From	ft. to	ft.	Size of perforations	in., length, by	Perf. per row	Rows per ft.
820	830	6			2	
885	900	6			1	3
900	124	6			1	3

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes No To what depth _____ ft.
Were any strata sealed against pollution? Yes No If yes, note depth of strata _____
From _____ ft. to _____ ft.
Method of Sealing _____

(9) WATER LEVELS:

Depth at which water was first found 298 ft.
Standing level before perforating 565 ft.
Level after perforating 565 ft.

(10) WELL TESTS:

Was a pump test made? Yes No If yes, by whom? _____
Yield: _____ gal./min. with _____ ft. draw down after _____ hrs.
Temperature of water _____ Was a chemical analysis made? Yes No
Was electric log made of well? Yes No

MICROFILMED

CONFIDENTIAL - NOT FOR PUBLIC RELEASE

Work started 5/23/60 19 _____ Completed 1/25 19 61

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME San Diego Pump & Well Drillers, Inc.
Address 1410 Hwy 101 Alt., Imperial Beach, Calif.

[SIGNED] Jack Hamilton Well Driller
License No. 160313 Dated 4/13
95689 3-54 50M QUIN © SPO DWR FORM NO. 246 (R)

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

DWR USE ONLY - DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

Owner's Well No. _____ No. **447315**

Date Work Began **13 July 95** Ended **5 August 95**

Local Permit Agency **County of San Diego, Dept. of Health Services**

Permit No. _____ Permit Date _____

GEOLOGIC LOG

ORIENTATION () VERTICAL _____ HORIZONTAL _____ ANGLE _____ (SPECIFY)

DEPTH TO FIRST WATER _____ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE		DESCRIPTION
Ft.	to Ft.	
0	20	Sand, fine to medium
20	60	Sand, fine to very coarse, poorly sorted shell fragments
60	150	Sandy gravel, medium to very
150	190	Sand, fine
190	310	Silty sand, very fine sand to medium
310	650	Clayey sand with very fine to fine sand
650	670	Sandy clay
670	710	Sandy silt, very fine sand to medium
710	770	Clayey silt, some fine sands
770	830	Sandy clay
830	950	Clayey silt, some very fine to fine sands
950	970	Sandy silt
970	990	Silty sand
990	1030	Sand very fine to very coarse
1030	1050	Silty sand
1050	1430	Sand, very fine sand to medium sand

Geologic log for well 1 through 5 (completed in the same hole)

TOTAL DEPTH OF BORING **1430** (Feet)

TOTAL DEPTH OF COMPLETED WELL **1360** (Feet)

WELL LOCATION

Address **2223 Dairy Mart Rd**

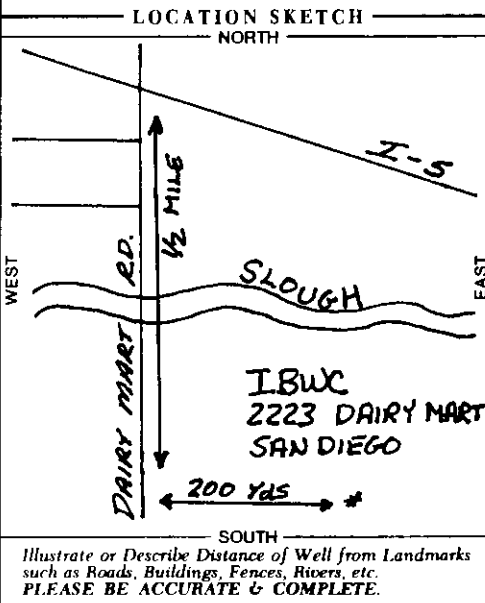
City **San Diego**

County **San Diego**

APN Book **760** Page **107** Parcel **60**

Township **19S** Range **2W** Section **2C**

Latitude **32 33 13** NORTH Longitude **117 03 39** WEST
DEG. MIN. SEC. DEG. MIN. SEC.



ACTIVITY ()

NEW WELL

MODIFICATION/REPAIR

_____ Deepen

_____ Other (Specify)

DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) ()

MONITORING

WATER SUPPLY

_____ Domestic

_____ Public

_____ Irrigation

_____ Industrial

_____ "TEST WELL"

CATHODIC PROTECTION

_____ OTHER (Specify)

DRILLING METHOD **Hydraulic Rotary** FLUID **Bentonite Mud**

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL **50.56** (Ft.) & DATE MEASURED **7/25/95**

ESTIMATED YIELD* _____ (GPM) & TEST TYPE _____

TEST LENGTH _____ (Hrs.) TOTAL DRAWDOWN _____ (Ft.)

* May not be representative of a well's long-term yield.

DEPTH FROM SURFACE	BORE-HOLE DIA. (Inches)	CASING(S)							
		TYPE ()				MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
		BLANK	SCREEN	CON. DUCTOR	FILL PIPE				
0	5			X		Steel	10		
	1340	X				Sch 80 pvc	2		
1340	1360		X			Sch 80 pvc	2	0.020	

Well construction for well 1

DEPTH FROM SURFACE	ANNULAR MATERIAL			
	TYPE			
	CE-MENT ()	BEN-TONITE ()	FILL ()	FILTER PACK (TYPE / SIZE)
0	25	X		
25	225		X	
225	283			X #3 sand
283	532		X	
532	613			X #3 sand
613	898		X	

ATTACHMENTS ()

_____ Geologic Log

_____ Well Construction Diagram

Geophysical Log(s)

_____ Soil/Water Chemical Analyses

_____ Other _____

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

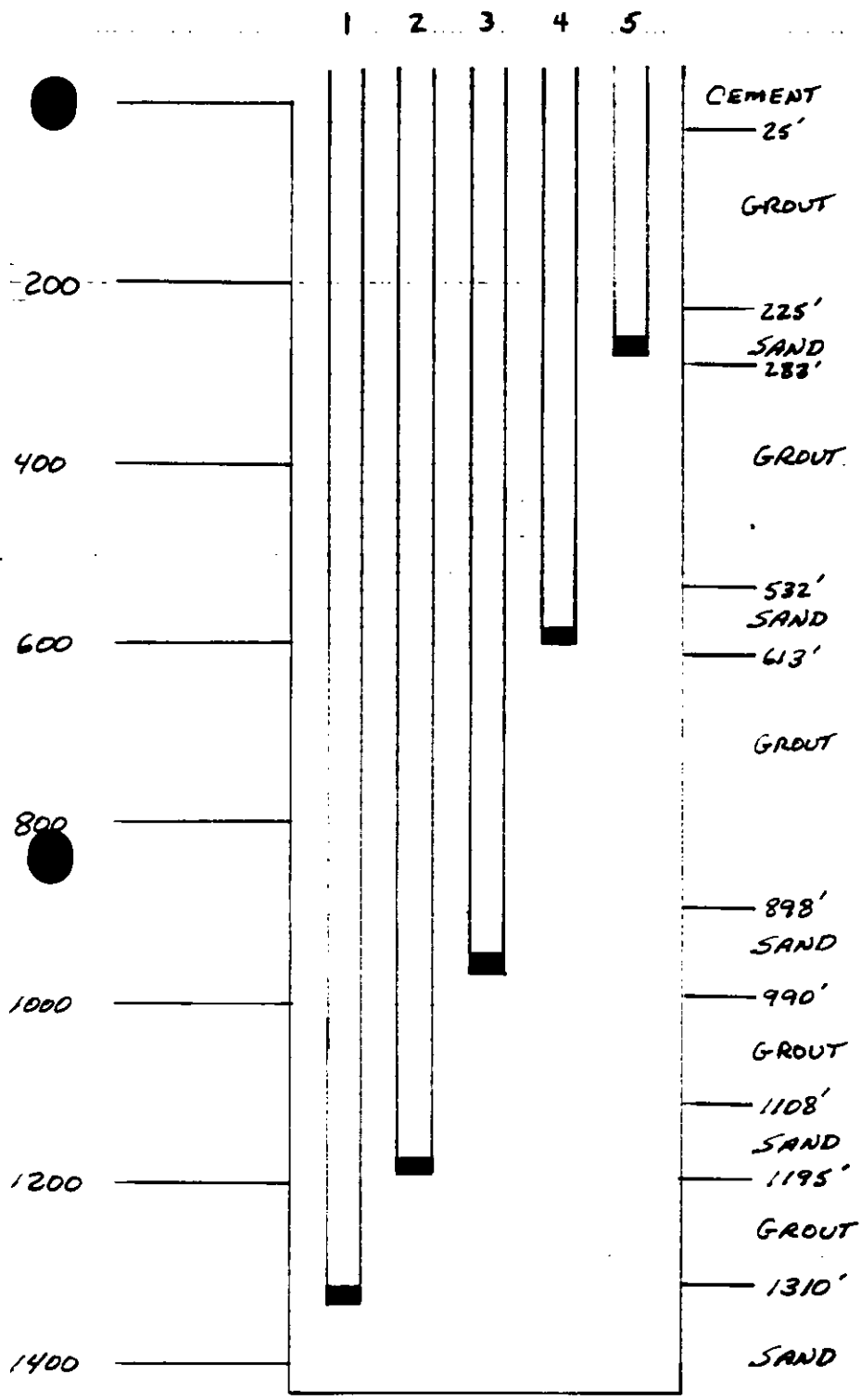
I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME **JOHN IZBICKI** U.S. GEOLOGICAL SURVEY
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS **5735 KEARNY VILLA RD, STE 0 San Diego, CA 92123-1135**
CITY STATE ZIP

Signed *[Signature]* DATE SIGNED **9/8/95** U.S. LICENSE NUMBER **NA**

WELL DRILLER/AUTHORIZED REPRESENTATIVE



WELL #	Start Depth	End Depth
1	1340	1360
2	1170	1190
3	945	965
4	580	600
5	260	280

TYPE OF WORK (Check)		USE (Check)		EQUIPMENT (Check)	
New Well	<input checked="" type="checkbox"/>	Individual Domestic	<input type="checkbox"/>	Rotary	<input type="checkbox"/>
Repair or Modification	<input type="checkbox"/>	Agricultural	<input type="checkbox"/>	Cable Tool	<input type="checkbox"/>
Time Extension	<input type="checkbox"/>	Industrial	<input type="checkbox"/>	Other	<input type="checkbox"/>
Destruction	<input type="checkbox"/>		<input type="checkbox"/>	Community	<input type="checkbox"/>
			<input checked="" type="checkbox"/>	Other	<input checked="" type="checkbox"/>

PROPOSED WELL DEPTH	PROPOSED CASING
Max. <u>1400</u> Min. <u>2200</u> (Feet)	Type <u>PVC</u> Depth <u>1400'</u> Diameter <u>2"</u> Wall or Gage <u>Sched. 80</u>

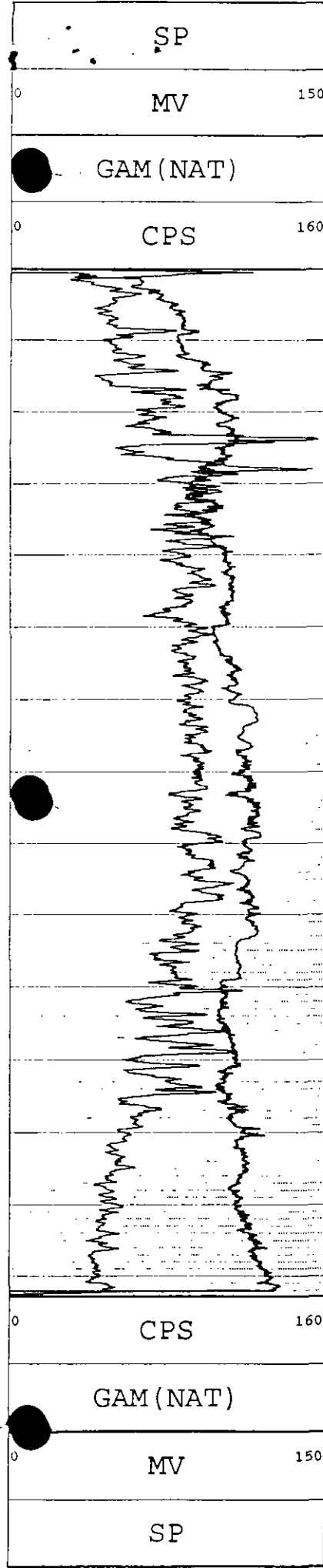
PROPOSED SEALING ZONE(S)	SEALING MATERIAL (Check)
From <u>(see Attached)</u> Feet	Neat Cement Grout <input type="checkbox"/>
From _____ to _____ Feet	Bentonite Clay <input type="checkbox"/>
From _____ to _____ Feet	Sand Cement Grout <input type="checkbox"/>
	Concrete <input checked="" type="checkbox"/>
	Other-Specify: _____
PROPOSED PERFORATIONS OR SCREEN	DATE OF WORK
From _____ to _____ Feet	Start <u>6/13/95</u>
From _____ to _____ Feet	Completion <u>6/22/95</u>
From _____ to _____ Feet	
From _____ to _____ Feet	

NAME OF WELL OWNER	NAME OF WELL DRILLER
	<u>U. S. Geological Survey</u>
LOCATION OF WELL <u>Inter. Board. & West. Comm. 2223 Dairy Mast Rd San Diego</u>	COMPANY <u>U. S. Geological Survey</u>

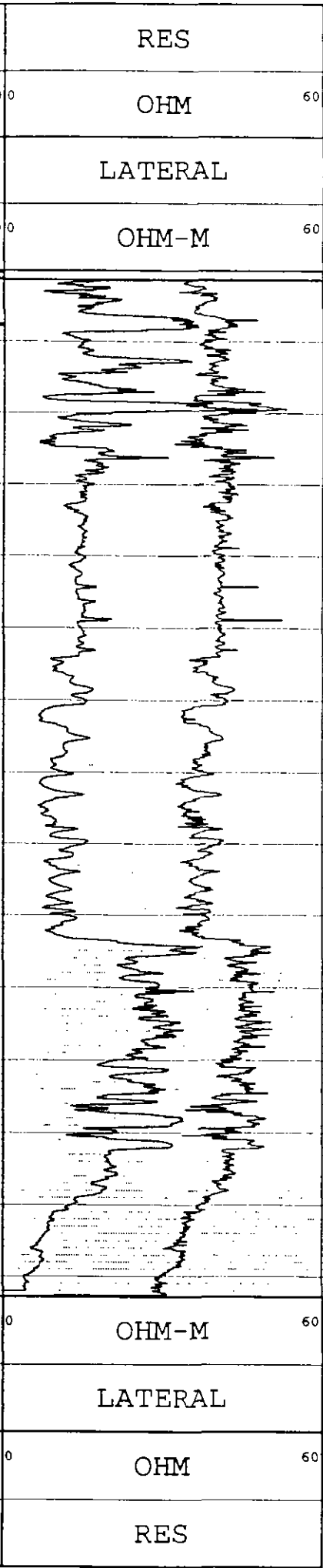
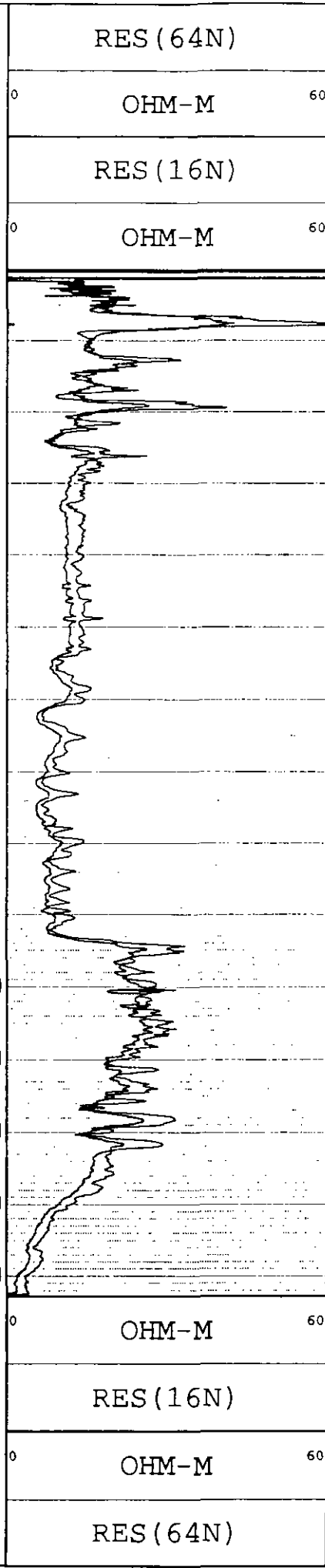
DISPOSITION OF APPLICATION (FOR HEALTH OFFICERS USE ONLY)	BUSINESS ADDRESS
<input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> DENIED	<u>San Diego, Ca 92123</u>
<input type="checkbox"/> APPROVED WITH CONDITIONS	<u>5735 Kearny Villa Rd, Suite 0</u>

Report Reason(s) for Denial or Necessary Conditions Here:	LICENSE NUMBER
_____	<u>NA</u>
_____	Cash Deposit <input type="checkbox"/> NA
_____	Bond Posted <u>WAIVED</u>
_____	<u>\$150 (HAZMAT Fee) Fee paid on 4/26/95</u>

<p>I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction; repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.</p> <p><u>[Signature]</u> HEALTH OFFICER</p> <p><u>4-26-95</u> DATE</p>	<p><u>[Signature]</u> APPLICANT'S SIGNATURE</p> <p><u>4/26/95</u> DATE</p>
--	--



FEET
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
FEET



File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet
No. e0084925

DWR Use Only - Do Not Fill In

1 8 S 0 2 W 2 3 G 0 0 2 S
State Well Number/Site Number

Latitude Longitude

APN/TRS/Other

Page 1 of 5

Owner's Well Number SDOR #1

Date Work Began 11/06/2008

Date Work Ended 12/13/2008

Local Permit Agency County of San Diego Department of Environmental Health

Permit Number LMON T106077 Permit Date 10/31/08

Geologic Log		
Orientation <input checked="" type="radio"/> Vertical <input type="radio"/> Horizontal <input type="radio"/> Angle Specify _____		
Drilling Method <u>Direct Rotary</u> Drilling Fluid <u>Bentonite mud</u>		
Depth from Surface		Description
Feet	to Feet	Describe material, grain size, color, etc
0	10	Gravelly sand; m-vc sand w/ granules-sm pebbles; olive gray (5Y 5/2)
10	20	Gravelly sand; m-vc sand w/ granules; grayish brown (2.5Y 5/2)
20	30	Gravelly sand; m-vc sand w/ granules; lt olive brown (2.5Y 5/4)
30	40	Gravelly sand; m-vc sand w/ granules; dk yellowish brown (10YR 4/6)
40	60	Gravel; granules-med pebbles; various colors
60	70	Clayey silt; silt w/ clay; olive (5Y 4/3)
70	80	Silty sandy gravel; granules-med pebbles w/ vf-vc sand and silt; olive gray (5Y 4/2)
80	200	Clayey silt; silt w/ clay and shell fragments; v dk gray (5Y 3/1)
200	240	Clayey silt; silt w/ clay and minor shell fragments; v dk gray (5Y 3/1)
240	320	Silt; silt; dk gray (5Y 4/1)
320	550	Clayey silt; silt w/ clay; v dk gray (5Y 3/1)
550	560	Sand; vf-coarse sand w/ shell fragments; dk gray (5Y 4/1)
560	570	Clayey silt; silt w/ clay; v dk gray (5Y 3/1)
570	580	Sandy clay; clay w/ med-coarse sand; greenish gray (10Y 5/1)
580	610	Clay; clay; grayish brown (2.5Y 5/2)
610	630	Clay; clay; grayish brown (10YR 5/2)
630	650	Clay; clay; lt brownish gray (2.5Y 6/2)
650	750	Clay; clay; grayish brown (2.5Y 5/2)
750	880	Sandy clayey silt; silt w/ clay & vf-med sand; grayish brown (2.5Y 5/2)
880	910	Clayey silty sand; vf-coarse sand w/ silt & clay; grayish brown (2.5Y 5/2)
910	920	Clay; clay; brown (10YR 5/3)
920	940	Gravelly sand; med-vc sand w/ granules-sm pebbles; grayish brown (2.5Y 5/2)
940	1,030	Clayey silty gravelly sand; vf-vc sand w/ granules, silt & clay; lt olive brown (2.5Y 5/3)
1030	1,120	Silty gravelly sand; vf-vc sand w/ granules & silt; grayish brown (2.5Y 5/2)
1120	1,140	Sandy clay; clay w/ med-vc sand; lt brownish gray (2.5Y 6/2)
1140	1,472	Clayey silty sand; vf-vc sand w/ silt & clay; grayish brown (2.5Y 5/2)
Total Depth of Boring <u>1472</u> Feet		
Total Depth of Completed Well <u>1460</u> Feet		

Well Owner

Well Location

Address 276 Mace Street

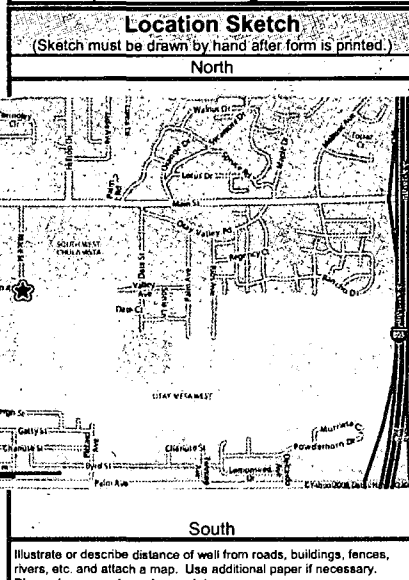
City Chula Vista, CA 91911 County San Diego

Latitude 32 35 28.45 N Longitude 117 03 14.06 W
Dec. Min. Sec. Dec. Min. Sec.

Datum NAD83 Decimal Lat. _____ Decimal Long. _____

APN Book _____ Page _____ Parcel _____

Township 18S Range 02W Section 23G2



Activity

New Well
 Modification/Repair
 Deepen
 Other _____
 Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

Water Supply
 Domestic Public
 Irrigation Industrial

Cathodic Protection
 Dewatering
 Heat Exchange
 Injection
 Monitoring
 Remediation
 Sparging
 Test Well
 Vapor Extraction
 Other _____

Water Level and Yield of Completed Well

Depth to first water _____ (Feet below surface)
 Depth to Static _____
 Water Level _____ (Feet) Date Measured _____
 Estimated Yield * _____ (GPM) Test Type _____
 Test Length _____ (Hours) Total Drawdown _____ (Feet)
 *May not be representative of a well's long term yield.

