SUPPLEMENTAL ENGINEERING GEOLOGIC STUDY

Onsite Wastewater Treatment System (OWTS)

Proposed Single-Family Residential Development
634 Palomar Drive
Redwood City, California

Prepared for:
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October 4, 2021
ATLAS Project No. 91-55905-C
(3067)

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October 4, 2021

Anusha Thalapaneni - athalapa@gmail.com
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RE: SUPPLEMENTAL ENGINEERING GEOLOGIC STUDY
Onsite Wastewater Treatment System (OWTS)
Proposed Single-Family Residential Development
634 Palomar Drive
Redwood City, California
ATLAS #91-55905-C (3067)

Dear Thalapaneni-Jackson Family:

INTRODUCTION

In accordance with our Agreement, we have prepared this letter report in reply to the June 14, 2021 geotechnical peer review letter prepared by Cotton, Shires and Associates, Inc., on behalf of the Environmental Health Department's feasibility assessment of the proposed OWTS (aka, Leachfield) associated with your proposed development at the property in Palomar Park referenced above (Plate 1, *Vicinity Map*, Figure 1; Plate 2, *Site Plan, Cross Section A-A'*). This report follows the April 29, 2019 engineering geologic report by Geosphere Consultants, Inc., and our July 29, 2020 geotechnical update report for the proposed development.

Tasks undertaken to arrive at the findings, conclusions and recommendations presented in this report included:

- Review of pertinent in-house documents, and documents by San Mateo County Environmental Health Department files;
- Supplemental characterization of topo-morphology and engineering geology in the OWTS area of influence from supplemental reconnaissance mapping, interpretation of recent drone imagery, 1953 USGS topographic mapping (Plate 1), 1956 vertical, panchromatic stereo aerial photography, interactive Google Earth Pro imagery, and 2017 315-degree azimuth hillshade LiDAR imagery (Plate 3, *Geomorphic Map*; Plate 4, *Photo Gallery*);
- Supplemental subsurface exploration and sampling to characterize the geologic profile to a depth of 19 feet at the locations depicted on Plate 2 (Appendix A, *Logs of Soil Exploration and Laboratory Test Results*);
- Evaluation of the distribution and maintenance of California Water Service mains in the local area of influence (Appendix B, *San Carlos District Water System Map and Legend*)

- Review and preliminary analysis of available geotechnical, and geohydrologic data pertaining to seepage from perched ground water onto Los Cerros Road, and landsliding on neighboring 13 Los Cerros Road and 738 Loma Court (Appendix C, *Evaluation of Seepage and 2017 Landsliding on 13 Los Cerros Road and 738 Loma Court*).

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Figure 1. Westerly aerial drone view of proposed residential development area and adjoining area (09/25/2021). Arrow in lower left of view is recent replacement of Cal Water Service main that caused seepage onto Palomar Drive in winter of 2020.

REPLY TO PEER REVIEW COMMENTS

Following are comments presented in the peer review letter and our respective reply:

a) The Project Engineering Geologist should discuss and clarify the natural and proposed slope gradients in the vicinity of the proposed primary and expansion leachfield lines. They should also clarify whether all existing undocumented fill will be removed or replaced as engineered fill as part of proposed construction. If existing natural slopes or proposed final grades surrounding the OWTS are steeper than 35 percent, then we understand a slope stability analysis will be required. If a slope stability analysis is found to be necessary, we recommend completion of additional subsurface borings extending confidently below the elevation of proposed site improvements (e.g., excavations for the residence and foundations, and OWTS, etc.) to collect supplemental samples, laboratory testing to determine accurate shear strengths and unit weights of the soil and bedrock materials, and further evaluate other geotechnical or geologic site conditions (e.g., groundwater/phreatic surface, etc.).

The proposed OWTS is located near the crest of a graded east-west trending ridgeline in highly dissected foothills terrain initially mass graded in the early 1900's for residential subdivision development (fig. 2). The proposed leachfield layout will occupy a flat area at the end of a dirt driveway extending from Palomar Drive across the southwest margin of the site and initially graded sometime before 1948 contemporaneously with the driveway for 636 Palomar Drive (fig. 2).

Google Earth imagery reveals evidence of subsequent grading of the same area as late as Fall of 2016, leaving the flat area bordered on the southwest side by an approximately 10-foot high northeast facing 70% cut slope and an arcuate undocumented fill slope inclined approximately 70% to the north, and ranging from 8 to 10 feet high. Remnants of the native slope, both detected in the field and from topographic data, indicate the native northeast facing slope to be occupied by the proposed leachfield had gradients ranging from approximately 15% to 33%.

We understand that most, if not all, of the undocumented fill bordering the downhill side of the leachfield will be removed by reclining the slope to approximately 33%. Removal of most of the fill on the downslope side of the dirt road is expected to accommodate house development. If necessary, to avoid constraining the proposed leachfield, the fill on the downhill side of the dirt driveway should be similarly reclined to 33%.

Four additional borings were sampled to further evaluate the earth materials to a depth of 19 feet (Appendix A). In the proposed leachfield area, Borings 1 and 2 encountered hard, mainly closely fractured greywacke thinly interbedded in Boring 1 with Clayey Sandstone and Shale breccia. Borings 3 and 4, in the dirt road leading up to the proposed leachfield, encountered 4½ to 7 feet of surficial soil composed of dense to very dense Silty SAND with Gravel, and Gravelly SAND fill mantling approximately 2½ feet of medium dense, Clayey SAND colluvium over greywacke bedrock. Ground water was not encountered. The surficial soils were generally moist.

The supplemental subsurface exploration and surface mapping revealed competent sandstone to be underlying the proposed leachfield. Sandstone exposed in the cut slope above Boring 1 exhibited a favorably steep inclination relative to slope stability, and steep closely spaced jointing relative to optimum OWTS performance over the project lifetime (Plate 2).

In our opinion, these findings buttress conclusions and recommendations pertaining to other principal geotechnical aspects of the project presented in our previous reports (Geosphere Consultants, Inc. 2019; Atlas Technical Consultants LLC, 2020).

Figure 2. 1948 oblique Google Earth Pro image of site area. **A** is proposed leachfield site bordered by initial driveway grading across site; **B** is residence at 13 Los Cerros Rd. removed in 1982-83 due to reactivation of 1950's landslide (Michelucci & Assoc., 2015); **C** is incipient landslide that failed in 2017(white arrow points to scar of small cut slope failure); **D** is 738 LC garage at foot of steep descending driveway; **E** is approximate location of existing California Water Service tank; **F** is approximate location of approx. 30-foot high cut slope; – ·· → is concentrated runoff - note light tone on hillside above 711 Loma Ct. is interpreted as erosion/sedimentation from uncontrolled roadway runoff.

b) The Project Engineering Geologist should discuss the earth materials anticipated to be encountered during OWTS construction (e.g., undocumented fill, expansive colluvium, hard bedrock, etc.). The Consultant should clarify whether proposed leach line excavations, as proposed, will extend below surficial colluvium encountered at the site. We note the reported layers of high plasticity soils along the bedrock/colluvium contact. The applicant's Consultant should evaluate whether additional percolation testing or pits are appropriate to document the applicable percolation rates of earth materials at depth. The location of the prior 14-foot-deep pit advanced in November of 2000 should be clarified on project plans or within a figure provided by the applicant's Engineering Geologist. The Project Engineering Geologist should evaluate whether the depth of high groundwater at the site is a minimum of 5 feet below the base of the proposed OWTS excavations.

The boring data and exposed site conditions confirm the leachfield trenches will be in conventionally excavable sandstone bedrock. The thin layer of fill mantling the leachfleld site will be removed from the trench footprints.

The distribution of structurally-controlled seasonal drainage patterns depicted on Figure 1 suggests the subdued and locally steep hills that characterize Palomar Park are underlain by somewhat chaotically deformed Franciscan rock (Plate 4). Thus, the local geologic section would be unlikely to represent a sandstone-shale layer-cake assemblage as implied in letters contained in the compendium of documents submitted to the County Environmental Health Department from neighbors and other citizens concerned about local seepage mechanisms.

In our experience, the "A"-rating determined by previous percolation testing is consistent with the closely fractured nature of the bedrock encountered in the borings and exposed in graded slopes surrounding the site (Plate 4). We therefore judge supplemental percolation testing unnecessary.

The Civil Engineer will provide the location of the 14-foot deep observation pit excavated in November 2000 under the auspices of Langley Hill Quarry.

c) The Project Engineering Geologist should evaluate and discuss the potential for the proposed septic leachfield to impact existing subdrainage infrastructure at the site or neighboring properties. The Consultant should also discuss whether there is a potential for the proposed OWTS and proposed expansion lines to degrade water quality or daylight as a result of effluent surfacing in engineered cuts, very steep slopes, or into existing subdrains. An appropriate finding of risk (e.g., low medium, high, etc.) for water degradation and effluent surfacing should be provided. The Consultant should consider recommendations provided by GeoForensics in their letter dated March 16, 2020. The Consultant should also consider setback requirements within Chapter 4.84.120 of the County Code of Ordinances.

