APPENDIX F

Geotechnical Engineering Report

February 22, 2011
File: 1610.01altr.doc

Willowglen Homes
900 College Avenue
Santa Rosa, California 95401

Attention: Mr. Ben Van Zutphen

Re: Updated Geotechnical Engineering Report
Evaluation of Shallow Soil Conditions and
Recommendations for Subgrade Preparation and Grading Specifications
Future Residential Development
Lands of Hunter
Adams Street
St. Helena, California

Introduction

This updated report presents the results of our geotechnical investigation of the shallow soil conditions underlying the future Adams Street (Hunter Parcel) residential development, located on Adams Street in St. Helena, California (Site Location Map, Figure 1). In 2009 our firm conducted an investigation of the shallow soil conditions at the project site, and published a report dated August 13, 2009 summarizing the field and laboratory data collected from ten exploratory borings drilled during our earlier study in 2009, and presenting our geotechnical recommendations for site preparation and grading at the project site. Subsequent to our earlier study and report, we understand that approximately 27,000 cubic yards of engineered fill has been placed on the Hunter parcel (during summer 2010) as a part of the City of St. Helena Flood Protection Project. The purpose of our services at this time is to provide an updated summary of the shallow soil conditions underlying the project site in order that we can provide revised recommendations for proper subgrade preparation beneath future development areas. This updated report re-summarizes the information included in the earlier August 13, 2009 report, and includes a discussion of the additional 27,000 cubic yards of engineered fill placed on the Hunter Parcel as a part of the City of St. Helena Flood Protection Project during the summer of 2010.

In accordance with our agreement dated July 28, 2009, the scope of our services in 2009 included the excavation of ten shallow exploratory borings, laboratory testing of selected soil samples, and the preparation of our report dated August 13, 2009 which summarized our field observations and test results, and presented our geotechnical conclusions and recommendations with respect to future grading at the site. In order to update our report to reflect the current shallow soil conditions subsequent to the placement of engineered fill at the site during the summer of 2010, members of our staff have made recent several site visits. Field density testing was conducted by our personnel on October 21, 2010 to measure the in-situ relative compaction of the recently placed engineered fill. Finally, we have reviewed field density testing conducted by Kleinfelder between June 10 and October 8, 2010 during the placement of the fill on the Hunter Parcel.

It is noted that when more detailed planning is available for the proposed residential development, design-level geotechnical investigations (including much deeper borings and additional soil sampling) should be undertaken for the design, permitting, and construction of the project.

Based on our understanding, the project site encompasses an area of roughly ten to fifteen acres of nearly level to gently sloping terrain. The site has been used until recently as a vineyard. A former pond, measuring roughly one hundred and thirty feet in diameter, was located near the northeastern portion of the parcel, as approximately shown on the Site Plan, Figure 2. The pond has been backfilled with undocumented, uncompacted fill. Some excavations (exploratory trenches) were made during 2009 (by others) at various locations on the site, extending to a depth of up to roughly four feet, to investigate archeological impacts at the site. It is thought that these exploratory trenches are also backfilled with undocumented, uncompacted fill.

We understand that excess clean soil generated during the construction of the adjacent St. Helena Flood Protection Project was placed as an engineered, compacted fill over a significant portion of the Hunter parcel during the summer of 2010. The planned grading on the Hunter parcel is shown on a grading plan prepared by Mead & Hunt Engineers and dated January 2009, with a latest revision of June 4, 2010. We understand that fills of up to three to four feet in thickness were placed relative to the former site grades. In general, the new fill placed during 2010 is thicker along the eastern portion of the Hunter Parcel, and thinner along the western portion of the site. Based on our understanding that roughly 27,000 cubic yards of fill was placed on the Hunter Parcel during 2010, the average depth of fill over the graded portion of the site would be approximately two feet.

We understand that at some future date, the Hunter parcel may be developed as a residential subdivision, including one, two, or three story residential structures, asphalt paved streets and concrete driveways, underground utilities, and associated improvements. No specific development plans are available at this time, however.

Subsurface Exploration and Laboratory Testing

Ten shallow exploratory borings were drilled at the site on July 21, 2009 using four inch diameter manual bucket auger drilling equipment. The borings were drilled to depths ranging between three and nine feet beneath the existing ground surface at that time. The approximate locations of the exploratory borings are shown on the attached Site Plan, Figure 2. As the borings were drilled, relatively undisturbed samples of the various soil layers encountered were obtained using a 2.5 inch diameter sampler driven into the bottom of the boring using a 35 pound hammer dropped 24 inches. The samples were sealed in the field to preserve their natural moisture content, and were transported to our laboratory for testing. Logs of the borings were prepared by our representative in the field based on cuttings emerging from the borings and observation of the collected samples. Occasional editing of the field logs was based on a closer examination of the samples in our laboratory and on the results of laboratory tests conducted on some of the samples. The logs of the borings, along with a soil classification chart, are presented in Figures A-1 through A-11.