Casings								Annular Material			
Depth from Surface	Borehole Diameter	Type	Material	Wall Thickness	Outside Diameter	Screen Type	Slot Size	Depth from Surface	Fill	Description	
Feet to Feet	(Inches)			(Inches)	(Inches)	Type	if Any (Inches)	Feet to Feet			
0	60	22.00	Conductor	PVC Sch. 80				51	97	Filter Pack	RMC #3 Sand
60	100	13.00						194	266	Filter Pack	RMC #3 Sand
100	460	12.00						530	584	Filter Pack	RMC #3 Sand
460/1000	1000/1472	10.00/8.00						926	985	Filter Pack	RMC #3 Sand
0	1420		Blank	PVC Sch. 80	0.30	3.5		1399	1472	Filter Pack	RMC #3 Sand
1,420	1,460		Screen	PVC Sch. 80	0.30	3.5	Milled Slots 0.020			Bentonite	All other depths

Attachments

Geologic Log
 Well Construction Diagram
 Geophysical Log(s)
 Soil/Water Chemical Analyses
 Other On file @ USGS- San Diego

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Anthony Brown Hydrologic Technician, U.S. Geological Survey
Person, Firm or Corporation

4165 Spruance Road Suite 200 San Diego CA 92101
Address City State Zip

Signed [Signature] 02/10/2009 Exempt- Federal Government
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

0084925

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California Well Completion Report

Refer to Instruction Pamphlet
No. e0084925

Page 3 of 5

Owner's Well Number SDOR #3

Date Work Began 11/06/2008

Date Work Ended 12/13/2008

Local Permit Agency County of San Diego Department of Environmental Health

Permit Number LMON T106077 Permit Date 10/31/08

DWR Use Only - Do Not Fill In

1 8 S 0 2 W 2 3 G 0 9 4 S
State Well Number/Site Number

Latitude Longitude

APN/TRS/Other

Geologic Log		
Orientation <input checked="" type="radio"/> Vertical <input type="radio"/> Horizontal <input type="radio"/> Angle Specify _____		
Drilling Method <u>Direct Rotary</u>		Drilling Fluid <u>Bentonite mud</u>
Depth from Surface	Description	
Feet to Feet	Describe material, grain size, color, etc.	
0	10	Gravelly sand; m-vc sand w/ granules-sm pebbles; olive gray (5Y 5/2)
10	20	Gravelly sand; m-vc sand w/ granules; grayish brown (2.5Y 5/2)
20	30	Gravelly sand; m-vc sand w/ granules; lt olive brown (2.5Y 5/4)
30	40	Gravelly sand; m-vc sand w/ granules; dk yellowish brown (10YR 4/6)
40	60	Gravel; granules-med pebbles; various colors
60	70	Clayey silt; silt w/ clay; olive (5Y 4/3)
70	80	Silty sandy gravel; granules-med pebbles w/ vf-vc sand and silt; olive gray (5Y 4/2)
80	200	Clayey silt; silt w/ clay and shell fragments; v dk gray (5Y 3/1)
200	240	Clayey silt; silt w/ clay and minor shell fragments; v dk gray (5Y 3/1)
240	320	Silt; silt; dk gray (5Y 4/1)
320	550	Clayey silt; silt w/ clay; v dk gray (5Y 3/1)
550	560	Sand; vf-coarse sand w/ shell fragments; dk gray (5Y 4/1)
560	570	Clayey silt; silt w/ clay; v dk gray (5Y 3/1)
570	580	Sandy clay; clay w/ med-coarse sand; greenish gray (10Y 5/1)
580	610	Clay; clay; grayish brown (2.5Y 5/2)
610	630	Clay; clay; grayish brown (10YR 5/2)
630	650	Clay; clay; lt brownish gray (2.5Y 6/2)
650	750	Clay; clay; grayish brown (2.5Y 5/2)
750	880	Sandy clayey silt; silt w/ clay & vf-med sand; grayish brown (2.5Y 5/2)
880	910	Clayey silty sand; vf-coarse sand w/ silt & clay; grayish brown (2.5Y 5/2)
910	920	Clay; clay; brown (10YR 5/3)
920	940	Gravelly sand; med-vc sand w/ granules-sm pebbles; grayish brown (2.5Y 5/2)
940	1,030	Clayey silty gravelly sand; vf-vc sand w/ granules, silt & clay; lt olive brown (2.5Y 5/2)
1030	1,120	Silty gravelly sand; vf-vc sand w/ granules & silt; grayish brown (2.5Y 5/2)
1120	1,140	Sandy clay; clay w/ med-vc sand; lt brownish gray (2.5Y 6/2)
1140	1,472	Clayey silty sand; vf-vc sand w/ silt & clay; grayish brown (2.5Y 5/2)
Total Depth of Boring		<u>1472</u> Feet
Total Depth of Completed Well		<u>570</u> Feet

Well-Owner

Well-Location

Address 276 Mace Street

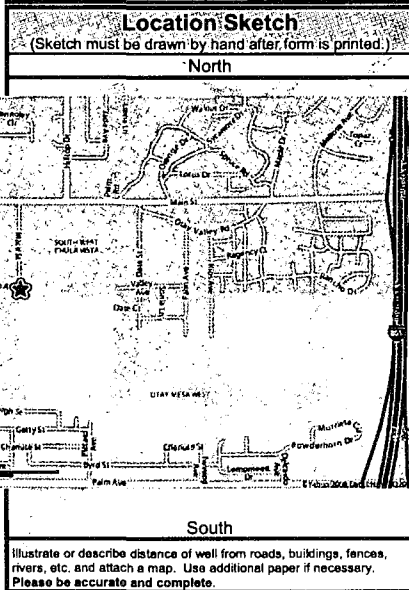
City Chula Vista, CA 91911 County San Diego

Latitude 32 35 28.45 N Longitude 117 03 14.06 W
Dec. Min. Sec. Dec. Min. Sec.

Datum NAD83 Decimal Lat. _____ Decimal Long. _____

APN Book _____ Page _____ Parcel _____

Township 18S Range 02W Section 23G4



Activity

New Well
 Modification/Repair
 Deepen
 Other _____
 Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

Water Supply
 Domestic Public
 Irrigation Industrial

Cathodic Protection
 Dewatering
 Heat Exchange
 Injection
 Monitoring
 Remediation
 Sparging
 Test Well
 Vapor Extraction
 Other _____

Water Level and Yield of Completed Well

Depth to first water _____ (Feet below surface)
 Depth to Static _____
 Water Level _____ (Feet) Date Measured _____
 Estimated Yield * _____ (GPM) Test Type _____
 Test Length _____ (Hours) Total Drawdown _____ (Feet)
 *May not be representative of a well's long term yield.

Casings							
Depth from Surface	Borehole Diameter	Type	Material	Wall Thickness	Outside Diameter	Screen Type	Slot Size if Any
Feet to Feet	(Inches)			(Inches)	(Inches)		(Inches)
0	60	22.00	Conductor	PVC Sch. 80			
60	100	13.00					
100	460	12.00					
460/1000	1000/1472	10.00/8.00					
0	550		Blank	PVC Sch. 80	0.218	2.375	
550	570		Screen	PVC Sch. 80	0.218	2.375	Milled Slots 0.020

Annular Material			
Depth from Surface	Fill	Description	
Feet to Feet			
51	97	Filter Pack	RMC #3 Sand
194	266	Filter Pack	RMC #3 Sand
530	584	Filter Pack	RMC #3 Sand
926	985	Filter Pack	RMC #3 Sand
1399	1472	Filter Pack	RMC #3 Sand
		Bentonite	All other depths

Attachments

Geologic Log
 Well Construction Diagram
 Geophysical Log(s)
 Soil/Water Chemical Analyses
 Other On file @ USGS- San Diego

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Anthony Brown, Hydrologic Technician, U.S. Geological Survey
 Person, Firm or Corporation
4165 Spruance Road Suite 200 San Diego CA 92101
 Address City State Zip
 Signed _____ Date Signed 02/10/2009 Exempt- Federal Government
 C-57 Licensed Water Well Contractor License Number

File Original with DWR

State of California Well Completion Report

Refer to Instruction Pamphlet
No. e0084925

DWR Use Only - Do Not Fill In

1 8 S 0 2 W 2 3 G 0 9 6 S
State Well Number/Site Number

N W
Latitude Longitude

APN/TRS/Other

Page 5 of 5

Owner's Well Number SDOR #5

Date Work Began 11/06/2008

Date Work Ended 12/13/2008

Local Permit Agency County of San Diego Department of Environmental Health

Permit Number LMON T106077

Permit Date 10/31/08

Geologic Log		
Orientation <input checked="" type="radio"/> Vertical <input type="radio"/> Horizontal <input type="radio"/> Angle Specify _____		
Drilling Method <u>Direct Rotary</u>		Drilling Fluid <u>Bentonite mud</u>
Depth from Surface	Description	Describe material, grain size, color, etc
Feet to Feet		
0	10	Gravelly sand; m-vc sand w/ granules-sm pebbles; olive gray (5Y 5/2)
10	20	Gravelly sand; m-vc sand w/ granules; grayish brown (2.5Y 5/2)
20	30	Gravelly sand; m-vc sand w/ granules; lt olive brown (2.5Y 5/4)
30	40	Gravelly sand; m-vc sand w/ granules; dk yellowish brown (10YR 4/6)
40	60	Gravel; granules-med pebbles; various colors
60	70	Clayey silt; silt w/ clay; olive (5Y 4/3)
70	80	Silty sandy gravel; granules-med pebbles w/ vf-vc sand and silt; olive gray (5Y 4/2)
80	200	Clayey silt; silt w/ clay and shell fragments; v dk gray (5Y 3/1)
200	240	Clayey silt; silt w/ clay and minor shell fragments; v dk gray (5Y 3/1)
240	320	Silt; silt; dk gray (5Y 4/1)
320	550	Clayey silt; silt w/ clay; v dk gray (5Y 3/1)
550	560	Sand; vf-coarse sand w/ shell fragments; dk gray (5Y 4/1)
560	570	Clayey silt; silt w/ clay; v dk gray (5Y 3/1)
570	580	Sandy clay; clay w/ med-coarse sand; greenish gray (10Y 5/1)
580	610	Clay; clay; grayish brown (2.5Y 5/2)
610	630	Clay; clay; grayish brown (10YR 5/2)
630	650	Clay; clay; lt brownish gray (2.5Y 6/2)
650	750	Clay; clay; grayish brown (2.5Y 5/2)
750	880	Sandy clayey silt; silt w/ clay & vf-med sand; grayish brown (2.5Y 5/2)
880	910	Clayey silty sand; vf-coarse sand w/ silt & clay; grayish brown (2.5Y 5/2)
910	920	Clay; clay; brown (10YR 5/3)
920	940	Gravelly sand; med-vc sand w/ granules-sm pebbles; grayish brown (2.5Y 5/2)
940	1,030	Clayey silty gravelly sand; vf-vc sand w/ granules, silt & clay; lt olive brown (2.5Y 5/2)
1030	1,120	Silty gravelly sand; vf-vc sand w/ granules & silt; grayish brown (2.5Y 5/2)
1120	1,140	Sandy clay; clay w/ med-vc sand; lt brownish gray (2.5Y 6/2)
1140	1,472	Clayey silty sand; vf-vc sand w/ silt & clay; grayish brown (2.5Y 5/2)

Well Owner

Well Location

Address 276 Mace Street

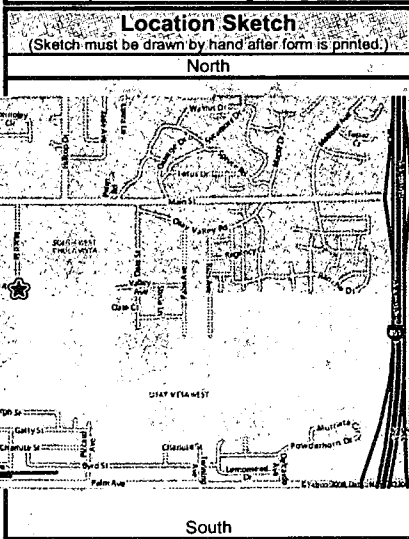
City Chula Vista, CA 91911 County San Diego

Latitude 32 35 28.45 N Longitude 117 03 14.06 W
Dec. Min. Sec. Dec. Min. Sec.

Datum NAD83 Decimal Lat. _____ Decimal Long. _____

APN Book _____ Page _____ Parcel _____

Township 18S Range 02W Section 23G6



Activity

New Well
 Modification/Repair
 Deepen
 Other _____
 Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

Water Supply
 Domestic Public
 Irrigation Industrial

Cathodic Protection
 Dewatering
 Heat Exchange
 Injection
 Monitoring
 Remediation
 Sparging
 Test Well
 Vapor Extraction
 Other _____

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Water Level and Yield of Completed Well

Depth to first water _____ (Feet below surface)
 Depth to Static _____
 Water Level _____ (Feet) Date Measured _____
 Estimated Yield * _____ (GPM) Test Type _____
 Test Length _____ (Hours) Total Drawdown _____ (Feet)
 *May not be representative of a well's long term yield.

Total Depth of Boring 1472 Feet
 Total Depth of Completed Well 90 Feet

Casings							
Depth from Surface	Borehole Diameter	Type	Material	Wall Thickness	Outside Diameter	Screen Type	Slot Size if Any
Feet to Feet	(Inches)			(Inches)	(Inches)		(Inches)
0	60	22.00	Conductor	PVC Sch. 80			
60	100	13.00					
100	460	12.00					
460/1000	1000/1472	10.00/8.00					
0	70		Blank	PVC Sch. 80	0.218	2.375	
70	90		Screen	PVC Sch. 80	0.218	2.375	Milled Slots 0.020

Annular Material			
Depth from Surface	Fill	Description	
Feet to Feet			
51	97	Filter Pack	RMC #3 Sand
194	266	Filter Pack	RMC #3 Sand
530	584	Filter Pack	RMC #3 Sand
926	985	Filter Pack	RMC #3 Sand
1399	1472	Filter Pack	RMC #3 Sand
		Bentonite	All other depths

Attachments

Geologic Log
 Well Construction Diagram
 Geophysical Log(s)
 Soil/Water Chemical Analyses
 Other On file @ USGS- San Diego

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

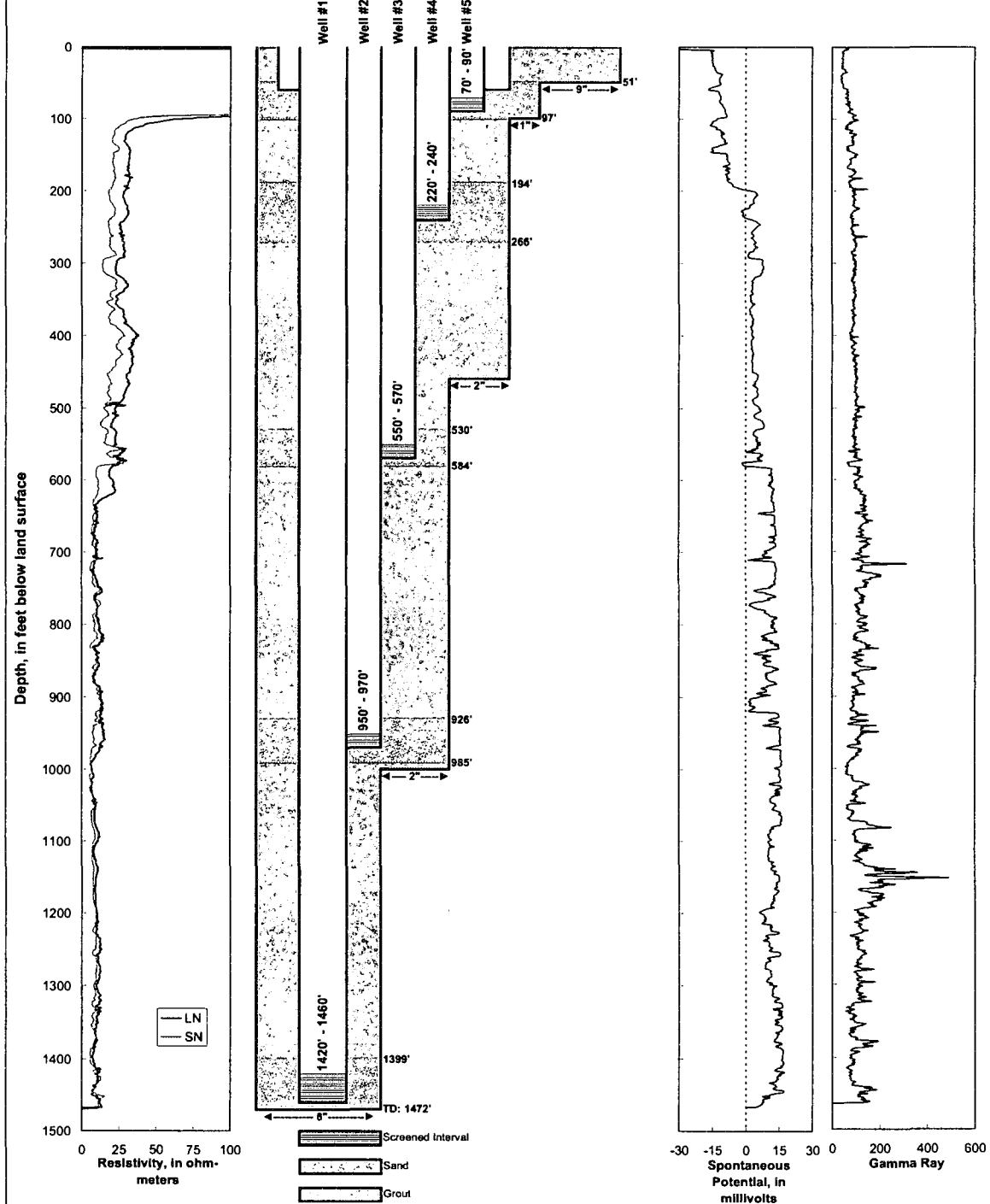
Name Anthony Brown, Hydrologic Technician, U.S. Geological Survey
Person, Firm or Corporation

4165 Spruance Road Suite 200 San Diego CA 92101
Address City State Zip

Signed [Signature] 02/10/2009 Exempt- Federal Government
C-57 Licensed Water Well Contractor Date Signed License Number

00084925

SITE I.D.: 323528117031401-05	COMPLETION DATE: 12/13/2008
STATION NAME: 0018S002W32G002-06s	TOTAL DEPTH: 1472'
USGS SITE: San Diego Otay River (SDOR)	WELL FINISH: VAULT
OWNER:	



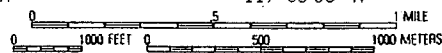
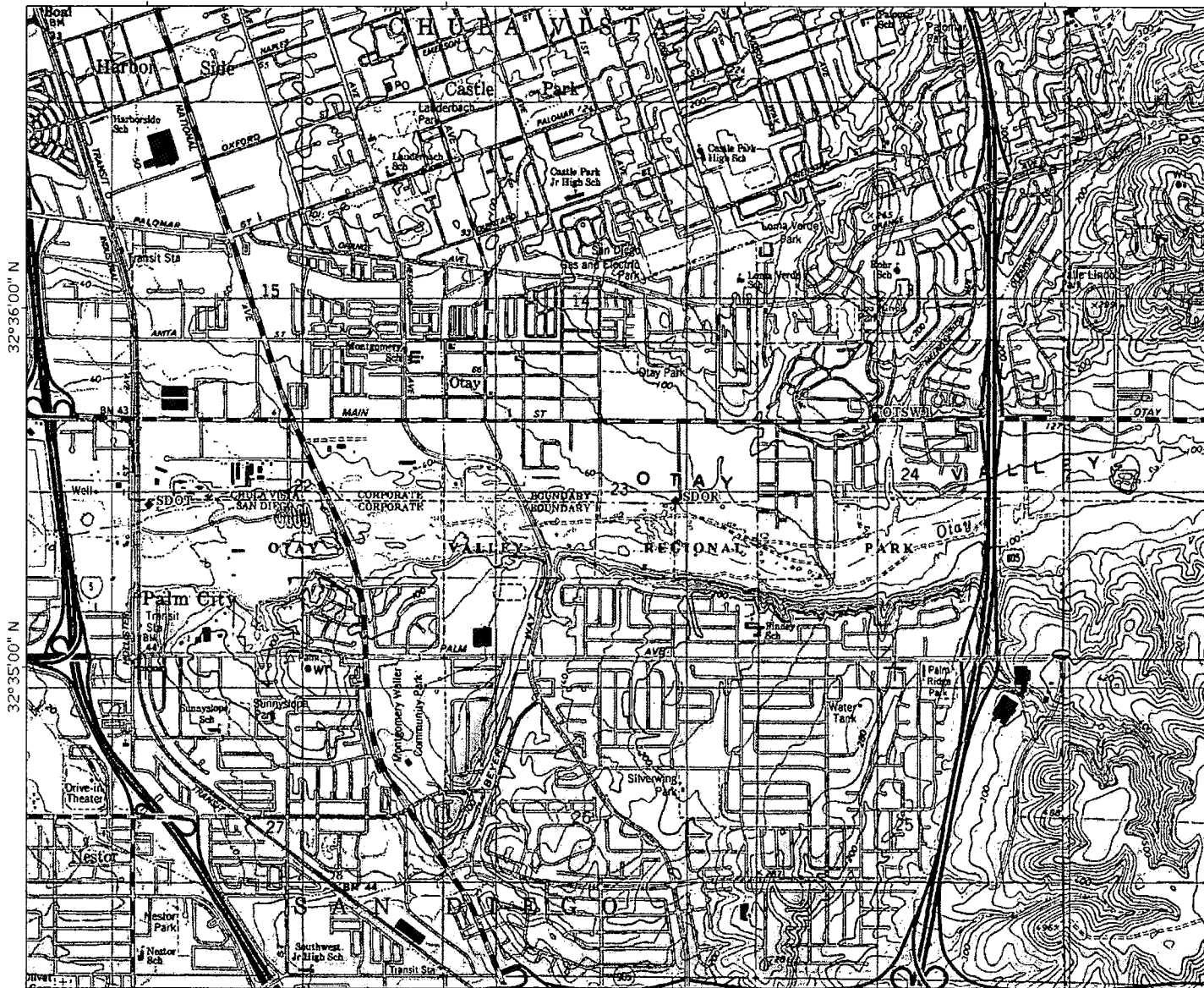
DRILL TYPE: HYDRAULIC MUD ROTARY	DRILLER: USGS WESTERN REGION RESEARCH DRILLING UNIT
CASING TYPE: SCHD. 80 PVC 20' SEC (#1: 3", #2-5: 2")	SCREEN TYPE: SCHD. 80 1.5"x0.02" SLOTS (Except #1: 2.0"x0.02")
GROUT: PUREGOLD GROUT @ 30% SOLIDS	SAND: RMC #3
BOREHOLE DIA: 22": 0' - 60'; 13": 60' - 100'; 12": 100' - 460'; 10": 460' - 1000'; 8": 1000' - 1472'	
SURFACE/CONDUCTOR CASING: 15": 0' - 60' PVC BELL-END SDR35	

117°05'00" W



117°04'00" W

117°03'00" W

WGS84 117°02'00" W



Map created with TOPO! © 2003 National Geographic (www.nationalgeographic.com/topo)

0 25 50 75 100 Resistivity, in ohm-meters	 Sand  Grout	-30 -15 0 15 30 0 200 400 600 Spontaneous Potential, in millivolts Gamma Ray
DRILL TYPE: HYDRAULIC MUD ROTARY		DRILLER: USGS WESTERN REGION RESEARCH DRILLING UNIT
CASING TYPE: SCHD. 80 PVC 20' SEC (#1: 3", #2-5: 2")		SCREEN TYPE: SCHD. 80 1.5"x0.02" SLOTS (Except #1: 2.0"x0.02")
GROUT: PUREGOLD GROUT @ 30% SOLIDS		SAND: RMC #3
BOREHOLE DIA: 22": 0' - 60'; 13": 60' - 100'; 12": 100' - 460'; 10": 460' - 1000'; 8": 1000' - 1472'		
SURFACE/CONDUCTOR CASING: 15": 0' - 60' PVC BELL-END SDR35		

0084925



© USFWS
 © 2008 Tele Atlas

2008 Google

Eye alt 1987 ft

elev 80 ft

32°35'32.81" N 117°03'12.31" W

ORIGINAL
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. e010426

Page 1 of 3

Owner's Well No. B-20

Date Work Began 11-4-03, Ended 11-4-03

Local Permit Agency San Diego County

Permit No. _____ Permit Date _____

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.	
LATITUDE	LONGITUDE
APN/TRS/OTHER	

GEOLOGIC LOG

ORIENTATION (✓) VERTICAL HORIZONTAL ANGLE _____ (SPECIFY)

DEPTH FROM SURFACE

Fl.	to	Fl.	DESCRIPTION
			Describe material, grain size, color, etc.
			SEE ATTACHED LOG

DRILLING METHOD HSA FLUID _____

WELL LOCATION

Address 314 E. San Ysidro Blvd

City San Diego

County San Diego

APN Book _____ Page _____ Parcel _____

Township 19S Range 2W Section 1

Latitude 32° 33' 8" NORTH Longitude 117° 2' 18" WEST

DEG. MIN. SEC. DEG. MIN. SEC.

LOCATION SKETCH

NORTH

SEE ATTACHED MAP

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

NEW WELL

MODIFICATION/REPAIR

Deepen

Other (Specify) _____

DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY

Domestic Public

Irrigation Industrial

MONITORING

TEST WELL _____

CATHODIC PROTECTION _____

HEAT EXCHANGE _____

DIRECT PUSH _____

INJECTION _____

VAPOR EXTRACTION _____

SPARGING _____

REMIEDIATION _____

OTHER (SPECIFY) _____

WATER LEVEL & YIELD OF COMPLETED WELL.

DEPTH TO FIRST WATER 15 (Fl.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL _____ (Fl.) & DATE MEASURED _____

ESTIMATED YIELD _____ (GPM) & TEST TYPE _____

TEST LENGTH _____ (Hrs.) TOTAL DRAWDOWN _____ (Fl.)

* May not be representative of a well's long-term yield.