The bedrock encountered in exposures around the property is characterized by steep, closely spaced, joint sets that would encourage primarily vertical movement of effluent dispersed directly into the bedrock from the OWTS trenches to be constructed in strict accordance with the approved plans. This conclusion is supported by the absence of reported problems with OWTS operation in the immediate neighborhood; particularly with respect to the neighboring uphill properties on Loma Court constructed more than 6 decades ago, and the nearly century-old residential development at 738 Loma Court. Moreover, there is an absence of evidence of effluent seepage from the steep cut slope bordering the uphill side of the proposed OWTS.

Given the apparent satisfactory OWTS performance on neighboring residential properties, is our opinion operation of the proposed OWTS over the project lifetime presents a **Low Risk** for surfacing of effluent on the descending site slope below the proposed driveway.

In addition, we judge the proposed OWTS presents a **Low Risk** for contaminating water quality in the site slope repair subdrain system adequately located approximately 70 feet downslope from the Primary Leachfield (PL) and approximately 80 feet from the Expansion Leachfield (EL) (Plates 2 and 3). Similarly, the proposed PL and EL are respectively located approximately 170 and 102 feet from the southern margin of the slope repair subdrain system spanning 13 Los Cerros into 738 Loma Court (Plate 3).

It is noteworthy that the OWTS serving 738 Loma Court is apparently located on the descending slope behind the historic residence, estimated to be within approximately 20 feet of the 2017 landslide flank, and within approximately 50 feet of the slope repair subdrain system without detection of a fetid effluent odor from the currently minor subdrain

discharge of water into the Los Cerros Road storm drain system noted during field reconnaissance (Plate 4).

We are aware of a single OTWS failure, associated with a 1955 landslide event in northeast corner of 13 Los Cerros Road, approximately 150 feet from the proposed OTWS. According to Michelucci and Associates, Inc. (2015), the event damaged the historic house that had occupied the property since before 1948 (fig. 1). It was subsequently re-habilitated on a new foundation that encroached into the roadway, and the associated OTWS was relocated ***under the roadway***, and later removed due to subsequent roadway movement that we suspect simultaneously damaged the water main, which we learned from Cal Water Service had a history of breaks until it was replaced in 2006.

Subsequent landslide events in 1974 and 1982-83 on the same property resulted in removal of the house and infrastructure, and later removal of the foundation remnants and appurtenant structures concurrent with slope repair of the 2017 landslide event. There is no perceived potential adverse geologic impact to the proposed site development from the mitigated slope conditions on this property.

It is our opinion the conditions described above effectively obviate the concerns over operation of the proposed OWTS, and OTWS siting recommendations presented by Geoforensics, Inc. (2020).

We further understand retaining walls for the proposed house development will be designed for hydrostatic conditions to account for close proximity to the OTWS.

d) The Project Engineering Geologist should confirm the trench spacing is adequate from an engineering geologic perspective, or provide supplemental recommendations.

From an engineering geologic standpoint, we judge the proposed OWTS trench spacing is conservative based upon subsurface conditions and performance of the historic neighboring systems.

e) Typically, OWTS are set-back 100 feet from areas identified as landslides unless otherwise recommended or found appropriate by a Certified Engineering Geologist. We recommend the Project Engineering Geologist process and review hillshade topographic maps derived from publicly available LiDAR data-sets as well as review the results of their previous research to determine areas surrounding the site that have been subject to landsliding and subsequently clarify appropriate set-backs, as necessary.

There are no unmitigated landslides within 100 feet of the proposed OWTS (Plate 3). In our opinion, existing OWTS setbacks are sufficient.

Figure 2 depicts early residential development in Palomar Park featured by an array of roadways likely to have directed uncontrolled storm drainage to undeveloped slopes in the neighborhood causing erosion as well as landsliding from the over-steepened Los Cerros Road cut slope coincident with the location of the 2017 landslide event on the east side of the site. Hillshade LiDAR imagery highlights deflections from apparent roadway runoff erosion on slopes in the site area that would be otherwise obscured by vegetation. An example is an inactive erosional inflection from runoff extending onto the northwest corner of the site from 730 Loma Court that imposes no potential impact to performance of the OWTS site.

Uncontrolled runoff and associated seepage on 738 Loma Court has cast a shadow over the rest of the neighborhood relative to perception of slope stability. It is our opinion this seepage represents the principal mechanism for recurrent landsliding over the past decades, and is an issue introduced in our 2019 report.

From our studies we conclude for decades, since the property was developed in 1927 (Zillow.com), runoff from the descending driveway off Loma Court to the parking area, as well as garage and roof runoff, has historically been the principal sources for water to accumulate and overflow onto the adjoining slope. The condition was apparently mitigated in the recent past by installation of a trough drain across the paved surface and connecting roof downspouts to flexible plastic pipes. However, the location for discharge of the water is unknown as there is no evidence of a surface drain outfall onto Los Cerros Road.

Currently and apparently for a period of years a large catchment formed by an array of terrace surfaces bordered by retaining walls would tend to accumulate runoff (Appendix C). The source of a “spring” draining from the landscape terrace area would be perennially recharged by accumulation of rainfall runoff in the winter, followed by irrigation in the summer to maintain landscaping at the head of the retrogression landslide

complex.

To our knowledge, a detailed engineering geologic study to identify/mitigate the source of the "spring" has not been conducted. Balance Hydrologics, Inc. (2014) performed a reconnaissance-level evaluation of the spring and concluded, on the basis of water quality testing, the source was not local, as did Michelucci and Associates, Inc. (2015), but was instead derived from a broader "aquifer" to the south.

Both evaluations were apparently without consideration to the location of seepage issuing from the downslope side of the enclosed landscape terrace, or the relation of the seepage elevation relative to the opposing slope of the deeply eroded south ridge flank descending to Edgewood Road approximately 200 feet below Loma Court.

Nevertheless, the proposed OWTS is outside the area of influence of the adverse drainage and slope issues on 738 Loma Court.

We trust this supplemental engineering geologic study/reply to peer review provides you with the information required at this time. If you have any questions please contact Mr. Baldwin at 650.557.0262, or by e-mail joel.baldwin@oneatlas.com.

Sincerely,

ATLAS TECHNICAL CONSULTANTS LLC

(Renewal date 02/28/2023)

Joel E. Baldwin, II, P.G., C.E.G.
Principal Engineering Geologist

REFERENCES

Balance Hydrologics, Inc., 2014, Spring source and protection reconnaissance, APN 051-0220310 (360 Loma Court): Geologist's April 16 report, 8 pages with illustrations.

Geoforensics, Inc., 2020, Comments on Proposed Leachfield (on 634 Palomar Drive) Enea property, 738 Loma Court, Redwood City, California: Geotechnical consultant's March 16 letter, 1 page, File 217101.

Geosphere Consultants, Inc. Engineering geologic report, proposed leachfield constraint assessment, 634 Palomar Drive, Redwood City, California: Geotechnical consultant's April 29 report, GEO#-04214-B (2572.01), 5 pages with illustrations.

Atlas Technical Consultants LLC, Geotechnical report update, proposed residential development, 634 Palomar Drive, Redwood City, California: Geotechnical consultant's July 29 report, GEO Project No. 91-55905-A (3067.01.00 (5 pages with illustrations.

Michelucci and Associates, Inc., 2015, Preliminary geotechnical evaluation, property at 738 Loma Court, Redwood City, California: Geotechnical consultant's January 12 report, Job. 14-1422, 6 pages with site plan and pit log.