The collected samples were subjected to laboratory testing, including unconfined compressive strength, moisture content, and dry density determinations on most of the collected samples. A bulk sample representative of the near surface soil (between a depth of roughly one to three feet below the former existing grade) was collected and used to obtain a laboratory compaction curve, based on ASTM D1557. The results of the laboratory compaction curve are shown on the attached Figure A-12.

Shallow Soil Conditions

Based on the ten exploratory borings drilled during our 2009 study, and subsequent observations at the site, the shallow soil profile beneath the Hunter Parcel currently consists of a layer of recent, compacted fill having a thickness of typically one to four feet (average depth two feet), underlain by a thin layer of older fill (scarified and recompacted native soil) composed of stiff, relatively dry, light brown clayey silt with some sand extending to a depth of between 6 inches and 18 inches beneath the bottom of the new fill layer. Beneath the stiff light brown clayey silt, soft to medium stiff dark brown, moist, clayey silt was encountered, extending typically to a depth of four to seven feet beneath the current ground surface (three feet below the former ground surface). The medium stiff dark brown clayey silt typically grades denser, lighter in color, and with a lower moisture content below a depth of four to seven feet relative to the existing site grade (three feet below the bottom of the new fill layer). The exception to this typical soil profile is found in the former pond area (exploratory boring 4). In the former pond area, soft to medium stiff mottled light brown to dark brown clayey silt (fill) was encountered, extending to a depth of approximately ten feet beneath the existing ground surface. Beneath the fill in boring 4, stiff light gray brown clayey silt with sand (undisturbed native soil) was encountered, extending to the maximum depth drilled (thirteen feet relative to the current site grades). No groundwater was encountered in any of the borings at the time of drilling. However, it is anticipated that the shallow groundwater level beneath the site will vary seasonally, and may be higher during certain times of the year.

Based on our laboratory testing, the soft to medium stiff dark brown clayey silt found at a depth of between roughly six inches and 36 inches beneath the bottom of the recent, compacted fill layer is unsuitable to leave in place beneath new engineered fills that at some time in the future will support a residential development. The dark brown clayey silt layer (between 0.5 and 3 feet) was found to typically have a moisture content of five to ten percent or more over optimum (as defined by the laboratory compaction curve, ASTM D1557), and was found to have an in-situ dry density of only approximately eighty percent of the laboratory maximum density (ASTM D1557). Engineered fills are typically compacted to at least 90 percent of the laboratory maximum density.

Based on our understanding of the grading operation undertaken during summer 2010 to place the 27,000 cubic yards of new fill at the Hunter Parcel, only shallow, six to eight inches deep scarifying and recompacting was undertaken to prepare the formerly existing ground surface prior to the placement and compaction of new fill. Therefore, the three foot thick layer of soft, weak natural soil remains beneath the recently placed and compacted fill layer.

Conclusions and Recommendations

In our opinion, based on the ten exploratory borings drilled as a part of our study, the site is underlain by a shallow layer of soft to medium stiff dark brown clayey silt that typically extends to a minimum depth of three feet beneath the bottom of the recently placed fill layer. In our opinion, this layer of soft to medium stiff clayey silt must be overexcavated, moisture conditioned to permit proper compaction, and then be replaced as compacted, engineered fill prior to the construction of new homes and other improvements on the Hunter parcel. It is not acceptable to place compacted, engineered fill (designed to support future development) on the Hunter Parcel without first overexcavating and recompacting the existing weak surface layer, due to the anticipated settlement of the weak soil layer as a result of the loads imposed by the new fill, as well as future building loads. Settlement of the weak soil layer, if left in place beneath the recently placed compacted fill, could lead to damage to new residential structures, streets, utilities, and concrete flatwork supported over the weak soil layer.

Specifically, prior to the development of the project site, we recommend that all of the recently placed (2010) fill, and the upper 2.5 feet of soil (measured from the bottom of the new fill layer) should be overexcavated and the overexcavated soil aerated or moisture conditioned, as necessary, to permit proper compaction. Based on an average thickness of the new fill layer of two feet, the average depth of the required overexcavation and recompaction of the site is 4.5 feet. The bottom of the excavated area should then be scarified to a minimum depth of eight inches, moisture conditioned to permit proper compaction, and then be recompacted to a minimum degree of compaction of 90 percent (based on ASTM D1557) to provide a smooth, uniform, and unyielding surface. Fill can then be placed in thin lifts (uncompacted thickness eight inches or less), moisture conditioned to permit proper compaction, and compacted to a minimum degree of compaction of 90 percent. Soil used as fill should be clean and free of organic or toxic contamination, and should not have rock pieces larger than six inches in diameter or more than 15 percent by weight of rock pieces larger than 2.5 inches in diameter.