DEPTH FROM SURFACE	BORE-HOLE DIA. (Inches)	CASING (S)						DEPTH FROM SURFACE	ANNULAR MATERIAL					
		TYPE (✓)				MATERIAL / GRADE	INTERNAL DIAMETER (Inches)		GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)	TYPE			
Fl.	to	Fl.	Fl.	Fl.	Fl.			Fl.			Fl.	to	Fl.	CE- MENT (✓)
0	10	10	✓				PVC	4	sch 40					
10	30	10	✓				PVC	4	sch 40	.020			chips	# 3

ATTACHMENTS (✓)

Geologic Log

Well Construction Diagram

Geophysical Log(s)

Soil/Water/Chemical Analyses

Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BC² ENVIRONMENTAL CORP.

(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 1212 EAST ASH AVE., FULLERTON, CA 92831

CITY STATE ZIP

Signed M. DeRose DATE SIGNED 2-11-04 686255

WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-37 LICENSE NUMBER

Logged by: Aaron Hill

Drilling Co.: BC2

Well No.: B-20

Location: 314 East San Ysidro Blvd.

Drilling Method: Hollow Stem Auger

Well Casing Dimension: 10-ft of 4" SCH 40 PVC

Project No.: NS-02-1100

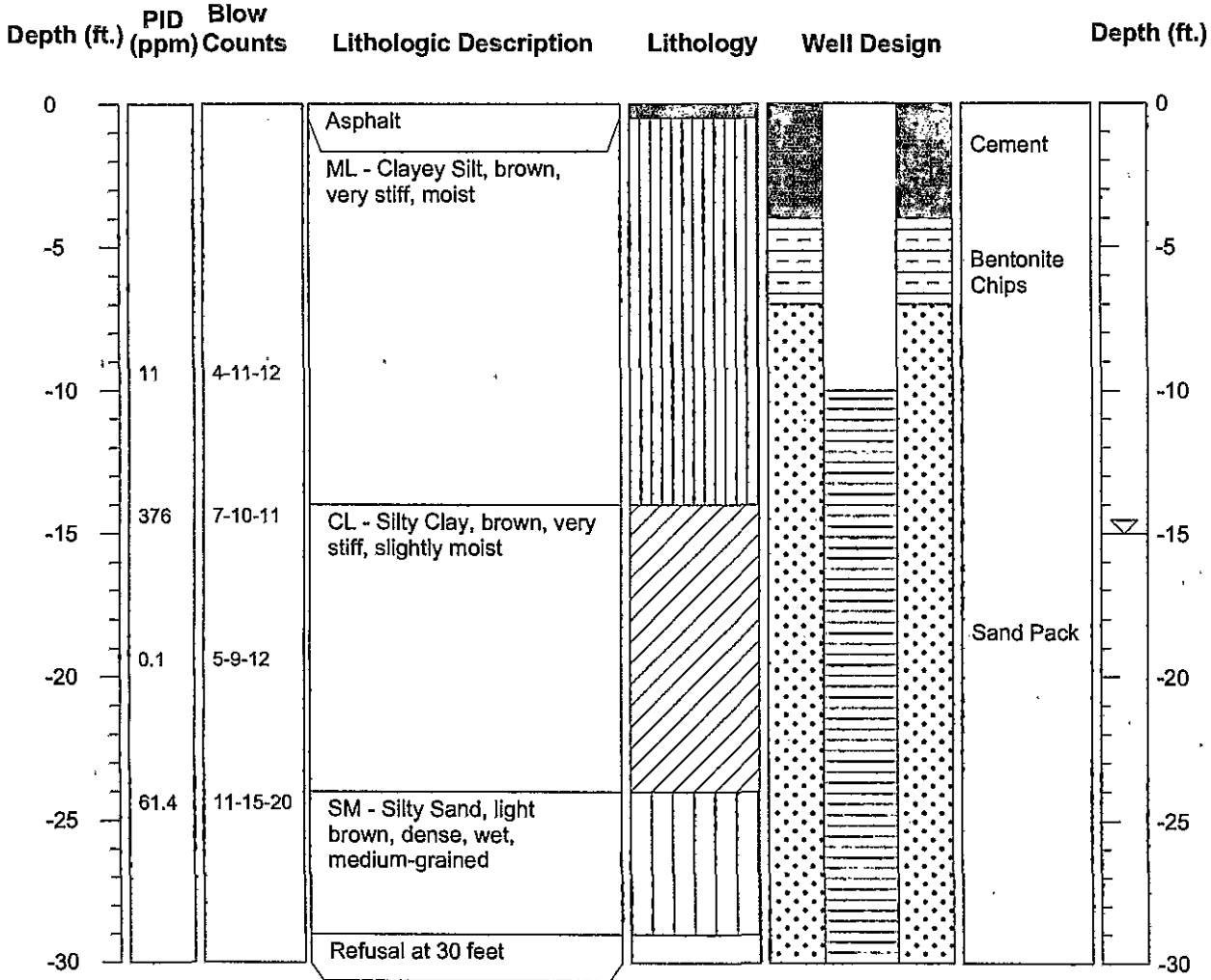
Depth to First Saturation: 15 feet

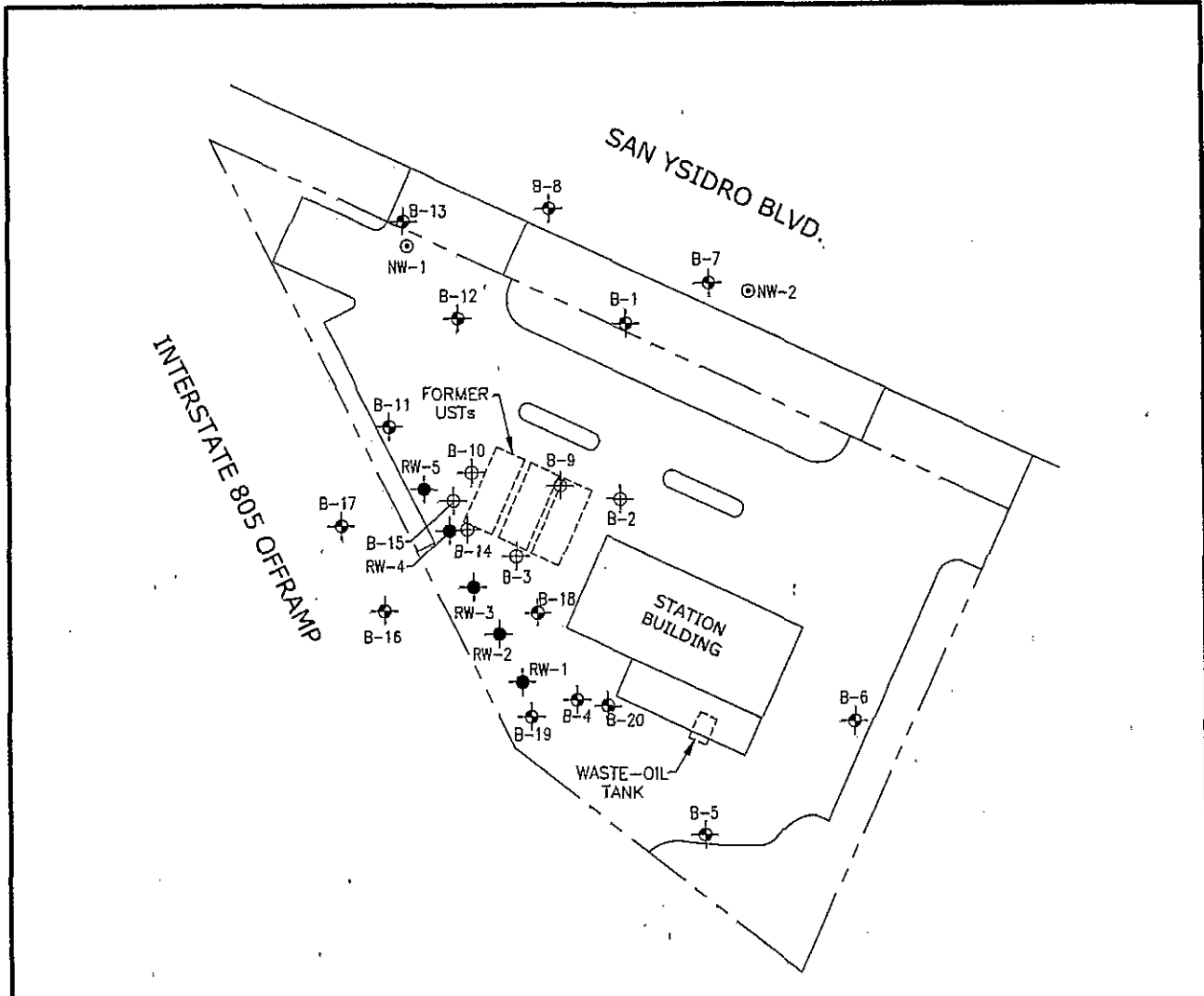
Well Screen: 20-ft of 4" SCH 40 Slotted PVC Casing

Date Drilled: November 4, 2003

Total Depth: 30 feet


Boring Dimension: 10" O.D.





LEGEND:

- B-1 EXISTING GROUNDWATER MONITORING WELL
- B-2 ABANDONED GROUNDWATER WELL
- RW-1 ABANDONED GROUNDWATER RECOVERY WELL
- NW-1 NESTED WELL LOCATION

 NorthShore Engineering, Inc.
 2551 STATE STREET, SUITE 226
 CARLSBAD, CA 92008 TEL: (760) 729-9425
 FAX: (760) 729-9425

SITE PLAN

CLIENT:
 LOCATION: 314 EAST SAN YSIDRO BLVD.
 SAN DIEGO, CALIFORNIA

PROJECT MANAGER: BILL LANTZ
 DATE: FEBRUARY 2004

PROJECT NUMBER: NS-D2-1100
 FIGURE: 2

ORIGINAL
File with DWR

DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

No. 336128

Office of Intent No. 250338
Local Permit No. or Date W91968

State Well No. _____
Other Well No. MW1

12) WELL LOG. Total depth 265 ft Completed depth 250 ft

From ft	To ft	Formation (Describe by color, character, size or material)
<u>0</u>	<u>80</u>	<u>MODERATE, YELLOWISH BROWN (10YR 5/4), DRY, MEDIUM TO COARSE SAND (SP) WITH COBBLES</u>
<u>80</u>	<u>85</u>	<u>BECOMES MOIST, FINE SILTY SAND (SM)</u>
<u>85</u>	<u>110</u>	<u>BECOMES CLAYEY SAND (SC)</u>
<u>110</u>	<u>237</u>	<u>DARK, YELLOWISH ORANGE (10YR 5/6), MOIST, FINE SAND (SP)</u>
<u>237</u>	<u>265</u>	<u>GRAY, VERY MOIST, SILT (ML)</u>

(2) LOCATION OF WELL (See instructions):
County SAN DIEGO Owner's Well Number _____
Well address if different from above _____
Township 18S Range 2W Section 24
Distance from cities, roads, railroads, fences, etc. APPROXIMATELY 400 FEET EAST OF INTERSTATE 805.

SEE ATTACHED

(3) TYPE OF WORK
New Well Deepening
Reconstruction
Reconditioning
Horizontal Well
Destruction (Describe destruction materials and procedures in Item 12)
(4) PROPOSED USE
Domestic
Irrigation
Industrial
Test Well
Municipal
Other **GROUNDWATER MONITOR**
(Describe)

WELL LOCATION SKETCH

(5) EQUIPMENT
Rotary Reverse
Cable Air
Other Bucket
AUGER

(6) GRAVEL PACK
Yes No Size _____
Diameter of bore 8 INCH
Packed from 265 to 218 ft

(7) CASING INSTALLED:
Steel Plastic Concrete

From ft	To ft	Dia in	Gage or Wall
<u>0.5</u>	<u>250</u>	<u>2</u>	

(8) PERFORATIONS **SLOTTED**
Type of perforation or size of screen 0.020

From ft	To ft	Slot size
<u>220</u>	<u>250</u>	<u>0.020</u>

(9) WELL SEAL:
Was surface sanitary seal provided? Yes No If yes, to depth 218 ft
Were strata sealed against pollution? Yes No Interval _____ ft
Method of sealing BENTONITE/CEMENT


(10) WATER LEVELS:
Depth of first water, if known NOT KNOWN ft
Standing level after well completion 210 ft

(11) WELL TESTS:
Was well test made? Yes No If yes, by whom? _____
Type of test Pump Bailer Air lift
Depth to water at start of test _____ ft At end of test _____ ft
Discharge _____ gal/min after _____ hours Water temperature _____
Chemical analysis made? Yes No If yes, by whom? _____
Was electric log made Yes No If yes, attach copy to this report



Work started 24 MAY 1991 Completed 26 JUNE 1991

WELL DRILLER'S STATEMENT
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief
Signed Laura Kalife (Well Driller)
NAME A & R DRILLING, INC.
(Person, firm, or corporation) (Typed or printed)
Address 1210 EAST 223RD STREET, SUITE 319
City CARSON ZIP 90745
License No. 492082 Date of this report 5 AUGUST 1991

336128

PROJECT ▷ JACK 3014		 APPLIED GEOSCIENCES INC.	PROJECT NUMBER ▷ A901924A	
LOGGED BY ▷ C. HILL/P. ROBERTS			START DATE ▷ 24 May 1991	
CHECKED BY ▷			COMPLETION DATE ▷ 26 June 1991	
GROUND SURFACE ELEVATION DATUM (FT-MSL) ▷			DRILLING COMPANY ▷ LAYNE/A & R DRILLING	
DRILLING EQUIPMENT ▷ FAILING F-10 W/8-INCH HOLLOW STEM AUGERS/CME 75 ROTARY RIG				
BORING DEPTH (FT) ▷ 265.0		WELL DEPTH (FT) ▷ 250		WATER DEPTH (FT)-Initial: Completion: 210.0
WELL MATERIALS ▷ SCHEDULE 80 PVC W/0.02 SLOT			WELL SCREEN INTERVAL (FT) ▷ 220 TO 250	
WELL CASING ELEVATION (FT-MSL) ▷ N/A			OVM/OVA ▷ N/A	

BACKFILL MATERIAL ▷ #3 SAND, BENTONITE, AND CEMENT

DEPTH (FT)	LITHOLOGY		WELL	BLOW COUNT	OUM/OVA (PPM)	SAMPLE			COMMENTS
	DESCRIPTION	GRAPHIC				RECOVERY X	TYPE	NUMBER	
0	Moderate yellowish brown (10 YR 5/4), dry, medium to coarse SAND (SP) with cobbles.								
5									
10									
15									
20									
25									
30									

BORING DESIGNATION
MW1

BORING LOG

PAGE NUMBER
1 OF 7

FIGURE NUMBER
2

33628

PROJECT ▷ JACK 3014

PROJECT NUMBER ▷ A901924A

DEPTH (FT)	LITHOLOGY		WELL	BLOW COUNT	OUM/DUA (PPM)	SAMPLE			COMMENTS
	DESCRIPTION	GRAPHIC				RECOVERY %	TYPE	NUMBER	
30									
35									
40									
45									
50									
55									
60									
65									
70									

BORING DESIGNATION
MW1

BORING LOG



PAGE NUMBER
2 OF 7

FIGURE NUMBER
b

386128

PROJECT ▷ JACK 3014

PROJECT NUMBER ▷ A901924A

DEPTH (FT)	LITHOLOGY		WELL	BLOW COUNT	CUM./CUA (PPM)	SAMPLE			COMMENTS
	DESCRIPTION	GRAPHIC				RECOVERY %	TYPE	NUMBER	
70	Soil becomes moist, more clayey, fewer cobbles								
80	Became moist, fine silty SAND (SM)								
85	Became clayey SAND (SC)								
90									
95									
100									
105									
110									

BORING DESIGNATION
MW1

BORING LOG

PAGE NUMBER
3 OF 7

FIGURE NUMBER
c

33623

PROJECT ▷ JACK 3014

PROJECT NUMBER ▷ A901924A

DEPTH (FT)	LITHOLOGY		WELL	BLOW COUNT	OUM/DUA (PPM)	SAMPLE			COMMENTS
	DESCRIPTION	GRAPHIC				RECOVERY %	TYPE	NUMBER	
110	Dark yellowish orange, moist, fine SAND (SP) Became cobbly								
115									
120									
125									
130									
135									
140									
145									
150									

BORING DESIGNATION
MW1

BORING LOG

PAGE NUMBER
4 OF 7

FIGURE NUMBER
d

336128

PROJECT ▷ JACK 3014

PROJECT NUMBER ▷ A901924A

DEPTH (FT)	LITHOLOGY		WELL	BLOW COUNT	OUN/OVA (PPM)	SAMPLE			COMMENTS
	DESCRIPTION	GRAPHIC				RECOVERY X	TYPE	NUMBER	
150									
155									
160									
165									
170									
175									
180									
185	Became gravelly								
190									

BORING DESIGNATION
MW1

BORING LOG

PAGE NUMBER
5 OF 7

FIGURE NUMBER
e

33628

PROJECT ▷ JACK 3014

PROJECT NUMBER ▷ A901924A

DEPTH (FT)	LITHOLOGY		WELL	BLOW COUNT	OUM/DVA (PPM)	SAMPLE			COMMENTS
	DESCRIPTION	GRAPHIC				RECOVERY %	TYPE	NUMBER	
190									
195									
200									
205									
210									
215									
220									
225									
230									

BORING DESIGNATION
MW1

BORING LOG

PAGE NUMBER
6 OF 7

FIGURE NUMBER
f

336128

PROJECT ▷ JACK 3014

PROJECT NUMBER ▷ A901924A

DEPTH (FT)	LITHOLOGY		WELL	BLOW COUNT	OUM/OVA (PPM)	SAMPLE			COMMENTS
	DESCRIPTION	GRAPHIC				RECOVERY %	TYPE	NUMBER	
230									
235									
240	Gray, very moist, SILT (ML)								
245									
250									
255									
260									
265	Boring terminated at approximately 265 feet								

BORING DESIGNATION
MW1

BORING LOG

PAGE NUMBER
7 OF 7

FIGURE NUMBER
8

APPLIED GEOSCIENCES INC.

185/2W/24

33028

5505-Morehouse Drive, Suite 230
South Sorrento Plaza
San Diego, CA 92121
(619) 558-0600
FAX (619) 558-7180

8 August 1991
A901924A

Site Assessment and Mitigation
Environmental Health Services (HMMD)
P.O. Box 85261
San Diego, California 92138-5261

Attn:

**SUBJECT: 30 DAY REPORT CONCERNING DRILLING AND CONSTRUCTION OF
WELLS AT THE NORTHEAST CORNER OF INTERSTATE 805 AND
PALM AVENUE, CHULA VISTA, CALIFORNIA**

Dear :

Enclosed please find a copy of the Department of Water Resources Water Well Drillers Report. This information is requested as conditions of the well permit issued for the installation of one groundwater monitoring well at the site. Also enclosed are the boring log and site plot plan with the well location. A water sample has not been collected as of the date of this report. Laboratory results for the water sample will be forwarded at a later date.

If further information is needed, please feel free to contact me at (619) 558-0600.

Sincerely,
APPLIED GEOSCIENCES INC.



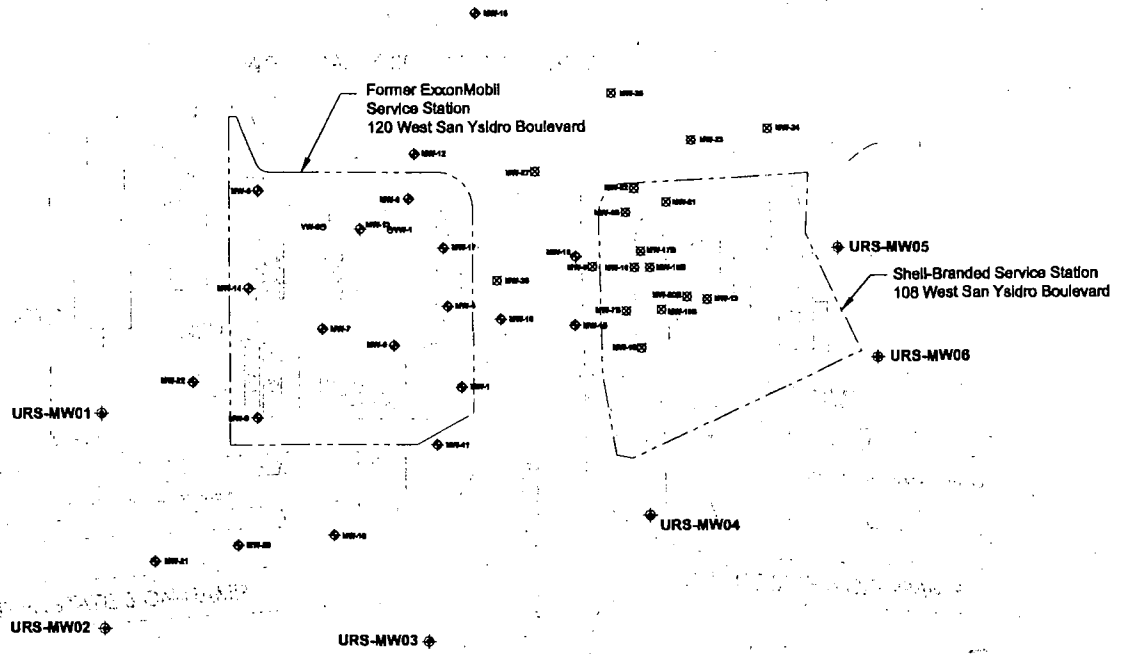
Craig L. Carlisle
Senior Project Hydrogeologist

CC: File A901924A



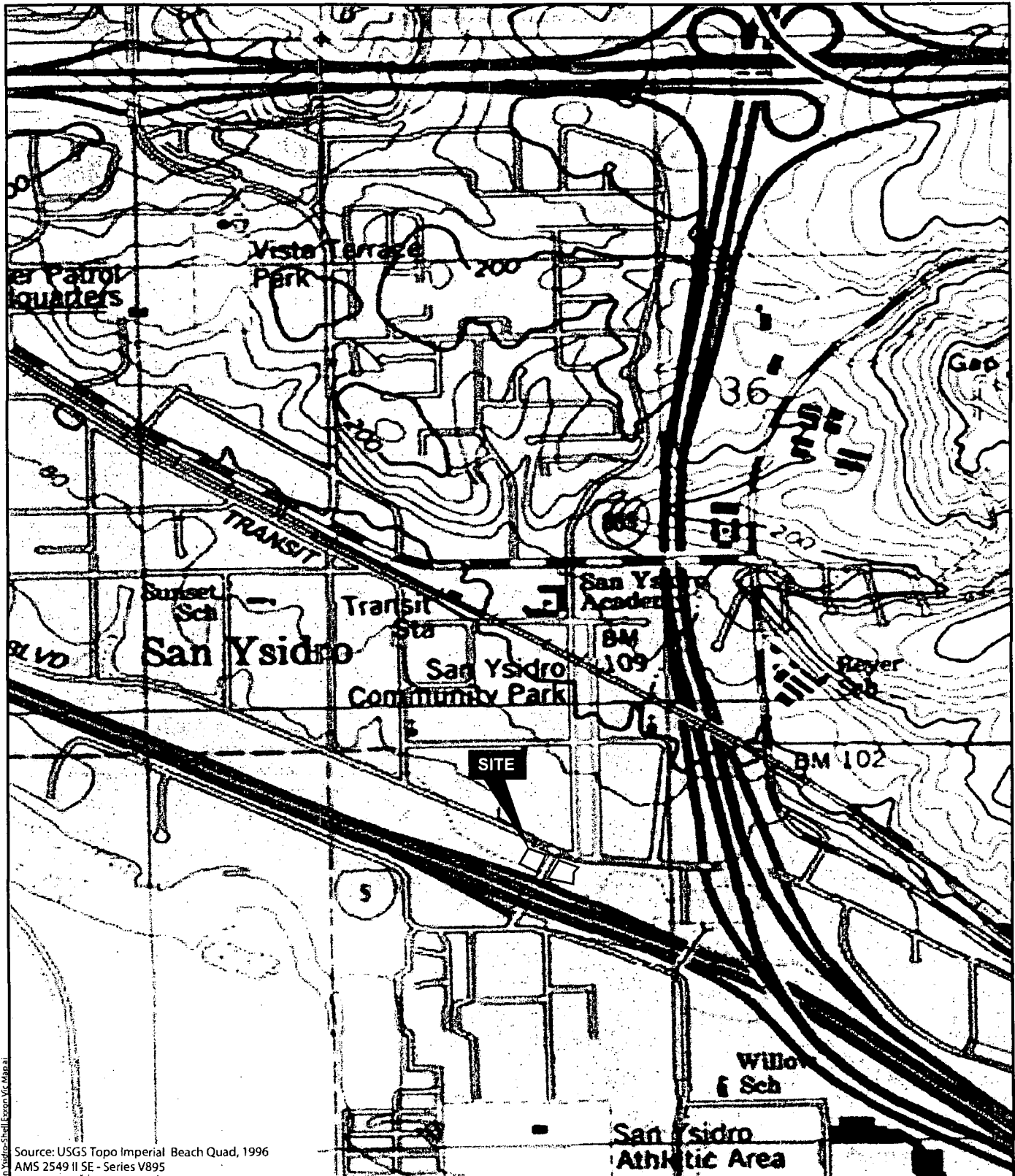
LEGEND

- ☒ Shell-Branded Service Station Groundwater Monitoring Well
- ◆ Former ExxonMobil Service Station Groundwater Monitoring Well
- Former ExxonMobil Service Station Vapor Extraction Well
- ◆ RELC Groundwater Monitoring Well



SITE PLAN
 Shell-Branded Service Station and Former ExxonMobil Service Station
 108 and 120 West San Ysidro Boulevard
 San Diego, California

Figure 2



Source: USGS Topo Imperial Beach Quad, 1996
 AMS 2549 II SE - Series V895



VICINITY MAP

URS	Project No.: 15301786	Date: MAY 2009	Project: RELLC - SAN YSIDRO	Figure 1
------------	-----------------------	----------------	-----------------------------	----------

D:\000\REL\CS\San Ysidro\12_Maps\Vicinity_Map_San Ysidro_Shell_Escrow_Vic_Map.dwg

86	90	SEDIMENTARY ROCK (CLAYSTONE), laminated, brown, slightly weathered, moderately soft, unfractured
90	100	SEDIMENTARY ROCK (SANDSTONE), thickly interbedded with CLAYSTONE; SANDSTONE: fine-grained, brown, moderately weathered, unfractured, CLAYSTONE: very thinly bedded, reddish brown, moderately weathered, moderately soft, unfractured
100	106	SEDIMENTARY ROCK (CLAYSTONE), laminated, reddish brown, slightly weathered, hard, moderately fractured
106	111	SEDIMENTARY ROCK (SILTSTONE), moderately bedded, brown, slightly weathered, soft, unfractured
111	120.5	SEDIMENTARY ROCK (CLAYSTONE), laminated, reddish brown, slightly weathered, hard, slightly fractured

Casing #	Depth from Surface Feet to Feet	Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description

Depth from Surface Feet to Feet	Fill	Fill Type Details	Filter Pack Size	Description

Destruction Details:
Boring backfilled using 80 gallons of grout using proportions of 6 gallons of water each #94 sack of cement.