ILLUSTRATIONS

Figures

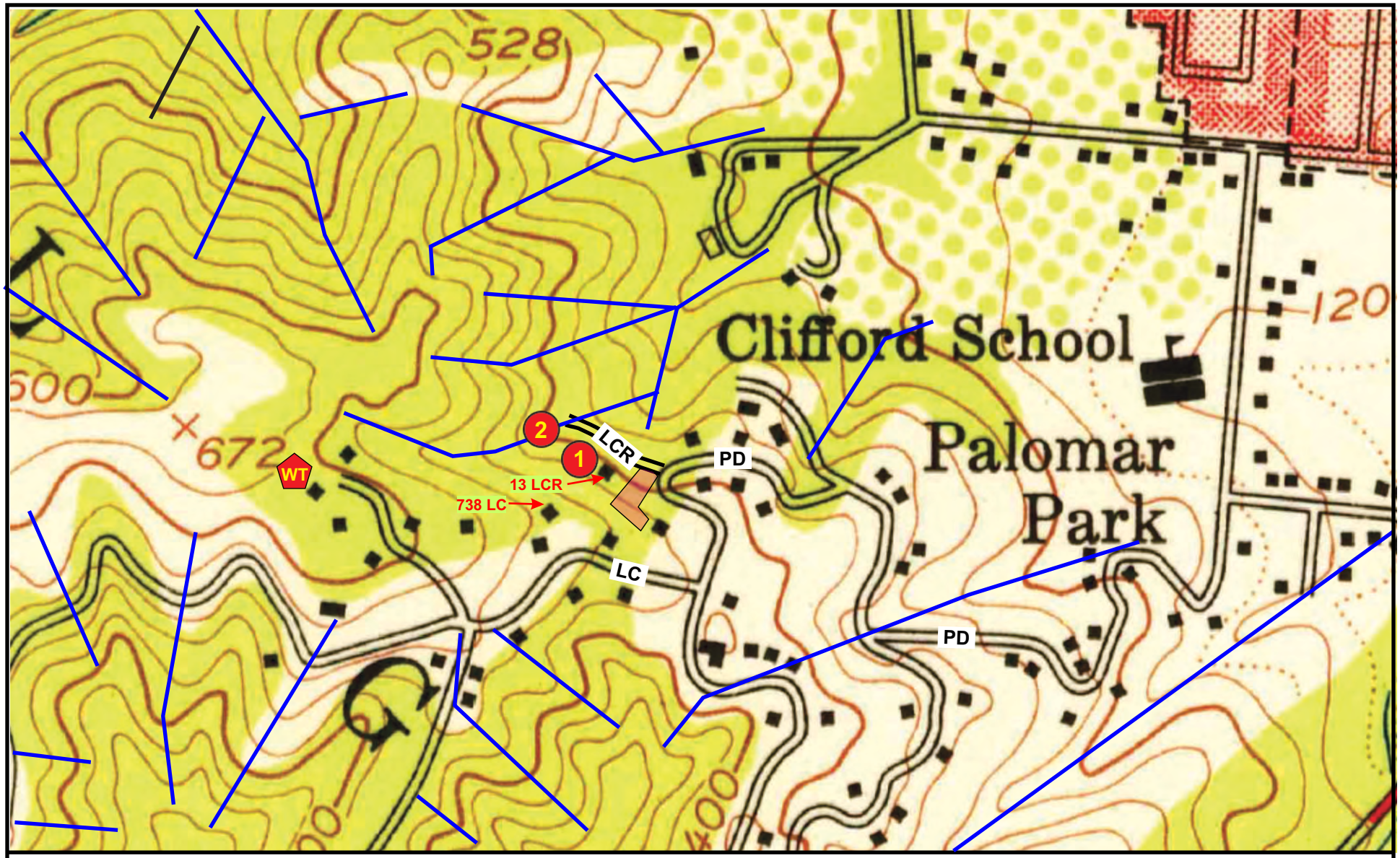
Figure 1 – Aerial Drone Site Overview
Figure 2 – 1948 Google Earth Oblique Aerial Image

Plates

Plate 1 – Vicinity Map
Plate 2 – Site Plan, Cross Section A-A'
Plate 3 – Geomorphic Map, Cross Section X-X'
Plate 4 – Photo Gallery

Appendices

Appendix A – Logs of Borings and Laboratory Test Results
Appendix B – California Water Service, San Carlos District Water System Map and Legend
Appendix C – Seepage and Landslide @ 738 Loma Court, Redwood City, CA



N

500 ft.
Scale
Contour Interval 40 ft.
Base Map after USGS Woodside 7½' quad. (1953)

EXPLANATION

Site

Structurally controlled seasonal drainage pattern

1 Seepage Location 1

WT New Water Tank
(Cal Water Service well pump site, Appendix C)

LC Loma Ct.
LCR Los Cerros Rd.
PD Palomar Dr.

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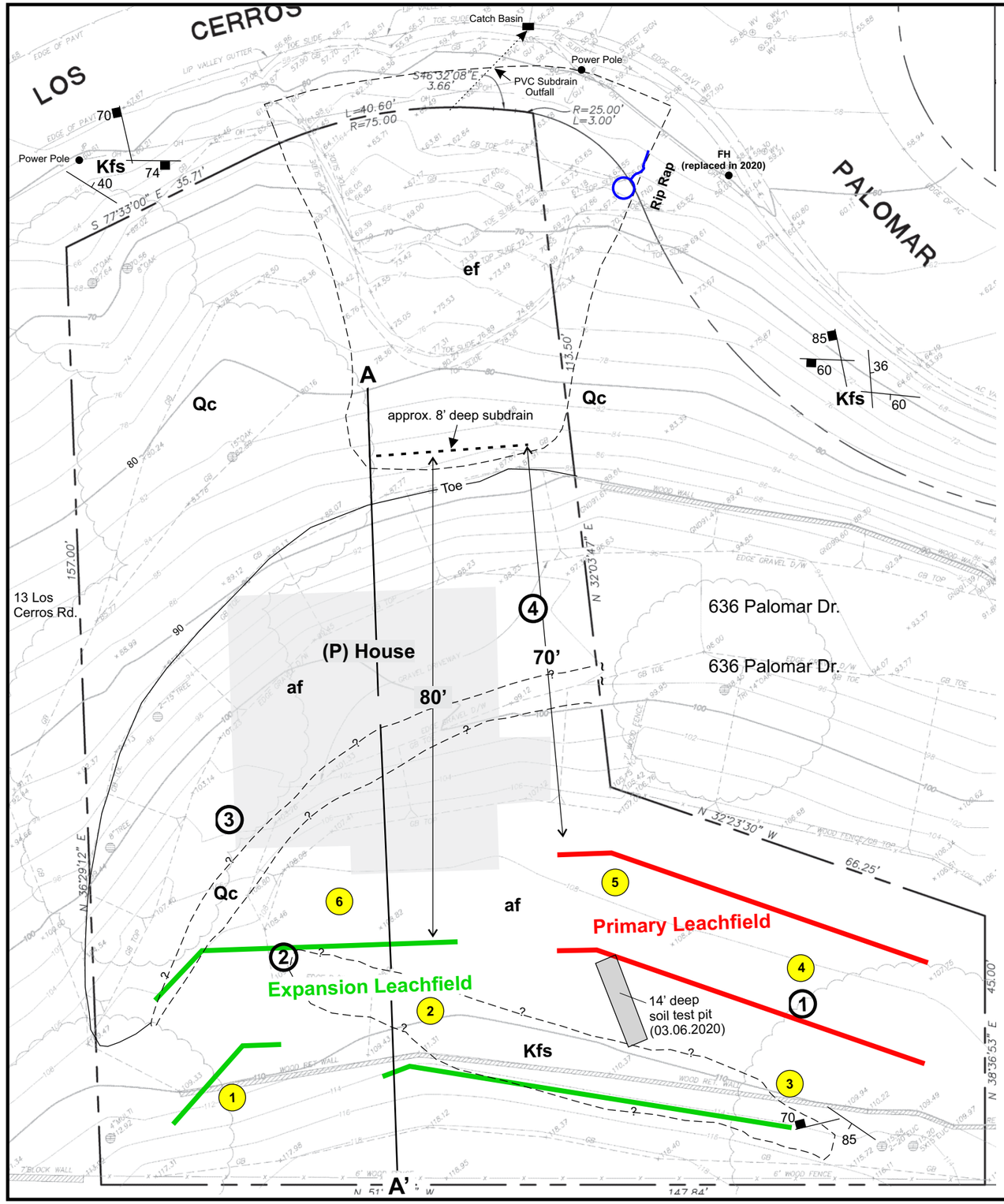
Date:	10.01.2021

VICINITY MAP

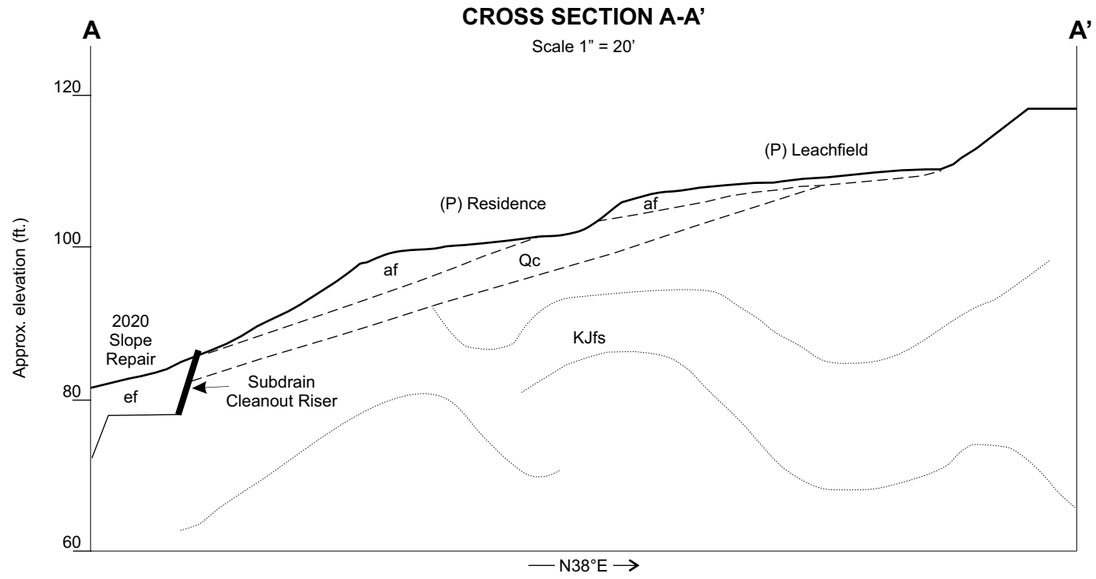
634 Palomar Drive
Redwood City, California

Plate
1



CROSS SECTION A-A'

Scale 1" = 20'



EXPLANATION

- **ef** Engineered Fill
- **af** Artificial Fill
- **Qc** Colluvium
- **Kfs** Sandstone
- —?— Inferred geologic contact
- 85 Strike & dip of bedding
- 70 Strike & dip of joint
- Extinct seep (active in 2019-2020)
- (1) Approx. Boring Location (08.2021)
- (4) Approx. Perc Test Location (11.2000, Langley Hill Quarry)
- A A' Line of Cross Section A-A'

N

20 ft.
Scale

Sources:

Site Plan: Guiliani & Kull, Inc.
Sheet S1 Topographic Survey
Dated 03.24.2017

Leachfield: Lea & Braze Engineering, Inc.
Sheet SS-1, Septic Construction Plan
Job: 2200474, rev. date 12.10.2020

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Date:	09.27.2021

SITE PLAN, CROSS SECTION A-A'
634 Palomar Drive
Redwood City, California

Plate 2

ponded alluvium?