In the former pond area, located roughly as shown on the attached Site Plan, Figure 2, the required depth of overexcavation will be roughly ten feet relative to the current site grades. The bottom of the overexcavated area should be scarified to a depth of eight inches, moisture conditioned to permit proper compaction, and compacted to a minimum degree of compaction of 90 percent. Fill can then be placed as described above.

It is possible that there may be areas on the site where weak soil extends to a depth greater than seven feet below the existing grade (or greater than three feet below the bottom of the recent fill layer). In general, aside from the former pond area, we believe that an overexcavation depth of 2.5 feet (measured from the bottom of the new fill layer) will be sufficient. However, if localized areas of deeper weak surface soil are encountered during the site grading operation, the soil engineer's representative may recommend deeper overexcavation in these areas.

Supplemental Services

Construction Observation & Testing

During construction, including any grading operation, our representative must be present intermittently to verify that the soil conditions are as anticipated and to observe and test the geotechnical portions of the work, including overexcavation of existing weak surface soil, scarification and recompaction at the bottom of the overexcavated areas, and placement and compaction of fills.

Design Level Geotechnical Investigation

When more detailed plans are available for the proposed residential development, a much more detailed geotechnical study should be undertaken. This study would include much deeper borings, additional soil sampling, laboratory testing, and engineering analyses, including an evaluation of liquefaction potential and settlement potential based on an evaluation of the deeper soil conditions beneath the site.

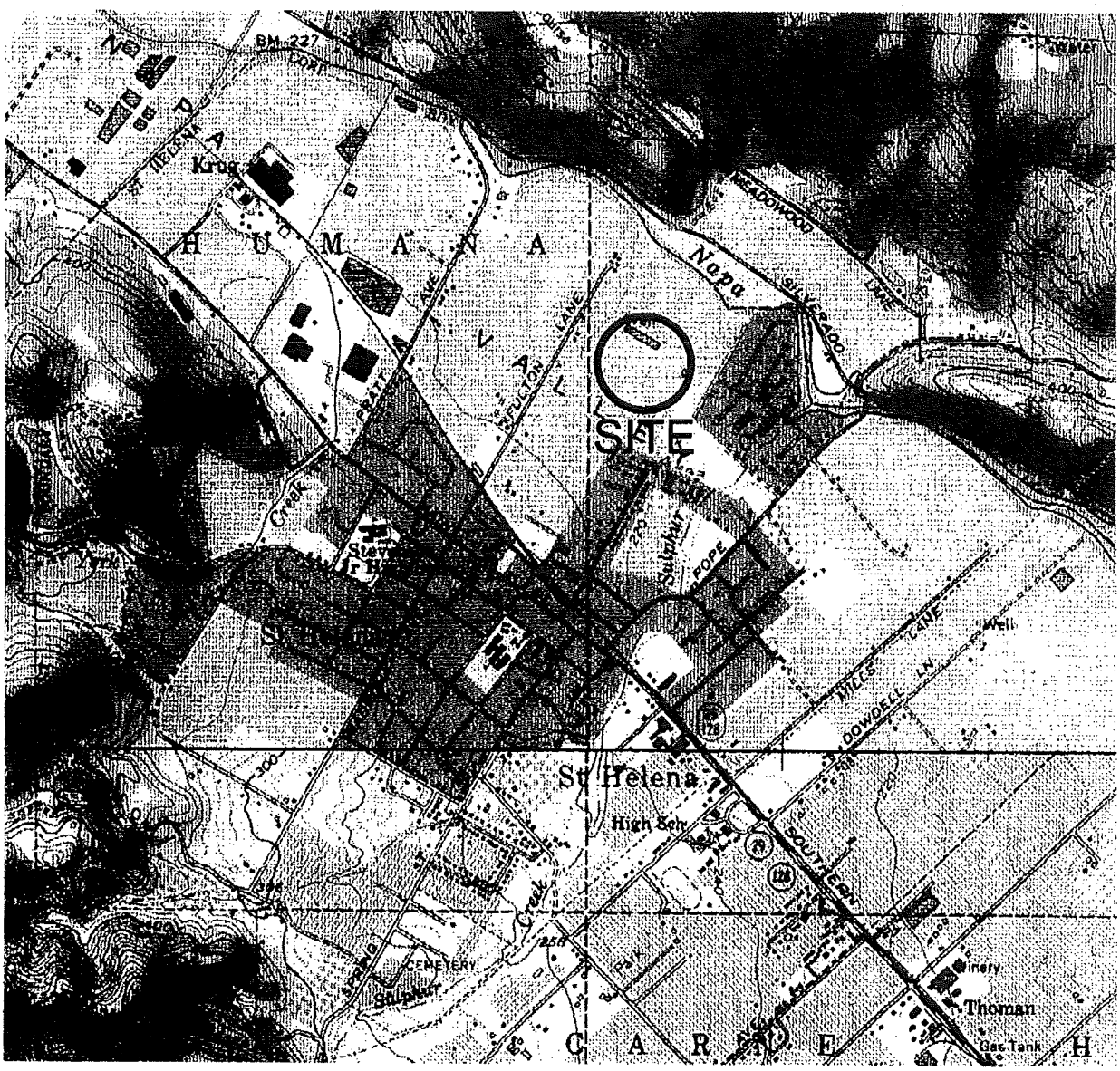
If you have any questions about our findings and conclusions, or if we can be of further assistance, please do not hesitate to call us at your convenience.