Other Observations:

Depth from Surface Feet to Feet	Borehole Diameter (inches)	
0	120.5	4

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name FUGRO USA LAND INC
Person, Firm or Corporation

6100 HILLCROFT ST HOUSTON TX 77081
Address City State Zip

Signed electronic signature received 12/26/2018 909719
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

CSG #	State Well Number	Site Code	Local Well Number

N	W
Latitude Deg/Min/Sec	Longitude Deg/Min/Sec
TRS:	
APN:	

37-2510

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

Do Not Fill In
State Well No. 185/LW 22K1
Other Well No. _____
Region 9

(1) **Driller:**
Name San Diego Pump & Well Drillers
Address 145 Brighton St.
Chula Vista, Calif.
License No. BS485 Classification C 37

(2) **Proposed use or uses (check):** (3) **Equipment used (check):**
Domestic Municipal
Irrigation Industrial Rotary
Domestic and Irrigation Test well Cable
Other _____ Dug well
Other _____

Owner 16467
Name _____
Address _____

(4) **Type of work (check):**
New well Reconditioning of well
Deepening existing well

(5) **Well log:**
Total depth of well 870 ft.

Give details of formations penetrated, such as silt, peat, muck, sand, gravel, clay, shale, sandstone, hardpan, rock. Include size of gravel (diameter) and sand (fine, medium, coarse), color of material, structure (loose, packed, cemented, soft, hard, brittle).

Depth From Ground Surface

660 ft. to 870 ft.

Clay, gray

**CONFIDENTIAL - NOT
FOR PUBLIC RELEASE**

MICROFILMED

If additional space is required, continue on DWR Form No. 246—Supplement, and attach to respective report copies.

(6) **Casing left in well:**

LENGTH FT.	DIAMETER INCHES	SINGLE, DOUBLE, WELDED, OTHER	LBS. PER FOOT OR GAGE OF CASING	SEATING BELOW GROUND SURFACE, FT.
<u>138</u>	<u>6" x 6"</u>	<u>Welded</u>	<u>12 lbs.</u>	<u>787</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Type and size of shoe or well ring _____ Welded joints— Yes No

6" x 6" x 3/4"
1-75-6

37-2510

FIELD CHECK OF WELL LOCATION

BRILLER S.D. [unclear] [unclear]

CHECKED BY D.J. LEVE

OWNER _____

DATE _____ 19____

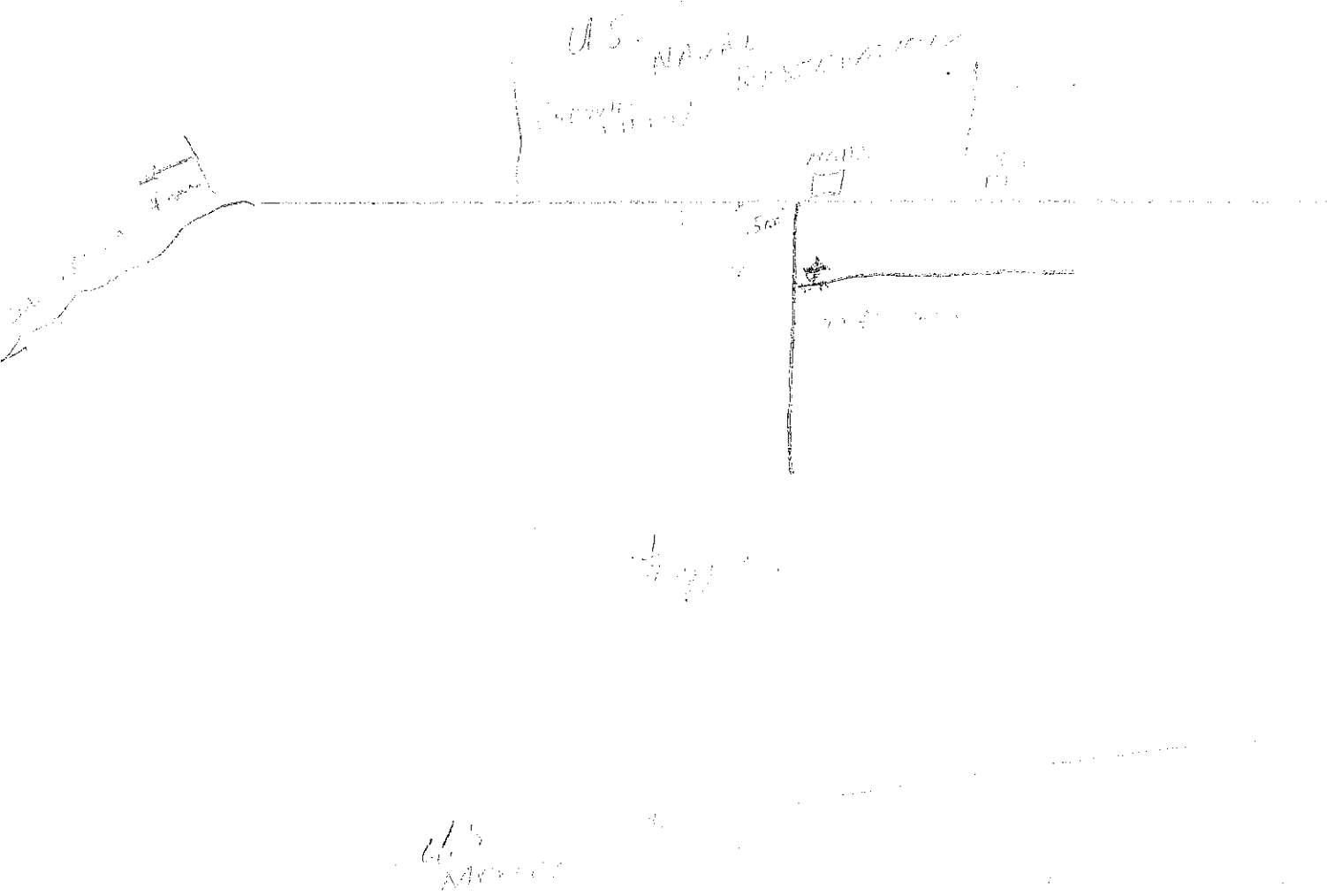
PUMP NO. _____

METER NO. _____

STATE WELL NO. 185/1W.33K1

LOCATE WELL WITH REFERENCE TO ROADS AND ROAD INTERSECTIONS: ALSO INDICATE DISTANCES AND DIRECTIONS TO NEARBY CITIES OR TOWNS.

MICROFILMED



ORIGINAL

File with DWR

STATE OF CALIFORNIA

THE RESOURCES AGENCY

DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 00929

Notice of Intent No. ~~XXXXXX~~ 97018

State Well No. 18S/2W-33 No 4

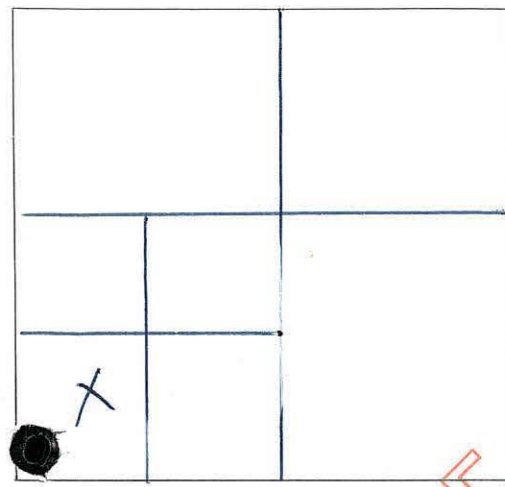
Local Permit No. or Date

Other Well No.

(1) OWNER: Name [Redacted] Address [Redacted] City [Redacted]

(12) WELL LOG: Total depth 150 ft. Depth of completed well 150 ft. from ft. to ft. Formation (Describe by color, character, size or material) 0 - 14 Cobble stone 14 - 19 Silt and sand 19 - 48 Sand 48 - 68 Gravel 68 - 69 Cobble stone 69 - 80 Gravel 80 - 85 Sand 85 - 140 Gravel 140 - 150 Gravel and clay

(2) LOCATION OF WELL (See instructions): County San Diego Owner's Well Number Well address if different from above San Ysidro Township 18 Range 2W Section 33 Distance from cities, roads, railroads, fences, etc. San Ysidro, Ca.



(3) TYPE OF WORK: New Well [X] Deepening [] Reconstruction [] Reconditioning [] Horizontal Well [] Destruction [] (Describe destruction materials and procedures in Item 12) (4) PROPOSED USE: Domestic [X] Irrigation [] Industrial [] Test Well [] Stock [] Municipal [] Other []

(5) EQUIPMENT: Rotary [X] Reverse [] Cable [] Air [X] Other [] Bucket []

(6) GRAVEL PACK: Yes [X] No [] Size #4 [X] #7 [] Diameter of bore 8-3/4" Packed from to ft.

(7) CASING INSTALLED: Steel [X] Plastic [X] Concrete []

(8) PERFORATIONS: 60 ft. Type of perforation or size of screen

Table with 7 columns: From ft., To ft., Dia. in., Gage or Wall, From ft., To ft., Slot size. Row 1: 0, 20, 8-5/8, .188, 110, 150, -

(9) WELL SEAL: Was surface sanitary seal provided? Yes [X] No [] If yes, to depth 20 ft. Were strata sealed against pollution? Yes [] No [X] Interval cement grout Method of sealing

(10) WATER LEVELS: Depth of first water, if known ft. Standing level after well completion 40 ft.

(11) WELL TESTS: Was well test made? Yes [X] No [] If yes, by whom Rex Anderson Type of test Pump [] Bailer [] Air lift [X] Depth to water at start of test ft. At end of test ft. Discharge 75 gal/min after hours Water temperature unk Chemical analysis made? Yes [] No [X] If yes, by whom? electric log made? Yes [] No [X] If yes, attach copy to this report

Work started June 15, 1977 Completed June 29, 1977

WELL DRILLER'S STATEMENT: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. SIGNED Rex Anderson (Well Driller) NAME REX ANDERSON CORP. (Person, firm, or corporation) (Typed or printed) Address 10303 Channel Rd. City Lakeside, Ca. Zip 92040 License No. A 305739 Date of this report July 19, 1977

File Original with DWR 19502W01

State of California

Well Completion Report

Refer to Instruction Pamphlet
No. e0131746

Page 1 of 1

Owner's Well Number URS-MW08

Date Work Began 05/11/2011 Date Work Ended 5/11/2011

Local Permit Agency San Diego County Department of Environmental Health

Permit Number LMON107780 Permit Date 5/3/11

DWR Use Only - Do Not Fill In	
State Well Number/Site Number	
Latitude	Longitude
APN/TRS/Other	

Geologic Log		
Orientation <input checked="" type="radio"/> Vertical <input type="radio"/> Horizontal <input type="radio"/> Angle Specify _____		
Drilling Method <u>Hollow Stem Auger</u> Drilling Fluid _____		
Depth from Surface Feet	to Feet	Description
0	1	Asphalt
1	4	Brown, Silty fine SAND (SM), moist, trace gravel clay
4	11	Light olive brown, fine to medium SAND (SP) medium dense, moist, trace coarse sand, trace silt
11	15	Dark yellowish brown, SILT (ML), very stiff, moist trace fine sand, trace fine to coarse gravel
15	20	Becomes very dark grayish brown, hard, trace clay, trace mica
20	21	Becomes dark grayish brown, silt with fine sand, very stiff, abundant mica
21	24	Dark grayish brown, Lean CLAY (CL), very stiff, moist, trace silt, trace mica
24	26	Grayish brown, fine to medium SAND (SP), dense moist, trace coarse sand, trace silt
26	29	Light brownish gray, SAND (SW), dense, moist trace silt
29	31	Grayish brown, medium SAND (SP), dense, wet, trace fine sand, trace silt
31	38	Dark grayish brown, Fat CLAY (CH), hard, wet, trace mica, trace cobbles
38	40	Dark grayish brown, Silty fine SAND (SM), dense wet, trace medium sand, abundant mica
40	42	Light yellowish brown, SAND (SW), dense, wet trace silt, trace fine and coarse gravel
Total Depth of Boring		<u>42</u> Feet
Total Depth of Completed Well		<u>39</u> Feet

Well Owner

Well Location
Address <u>104 W. San Ysidro Blvd.</u>
City <u>San Diego</u> County <u>San Diego</u>
Latitude _____ N Longitude _____ W Dec. Min. Sec. Dec. Min. Sec.
Datum <u>NAD83</u> Decimal Lat. <u>32.5520237</u> Decimal Long. <u>-117.0439</u>
APN Book _____ Page _____ Parcel <u>666-380-28-00</u>
Township _____ Range _____ Section _____

Location Sketch
(Sketch must be drawn by hand after form is printed.)
North
SEE ATTACHED SITE PLAN FOR WELL LOCATIONS
West East
South
Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity
<input checked="" type="radio"/> New Well
<input type="radio"/> Modification/Repair
<input type="radio"/> Deepen
<input type="radio"/> Other _____
<input type="radio"/> Destroy
<small>Describe procedures and materials under "GEOLOGIC LOG"</small>
Planned Uses
<input type="radio"/> Water Supply
<input type="checkbox"/> Domestic <input type="checkbox"/> Public
<input type="checkbox"/> Irrigation <input type="checkbox"/> Industrial
<input type="radio"/> Cathodic Protection
<input type="radio"/> Dewatering
<input type="radio"/> Heat Exchange
<input type="radio"/> Injection
<input checked="" type="radio"/> Monitoring
<input type="radio"/> Remediation
<input type="radio"/> Sparging
<input type="radio"/> Test Well
<input type="radio"/> Vapor Extraction
<input type="radio"/> Other _____

Water Level and Yield of Completed Well
Depth to first water <u>30</u> (Feet below surface)
Depth to Static _____
Water Level <u>26</u> (Feet) Date Measured <u>05/23/2011</u>
Estimated Yield * _____ (GPM) Test Type _____
Test Length _____ (Hours) Total Drawdown _____ (Feet)
*May not be representative of a well's long term yield.

Casings								
Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	19	10	Blank	PVC Sch. 40	0.25	4.5		
19	39	10	Screen	PVC Sch. 40	0.25	4.5	Milled Slots	0.010

Annular Material			
Depth from Surface Feet	to Feet	Fill	Description
0	3	Cement	Concrete
3	14	Bentonite	Bentonite Grout
14	17	Bentonite	Chips
17	42	Filter Pack	#2/12 Sand

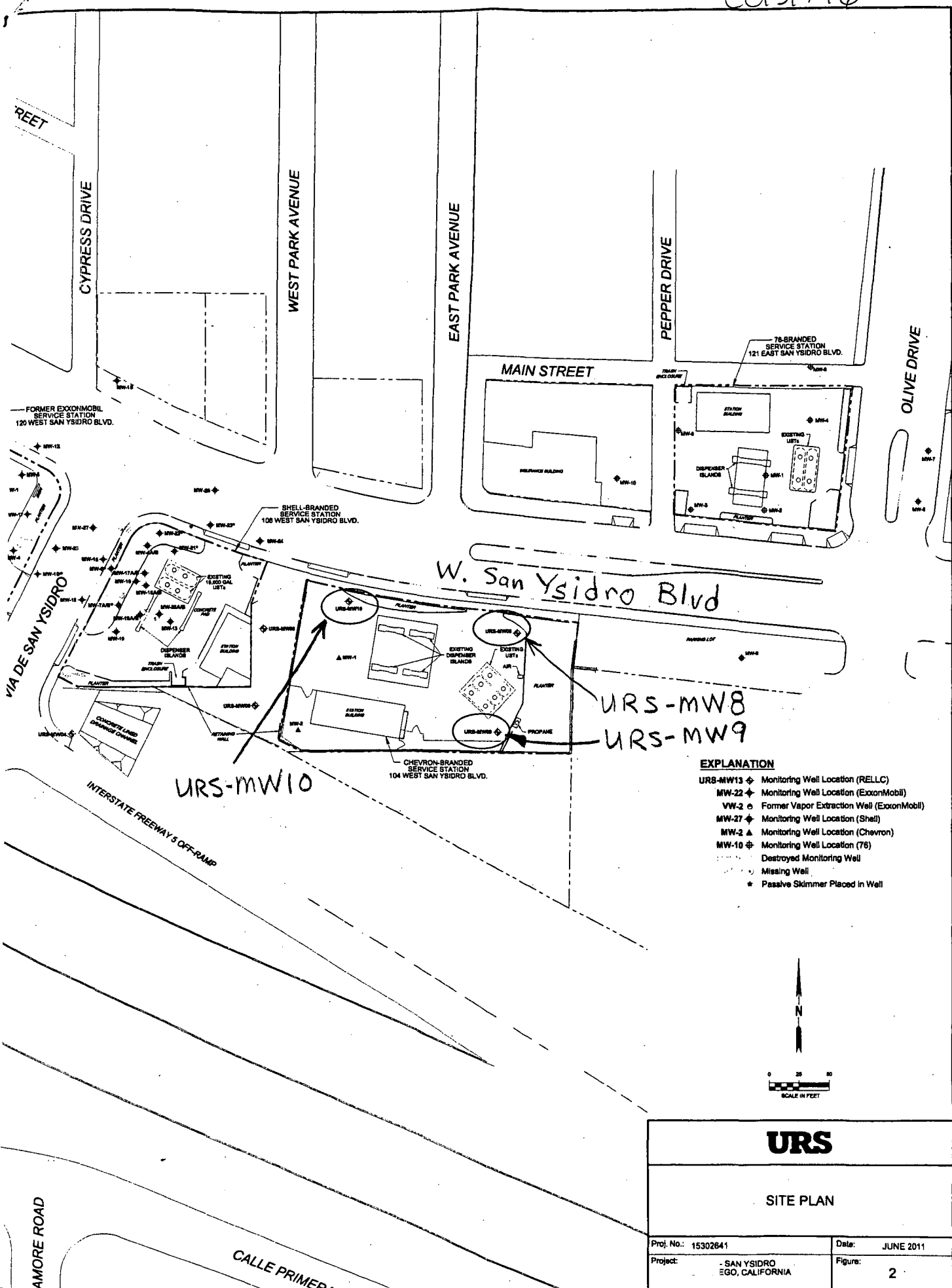
Attachments
<input type="checkbox"/> Geologic Log
<input type="checkbox"/> Well Construction Diagram
<input type="checkbox"/> Geophysical Log(s)
<input type="checkbox"/> Soil/Water Chemical Analyses
<input checked="" type="checkbox"/> Other <u>Well Location Site Plan</u>
Attach additional information, if it exists.