Car Body obstructing culvert outfall

WS-1

WS-2

HOUSE

HOUSE

HOUSE

HOUSE

HOUSE

HOUSE

GARAGE

Graded

Graded

Graded

Los Cerros Road

Palomar Drive

Palomar Drive

Loma Court

footpath

738 Loma Ct.

13 Los Cerros Rd.

Former House Site

Dilapidated CMP

Clayey Sand/Sandstone

Graywacke

634 Palomar Dr.

636 Palomar Dr.

170'/102'

70'/80'

SR

SR

S

S

S

Expansion Leachfield

Primary Leachfield

New Concrete Retaining Wall

Driveway

Driveway

Water Tank/ Pump Site

X

X'

320

340

360

380

400

420

440

460

480

500

EXPLANATION

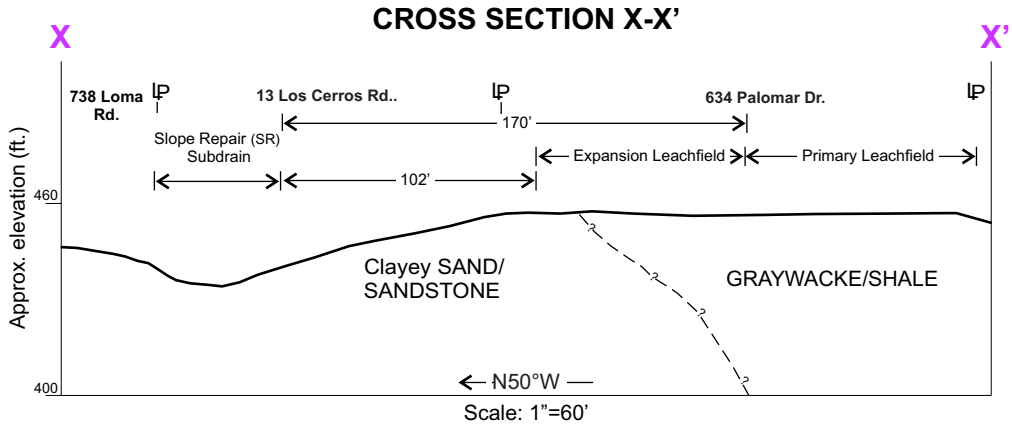
- Approximate limits of slope inflection/feature
- Direction of landslide movement
- Direction of debris slide movement
- **SR** Slope repair
- **S** Scoured surface from uncontrolled historic/recent runoff
- Flow direction of uncontrolled runoff
- 170'/102' Approximate distance from proposed Primary/Expansion Leachfields from site and off-site subdrains
- X——X' Line of Cross Section X-X'

N

60 ft.
Scale

Base Map from 2017 San Mateo County LiDAR and parcel database

CROSS SECTION X-X'



ATLAS	**Job No.:** 91-55905-C **Approved:** JEB **Date:** 10.01.2021	**GEOMORPHIC MAP, CROSS SECTION X-X'** 634 Palomar Drive Redwood City, California	**Plate** 3

Photo 1a. Southeast view along top of cut slope along southwest margin of Site. Inferred 18% northeast facing native slope extends across property line fence.

Photo 1b. Exposure of closely jointed shale and graywacke at arrow in Photo 1a.

Photo 2a.Norhterely view along Palmar Drive cut slope bordering northeast side of 636 Palomar Drive.

Photo 2b. Exposure of recumbent fold in closely jointed shale and graywacke at arrow in Photo 2a.

Photo 3a. Easterly view along Los Cerros Rd cut across nose of spur separating site from vacant lot at 13 Los Cerros Rd. where 1982 landslide damaged house.

Photo 3b. Exposure at arrow in Photo 3a of closely jointed shale and graywacke mantled by Gravely Clayey Sand colluvium .

Photo 4a. Northwest view seasonal channel intersection with Los Cerros Road. Arrow points to location of Balance Hydrologics (2014) creek Water Sample.

Photo 4b. Exposure of closely jointed graywacke in bank of the dry channel about 100 feet downstream from the sample location in Photo 4a.

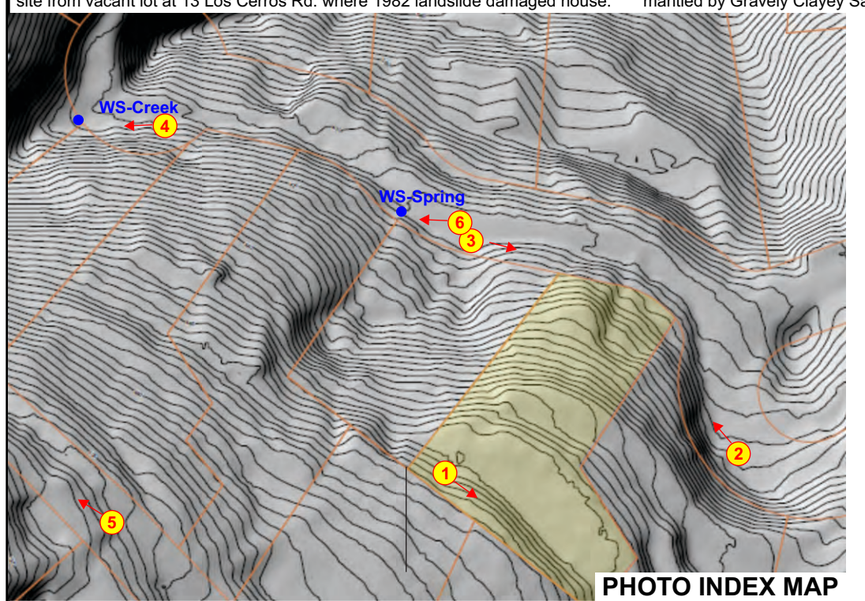


PHOTO INDEX MAP

EXPLANATION

2 Approx. line of sight, Photo 2

WS Balance Hydrologics (2014) water sample location

N

~100 ft.
Scale

Base map from 2017 San Mateo Co. LiDAR and parcel database

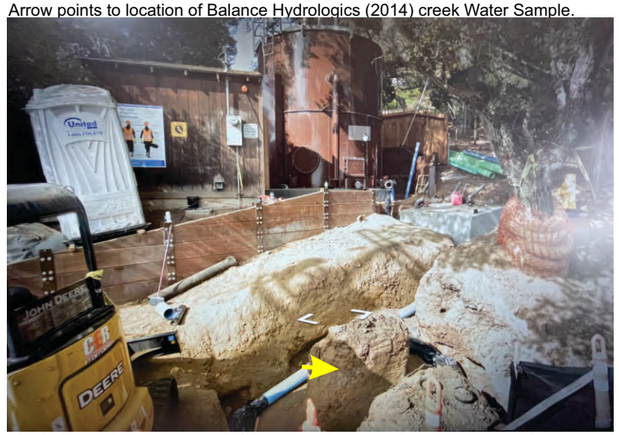


Photo 5. Northwest view of 2020 construction of water tank and booster pump at Cal Water Service Station 112 across from 742 Loma Ct. About 50 feet of new 6" diameter pressure line pipe was connected to the pre-existing line installed some time before 1985. Arrow points to trench exposure of soil similar to that reportedly underlying the landslide on 13 Los Cerros Rd. and 738 Loma Ct.

Photo 6. West view of Balance Hydrologics 738 Loma Ct. spring water sample onto Los Cerros Rd.Gutter that drains to catch basin/culvert system at head of stream across road from Photo 4a.