Yours very truly,
MILLER PACIFIC ENGINEERING GROUP

Daniel S. Caldwell
Geotechnical Engineer No. 2006
(Expires 9/30/11)

4 copies submitted

Attachments: Figures 1-2,
Appendix A: A-1-A-12



SITE LOCATION

SCALE

0 1000 2000 4000 FEET

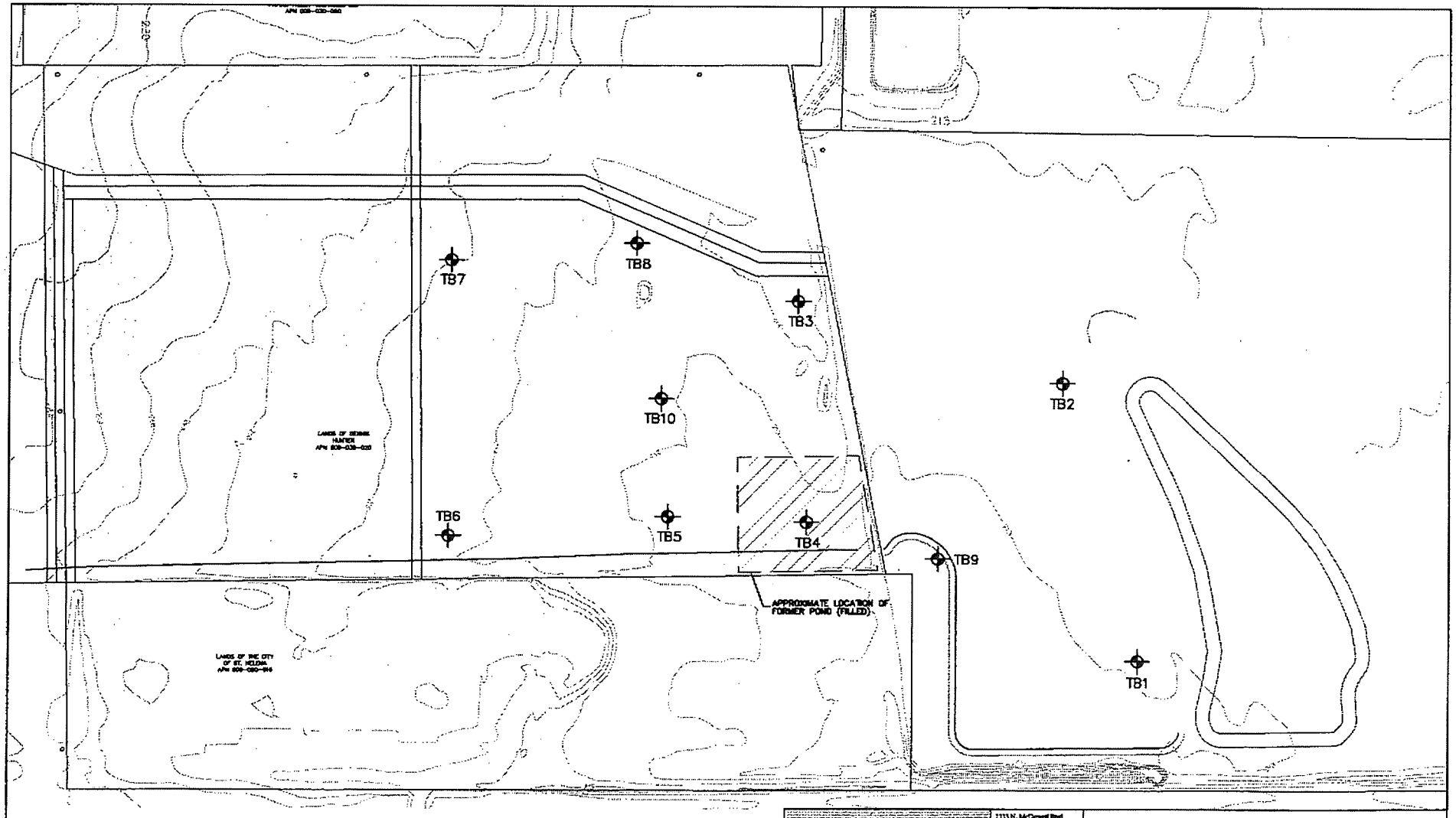
0 500 1000 METERS

NORTH

REFERENCE: DeLorme 3D TopoQuads, 1999

Miller Pacific ENGINEERING GROUP	504 Redwood Blvd. Suite 220 Novato, CA 94947 T 415 / 382-3444 F 415 / 382-3450 www.millerpac.com	SITE LOCATION MAP		
		Lands of Hunter Adams Street Saint Helena, California Project No. 09-5084 Date: 8/11/09	Drawn JSC Checked	1 FIGURE

FILE: 09-5084 SLM.dwg


TB7
TB8
TB3
TB10
TB2
TB6
TB5
TB4
TB9
TB1
APPROXIMATE LOCATION OF FORMER POND (FILLED)
LANDS OF HUNTER
LANDS OF THE CITY OF ST. HELENA
SCALE
0 50 100 200 FEET
Approximate location of boring
Ref: Civil Design Consultants, Inc., Preliminary Grading Plan – Hunter & City Property, 2008
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FILE: 09-5064 SP.dwg
1333 N. McDowell Blvd.
Suite C
Petaluma, CA 94954
T 707 / 765-6140
F 707 / 765-6222
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SITE PLAN
Lands of Hunter
Adams Street
Saint Helena, California
Project No. 09-5064
Date: 6/11/09
Drawn JSC
Checked
2
FIGURE

MAJOR DIVISIONS		SYMBOL	DESCRIPTION
COARSE GRAINED SOILS over 50% sand and gravel	CLEAN GRAVEL	GW	Well-graded gravels or 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
		GC	Clayey gravels, gravel-sand-clay mixtures
	CLEAN SAND	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
	SAND with fines	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS over 50% silt and clay	SILT AND CLAY liquid limit <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, gravely clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	SILT AND CLAY liquid limit >50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS		PT	Peat, muck, and other highly organic soils