Certification Statement
I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief
Name <u>WDC Exploration & Wells</u>
Person, Firm or Corporation <u>5566 ARROW HWY. MONTCLAIR CA 91763</u>
Address City State Zip
Signed <u>[Signature]</u> Date Signed <u>6/17/11</u>
C-57 Licensed Water Well Contractor License Number <u>283326</u>

DWR 188 REV. 1/2006
231353U SAN YSIDRO

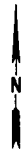
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

06/27/11

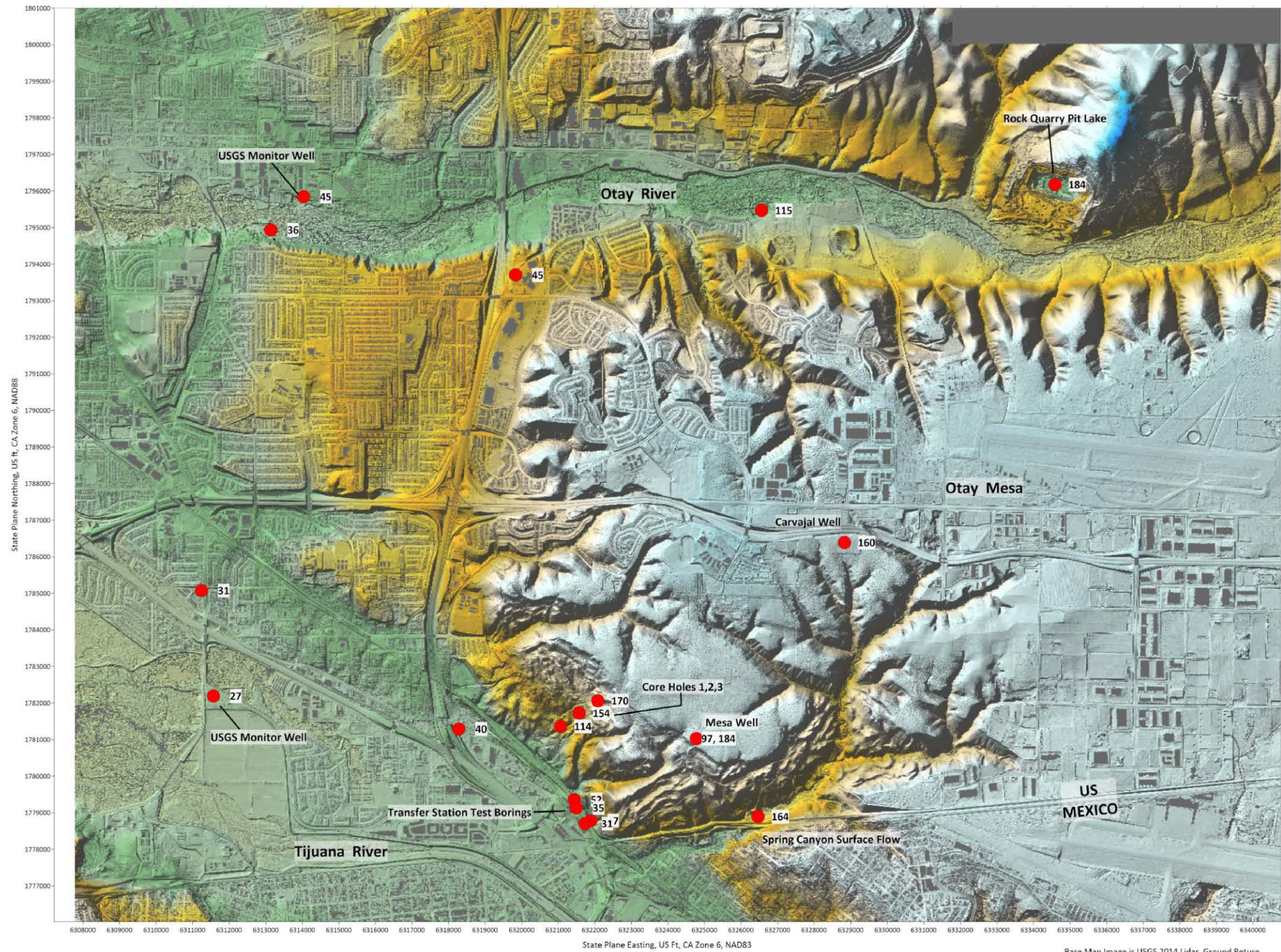


EXPLANATION

- UR8-MW13 ◆ Monitoring Well Location (RELLC)
- MW-22 ◆ Monitoring Well Location (ExxonMobil)
- VW-2 ○ Former Vapor Extraction Well (ExxonMobil)
- MW-27 ◆ Monitoring Well Location (Shell)
- MW-2 ▲ Monitoring Well Location (Chevron)
- MW-10 ◆ Monitoring Well Location (78)
- Destroyed Monitoring Well
- Missing Well
- ★ Passive Skimmer Placed in Well



URS	
SITE PLAN	
Proj. No.: 15302641	Date: JUNE 2011
Project: - SAN YSIDRO - EGO, CALIFORNIA	Figure: 2



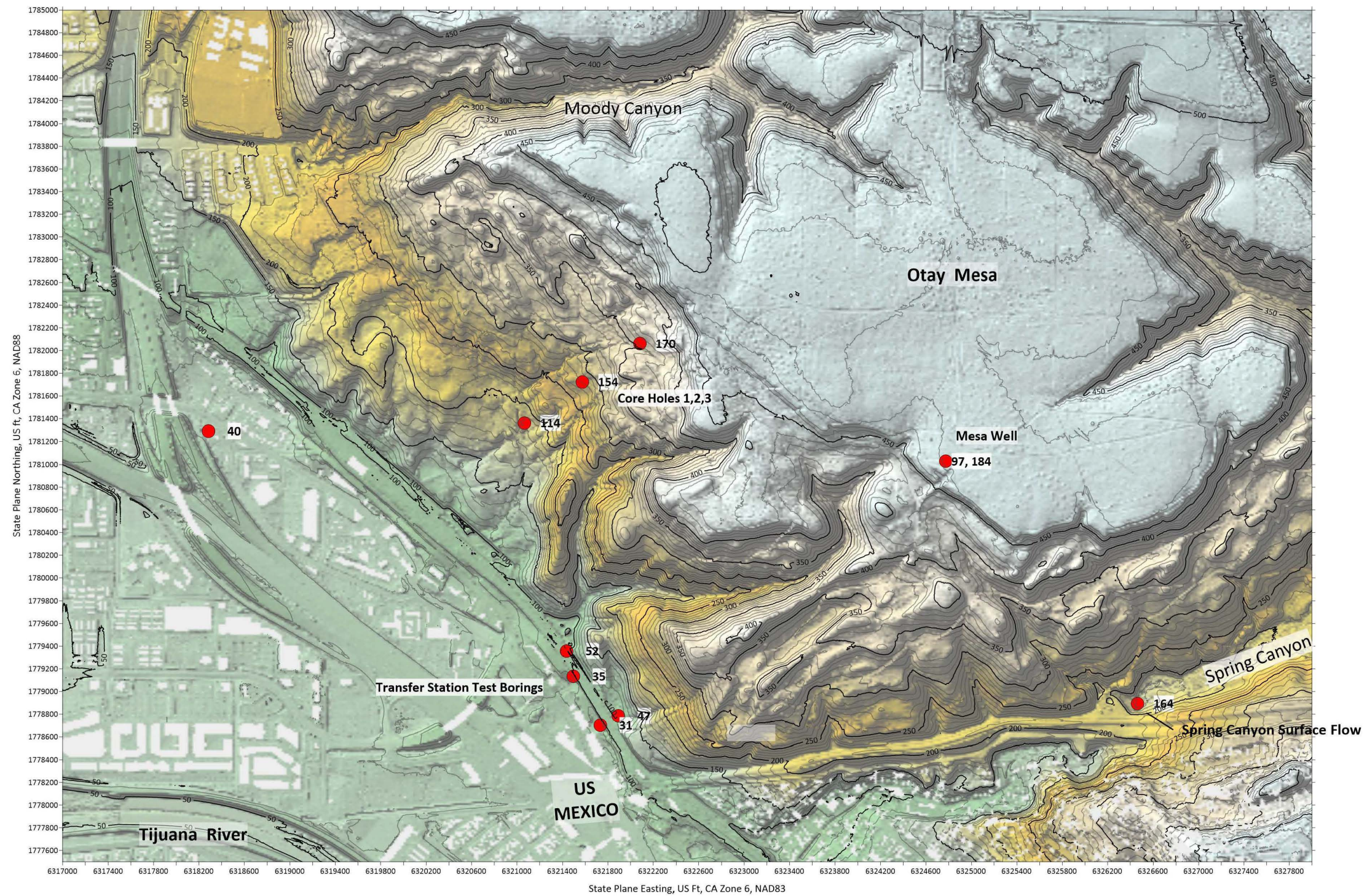
Base Map Image is USGS 2014 Lidar, Ground Return, Obtained from NOAA Digital Coast

● 42 Groundwater Observation Point, Consisting of Wells and Surface Water Exposures. Approximate Groundwater Elevation, NAVD88 Shown at Right.

Data Sources:

- CA DWR Well Completion Reports, 1951 - Present
- Examination of Historical and Current Aerial Photography
- USGS Multiple Completion Monitor Wells at Boundary Waters and Otay River
- Geocoin, Inc. 2000 Geotechnical Report for Intermodal Transfer Station
- Geocoin, Inc. Boring Logs and Test Data for Southwest Village Investigation

PLATE 1
Map Summarizing Groundwater Observation Points for Estimating Groundwater Conditions Affecting Southwest Village Area, Otay Mesa



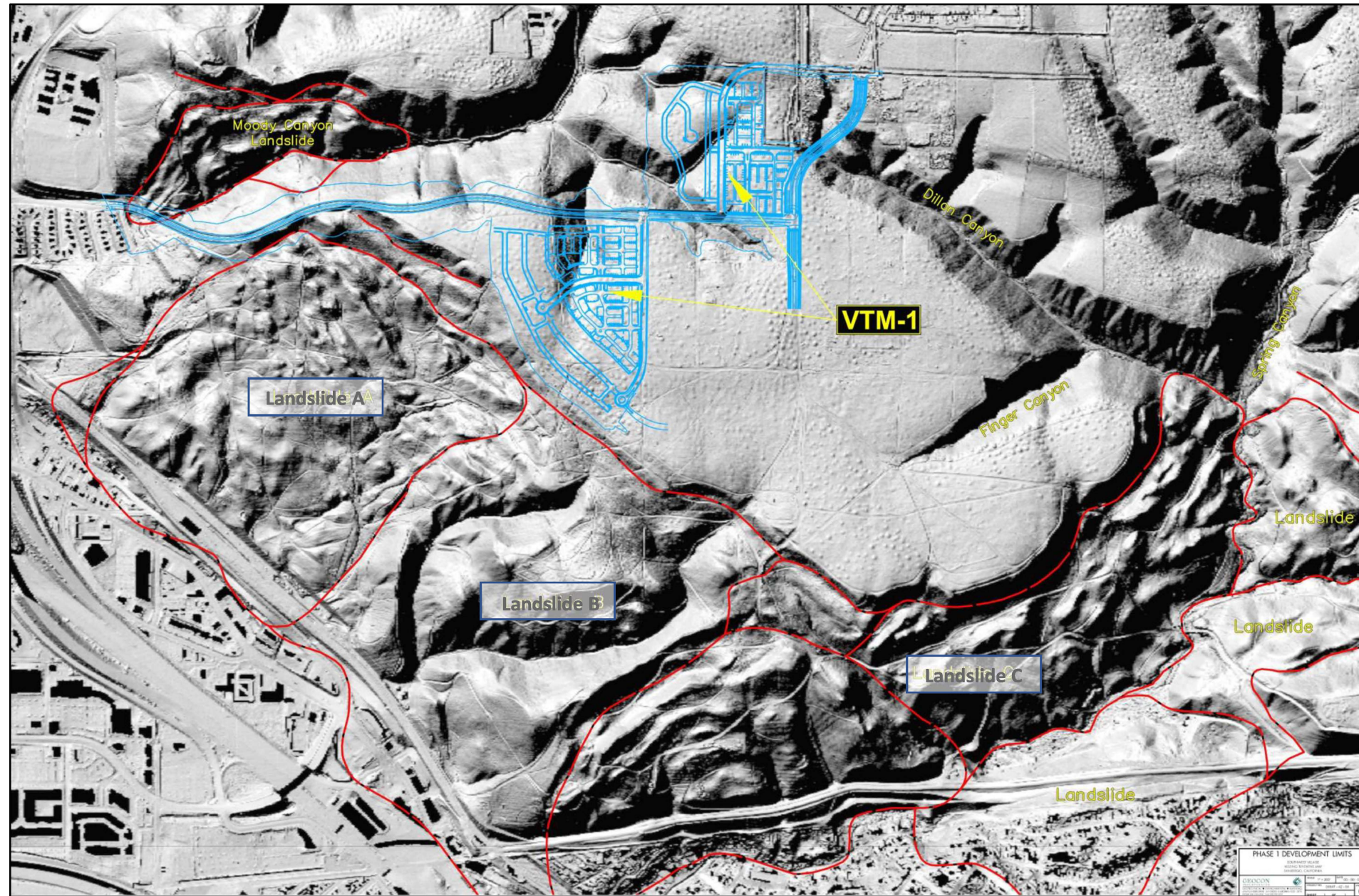
42 Groundwater Observation Point, Consisting of Wells and Surface Water Exposures. Approximate Groundwater Elevation, NAVD88 Shown at Right.

Data Sources:

- o CA DWR Well Completion Reports, 1951 - Present
- o Examination of Historical and Current Aerial Photography
- o USGS Multiple Completion Monitor Wells at Boundary Waters and Otay River
- o Geocon, Inc. 2000 Geotechnical Report for Intermodal Transfer Station
- o Geocon, Inc. Boring Logs and Test Data for Southwest Village Investigation

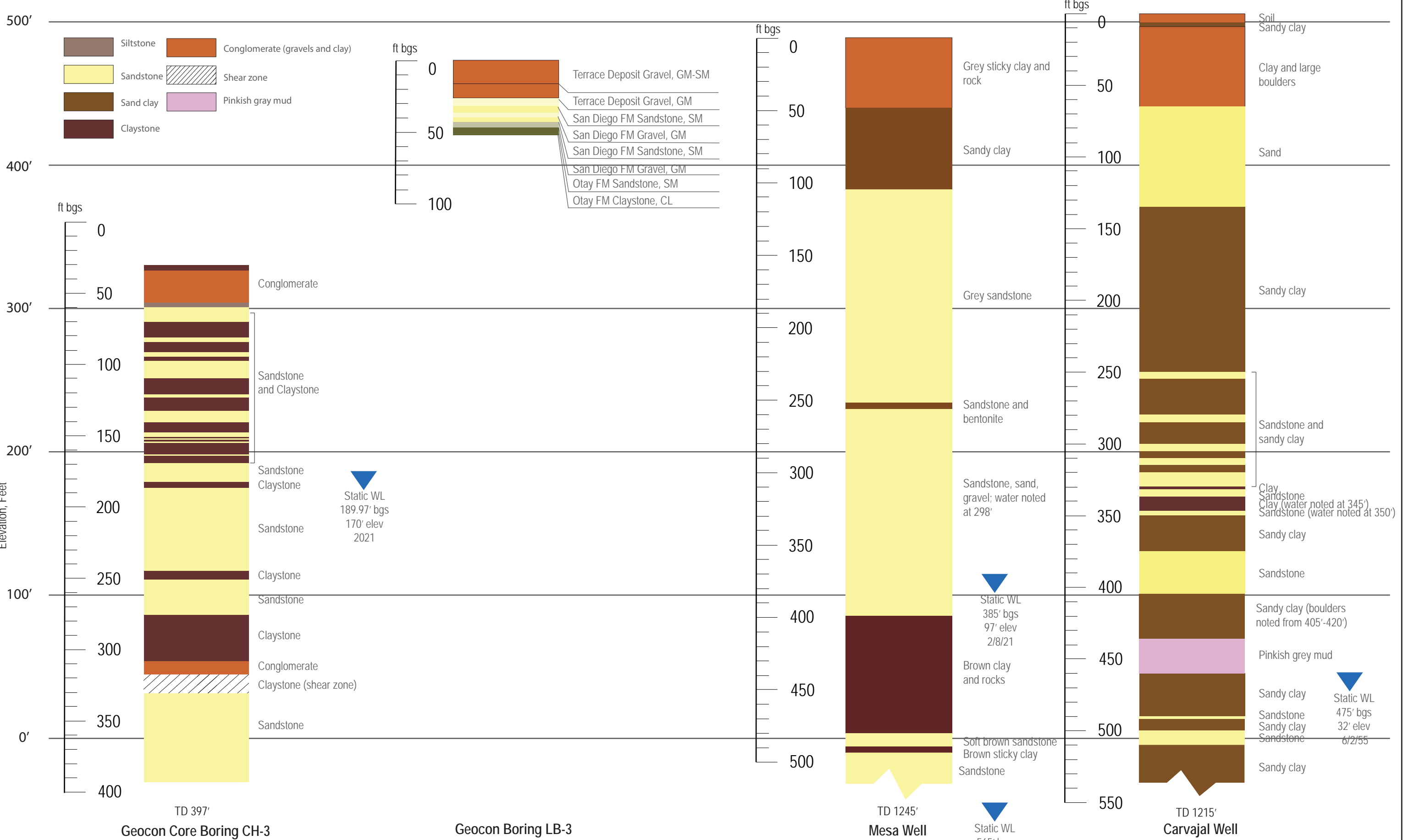
Base Map Image is USGS 2014 Lidar, Ground Return, Obtained from NOAA Digital Coast. Elevations are NAVD88

PLATE 2
Map Summarizing Available Groundwater Observation Points Within and Closest To Landslide Areas for Estimating Groundwater Conditions Affecting Slope Stability, Southwest Village Area, Otay Mesa



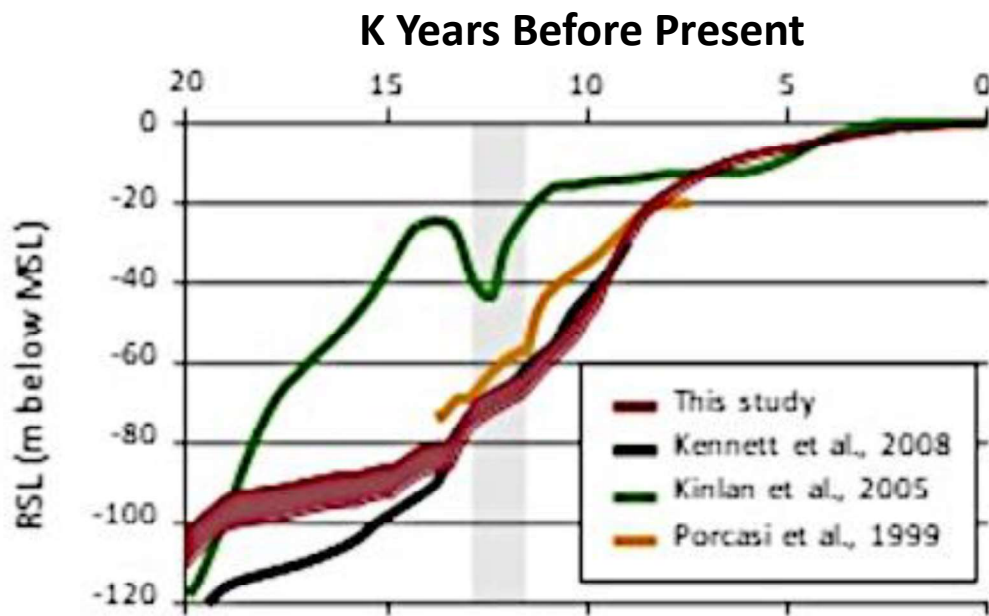
NOTE:
 Figure adapted from Geocon Inc Illustration
 Blue artwork is proposed village development
 And access road.

FIGURE 1
Location Map
Southwest Village

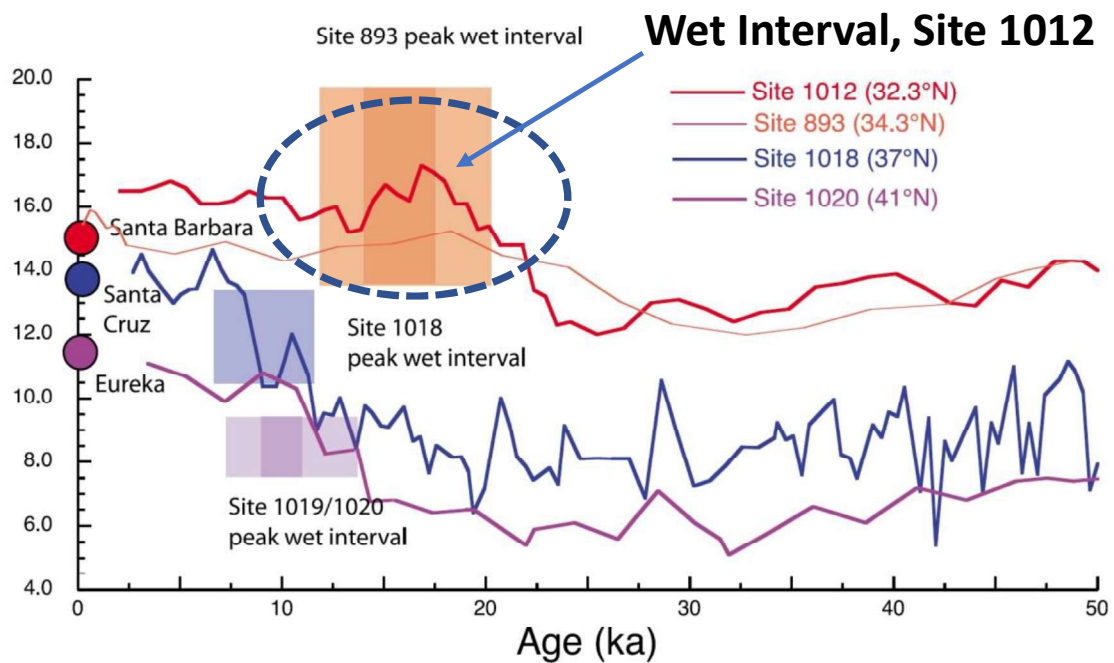


Note: Dark brown colors indicate clay bearing lithology
 Figure shows generalized geology
 Elevation Datum NAVD88

Figure 2
Otay Mesa Geotech Boring and Water Wells







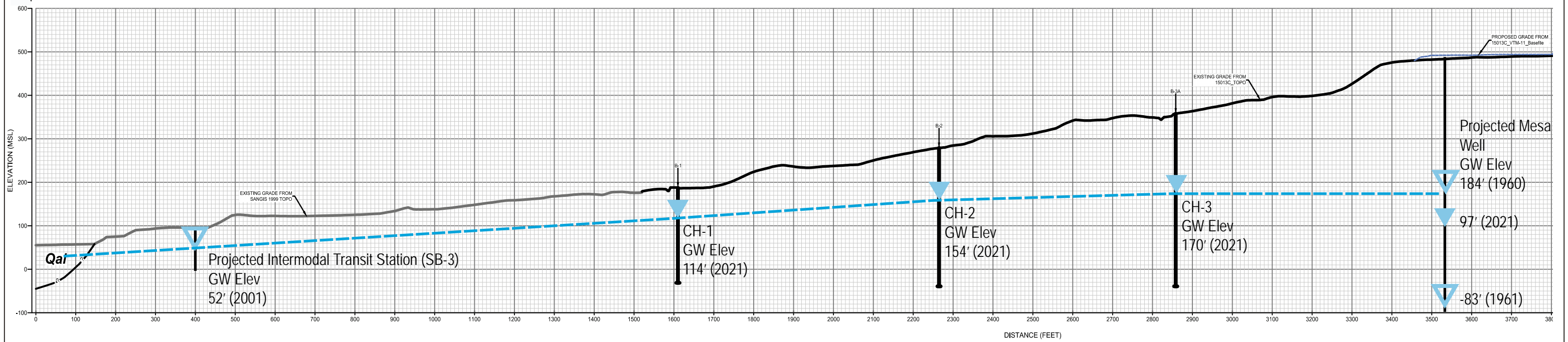
Sea Level Curve, reproduced from Reeder, et al, 2015



Wet Climate Interval, inferred from pollen analysis
 Of ocean bottom sediment cores, CA Borderland.
 Reproduced from Lyle, et al, 2010

FIGURE 3
 Pleistocene Sea Level Curve
 And Ocean Core Paleo
 Environment Analysis

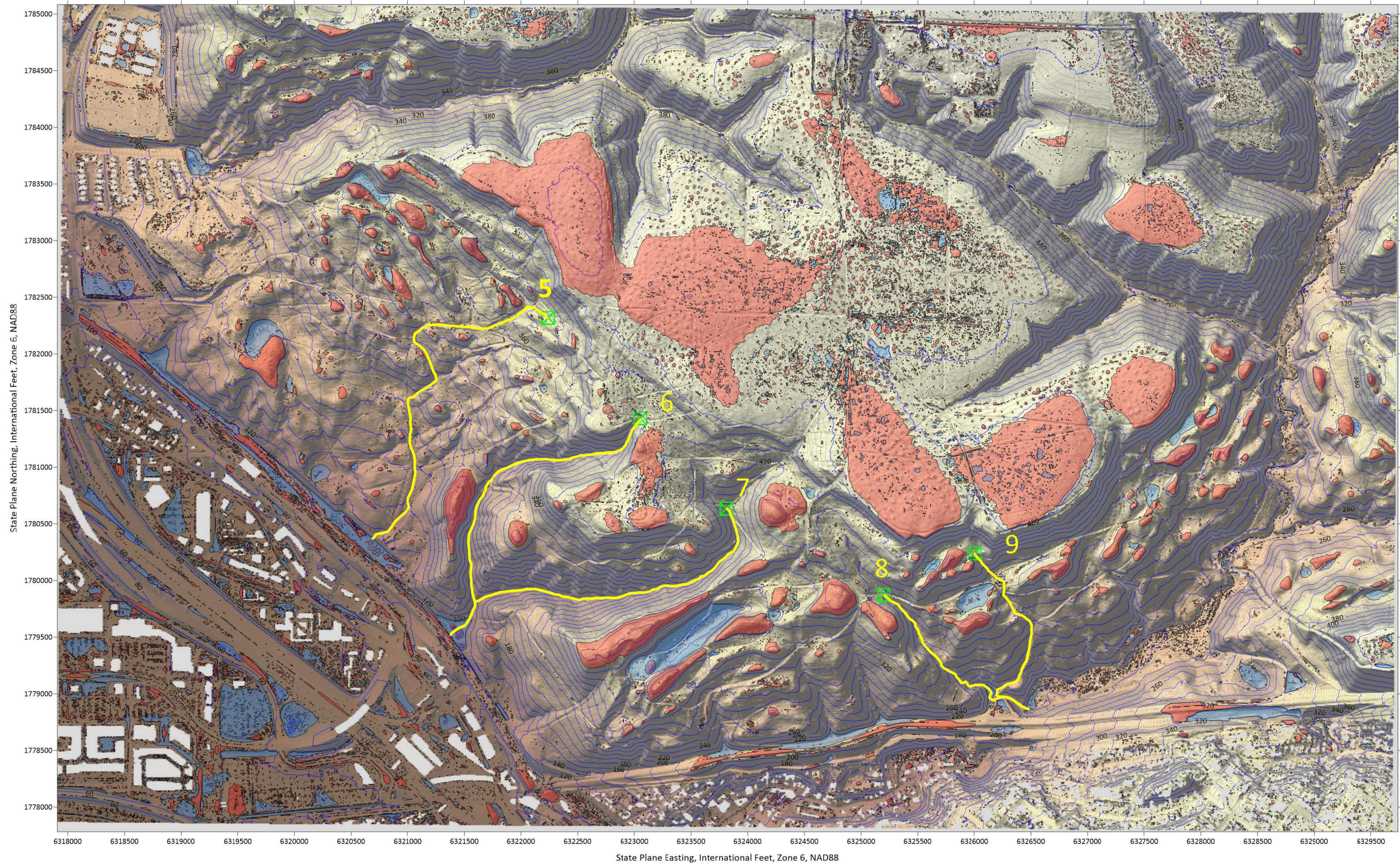
-  Recent Groundwater Elevation
-  Historical Groundwater Elevation
-  Estimated Groundwater Elevation
-  Corehole or Groundwater Wells