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Approved:	JEB
Date:	10.01.2021

PHOTO GALLERY

634 Palomar Drive
Redwood City, California

Plate
4

APPENDIX A

Logs of Soil Exploration and Laboratory Test Results

BORING 1

Equipment Truck-Mounted Solid Fight Auger

Elevation ~35 ft. **Date** 08/21/2021

Dry Density (pcf)	Moisture Content %	Blows/Foot (SPT)	Depth (ft.)	USCS	Description
			0 blows/ft 50	Sample	
93.1	9.4	50/5"	1–4	SM	Yellow brown Silty SAND with Gravel, moist, very dense (**af**)
	6.5	61	5	ROCK	Very dark brown GRAYWACKE, slight to moderately weathered, closely fractured, hard (Franciscan Bedrock)
		41	10	ROCK	Brown yellow brown SILTY, Clayey SANDSTONE w/ hard, angular SHALE fragments to ½", very weathered, closely fractured, soft (Franciscan Bedrock)
	5.3	50/5"	15	ROCK	Very dark brown GRAYWACKE, very weathered, closely fractured, moderately hard to hard (Franciscan Bedrock)
		50	19		
			20		Terminated @ 19'

*Approximate elevation from Plate 2

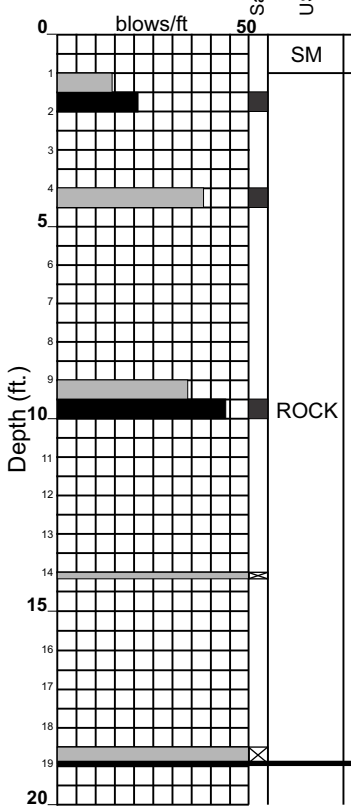
ATLAS	**Job No.:** 91-55905-C **Approved:** JEB **Date:** 09.17.2021	**LOG OF BORING 1** 634 Palomar Drive Redwood City, California	**Plate** A1

BORING 2

Equipment Truck-Mounted Solid Fight Auger

Elevation ~35 ft. **Date** 08/21/2021

Dry Density (pcf)	Moisture Content %	Blows/Foot (SPT)
104.5	12.7	34
122.3	7.3	38
132.1	6.4	77
		50/2"
		50



Yellow brown Silty SAND with Gravel, moist, dense (**af**)

Very dark brown GRAYWACKE, slight to moderately weathered, closely fractured, moderately hard to hard (Franciscan Bedrock)

Terminated @ 19'

*Approximate elevation from Plate 2

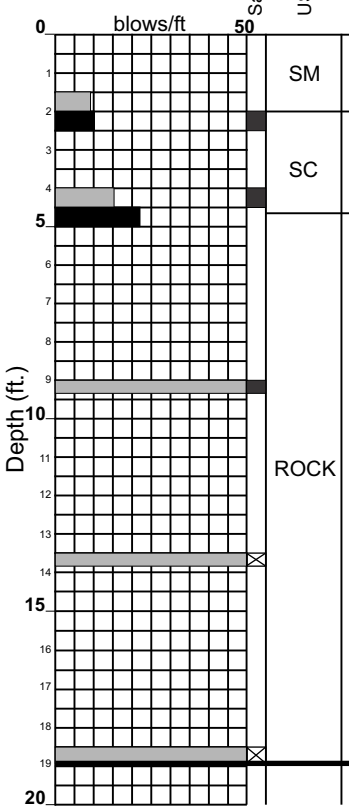
ATLAS	**Job No.:** 91-55905-C **Approved:** JEB **Date:** 09.17.2021	**LOG OF BORING 2** 634 Palomar Drive Redwood City, California	**Plate** A2

BORING 3

Equipment Truck-Mounted Solid Fight Auger

Elevation ~35 ft. **Date** 08/21/2021

Dry Density (pcf)	Moisture Content %	Blows/Foot (SPT)	USCS	Description
			SM	Yellow brown Silty SAND with Gravel, moist, medium dense (**af**)
90.4	9.2	19	SC	Dark brown Clayey SAND with Gravel, medium dense to dense moist (**Qc**)
101.5	8.1	37	ROCK	Very dark brown GRAYWACKE, slight to moderately weathered, closely fractured, hard (Franciscan Bedrock)
122.4	6.3	50/4"		
		50/4"		
		50		Terminated @ 19’



*Approximate elevation from Plate 2

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Job No.: 91-55905-C

Approved: JEB

Date: 09.17.2021

LOG OF BORING 3

634 Palomar Drive
Redwood City, California

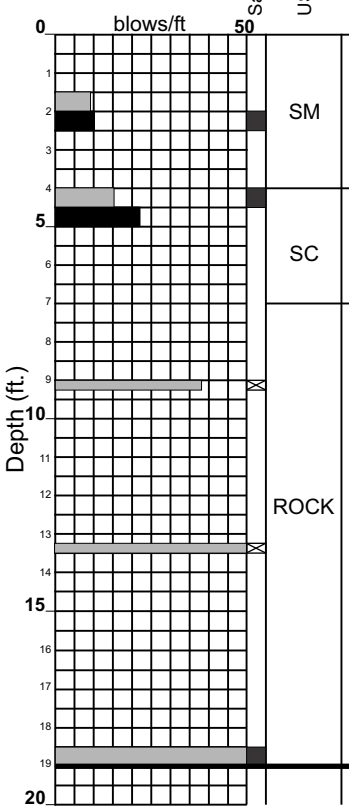
Plate A3

BORING 4

Equipment Truck-Mounted Solid Fight Auger

Elevation ~35 ft. **Date** 08/21/2021

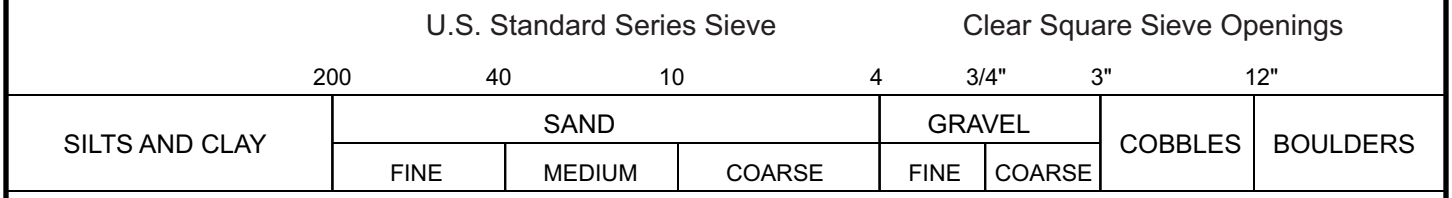
Dry Density (pcf)	Moisture Content %	Blows/Foot (SPT)	Sample	USCS	Description
				SM	Yellow brown Gravelly SAND, moist, very dense (**af**) concrete fragments
107.5	5.3	60			
100.5	6.7	28		SC	Dark brown Clayey SAND with Gravel, moist, medium dense (**Qc**)
		38/3"		ROCK	Very dark brown GRAYWACKE, slight to moderately weathered, closely fractured, hard (Franciscan Bedrock)
		50/3"			
112.6	8.8	50			
					Terminated @ 19'



*Approximate elevation from Plate 2

ATLAS	**Job No.:** 91-55905-C **Approved:** JEB **Date:** 09.17.2021	**LOG OF BORING 4** 634 Palomar Drive Redwood City, California	**Plate** A4

			GROUP SYMBOL	Secondary Divisions
COARSE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT IS LESS THAN 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Orangic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS — LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.



Grain Sizes

SAND AND GRAVELS	BLOWS/FOOT*
VERY LOOSE	0 -4
LOOSE	4 -10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

Relative Density

SILTS AND CLAYS	STRENGTH **	BLOWS/FOOT*
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

Consistency

* Number of blows of 140 pound hammer falling 30 inches to drive a split spoon, SPT sampler (ASTM D-1586)

** Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

Sample location; blow counts listed are from the bottom 12 inches of 18- inch drive sample.

Grab sample

59 Total number of SPT blow counts for sampling interval. Bar graph represents individual 6-inch intervals.

Unified Soil Classification System (ASTM D-2487)

ATLAS

Job No.: 91-55905-C

Approved: JEB

Date: 08.27.2021

KEY TO BORINGS

634 Palomar Drive
Redwood City, California

Plate
A5

ROCK HARDNESS & WEATHERING CHART

ROCK HARDNESS

Very Hard Cannot be scratched with knife or pick. Hand specimens require several hard blows of geologist's hammer.

Hard Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.

Moderately Hard Can be scratched with knife or pick. Gouges or grooves up to ¼ inch deep can be excavated by hard blow of point of a geologist's pick. Hard specimen can be detached by moderate blow.

Medium Can be grooved or gouged 1/16 inch deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1 inch maximum size by hand blows of the point of geologist's pick.

Soft Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of pick point. Small thin pieces can be broken by finger pressure.

Very Soft Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 inch or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

WEATHERING

Fresh Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.

Very Slight Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.