ROCK			Undifferentiated as to type or composition

KEY TO BORING AND TEST PIT SYMBOLS

CLASSIFICATION TESTS

PI	PLASTICITY INDEX
LL	LIQUID LIMIT
SA	SIEVE ANALYSIS
HYD	HYDROMETER ANALYSIS
P200	PERCENT PASSING NO. 200 SIEVE
P4	PERCENT PASSING NO. 4 SIEVE

STRENGTH TESTS

TV	FIELD TORVANE (UNDRAINED SHEAR)
UC	LABORATORY UNCONFINED COMPRESSION
TXCU	CONSOLIDATED UNDRAINED TRIAXIAL
TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL
	UC, CU, UU = 1/2 Deviator Stress

SAMPLER TYPE

- MODIFIED CALIFORNIA
- HAND SAMPLER
- STANDARD PENETRATION TEST
- ROCK CORE
- THIN-WALLED / FIXED PISTON
- X DISTURBED OR BULK SAMPLE

SAMPLER DRIVING RESISTANCE

Modified California and Standard Penetration Test samplers are driven 18 inches with a 140-pound hammer falling 30 inches per blow. Blows for the initial 6-inch drive seat the sampler. Blows for the final 12-inch drive are recorded onto the logs. Sampler refusal is defined as 50 blows during a 6-inch drive. Examples of blow records are as follows:

- 25 sampler driven 12 inches with 25 blows afte initial 6-inch drive
- 85/7" sampler driven 7 inches with 85 blows afte initial 6-inch drive
- 50/3" sampler driven 3 inches with 50 blows during initial 6-inch drive or beginning of final 12-inch drive

NOTE: Test boring and test pit logs are an interpretation of conditions encountered at the excavation location during the time of exploration. Subsurface rock, soil or water conditions may vary in different locations within the project site and with the passage of time. Boundaries between differing soil or rock descriptions are approximate and may indicate a gradual transition.