Groundwater cross section through Geocon Landslide A
 Figure adapted from Draft Geocon cross section
 Groundwater elevations shown for borings are NAVD88

SOURCE: Geocon

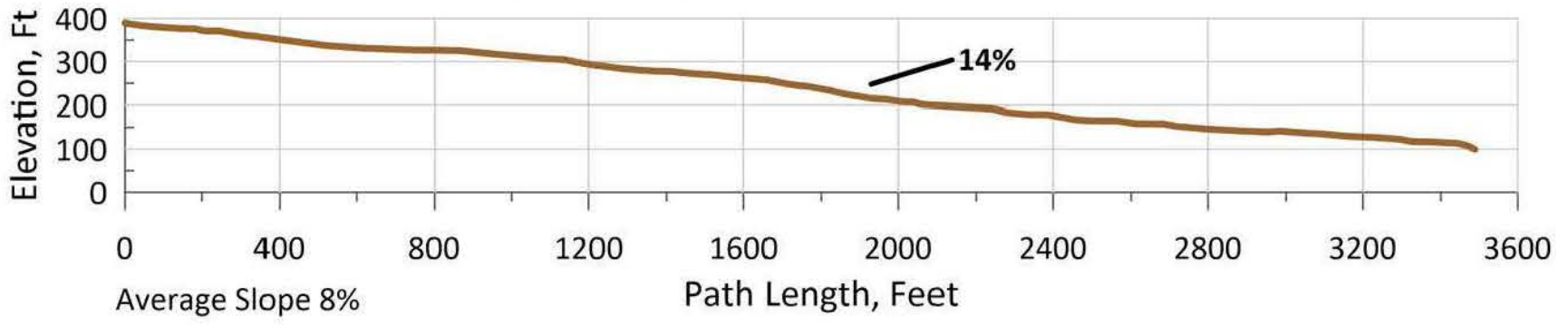
FIGURE 4



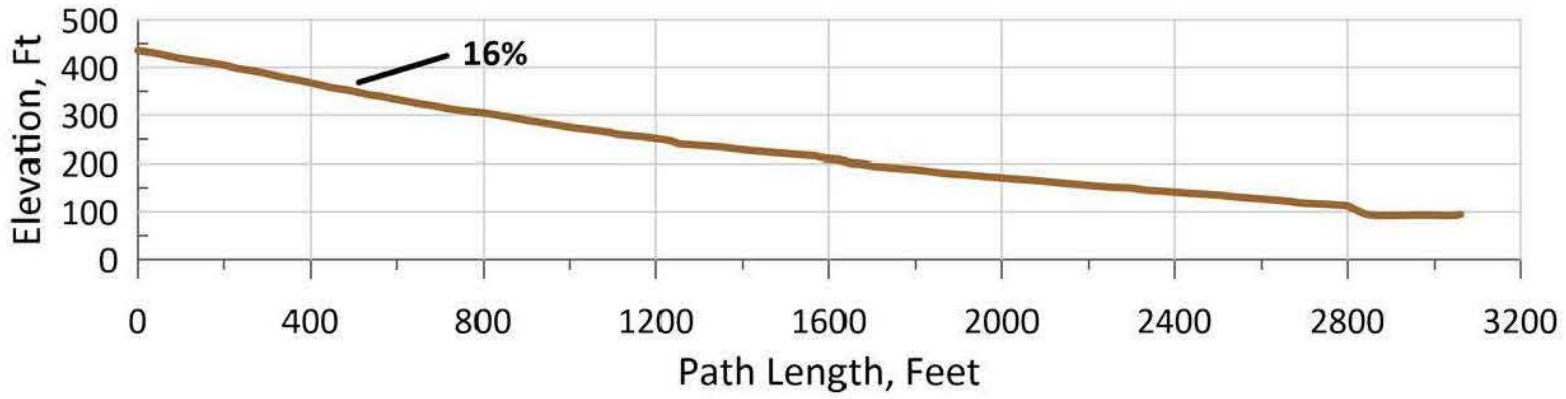
NOTES: Blue Topo Shading Indicates Closed Contour Depression
Salmon Topo Shading Indicates Closed Contour Hilltops
Yellow Lines are Outfall Flowpaths

FIGURE 5
Stormwater Outfalls and
Outfall Flow Paths

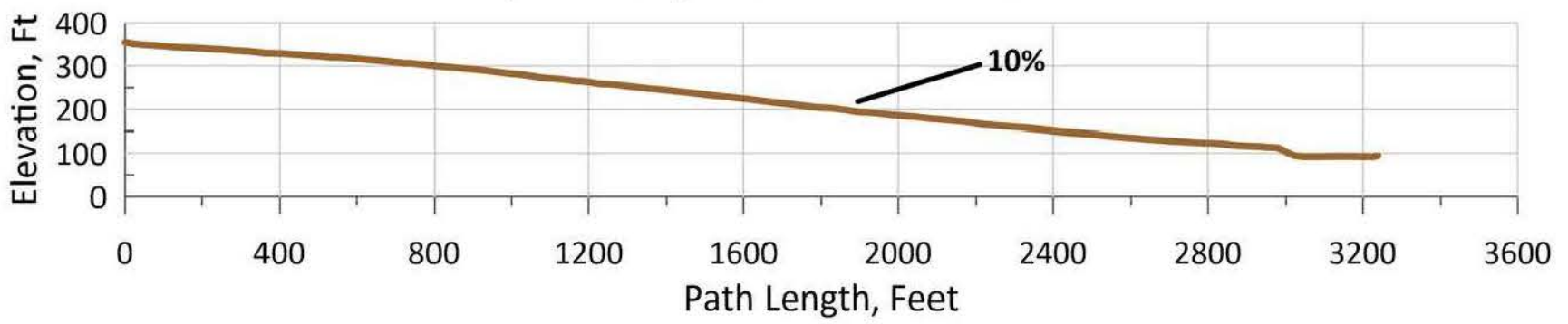
Slope of Gully Bottom From Outfall 5



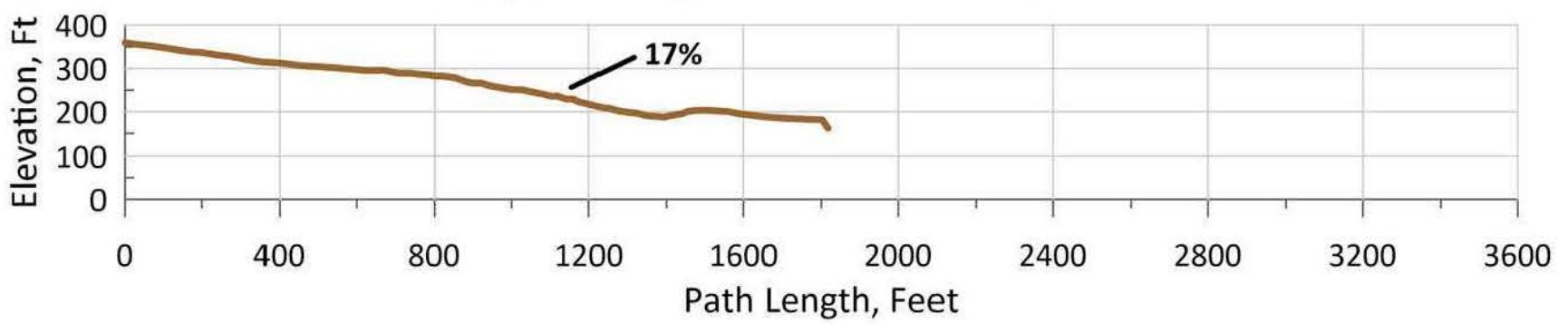
Slope of Gully Bottom From Outfall 6



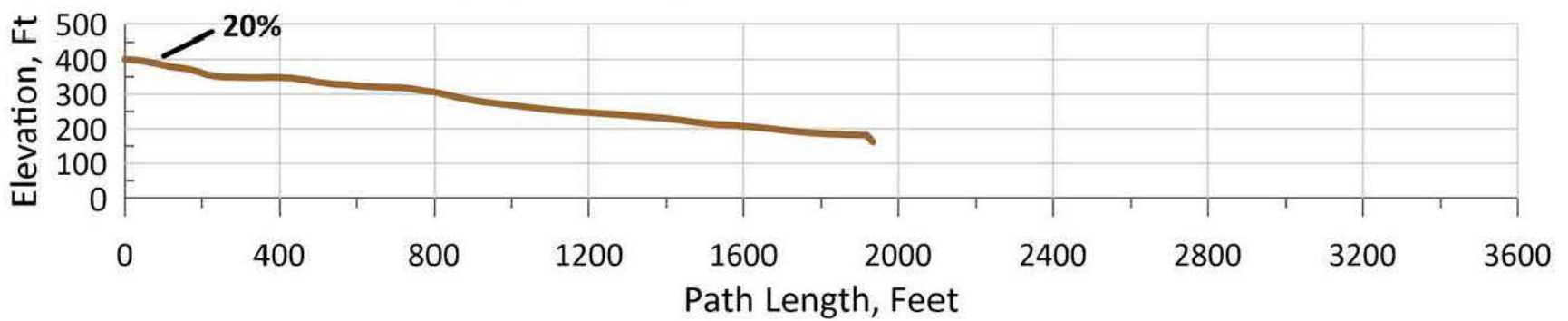
Slope of Gully Bottom From Outfall 7



Slope of Gully Bottom From Outfall 8



Slope of Gully Bottom From Outfall 9



NOTES:

Elevation profiles digitized from 2 foot contour map of USGS/San Diego County
2014 Lidar data downloaded from NOAA Digital Coast access server.

Gully plan view shapes meander; section data shown is calculated path length
unfolded into plane. Steepest portion of each outfall gully slope identified.

FIGURE 6
Drainage Bottom Profiles Leaving
Proposed Outfalls 5,6,7,8,9
Southwest Village

Claystone (282' - 396' bgs)

Sandstone (324' - 333.5' bgs)

Sandstone (382' - 392' bgs)

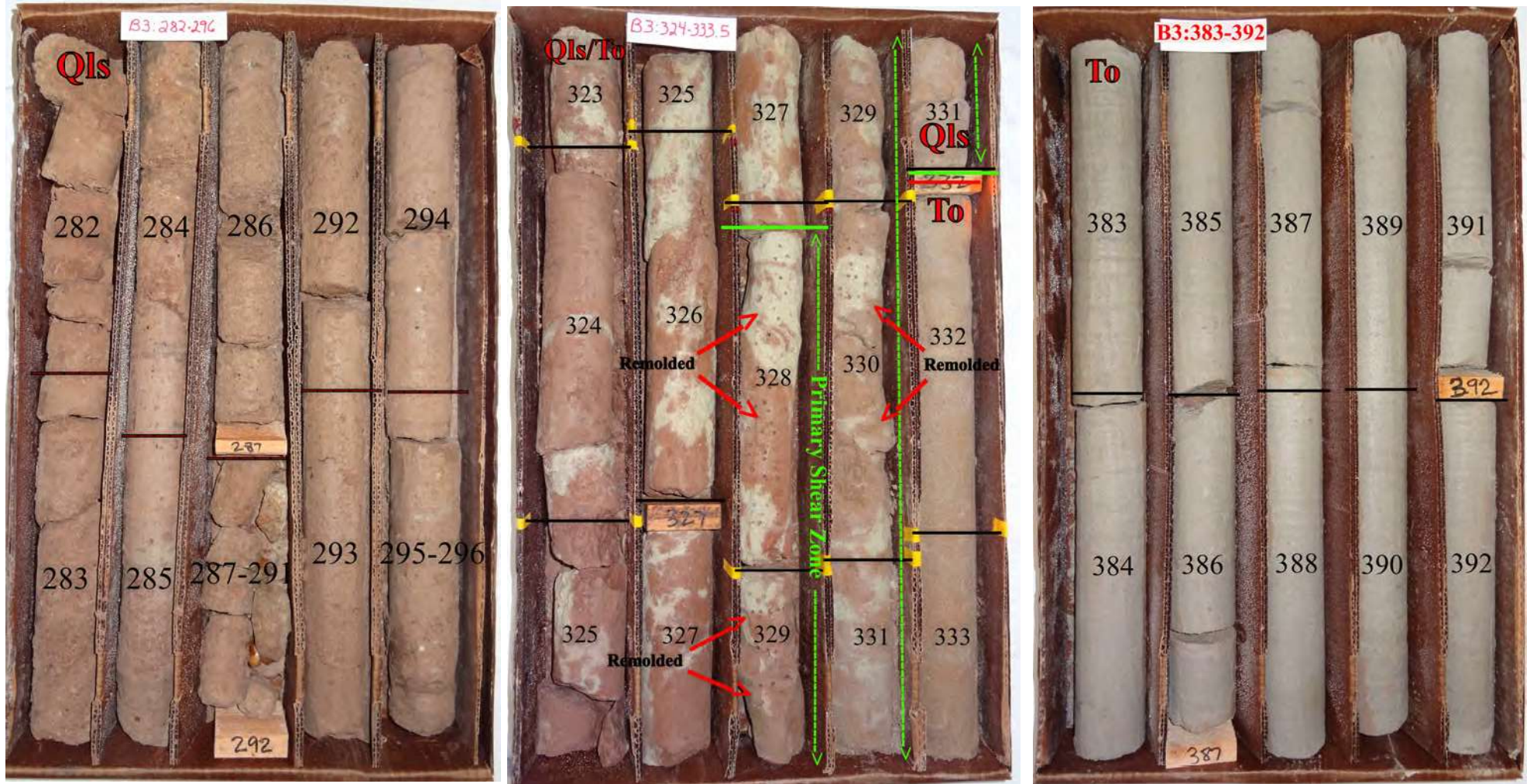
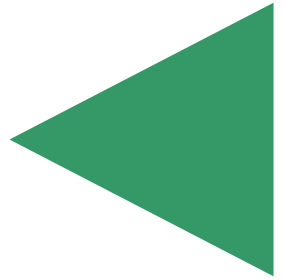


Figure 7
Lithology photographs of Borehole CB-3

APPENDIX





April 16, 2021

City of San Diego
Development Services
101 Ash Street
San Diego, California 92101

SUBJECT: LANDSLIDE HYDROLOGY ANALYSIS FOR SOUTHWEST VILLAGE
(RICK ENGINEERING COMPANY JOB NUMBER 15013-C)

1. Introduction

This letter report presents the existing and proposed hydrology associated with the landslide area adjacent to the Otay Mesa Southwest Village project area. The Southwest Village project is a smaller portion of the overall community of Otay Mesa. Specifically, the project boundary is generally located south of State Route 905, east of Interstate 805, north of US-Mexico border, and immediately west of the northerly branch of Spring Canyon Creek. Refer to the Vicinity Map in Attachment 1 as well as the drainage study maps included in Map Pockets 1 and 2 for the limits of the area analyzed.

2. Drainage Characteristics

In the existing condition, Basins 400, flows in a westerly direction to a collection point east of the existing railroad. Basin 500 and 700, drain in a southwesterly direction where they confluence before flowing to a collection point along the eastern edge of the existing railroad. From these locations, runoff is conveyed in an existing storm drain system (pipes and channels) to the Tijuana River by the border line with Mexico. Runoff from Basins 800 and 900 drain to the south and confluence in Spring Canyon Creek. Runoff is conveyed south within Spring Canyon Creek towards an existing culvert at the Spring Canyon concentration point along the border with Mexico. Based upon the available information, it is assumed that the runoff is conveyed via a system of storm drain and open channels to a concrete lined reach of the Tijuana River on the Mexican side of the border.

Throughout the landslide area there are several existing sump locations where it is anticipated that storm water will collect and infiltrate into the native soil or evaporate over time. The area analyzed also includes existing shallow sump locations, notably in Basins 800 and 900, where it is anticipated that in larger storm events, storm water will weir over the edge of the low point

and flow out to collection points along the border with Mexico by Spring Canyon Creek. Please refer to Map Pocket 1 for the existing condition drainage map.

The post-project drainage conditions will remain largely similar to those in the existing condition. However, drainage improvements are being proposed throughout the development area. Storm drain outfalls will be extended as far as practicable towards the bottom of mesa and located adjacent to established existing channels. Underground storage is proposed to detain peak flow rates back to existing conditions for the 50 and 100-year storm event. Additionally, the drainage area flowing into Mexico at the Spring Canyon concentration point and will need to comply with the US/Mexico International flood control detention requirements (i.e. – 5, 10, 25, 50, & 100-year storm events). Please refer to Map Pocket 2 for the proposed condition drainage map.

3. Hydrology Methodology and Results

This study considers peak flow rates in the existing and proposed project condition and a summary is provided in Table 1 below. Weighted Runoff Coefficients and Time of Concentration were calculated based on guidance from the City of San Diego Drainage Design Manual, dated January 2017. The Rational Method computer program developed by Advanced Engineering Software (AES 2014) was used for this study.

Table 1: Existing and Proposed Hydrology (AES)

Drainage Basin #	Drainage Node # at Point of Interest	Project Condition	Tributary Area, A (acres)	Time of Concentration, T _c (minutes)	100-year Flow Rates, Q ₁₀₀ (cfs ¹)	Change in Area (ac)	% Change in Peak Discharge (Pre to Post Detained)
400	499	Pre-project	188.9	15.4	244.1	-8.7	-32%
	499	Post-project	180.2	14.9	243.8		
	499	Post-Detained	180.2	27.8	165.1		
500 & 700	799	Pre-project	176.3	22.9	184.5	-3.9	-1%
	799	Post-project	172.4	10.9	312.4		
	799	Post-Detained	172.4	22.2 ²	181.9 ³		
800 & 900	999	Pre-project	83.5	16.7	103.8	+1.4	-16%
	999	Post-project	84.9	12.0	141.4		
	999	Post-Detained	84.9	22.9 ²	86.8 ³		

Notes:

1. Rainfall intensities for AES Rational Method analysis were calculated using the City of San Diego's 2017 Drainage Design Manual
2. Detailed detention analysis for basins that are not a part of the Vesting Tentative Map (VTM) (Basin 700, 800, & 900) has yet to be completed. For the purpose of this analysis the Time of Concentration was approximated by using detention analysis done on the adjacent Basins within the VTM (Basin 400 & 500). Peak flow rate for detention was based on the pre-project peak flow rates for the 100-year event.
3. For basins not a part of the VTM ((Basin 700, 800, & 900) percent imperviousness was conservatively assumed to be 85% impervious based on the proposed land use in the Specific Plan.

A summary of the average annual volume at key locations throughout the landslide area has also been quantified. The locations analyzed are at the upstream edge of the landslide buffer, the proposed storm drain outfall locations, and at the collection point either adjacent to the railroad for Basins 400, 500, and 700 or adjacent to the border with Mexico for Basins 800 and 900. A continuous simulation model using EPA SWMM v5 for each of the basins has been completed to determine the average annual volume of precipitation, runoff, and infiltration. Due to potential issues with the Lower Otay Reservoir rain gauge, the Lindberg Field rain gauge was used for this analysis. The time series for the rain gauges dates from October 17, 1948 to December 31, 2005. Parameters used within the EPA SWMM models will be consistent with guidance provided in the October 2018 City of San Diego Storm Water Standards Manual Appendix G. Please refer to Table 2 for a summary of precipitation, runoff, and infiltration.

Table 2: Existing and Proposed Average Annual Volume (SWMM)

Drainage Basin #	Drainage Node # at Point of Interest	Project Condition	Precipitation (ac-ft)	Runoff (ac-ft)	Infiltration (ac-ft)	% Change in Runoff	% Change in Infiltration
400	499	Pre-project	149.9	30.7	120.5	0.4%	-7%
	499	Post-project	144.4	30.8	111.6		
500 & 700	799	Pre-project	139.9	25.6	113.7	60%	-22%
	799	Post-project	136.9	40.9	88.4		
800 & 900	999	Pre-project	66.3	13.3	53.4	30%	-14%
	999	Post-project	67.4	17.3	45.9		

Notes:

1. The average annual rain fall was calculated to be 9.53-inches based on annual averages calculated in EPA SWMM using the Lindberg Field rain gauge
2. The Lindberg Field rain gauge was used for this analysis. The time series for this rain gauges dates from October 17, 1948 to December 31, 2005.

Table 2 shows that in the post project condition, average annual runoff volumes have increased. This is due to the development associated with the Southwest Village project site and the addition of impervious area. The increased impervious area and compacted fill soils with reduced conductivity result in a high runoff volume. This increase in runoff volume makes sense as flows are conveyed through the landslide area and are collected at points adjacent to the railroad or next to the border with Mexico. Because of the increase in impervious area due to the development of the project site and the decrease in conductivity of the compacted fill, Table 2 also shows a decrease in the average annual infiltration. The increase in runoff and the decrease in infiltration overall results in less storm water being infiltrated into the landslide area.

4. Irrigation – Estimate Total Water Use

Review was limited to the estimated landscape irrigation water use (potable water systems) as they relate to portions of irrigation to be utilized by residential and common area landscapes areas within the basin area footprint(s). Evaluation utilized a standard in the industry formula associated with this type of analysis, that being the Estimated Total Water Use (ETWU) found in the City of San Diego Landscape Standards of the Development Manual (Section 2.6) and City of San Diego Municipal code, Chapter 14, Division 4: Landscape Regulations 142.0413(d)(2). Assessment will be based on typical landscape irrigation requirements

associated with various plant types, Evapotranspiration (ETo), irrigation system, and component efficiency and standard irrigation scheduling practices.

Assessment of landscape area to be irrigated is based on a typical lot footprint of building architecture and layout of hardscape (driveways, patios, and walks). In the absence of typical building footprints and associated hardscape, assumptions were made as to percentage of lot coverage for non-irrigated areas.

Without a fit lot plan, architectural footprints were placed based on setback requirements. Based on this preliminary plan, a set number of each plan was determined for Basins 400 & 500. Each plan has a set area for the residence, driveway, walkway and rear patio. This area was subtracted from the overall lot area, to produce the total landscape area. Of this total landscape area, 5% was assumed to be turf. Based on the ratio of each plan found in Basin 500, a number of each plan was assumed for Basins 700, 800 & 900. Landscape areas for parks and recreational spaces were determined directly from the approved overall Conceptual Landscape Plan. For the park located in Basin 700, turf was assumed to be 85% of the landscape area.

An Estimated Total Water Use calculation was conducted for each basin footprint area and can be found below in Table 3. Turf was set at high water use, to be irrigated by rotors. Trees were to be moderate water use, irrigated by bubblers. Shrub and groundcover areas were assumed to be low water use, irrigated by drip. The results were then combined and illustrated in the summary table. Assumptions are listed below the summary.

Table 3: Average Annual Estimated Total Water Use for Irrigation

Basin ID	Average Annual Estimated Total Water Use for Irrigation (ac-ft)	Average Annual Volume Evapotranspired (ac-ft)	Average Annual Volume Infiltrated (ac-ft)
400	4.4	4.4	0.0
500	7.9	7.9	0.0
700	6.1	6.1	0.0
800	0.8	0.8	0.0
900	2.0	2.0	0.0

Notes:

1. Evaluation utilized a standard in the industry formula for Estimated Total Water Use (ETWU) found in the City of San Diego Landscape Standards of the Development Manual (Section 2.6) and City of San Diego Municipal code, Chapter 14, Division 4: Landscape Regulations 142.0413(d)(2)

5. Infiltration Summary

Table 4 below provides a summary of the change in storm water infiltration at the upstream edge of the land slide area. It is anticipated that the average annual water use for irrigation will be entirely used by the plants, stored in the top six to twelve inches of the soil, and evapotranspired. Resulting in no additional infiltration due to irrigation. However, considering the possibility that mismanagement of irrigation in the post-project condition could result in over application and increase infiltration, a factor of safety (FOS) was determined. Table 4 provides a factor of safety for over irrigation within the post-project drainage basins.