Slight Rock generally fresh, joints stained, and discoloration extends into rock up to 1 inch. Joints may contain clay. In granitoid rocks some occasional feldspar crystalsare dull and discolored. Rock rings under hammer if crystalline.

Moderate Significant portions of rock show discoloration and weathering effects. in granitoid rocks, most feldspars are dull and discolored; some are clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.

Moderately Severe All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. Rock goes "clank" when struck.

Severe All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinitized to some extent. Some fragments of strong rock usually left.

Very Severe All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.

Complete Rock reduced to "soil". Rock fabric not discernible or discernibleonly in small scattered locations. Quartz may be present as dikes or stringers.

FRACTURE SPACING

	Joint or Fracture Spacing Descriptor	True Spacing
1	Extremely Widely Spaced	Greater than 10 feet (<3m)
2	Very Widely Spaced	3 to 10 feet (1 to 3m)
3	Widely Spaced	1 to 3 feet (300 mm to 1m)
4	Moderately Spaced	0.3 feet to 1 foot (100 to 300 mm)
5	Closely Spaced	0.1 feet to .3 feet (30 to 100 mm)
6	Very Closely Spaced	Less than 0.1 feet (<30 mm)

ATLAS

Job No.: 91-55905-C
Approved: JEB
Date: 08.27.2021

ROCK HARDNESS & WEATHERING CHART
634 Palomar Drive
Redwood City, California

Plate
A6

APPENDIX B

California Water Service Bayshore District

1. San Carlos District Water System (Sheet SC-28-24, dated 01.2021)
2. Legend

ENGINEERING DEPARTMENT

GIS

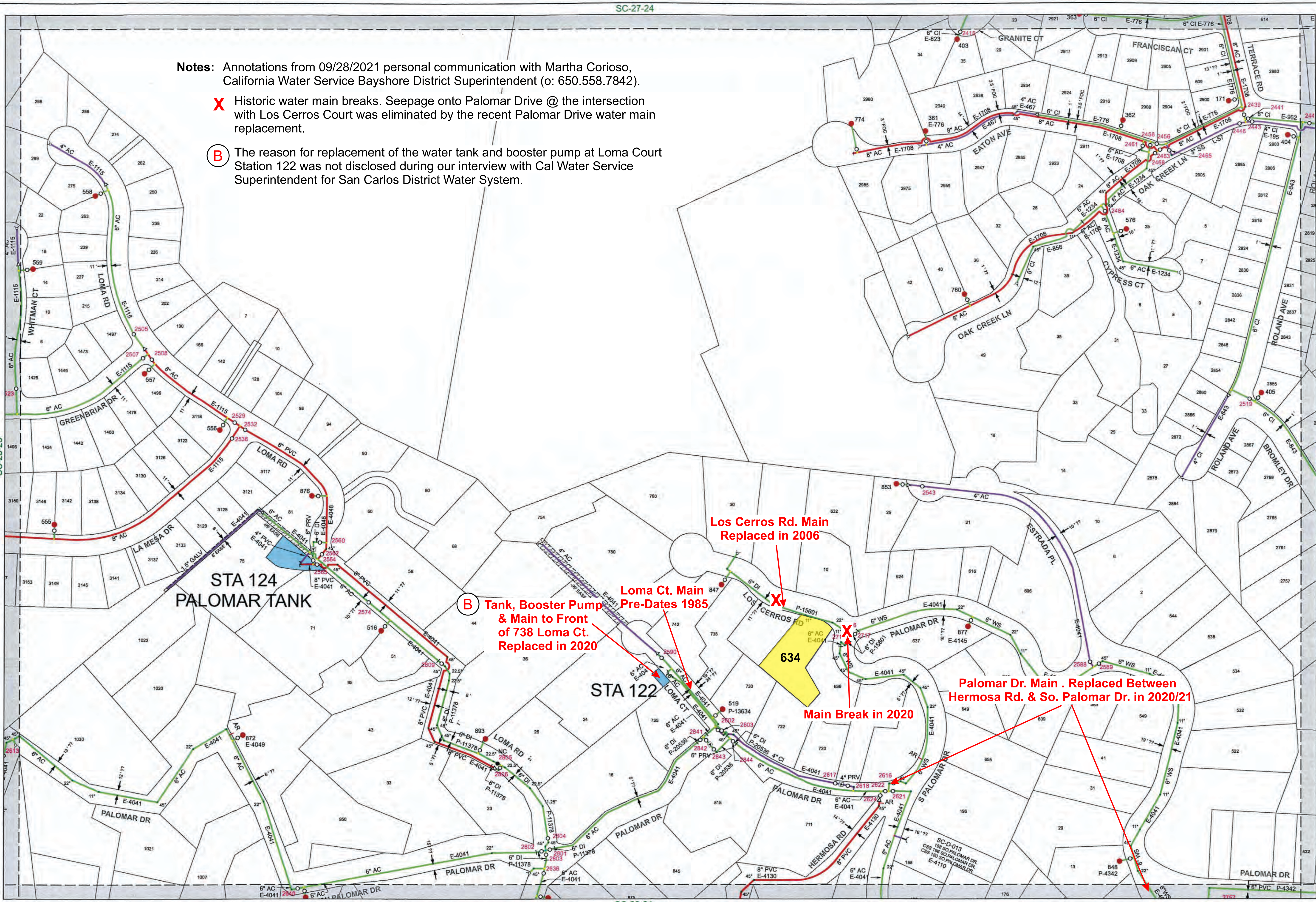
SAN CARLOS DISTRICT WATER SYSTEM

CONFIDENTIAL: Applicant hereby agrees that any plans or markings made by California Water Service (Cal Water) showing the estimated location of its underground facilities is done solely as an accommodation and without any warranties, representations, or guaranties of completeness or accuracy. Applicant acknowledges that said information is a suggestion as to possible locations, as would be necessary to protect Cal Water's property. Applicant accepts full responsibility for any damage to Cal Water's facilities. Applicant agrees that Cal Water is not liable for any direct or indirect damages arising out of the use of said information.

Notes: Annotations from 09/28/2021 personal communication with Martha Corioso, California Water Service Bayshore District Superintendent (o: 650.558.7842).

X Historic water main breaks. Seepage onto Palomar Drive @ the intersection with Los Cerros Court was eliminated by the recent Palomar Drive water main replacement.

(B) The reason for replacement of the water tank and booster pump at Loma Court Station 122 was not disclosed during our interview with Cal Water Service Superintendent for San Carlos District Water System.



N

SCALE: 1" = 200'

Issued: January 2021

Plat Sheet: SC-28-24

Legend

- Access Manhole
- Blowoff
- Catch Basin
- Chemical Injector
- Critical Customer
- Hydrant
- Hydrant (Private)
- Interconnect
- Lateral Point
- Pull Box
- Pump
- Sampling Station
- Tank
- Termination
- Water Network Structure
- Well

Control Valves:

- Air Release Valve
- Altitude Valve
- Backflow Control Valve
- Combination Valve
- Double Check Valve

Control Valves (cont.):

- Pressure Reducing Valve
- Pressure Relief Valve
- Pressure Sustaining Valve
- Simple Check Valve

Fittings:

- Cap
- Cross
- Elbow
- Expansion Joint
- Pipe Change
- Plug
- Other
- Reducer
- Saddle
- Tapping Sleeve
- Tee
- Vertical Offset

Meters:

- Flow Meter
- Interconnect Meter
- Service Connection Meter

System Valves:

- Ball Valve
- Butterfly Valve
- Gate Valve
- Normally Closed Valve

Water Mains (by diameter):

- Unknown
- Smaller than 6"
- 6"
- 8"
- 10" to 12"
- Larger than 12"
- Main with Cathodic Protection

Other Lines (Drain, Flushing, etc.):

- Unknown
- Smaller than 6"
- 6"
- 8"
- 10" to 12"
- Larger than 12"