Miller Pacific
ENGINEERING GROUP
504 Redwood Blvd.
Suite 220
Novato, CA 94947
T:415 / 382-3444
F:415 / 382-3450
www.millerpac.com

FILE: 09-5084 BL.dwg

SOIL CLASSIFICATION

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-1
FIGURE

BORING 1

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09

ELEVATION: ~213.0-Feet*

*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
						0 – 0			CLAYEY SILT (ML) Light brown, stiff, dry, low plasticity [FILL]
				31.3		1 – 2 – 3			CLAYEY SILT (ML-CL) Dark brown, medium stiff, moist, low plasticit [ALLUVIUM]
		560 UC		26.7	85	– 1 – 4 – 5 – 6			CLAYEY SILT (ML-CL) Light gray brown, stiff, moist, low plasticit [ALLUVIUM]
						– 2 – 7 – 8 – 9 – 3 – 10			Bottom of boring at 6 feet, dry at time of drilling

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

Miller Pacific ENGINEERING GROUP
504 Redwood Blvd.
Suite 220
Novato, CA 94947
T:415 / 382-3444
F:415 / 382-3450
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FILE: 09-5084.dwg

BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-2
FIGURE

BORING 2

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09

ELEVATION: ~213.5-Feet*

*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
						0 – 0			CLAYEY SILT (ML) Light brown, stiff, dry, low plasticity [FILL]
				19.7	80	1 – 2 – 3 – 1			CLAYEY SILT (ML-CL) Dark brown, medium stiff, moist, low plasticit [ALLUVIUM]
						4 – 2			CLAYEY SILT (ML-CL) Light gray brown, stiff, moist, low plasticit [ALLUVIUM]
						5 – 6 – 3 – 7 – 8 – 9 – 10			Bottom of boring at 4 feet, dry at time of drilling

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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ENGINEERING GROUP
504 Redwood Blvd.
Suite 220
Novato, CA 94947
T:415 / 382-3444
F:415 / 382-3450
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FILE: 09-5084.dwg

BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-3
FIGURE

BORING 3

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09

ELEVATION: ~214.0-Feet*

*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0			CLAYEY SILT WITH SAND (ML) Light brown, stiff, dry, low plasticity [FILL]
							1			CLAYEY SILT (ML-CL) Dark brown, medium stiff, moist, low plasticit [ALLUVIUM]
							2			
							3			
						1				CLAYEY SILT (ML-CL) Light gray brown, stiff, moist, low plasticit [ALLUVIUM]
							4			
							5			
							6			Minor 3/4" subangular pebbles/gravel at 6'
						2				
							7			Bottom of boring at 7 feet, dry at time of drilling
							8			
							9			
						3	10			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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ENGINEERING GROUP
504 Redwood Blvd.
Suite 220
Novato, CA 94947
T:415 / 382-3444
F:415 / 382-3450
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FILE: 09-5084.dwg

BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-4
FIGURE

BORING 4

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09
ELEVATION: ~213.0-Feet*
*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
						0 – 0			CLAYEY SILT (ML) Light brown, medium stiff, dry, low plasticity [FILL]
						1			CLAYEY SILT (ML-CL) Mottled dark brown/light brown, soft to mediu stiff, moist, low to moderate plasticity [FILL]
						2			
						3			
						– 1			
						4			
						5			
						6			
						– 2			CLAYEY SILT WITH SAND (ML) Brown to light gray brown, stiff, moist, lo plasticity [ALLUVIUM]
						7			
						8			
						9			Bottom of boring at 9 feet, dry at time of drilling
						– 3 10			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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ENGINEERING GROUP
504 Redwood Blvd.
Suite 220
Novato, CA 94947
T:415 / 382-3444
F:415 / 382-3450
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BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California
Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-5
FIGURE

BORING 5

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09

ELEVATION: ~213.0-Feet*

*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
						0 – 0			CLAYEY SILT WITH SAND (ML) Light brown, medium stiff, dry to moist, lo plasticity [FILL]
		1550 UC		30.4	89	1 – 2 – 3 – 1 – 4			CLAYEY SILT (ML-CL) Dark brown, medium stiff, moist, low to moderate plasticity [ALLUVIUM]
						5 – 6 – 2			CLAYEY SILT WITH SAND (ML) Light gray brown to light brown, stiff, moist, lo plasticity [ALLUVIUM]
						7 – 8 – 9 – 3 – 10			Bottom of boring at 6 feet, dry at time of drilling

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-6
FIGURE

BORING 6

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09

ELEVATION: ~214.5-Feet*

*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
						0 – 0			CLAYEY SILT (ML) Light brown, medium stiff, dry, low plasticity with some cobbles [FILL]
						1			
						2			CLAYEY SILT (ML-CL) Dark brown, medium stiff, moist, low plasticity with cobbles [ALLUVIUM]
						3 – 1			
						4			Bottom of boring at 3.5 feet, refusal on cobble, dry at time of drilling
						5			
						6			
						2			
						7			
						8			
						9			
						3 10			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