Table 4: Infiltration Summary and Factor of Safety (FOS) for Over Irrigation

Basin ID	Node #	Average Annual Volume Storm Water Infiltrated Pre-Project (ac-ft)	Average Annual Volume Storm Water Infiltrated Post-Project (ac-ft)	Change in Average Annual Volume of Storm Water Infiltration (ac-ft)	Average Annual Estimated Total Water Use for Irrigation (ac-ft)	Average Annual Volume of Irrigation Infiltrated (ac-ft)	Factor of Safety for Over Irrigation
400	417	4.6	1.7	-2.9	4.4	0.0	166%
500	545	9.1	2.4	-6.7	7.9	0.0	185%
700	780	23.6	4.7	-18.9	6.1	0.0	409%
800	860	2.7	0.4	-2.3	0.8	0.0	386%
900	980	4.3	0.7	-3.7	2.0	0.0	284%

6. Conclusion

This letter report presents the existing and proposed hydrology and proposed irrigation associated with the landslide area adjacent to the Otay Mesa Southwest Village project area. Peak flow rates for the 100-year storm event were determined using the Rational Method computer program developed by Advanced Engineering Software (AES 2014) in conformance with the City of San Diego Drainage Design Manual, dated 2017. It is anticipated that peak flow rates will be detained back to pre-project levels as shown in Table 1. Average annual volume of precipitation, runoff, and infiltration were determined through continuous simulation modeling using EPA SWMM v5. Average annual runoff volume has increased while the average annual infiltration has decreased resulting in less storm water being infiltrated into the landslide area as shown in Table 2. The average annual Estimated Total Water Use for irrigation will be entirely used by the plants and evapotranspired based on City of San Diego Landscape Standards of the Development Manual as show in Table 3. Table 4 shows the factor of safety for over irrigation in the event that the water use for irrigation is mismanaged. Considering both the infiltration of

storm water and the application of irrigation, the average annual infiltration volume has decreased in the post-project condition as compared to the pre-project condition.

Reference and supporting documents are included in the Attachments of this letter. A list discussing the Attachments and Exhibits may be found below.

Please feel free to contact Eric Hengesbaugh or myself if you have any questions and/or concerns at (619) 291-0707.

Sincerely,

RICK ENGINEERING COMPANY

Brendan Hastie, P.E.
R.C.E. #65809, Exp. 9/21
Principal

BH:EGH:vs/files/Report/15013-C.016

Attachments

1. Vicinity Map
2. Landslide Hydrology Table
3. Preliminary Water Budget Summary for Landscape Areas

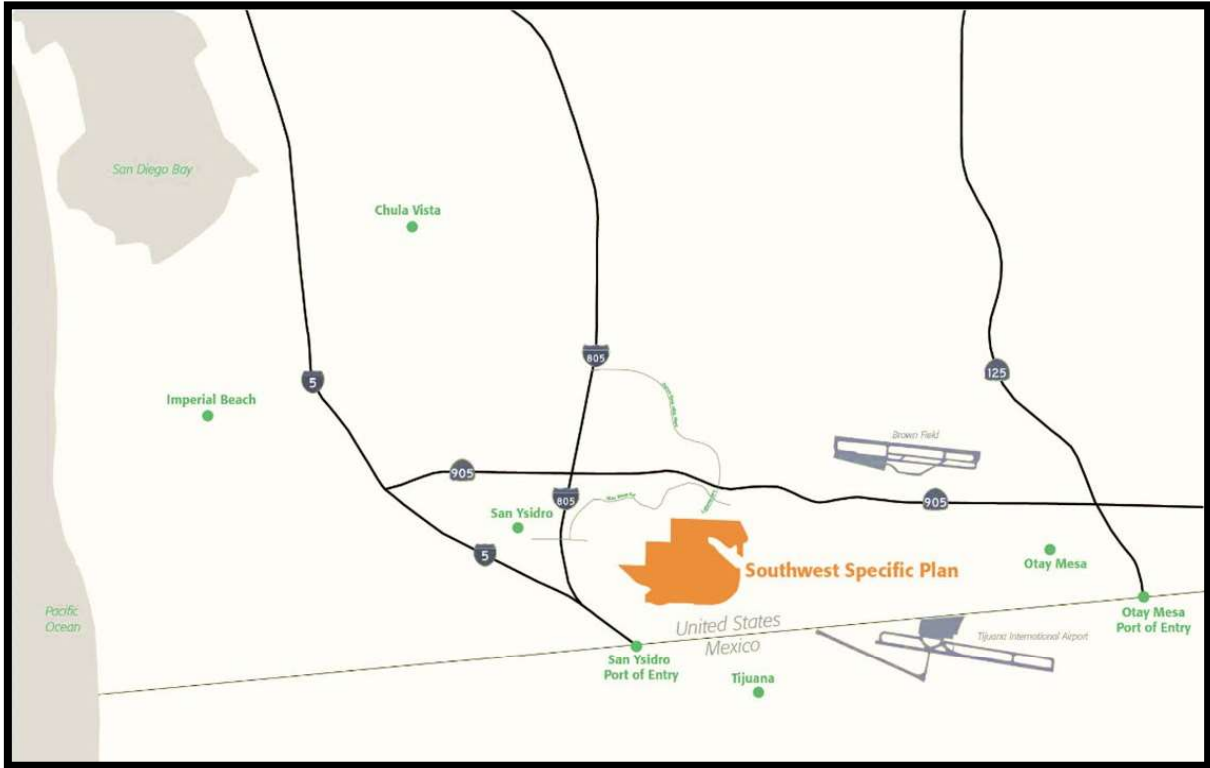
Map Pockets

1. Landslide Hydrology Pre-Project Exhibit
2. Landslide Hydrology Post-Project Exhibit

Attachments

Vicinity Map

Vicinity Map



Landslide Hydrology Table

15013C: Southwest Village Landslide Hydrology and Irrigation Summary Table

9.53in = average annual precip.

Southwest Village Landslide Hydrology Summary (AES)										Southwest Village Landslide Volume Summary (SWMM)										Southwest Village Landslide Irrigation Volume Summary											
Node	Description	Pre-Project			Post-Project (Unmitigated)			Post-Project (Mitigated)			Change in Area (ac)	% Change Peak Discharge (Post-Project Mitigated - Pre-Project)	Node	Description	Precipitation		Runoff		Infiltration		% Change Runoff	% Change Infiltration	Change in Infiltration	Node	Description	Pre-Project	Post-Project	Post-Project	Post-Project	Change in Total Infiltration	Available FOS for Over Irrigation
		Area (ac)	Tc (min)	Q100 (cfs)	Area (ac)	Tc (min)	Q100 (cfs)	Area (ac)	Tc (min)	Q100 (cfs)					Pre-Project	Post-Project	Pre-Project	Post-Project	Pre-Project	Post-Project						Avg. Annual Volume (ac-ft)	Avg. Annual Volume Applied (ac-ft)	Avg. Annual Volume Evapotranspired (ac-ft)	Avg. Annual Volume Infiltrated (ac-ft)		
		Avg. Annual Precipitation Volumes (ac-ft)	Avg. Annual Precipitation Volumes (ac-ft)	Avg. Annual Runoff Volume (ac-ft)	Avg. Annual Runoff Volume (ac-ft)	Avg. Annual Infiltration Volume (ac-ft)	Avg. Annual Infiltration Volume (ac-ft)	Avg. Annual Volume (ac-ft)	Avg. Annual Volume (ac-ft)																						
Westerly Drainage toward Railroad Collection Points												Westerly Drainage toward Railroad Collection Points												Westerly Drainage toward Railroad Collection Points							
417	Upstream Edge of Landslide	7.4	10.2	10.8	8.8	10.3	23.0	8.8	22.1	4.5	1.4	-58%	417	Upstream Edge of Landslide	6.0	7.2	1.3	4.1	4.6	1.7	220%	-64%	-2.9	417	Upstream Edge of Landslide	-	4.4	4.4	0.0	-2.9	166%
430	Outfall	15.2	11.5	20.7	17.0	11.2	34.6	17.0	23.5	12.9	1.8	-38%	430	Outfall	12.3	13.6	2.6	4.2	9.4	6.5	63%	-31%	-2.9	430	Outfall	-					
499	Downstream Collection Point near Railroad	188.9	15.4	244.1	180.2	14.9	243.8	180.2	27.8	165.1	-8.7	-32%	499	Downstream Collection Point near Railroad	149.9	144.4	30.7	30.8	120.5	111.6	0.4%	-7%	-8.8	499	Downstream Collection Point near Railroad	-					
545	Upstream Edge of Landslide	14.3	12.7	20.3	12.9	9.6	36.4	12.9	19.7	9.8	-1.4	-52%	545	Upstream Edge of Landslide	11.4	10.2	2.2	6.5	9.1	2.4	202%	-74%	-6.7	545	Upstream Edge of Landslide	-	7.9	7.9	0.0	-6.7	185%
550	Outfall	21.6	13.5	29.8	21.6	10.0	49.2	21.6	20.2	19.4	0.0	-35%	550	Outfall	17.1	17.1	3.5	7.0	13.6	7.6	102%	-44%	-5.9	550	Outfall	-					
780	Upstream Edge of Landslide	36.4	16.1	46.1	32.5	6.0	107.9	32.5	15.0	40.0	-3.9	-13%	780	Upstream Edge of Landslide	28.9	25.8	4.7	17.4	23.6	4.7	266%	-80%	-18.9	780	Upstream Edge of Landslide	-	6.1	6.1	0.0	-18.9	409%
782	Outfall	58.8	17.4	71.6	54.9	6.5	147.0	54.9	15.6	68.0	-3.9	-5%	782	Outfall	46.7	43.6	8.5	20.9	37.5	18.6	146%	-50%	-18.9	782	Outfall	-					
799	Downstream Collection Point near Railroad	176.3	22.9	184.5	172.4	10.9	312.4	172.4	22.2	181.9	-3.9	-1%	799	Downstream Collection Point near Railroad	139.9	136.9	25.6	40.9	113.7	88.4	60%	-22%	-25.4	799	Downstream Collection Point near Railroad	-					
Total		365.2			352.6			352.6			-12.6				289.8	281.2	56.3	71.8	234.2	200.0	28%	-15%	-34.2			18.4	18.4	0.0	-34.2	286%	
Southerly Drainage towards Spring Canyon at Border												Southerly Drainage towards Spring Canyon at Border												Southerly Drainage towards Spring Canyon at Border							
860	Upstream Edge of Landslide	4.3	11.5	6.4	5.3	9.6	15.7	5.3	20.0	6.0	1.0	-6%	860	Upstream Edge of Landslide	3.4	4.2	0.7	3.2	2.7	0.4	329%	-85%	-2.3	860	Upstream Edge of Landslide	-	0.8	0.8	0.0	-2.3	386%
870	Outfall	20.6	12.2	29.8	19.8	10.0	37.8	19.8	20.6	21.0	-0.8	-30%	870	Outfall	12.9	11.5	3.1	3.5	10.3	9.0	10%	-13%	-1.3	870	Outfall	-					
980	Upstream Edge of Landslide	6.9	14.1	9.3	9.1	6.9	30.9	9.1	20.0	8.0	2.2	-14%	980	Upstream Edge of Landslide	5.5	7.2	1.1	5.7	4.3	0.7	421%	-85%	-3.7	980	Upstream Edge of Landslide	-	2.0	2.0	0.0	-3.7	284%
981	Outfall	8.5	14.4	11.4	10.7	7.1	33.5	10.7	20.2	9.8	2.2	-14%	981	Outfall	6.7	8.5	1.4	5.8	5.3	1.6	324%	-69%	-3.7	981	Outfall	-					
999	Downstream Collection Point near Border	83.5	16.7	103.8	84.9	12.0	141.4	84.9	22.9	86.8	1.4	-16%	999	Downstream Collection Point near Border	66.3	67.4	13.3	17.3	53.4	45.9	30%	-14%	-7.5	999	Downstream Collection Point near Border	-					
Total		83.5			84.9			84.9			1.4				66.3	67.4	13.3	17.3	53.4	45.9	30%	-14%	-7.5			2.8	2.8	0.0	-7.5	367%	

Notes:
1. Rainfall intensities for AES Rational Method analysis were calculated using the City of San Diego's 2017 Drainage Design Manual
2. Detailed detention analysis for basins that are not a part of the Vesting Tentative Map (VTM) (Basin 700, 800, & 900) has yet to be completed. For the purpose of this analysis the Time of Concentration was approximated by using detention analysis done on the adjacent Basins within the VTM (Basin 400 & 500). Peak flow rate for detention was based on the pre-project peak flow rates for the 100-year event.
3. For basins not apart of the VTM ((Basin 700, 800, & 900) percent imperviousness was conservatively assumed to be 85% impervious based on the proposed land use in the Specific Plan.
4. The average annual rain fall was calculated to be 9.53-inches based on annual averages calculated in EPA SWMM using the Lindberg Field rain gauge
5. The Lindberg Field rain gauge was used for this analysis. The time series for this rain gauges dates from October 17, 1948 to December 31, 2005.
6. Irrigation Assumptions:
Residential lots have 5% turf
Plan ratio (ie Plan 1, Plan 2, Plan 3...) for Basins 700, 800 and 800 follows ratios from Basin 500
Basin 500, buildings 74, 75, 76 & 78 have no trees
One (1) tree per residential lot
Turf will be irrigated by rotors
Shrub and groundcover area will be irrigated by drip
Standard as the industry formula for Estimated Total Water Use (ETWU) found in the City of San Diego Landscape Standards of the Development Manual (Section 2.6) and City of San Diego Municipal code, Chapter 14, Division 4: Landscape Regulations 142.0413(d)(2)

Preliminary Water Budget Summary for Landscape Areas

SOUTHWEST VILLAGE

PRELIMINARY WATER BUDGET SUMMARY FOR LANDSCAPE AREAS

4/6/2021 - r2

OVERALL TOTALS	
1,072,837 sf	Total Area of Site (sq. ft.):
695,943 sf	Landscape Area (sq. ft.):
38,971 sf	Special Landscape Area
56,869 sf	Total Area Landscaped in Turf (sq. ft.):
8% sf	Turf to Landscape Area Ratio:
533,732 sf	Drip
10,892 sf	Bubbler
0 sf	Spray
87,230 sf	Rotor
631,854	TOTAL SF
3,750,354 gpy	Drip
202,591 gpy	Bubbler
0 gpy	Spray
2,942,109 gpy	Rotor
6,895,054	TOTAL GPY
21.16	TOTAL AC/FT

Assumptions:

1. Residential lots have 5% turf
2. Plan ratio (ie Plan 1, Plan 2, Plan 3..) for Basins 700, 800 and 800 follows ratios from Basin 500
3. Basin 500, buildings 74, 75, 76 & 78 have no trees
4. (1) tree per residential lot
5. Turf will be irrigated by rotors
6. Shrub and groundcover area will be irrigated by drip

	Basin 400		Basin 500		Basin 700		Basin 800		Basin 900	
	269,714 SF		337,049 SF		181,001 SF		88,427 SF		196,645 SF	
	137,549 SF		232,646 SF		184,893 SF		52,944 SF		87,910 SF	
	11,325 SF		27,646 SF		0 SF		0 SF		0 SF	
	16,729 SF		31,088 SF		3,812 SF		1,429 SF		3,812 SF	
	12% SF		13% SF		2% SF		3% SF		4% SF	
	118,132 SF	830,077.00 GPY	206,149 SF	1,448,541.71 GPY	112,221 SF	788,542.33 GPY	26,512 SF	186,291.83 GPY	70,717 SF	496,901.58 GPY
	2,688 SF	49,996.80 GPY	3,164 SF	58,850.40 GPY	2,688 SF	49,996.80 GPY	644 SF	11,978.40 GPY	1,708 SF	31,768.80 GPY
	0 SF	0.00 GPY	0 SF	0.00 GPY	0 SF	0.00 GPY	0 SF	0.00 GPY	0 SF	0.00 GPY
	16,729 SF	564,222 GPY	31,496 SF	1,062,290 GPY	33,765 SF	1,138,825 GPY	1,429 SF	48,206 GPY	3,812 SF	128,565 GPY
Totals	137,549 SF	1,444,296.02 GPY	240,809 SF	2,569,682.45 GPY	148,674 SF	1,977,363.97 GPY	28,585 SF	246,476.63 GPY	76,236 SF	657,235.38 GPY
		4.4 AC/FT		7.9 AC/FT		6.1 AC/FT		0.8 AC/FT		2.0 AC/FT

Map Pocket 1

Landslide Hydrology Pre-Project Exhibit



April 16, 2021

City of San Diego
Development Services
101 Ash Street
San Diego, California 92101

SUBJECT: LANDSLIDE HYDROLOGY ANALYSIS FOR SOUTHWEST VILLAGE
(RICK ENGINEERING COMPANY JOB NUMBER 15013-C)

1. Introduction

This letter report presents the existing and proposed hydrology associated with the landslide area adjacent to the Otay Mesa Southwest Village project area. The Southwest Village project is a smaller portion of the overall community of Otay Mesa. Specifically, the project boundary is generally located south of State Route 905, east of Interstate 805, north of US-Mexico border, and immediately west of the northerly branch of Spring Canyon Creek. Refer to the Vicinity Map in Attachment 1 as well as the drainage study maps included in Map Pockets 1 and 2 for the limits of the area analyzed.

2. Drainage Characteristics

In the existing condition, Basins 400, flows in a westerly direction to a collection point east of the existing railroad. Basin 500 and 700, drain in a southwesterly direction where they confluence before flowing to a collection point along the eastern edge of the existing railroad. From these locations, runoff is conveyed in an existing storm drain system (pipes and channels) to the Tijuana River by the border line with Mexico. Runoff from Basins 800 and 900 drain to the south and confluence in Spring Canyon Creek. Runoff is conveyed south within Spring Canyon Creek towards an existing culvert at the Spring Canyon concentration point along the border with Mexico. Based upon the available information, it is assumed that the runoff is conveyed via a system of storm drain and open channels to a concrete lined reach of the Tijuana River on the Mexican side of the border.

Throughout the landslide area there are several existing sump locations where it is anticipated that storm water will collect and infiltrate into the native soil or evaporate over time. The area analyzed also includes existing shallow sump locations, notably in Basins 800 and 900, where it is anticipated that in larger storm events, storm water will weir over the edge of the low point

and flow out to collection points along the border with Mexico by Spring Canyon Creek. Please refer to Map Pocket 1 for the existing condition drainage map.

The post-project drainage conditions will remain largely similar to those in the existing condition. However, drainage improvements are being proposed throughout the development area. Storm drain outfalls will be extended as far as practicable towards the bottom of mesa and located adjacent to established existing channels. Underground storage is proposed to detain peak flow rates back to existing conditions for the 50 and 100-year storm event. Additionally, the drainage area flowing into Mexico at the Spring Canyon concentration point and will need to comply with the US/Mexico International flood control detention requirements (i.e. – 5, 10, 25, 50, & 100-year storm events). Please refer to Map Pocket 2 for the proposed condition drainage map.

3. Hydrology Methodology and Results

This study considers peak flow rates in the existing and proposed project condition and a summary is provided in Table 1 below. Weighted Runoff Coefficients and Time of Concentration were calculated based on guidance from the City of San Diego Drainage Design Manual, dated January 2017. The Rational Method computer program developed by Advanced Engineering Software (AES 2014) was used for this study.

Table 1: Existing and Proposed Hydrology (AES)

Drainage Basin #	Drainage Node # at Point of Interest	Project Condition	Tributary Area, A (acres)	Time of Concentration, T _c (minutes)	100-year Flow Rates, Q ₁₀₀ (cfs ¹)	Change in Area (ac)	% Change in Peak Discharge (Pre to Post Detained)
400	499	Pre-project	188.9	15.4	244.1	-8.7	-32%
	499	Post-project	180.2	14.9	243.8		
	499	Post-Detained	180.2	27.8	165.1		
500 & 700	799	Pre-project	176.3	22.9	184.5	-3.9	-1%
	799	Post-project	172.4	10.9	312.4		
	799	Post-Detained	172.4	22.2 ²	181.9 ³		
800 & 900	999	Pre-project	83.5	16.7	103.8	+1.4	-16%
	999	Post-project	84.9	12.0	141.4		
	999	Post-Detained	84.9	22.9 ²	86.8 ³		

Notes:

1. Rainfall intensities for AES Rational Method analysis were calculated using the City of San Diego's 2017 Drainage Design Manual
2. Detailed detention analysis for basins that are not a part of the Vesting Tentative Map (VTM) (Basin 700, 800, & 900) has yet to be completed. For the purpose of this analysis the Time of Concentration was approximated by using detention analysis done on the adjacent Basins within the VTM (Basin 400 & 500). Peak flow rate for detention was based on the pre-project peak flow rates for the 100-year event.
3. For basins not a part of the VTM ((Basin 700, 800, & 900) percent imperviousness was conservatively assumed to be 85% impervious based on the proposed land use in the Specific Plan.

A summary of the average annual volume at key locations throughout the landslide area has also been quantified. The locations analyzed are at the upstream edge of the landslide buffer, the proposed storm drain outfall locations, and at the collection point either adjacent to the railroad for Basins 400, 500, and 700 or adjacent to the border with Mexico for Basins 800 and 900. A continuous simulation model using EPA SWMM v5 for each of the basins has been completed to determine the average annual volume of precipitation, runoff, and infiltration. Due to potential issues with the Lower Otay Reservoir rain gauge, the Lindberg Field rain gauge was used for this analysis. The time series for the rain gauges dates from October 17, 1948 to December 31, 2005. Parameters used within the EPA SWMM models will be consistent with guidance provided in the October 2018 City of San Diego Storm Water Standards Manual Appendix G. Please refer to Table 2 for a summary of precipitation, runoff, and infiltration.

Table 2: Existing and Proposed Average Annual Volume (SWMM)

Drainage Basin #	Drainage Node # at Point of Interest	Project Condition	Precipitation (ac-ft)	Runoff (ac-ft)	Infiltration (ac-ft)	% Change in Runoff	% Change in Infiltration
400	499	Pre-project	149.9	30.7	120.5	0.4%	-7%
	499	Post-project	144.4	30.8	111.6		
500 & 700	799	Pre-project	139.9	25.6	113.7	60%	-22%
	799	Post-project	136.9	40.9	88.4		
800 & 900	999	Pre-project	66.3	13.3	53.4	30%	-14%
	999	Post-project	67.4	17.3	45.9		

Notes:

1. The average annual rain fall was calculated to be 9.53-inches based on annual averages calculated in EPA SWMM using the Lindberg Field rain gauge
2. The Lindberg Field rain gauge was used for this analysis. The time series for this rain gauges dates from October 17, 1948 to December 31, 2005.

Table 2 shows that in the post project condition, average annual runoff volumes have increased. This is due to the development associated with the Southwest Village project site and the addition of impervious area. The increased impervious area and compacted fill soils with reduced conductivity result in a high runoff volume. This increase in runoff volume makes sense as flows are conveyed through the landslide area and are collected at points adjacent to the railroad or next to the border with Mexico. Because of the increase in impervious area due to the development of the project site and the decrease in conductivity of the compacted fill, Table 2 also shows a decrease in the average annual infiltration. The increase in runoff and the decrease in infiltration overall results in less storm water being infiltrated into the landslide area.

4. Irrigation – Estimate Total Water Use

Review was limited to the estimated landscape irrigation water use (potable water systems) as they relate to portions of irrigation to be utilized by residential and common area landscapes areas within the basin area footprint(s). Evaluation utilized a standard in the industry formula associated with this type of analysis, that being the Estimated Total Water Use (ETWU) found in the City of San Diego Landscape Standards of the Development Manual (Section 2.6) and City of San Diego Municipal code, Chapter 14, Division 4: Landscape Regulations 142.0413(d)(2). Assessment will be based on typical landscape irrigation requirements

associated with various plant types, Evapotranspiration (ETo), irrigation system, and component efficiency and standard irrigation scheduling practices.

Assessment of landscape area to be irrigated is based on a typical lot footprint of building architecture and layout of hardscape (driveways, patios, and walks). In the absence of typical building footprints and associated hardscape, assumptions were made as to percentage of lot coverage for non-irrigated areas.