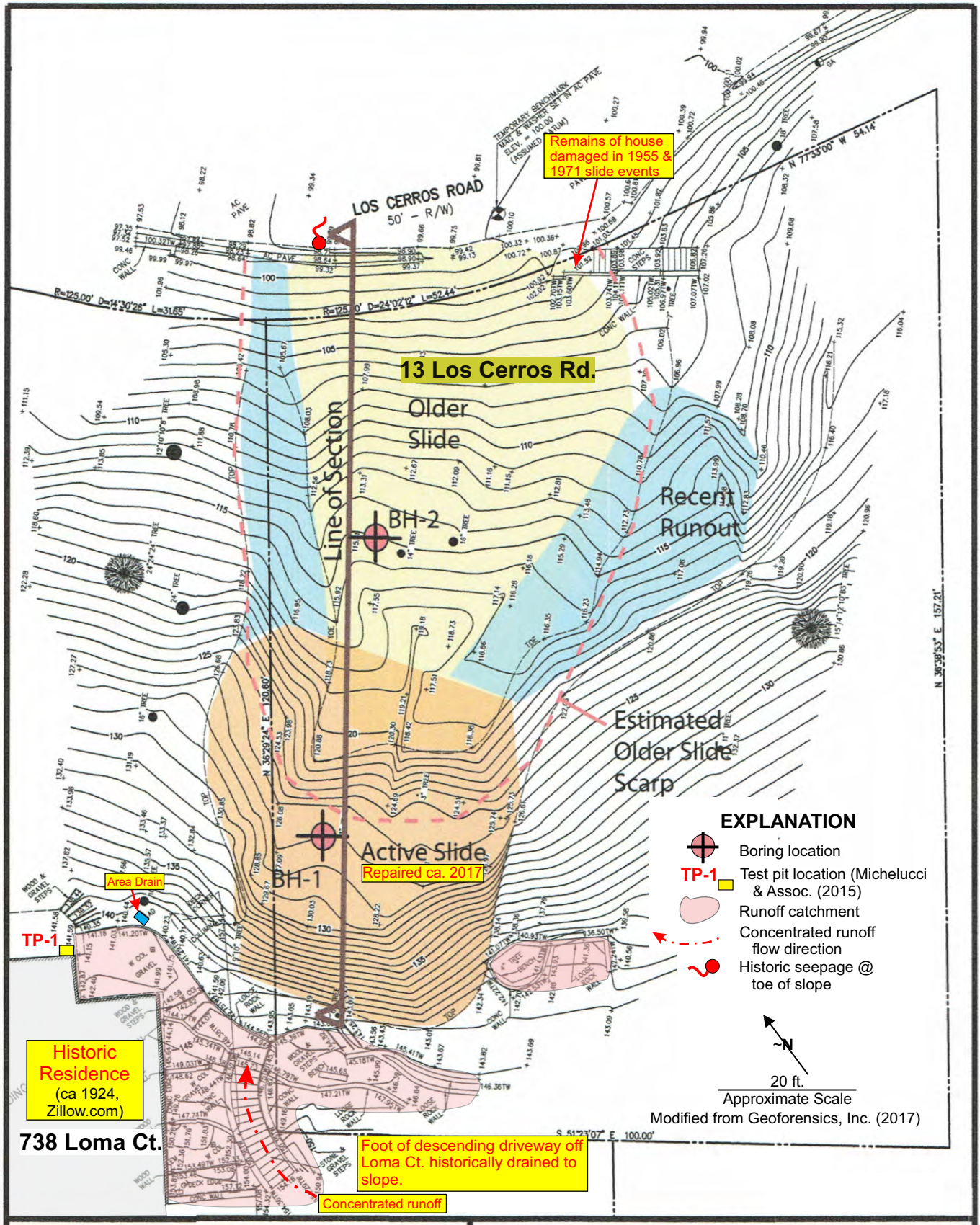
- Casing
- Conduit
- Other Agency Pipe

- Cal Water-Owned Property
- Easement
- Grid Boundary
- Parcel*
- Station
- Underground Enclosure

APPENDIX C

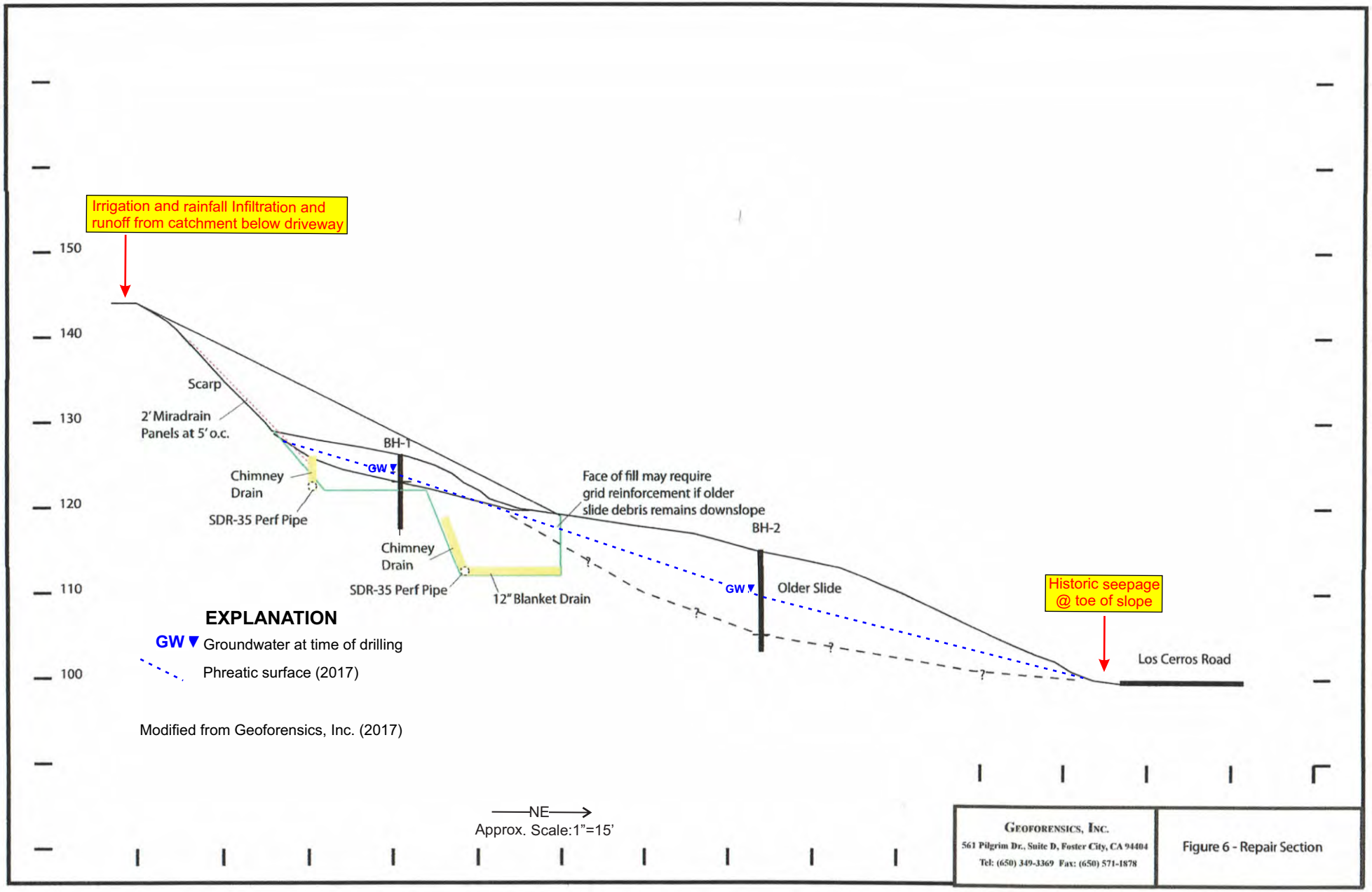
Seepage and Landslide @ 738 Loma Court, Redwood City, California

This appendix presents illustrations of adverse drainage conditions at the head of a retrogressive landslide that has persisted for decades without pursuit of characterizing the source and mitigation for causative perched ground water. Seepage was inferred from Geoforensics, Inc. (2017) boring data and cross section, and an earlier reconnaissance study by Michelucci & Associates (2015) to evaluate seepage and deflection of the nearly century-old residence. Neither report presented a characterization of the drainage conditions at the head of the landslide scarp.



GEOFORENSICS, INC.
561 Pilgrim Dr., Suite D, Foster City, CA 94404
Tel: (650) 349-3369 Fax: (650) 571-1878

Figure 4 - Site PLan


Irrigation and rainfall Infiltration and runoff from catchment below driveway
150
140
130
120
110
100
Scarp
2' Miradrain Panels at 5' o.c.
BH-1
GW
Chimney Drain
SDR-35 Perf Pipe
Face of fill may require grid reinforcement if older slide debris remains downslope
BH-2
Chimney Drain
SDR-35 Perf Pipe
12" Blanket Drain
GW
Older Slide
Historic seepage @ toe of slope
Los Cerros Road
EXPLANATION
GW Groundwater at time of drilling
Phreatic surface (2017)
Modified from Geoforensics, Inc. (2017)
NE
Approx. Scale:1"=15'
GEOFORENSICS, INC.
561 Pilgrim Dr., Suite D, Foster City, CA 94404
Tel: (650) 349-3369 Fax: (650) 571-1878
Figure 6 - Repair Section

LOG OF BORING

DEPTH (ft)	SAMPLE NUMBER	SAMPLE LOC.	BLOW COUNTS (12 inches)	MATERIAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (70)
				Sandy CLAY - red brown, wet, soft to firm (CL)		
5	1-1		61/9"	Clayey Gravelly SAND - red brown, sl. moist, dense (RX)	79.3	42.1
	1-2		88/10"	Clayey SAND with rock fragments - green brown with red brown, sl. moist, dense (RX)		23.7
10				Bottom of Boring @ 9.5 ft Groundwater at 2 feet, rose to 1 foot		
15						
20						
25						
30						

Logged by: BA
Job No: 217101
Drilled on 5/3/17

Minute Man Portable Drilling Rig
70 Pound Hammer
Groundwater at 1 foot

Mod. Cal Sampler
SPT Sampler

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Tel: (650) 349-3369 Fax: (650) 571-1878