Miller Pacific
ENGINEERING GROUP
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Suite 220
Novato, CA 94947
T:415 / 382-3444
F:415 / 382-3450
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BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-7
FIGURE

BORING 7

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09

ELEVATION: ~215.0-Feet*

*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0			CLAYEY SILT (ML) Light brown, medium stiff, dry, low plasticit [FILL]
							1			
							2			CLAYEY SILT (ML-CL) Dark brown, medium stiff, moist, low to moderate plasticity, with cobbles [ALLUVIUM]
							3			Bottom of boring at 3 feet, refusal on cobble, dry at time of drilling
						1	4			
							5			
							6			
						2	7			
							8			
							9			
						3	10			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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504 Redwood Blvd.
Suite 220
Novato, CA 94947
T:415 / 382-3444
F:415 / 382-3450
www.millerpac.com

FILE: 09-5084.dwg

BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-8
FIGURE

BORING 8

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09

ELEVATION: ~214.0-Feet*

*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
						0 - 0			CLAYEY SILT (ML) Light brown, medium stiff, dry, low plasticity [FILL]
						1			SILTY SAND (SM) Brown, medium dense, moist, low plasticit [ALLUVIUM]
						2			
						3			SILTY CLAY (ML-CL) Dark brown to black, medium stiff, moist, low t moderate plasticity [ALLUVIUM]
						- 1			
						4			
						5			CLAYEY SILT (ML-CL) Gray brown, stiff, moist, low to moderate plasticity [ALLUVIUM]
						6			CLAYEY SILT (ML) Light gray brown, stiff, moist, low plasticit [ALLUVIUM]
						- 2			
						7			Bottom of boring at 7 feet, dry at time of drilling
						8			
						9			
						- 3			
						10			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-9
FIGURE

BORING 9

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09
ELEVATION: ~212.5-Feet*
*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
						0 – 0			CLAYEY SILT (ML) Light brown, medium stiff, dry, low plasticit [FILL]
		440 UC		22.9	79	1 – 2 – 3 – 1			CLAYEY SILT (ML-CL) Dark brown, medium stiff, moist, low to moderate plasticity [ALLUVIUM]
						4 – 5 – 6 – 2			CLAYEY SILT (ML) Light gray brown to gray brown, stiff, moist, lo plasticity [ALLUVIUM] Bottom of boring at 4 feet, dry at time of drilling
						7 – 8 – 9 – 3 – 10			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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F:415 / 382-3450
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BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California
Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-10
FIGURE

BORING 10

EQUIPMENT: 4" Diameter Manual Bucket Auger

DATE: 7/21/09

ELEVATION: ~213.0-Feet*

*REFERENCE: Topo Map used for Elevation

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
						0 – 0			CLAYEY SILT (ML) Light brown, medium stiff, dry, low plasticit [FILL]
		785 UC		28.1	85	1 – 2 – 3			CLAYEY SILT (ML-CL) Dark brown, medium stiff, moist, low to moderate plasticity [ALLUVIUM]
						1 – 4 – 5			CLAYEY SILT (ML) Light gray brown, stiff, moist, low plasticit [ALLUVIUM]
						2 – 6 – 7 – 8 – 9 – 3 – 10			Bottom of boring at 5.5 feet, dry at time of drilling