Without a fit lot plan, architectural footprints were placed based on setback requirements. Based on this preliminary plan, a set number of each plan was determined for Basins 400 & 500. Each plan has a set area for the residence, driveway, walkway and rear patio. This area was subtracted from the overall lot area, to produce the total landscape area. Of this total landscape area, 5% was assumed to be turf. Based on the ratio of each plan found in Basin 500, a number of each plan was assumed for Basins 700, 800 & 900. Landscape areas for parks and recreational spaces were determined directly from the approved overall Conceptual Landscape Plan. For the park located in Basin 700, turf was assumed to be 85% of the landscape area.

An Estimated Total Water Use calculation was conducted for each basin footprint area and can be found below in Table 3. Turf was set at high water use, to be irrigated by rotors. Trees were to be moderate water use, irrigated by bubblers. Shrub and groundcover areas were assumed to be low water use, irrigated by drip. The results were then combined and illustrated in the summary table. Assumptions are listed below the summary.

Table 3: Average Annual Estimated Total Water Use for Irrigation

Basin ID	Average Annual Estimated Total Water Use for Irrigation (ac-ft)	Average Annual Volume Evapotranspired (ac-ft)	Average Annual Volume Infiltrated (ac-ft)
400	4.4	4.4	0.0
500	7.9	7.9	0.0
700	6.1	6.1	0.0
800	0.8	0.8	0.0
900	2.0	2.0	0.0

Notes:

1. Evaluation utilized a standard in the industry formula for Estimated Total Water Use (ETWU) found in the City of San Diego Landscape Standards of the Development Manual (Section 2.6) and City of San Diego Municipal code, Chapter 14, Division 4: Landscape Regulations 142.0413(d)(2)

5. Infiltration Summary

Table 4 below provides a summary of the change in storm water infiltration at the upstream edge of the land slide area. It is anticipated that the average annual water use for irrigation will be entirely used by the plants, stored in the top six to twelve inches of the soil, and evapotranspired. Resulting in no additional infiltration due to irrigation. However, considering the possibility that mismanagement of irrigation in the post-project condition could result in over application and increase infiltration, a factor of safety (FOS) was determined. Table 4 provides a factor of safety for over irrigation within the post-project drainage basins.

Table 4: Infiltration Summary and Factor of Safety (FOS) for Over Irrigation

Basin ID	Node #	Average Annual Volume Storm Water Infiltrated Pre-Project (ac-ft)	Average Annual Volume Storm Water Infiltrated Post-Project (ac-ft)	Change in Average Annual Volume of Storm Water Infiltration (ac-ft)	Average Annual Estimated Total Water Use for Irrigation (ac-ft)	Average Annual Volume of Irrigation Infiltrated (ac-ft)	Factor of Safety for Over Irrigation
400	417	4.6	1.7	-2.9	4.4	0.0	166%
500	545	9.1	2.4	-6.7	7.9	0.0	185%
700	780	23.6	4.7	-18.9	6.1	0.0	409%
800	860	2.7	0.4	-2.3	0.8	0.0	386%
900	980	4.3	0.7	-3.7	2.0	0.0	284%

6. Conclusion

This letter report presents the existing and proposed hydrology and proposed irrigation associated with the landslide area adjacent to the Otay Mesa Southwest Village project area. Peak flow rates for the 100-year storm event were determined using the Rational Method computer program developed by Advanced Engineering Software (AES 2014) in conformance with the City of San Diego Drainage Design Manual, dated 2017. It is anticipated that peak flow rates will be detained back to pre-project levels as shown in Table 1. Average annual volume of precipitation, runoff, and infiltration were determined through continuous simulation modeling using EPA SWMM v5. Average annual runoff volume has increased while the average annual infiltration has decreased resulting in less storm water being infiltrated into the landslide area as shown in Table 2. The average annual Estimated Total Water Use for irrigation will be entirely used by the plants and evapotranspired based on City of San Diego Landscape Standards of the Development Manual as show in Table 3. Table 4 shows the factor of safety for over irrigation in the event that the water use for irrigation is mismanaged. Considering both the infiltration of

storm water and the application of irrigation, the average annual infiltration volume has decreased in the post-project condition as compared to the pre-project condition.

Reference and supporting documents are included in the Attachments of this letter. A list discussing the Attachments and Exhibits may be found below.

Please feel free to contact Eric Hengesbaugh or myself if you have any questions and/or concerns at (619) 291-0707.

Sincerely,

RICK ENGINEERING COMPANY

Brendan Hastie, P.E.
R.C.E. #65809, Exp. 9/21
Principal

BH:EGH:vs/files/Report/15013-C.016

Attachments

1. Vicinity Map
2. Landslide Hydrology Table
3. Preliminary Water Budget Summary for Landscape Areas

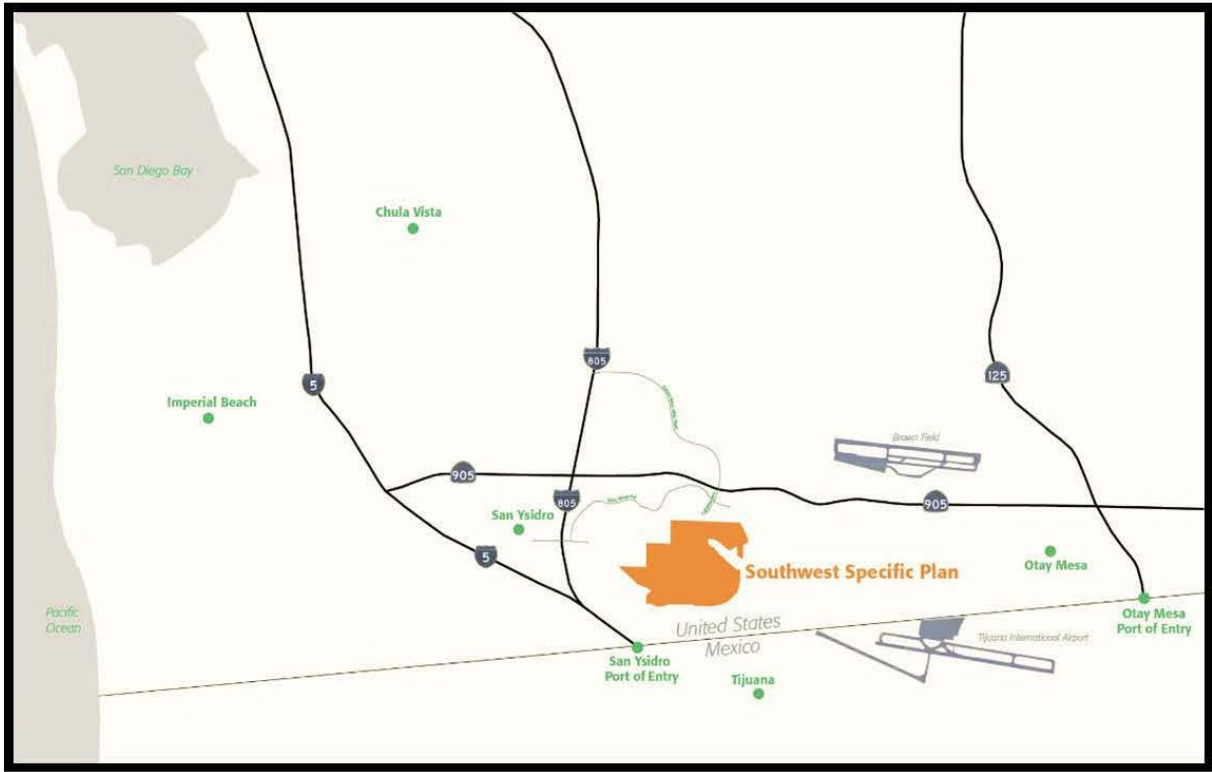
Map Pockets

1. Landslide Hydrology Pre-Project Exhibit
2. Landslide Hydrology Post-Project Exhibit

Attachments

Vicinity Map

Vicinity Map



Landslide Hydrology Table

15013C: Southwest Village Landslide Hydrology and Irrigation Summary Table

9.53in = average annual precip.

Southwest Village Landslide Hydrology Summary (AES)										Southwest Village Landslide Volume Summary (SWMM)										Southwest Village Landslide Irrigation Volume Summary																	
Node	Description	Pre-Project			Post-Project (Unmitigated)			Post-Project (Mitigated)			Change in Area (ac)	% Change Peak Discharge (Post-Project Mitigated - Pre- Project)	Node	Description	Precipitation		Runoff		Infiltration		% Change Runoff	% Change Infiltration	Change in Infiltration	Node	Description	Pre-Project	Post-Project	Post-Project	Post-Project	Change in Total Infiltration	Available FOS for Over Irrigation						
		Area (ac)	Tc (min)	Q100 (cfs)	Area (ac)	Tc (min)	Q100 (cfs)	Area (ac)	Tc (min)	Q100 (cfs)					Pre-Project	Post-Project	Pre-Project	Post-Project	Pre-Project	Post-Project						Avg. Annual Volume (ac-ft)	Avg. Annual Volume Applied (ac-ft)	Avg. Annual Volume Evapotranspired (ac-ft)	Avg. Annual Volume Infiltrated (ac-ft)								
		Avg. Annual Precipitation Volumes (ac-ft)	Avg. Annual Precipitation Volumes (ac-ft)	Avg. Annual Runoff Volume (ac-ft)	Avg. Annual Runoff Volume (ac-ft)	Avg. Annual Infiltration Volume (ac-ft)	Avg. Annual Infiltration Volume (ac-ft)																														
Westerly Drainage toward Railroad Collection Points												Westerly Drainage toward Railroad Collection Points												Westerly Drainage toward Railroad Collection Points													
417	Upstream Edge of Landslide	7.4	10.2	10.8	8.8	10.3	23.0	8.8	22.1	4.5	1.4	-58%	417	Upstream Edge of Landslide	6.0	7.2	1.3	4.1	4.6	1.7	220%	-64%	-2.9	417	Upstream Edge of Landslide	-	4.4	4.4	0.0	-2.9	166%						
430	Outfall	15.2	11.5	20.7	17.0	11.2	34.6	17.0	23.5	12.9	1.8	-38%	430	Outfall	12.3	13.6	2.6	4.2	9.4	6.5	63%	-31%	-2.9	430	Outfall	-											
499	Downstream Collection Point near Railroad	188.9	15.4	244.1	180.2	14.9	243.8	180.2	27.8	165.1	-8.7	-32%	499	Downstream Collection Point near Railroad	149.9	144.4	30.7	30.8	120.5	111.6	0.4%	-7%	-8.8	499	Downstream Collection Point near Railroad	-											
545	Upstream Edge of Landslide	14.3	12.7	20.3	12.9	9.6	36.4	12.9	19.7	9.8	-1.4	-52%	545	Upstream Edge of Landslide	11.4	10.2	2.2	6.5	9.1	2.4	202%	-74%	-6.7	545	Upstream Edge of Landslide	-	7.9	7.9	0.0	-6.7	185%						
550	Outfall	21.6	13.5	29.8	21.6	10.0	49.2	21.6	20.2	19.4	0.0	-35%	550	Outfall	17.1	17.1	3.5	7.0	13.6	7.6	102%	-44%	-5.9	550	Outfall	-											
780	Upstream Edge of Landslide	36.4	16.1	46.1	32.5	6.0	107.9	32.5	15.0	40.0	-3.9	-13%	780	Upstream Edge of Landslide	28.9	25.8	4.7	17.4	23.6	4.7	266%	-80%	-18.9	780	Upstream Edge of Landslide	-	6.1	6.1	0.0	-18.9	409%						
782	Outfall	58.8	17.4	71.6	54.9	6.5	147.0	54.9	15.6	68.0	-3.9	-5%	782	Outfall	46.7	43.6	8.5	20.9	37.5	18.6	146%	-50%	-18.9	782	Outfall	-											
799	Downstream Collection Point near Railroad	176.3	22.9	184.5	172.4	10.9	312.4	172.4	22.2	181.9	-3.9	-1%	799	Downstream Collection Point near Railroad	139.9	136.9	25.6	40.9	113.7	88.4	60%	-22%	-25.4	799	Downstream Collection Point near Railroad	-											
Total		365.2			352.6			352.6			-12.6				289.8	281.2	56.3	71.8	234.2	200.0	28%	-15%	-34.2			18.4	18.4	0.0	-34.2	286%							
Southerly Drainage towards Spring Canyon at Border												Southerly Drainage towards Spring Canyon at Border												Southerly Drainage towards Spring Canyon at Border													
860	Upstream Edge of Landslide	4.3	11.5	6.4	5.3	9.6	15.7	5.3	20.0	6.0	1.0	-6%	860	Upstream Edge of Landslide	3.4	4.2	0.7	3.2	2.7	0.4	329%	-85%	-2.3	860	Upstream Edge of Landslide	-	0.8	0.8	0.0	-2.3	386%						
870	Outfall	20.6	12.2	29.8	19.8	10.0	37.8	19.8	20.6	21.0	-0.8	-30%	870	Outfall	12.9	11.5	3.1	3.5	10.3	9.0	10%	-13%	-1.3	870	Outfall	-											
980	Upstream Edge of Landslide	6.9	14.1	9.3	9.1	6.9	30.9	9.1	20.0	8.0	2.2	-14%	980	Upstream Edge of Landslide	5.5	7.2	1.1	5.7	4.3	0.7	421%	-85%	-3.7	980	Upstream Edge of Landslide	-	2.0	2.0	0.0	-3.7	284%						
981	Outfall	8.5	14.4	11.4	10.7	7.1	33.5	10.7	20.2	9.8	2.2	-14%	981	Outfall	6.7	8.5	1.4	5.8	5.3	1.6	324%	-69%	-3.7	981	Outfall	-											
999	Downstream Collection Point near Border	83.5	16.7	103.8	84.9	12.0	141.4	84.9	22.9	86.8	1.4	-16%	999	Downstream Collection Point near Border	66.3	67.4	13.3	17.3	53.4	45.9	30%	-14%	-7.5	999	Downstream Collection Point near Border	-											
Total		83.5			84.9			84.9			1.4				66.3	67.4	13.3	17.3	53.4	45.9	30%	-14%	-7.5			2.8	2.8	0.0	-7.5	367%							

Notes:
1. Rainfall intensities for AES Rational Method analysis were calculated using the City of San Diego's 2017 Drainage Design Manual
2. Detailed detention analysis for basins that are not a part of the Vesting Tentative Map (VTM) (Basin 700, 800, & 900) has yet to be completed. For the purpose of this analysis the Time of Concentration was approximated by using detention analysis done on the adjacent Basins within the VTM (Basin 400 & 500). Peak flow rate for detention was based on the pre-project peak flow rates for the 100-year event.
3. For basins not apart of the VTM ((Basin 700, 800, & 900) percent imperviousness was conservatively assumed to be 85% impervious based on the proposed land use in the Specific Plan.
4. The average annual rain fall was calculated to be 9.53-inches based on annual averages calculated in EPA SWMM using the Lindberg Field rain gauge
5. The Lindberg Field rain gauge was used for this analysis. The time series for this rain gauges dates from October 17, 1948 to December 31, 2005.
6. Irrigation Assumptions:
Residential lots have 5% turf
Plan ratio (ie Plan 1, Plan 2, Plan 3...) for Basins 700, 800 and 800 follows ratios from Basin 500
Basin 500, buildings 74, 75, 76 & 78 have no trees
One (1) tree per residential lot
Turf will be irrigated by rotors
Shrub and groundcover area will be irrigated by drip
Standard as the industry formula for Estimated Total Water Use (ETWU) found in the City of San Diego Landscape Standards of the Development Manual (Section 2.6) and City of San Diego Municipal code, Chapter 14, Division 4: Landscape Regulations 142.0413(d)(2)

Preliminary Water Budget Summary for Landscape Areas

SOUTHWEST VILLAGE

PRELIMINARY WATER BUDGET SUMMARY FOR LANDSCAPE AREAS

4/6/2021 - r2

OVERALL TOTALS	
1,072,837 sf	Total Area of Site (sq. ft.):
695,943 sf	Landscape Area (sq. ft.):
38,971 sf	Special Landscape Area
56,869 sf	Total Area Landscaped in Turf (sq. ft.):
8% sf	Turf to Landscape Area Ratio:
533,732 sf	Drip
10,892 sf	Bubbler
0 sf	Spray
87,230 sf	Rotor
631,854	TOTAL SF
3,750,354 gpy	Drip
202,591 gpy	Bubbler
0 gpy	Spray
2,942,109 gpy	Rotor
6,895,054	TOTAL GPY
21.16	TOTAL AC/FT

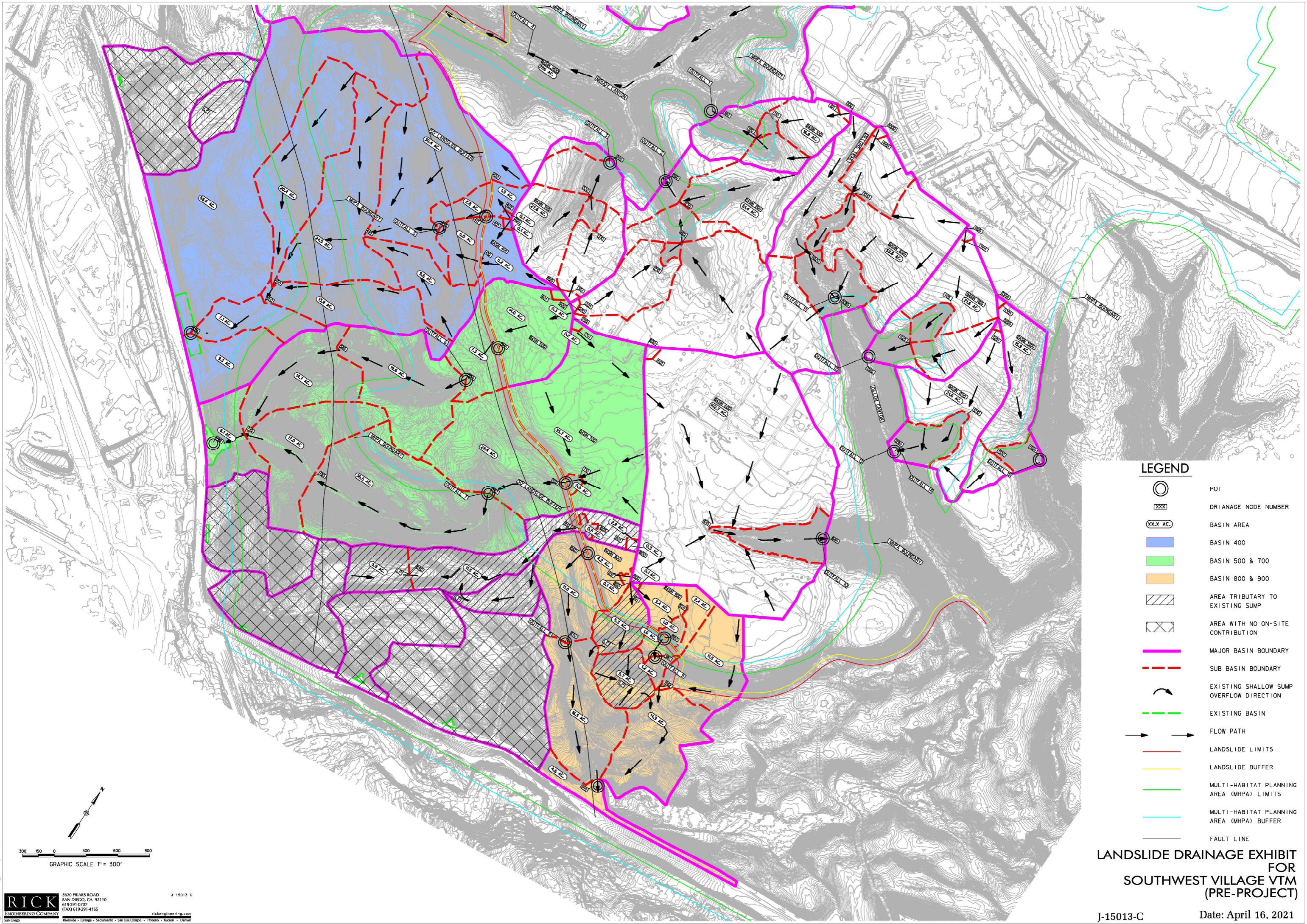
Assumptions:

1. Residential lots have 5% turf
2. Plan ratio (ie Plan 1, Plan 2, Plan 3..) for Basins 700, 800 and 800 follows ratios from Basin 500
3. Basin 500, buildings 74, 75, 76 & 78 have no trees
4. (1) tree per residential lot
5. Turf will be irrigated by rotors
6. Shrub and groundcover area will be irrigated by drip

	Basin 400		Basin 500		Basin 700		Basin 800		Basin 900	
	269,714 SF		337,049 SF		181,001 SF		88,427 SF		196,645 SF	
	137,549 SF		232,646 SF		184,893 SF		52,944 SF		87,910 SF	
	11,325 SF		27,646 SF		0 SF		0 SF		0 SF	
	16,729 SF		31,088 SF		3,812 SF		1,429 SF		3,812 SF	
	12% SF		13% SF		2% SF		3% SF		4% SF	
	118,132 SF	830,077.00 GPY	206,149 SF	1,448,541.71 GPY	112,221 SF	788,542.33 GPY	26,512 SF	186,291.83 GPY	70,717 SF	496,901.58 GPY
	2,688 SF	49,996.80 GPY	3,164 SF	58,850.40 GPY	2,688 SF	49,996.80 GPY	644 SF	11,978.40 GPY	1,708 SF	31,768.80 GPY
	0 SF	0.00 GPY	0 SF	0.00 GPY	0 SF	0.00 GPY	0 SF	0.00 GPY	0 SF	0.00 GPY
	16,729 SF	564,222 GPY	31,496 SF	1,062,290 GPY	33,765 SF	1,138,825 GPY	1,429 SF	48,206 GPY	3,812 SF	128,565 GPY
Totals	137,549 SF	1,444,296.02 GPY	240,809 SF	2,569,682.45 GPY	148,674 SF	1,977,363.97 GPY	28,585 SF	246,476.63 GPY	76,236 SF	657,235.38 GPY
		4.4 AC/FT		7.9 AC/FT		6.1 AC/FT		0.8 AC/FT		2.0 AC/FT

Map Pocket 1

Landslide Hydrology Pre-Project Exhibit

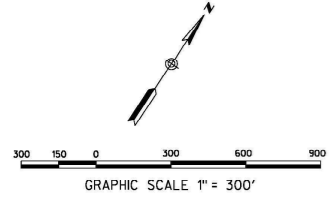


LEGEND

- POI
- DRAINAGE NODE NUMBER
- BASIN AREA
- BASIN 400
- BASIN 500 & 700
- BASIN 800 & 900
- AREA TRIBUTARY TO EXISTING SUMP
- AREA WITH NO ON-SITE CONTRIBUTION
- MAJOR BASIN BOUNDARY
- SUB BASIN BOUNDARY
- EXISTING SHALLOW SUMP OVERFLOW DIRECTION
- EXISTING BASIN
- FLOW PATH
- LANDSLIDE LIMITS
- LANDSLIDE BUFFER
- MULTI-HABITAT PLANNING AREA (MHPA) LIMITS
- MULTI-HABITAT PLANNING AREA (MHPA) BUFFER
- FAULT LINE

LANDSLIDE DRAINAGE EXHIBIT FOR SOUTHWEST VILLAGE VTM (PRE-PROJECT)

J-15013-C Date: April 16, 2021



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Map Pocket 2

Landslide Hydrology Post-Project Exhibit

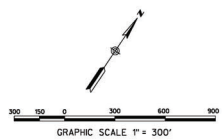


LEGEND

- POI
- DRAINAGE NODE NUMBER
- BASIN AREA
- BASIN 400
- BASIN 500 & 700
- BASIN 800 & 900
- AREA TRIBUTARY TO EXISTING SUMP
- AREA WITH NO ON-SITE CONTRIBUTION
- MAJOR BASIN BOUNDARY
- SUB BASIN BOUNDARY
- EXISTING SHALLOW OVERFLOW DIRECTION
- EXISTING BASIN
- FLOW PATH
- LANDSLIDE LIMITS
- LANDSLIDE BUFFER
- MULTI-HABITAT PLANNING AREA (MHPA) LIMITS
- MULTI-HABITAT PLANNING AREA (MHPA) BUFFER
- FAULT LINE

LANDSLIDE DRAINAGE EXHIBIT FOR SOUTHWEST VILLAGE VTM (POST-PROJECT)

J-15013-C Date: April 16, 2021



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