Figure A1 - Log of Boring 1

LOG OF BORING

DEPTH (ft)	SAMPLE NUMBER	SAMPLE LOC.	BLOW COUNTS (12 inches)	MATERIAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (70)
	2-1		19	Sandy CLAY - red brown,moist to wet, firm (CL/Als)	92	32
5						
	2-2		25	Clayey Gravelly SAND - blue green and red brown, sl. moist, firm (CL/Als)	97.5	27.6
10						
	2-3		49	Clayey SAND with rock fragments - red brown and blue green, sl. moist, medium dense (RX)		12.4
15				Bottom of Boring @ 13.5 ft Ground Water at 12 feet		
20						
25						
30						

Logged by: BA
Job No: 217101
Drilled on 5/3/17

Minute Man Portable Drilling Rig
70 Pound Hammer
Groundwater at 12 feet

Mod. Cal Sampler
SPT Sampler

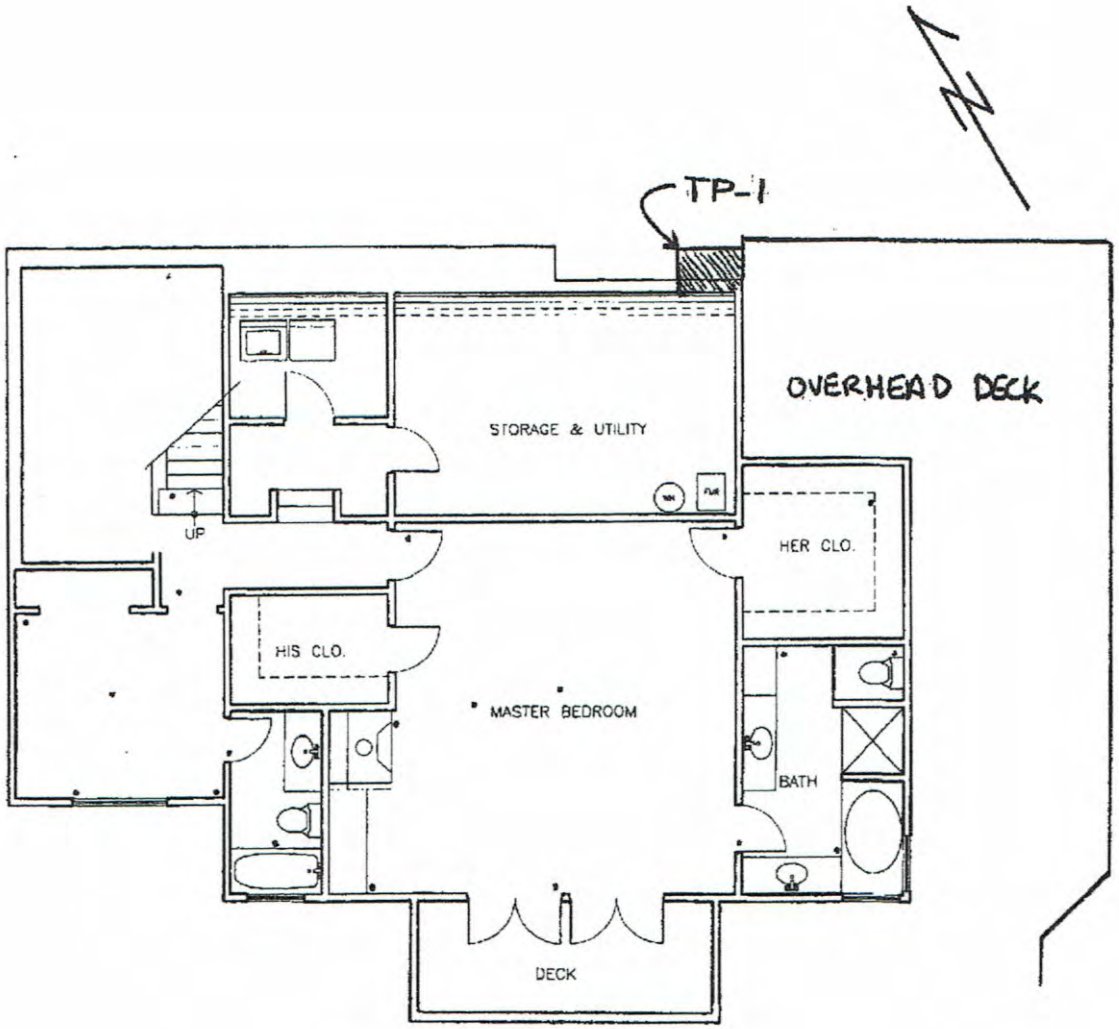
GEOFORENSICS, INC.
561 Pilgrim Dr., Suite D, Foster City, CA 94404
Tel: (650) 349-3369 Fax: (650) 571-1878

Figure A2 - Log of Boring 2

Site Plan*

738 Loma Court

Redwood City, California



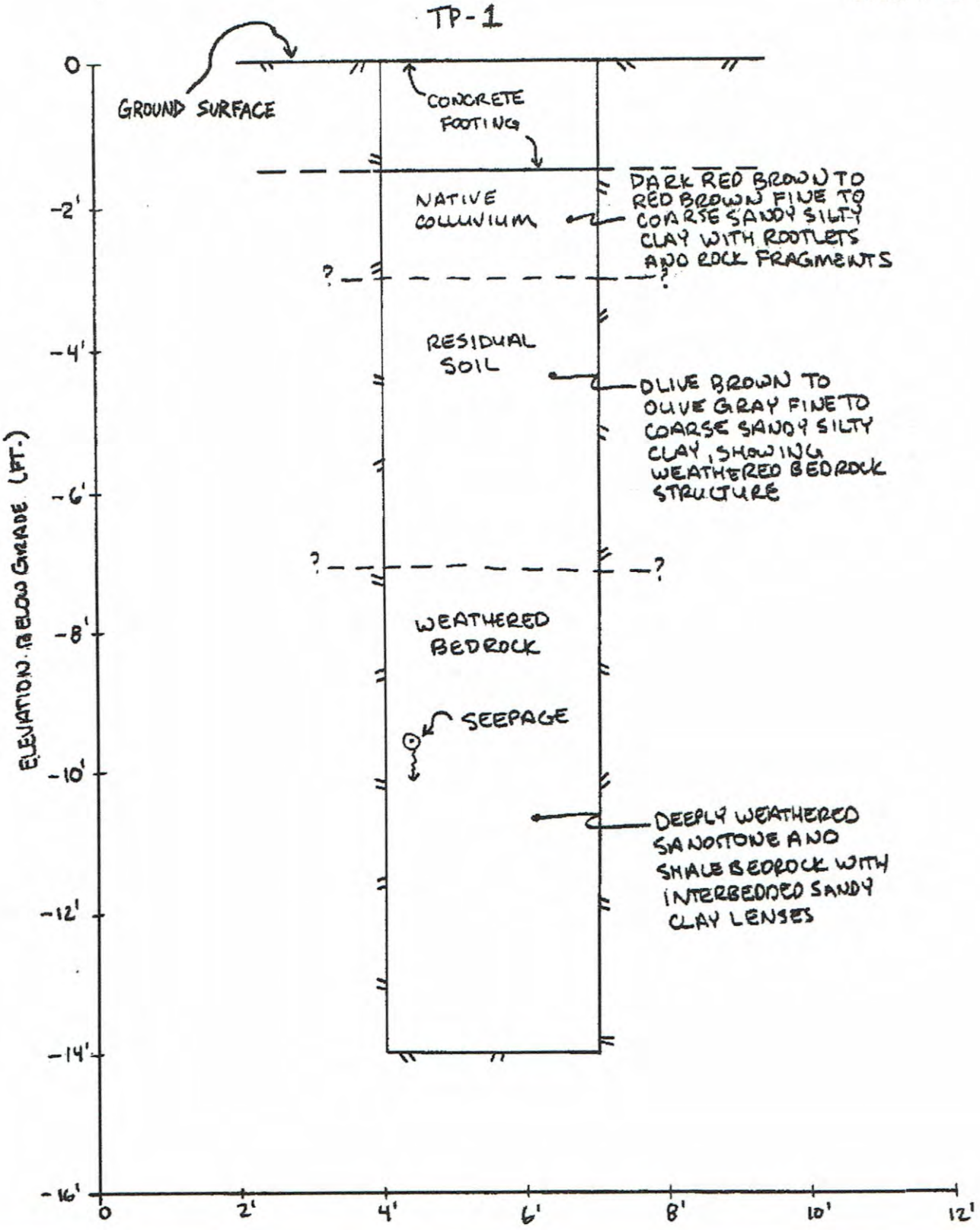
Scale: 1"=10' ±

*Base map taken from an undated existing ground floor plan (Sheet A-1) prepared by Luis Barbosa.

Job No. 14-4422	Michelucci & Associates	Figure 2

Test Pit Log*

Scale: 1"=2' ±



Job No. 14-4422	Michelucci & Associates	Figure 3