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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ENGINEERING GROUP
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Suite 220
Novato, CA 94947
T:415 / 382-3444
F:415 / 382-3450
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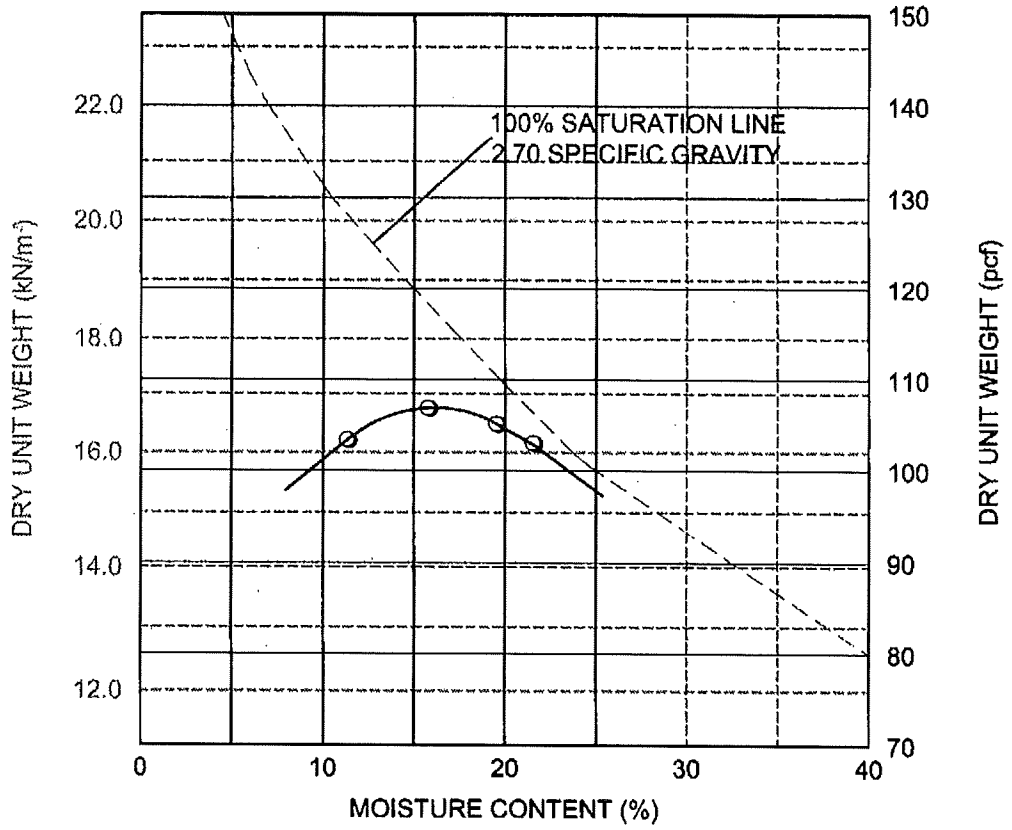
BORING LOG

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-11
FIGURE



NOTE: pcf x 0.157 = kN/m³ (rounded to 3 significant figures)

SYMBOL	SAMPLE SOURCE	CLASSIFICATION	OPTIMUM MOISTURE CONT. (%)	MAXIMUM DRY UNIT WEIGHT (kN/m³)	(pcf)
○	On-Site	CLAYEY SILT (ML-CL) dark brown	17.5	17.0	108

REFERENCE: ASTM Method D1557

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ENGINEERING GROUP
504 Redwood Blvd.
Suite 220
Novato, CA 94947
T 415 / 382-3444
F 415 / 382-3450
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FILE: 09-5084 Curve.dwg

COMPACTION CURVE

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 09-5084 Date: 8/11/09

Drawn JSC
Checked

A-12
FIGURE

MILLER PACIFIC ENGINEERING GROUP

October 1, 2018
File: 1610.01bltr.doc

Willowglen Homes
P. O. Box 2357
Healdsburg, California 95448

Attention: Mr. Ben vanZutphen

Re: Addendum to Geotechnical Engineering Report Dated February 22, 2011
Preliminary Evaluation of Liquefaction Potential and
Preliminary Recommendations for Mitigation of Liquefaction Induced Settlement (if any)
Proposed Hunter Residential Development
Lands of Hunter
Adams Street
St. Helena, California

Introduction and Scope

This report is an addendum to a geotechnical report by Miller Pacific Engineering Group dated February 22, 2011, which presented the results of a geotechnical investigation of the shallow soil conditions underlying the future Adams Street (Hunter Parcel) residential development, located on Adams Street in St. Helena, California (Site Location Map, Figure 1).

The proposed residential development is to consist of 51 single family residential lots and Lot 52, which is to be developed with 25 apartment units, as shown on the Site Plan, Figure 2. We understand that the proposed single family homes would typically consist of one or two story, wood frame structures with concrete slab-on-grade or raised wood floors. We anticipate that the apartment structures would also be one or two story wood frame structures. The proposed development would also include asphalt paved streets and concrete driveways, underground utilities, and associated improvements. No specific development plans are available at this time, however.

Regional geologic mapping indicates that the project site is underlain by an undetermined thickness of alluvial fan deposits consisting of poorly sorted sands and gravels, with interbedded silts and clays. A regional geologic map of the site and vicinity is shown on Figure 3.

The purpose of our services at this time is to provide a preliminary evaluation of liquefaction potential at the proposed development site, and provide an outline of typical mitigation measures to address the impacts of liquefaction induced ground settlement (if any) on the proposed development.

Liquefaction refers to the sudden, temporary loss of soil shear strength during strong ground shaking. Liquefaction-related phenomena include liquefaction-induced settlement, flow failure, and lateral spreading. These phenomena can occur where there are saturated, loose, granular deposits. Recent advances in liquefaction studies indicate that liquefaction can occur in granular materials with a high, 35 to 50%, fines content (soil particles that pass the #200 sieve), provided the fines exhibit a plasticity index of less than 7. The site is mapped regionally (ABAG, 2018) as having moderate susceptibility to liquefaction, as shown on Figure 4.

To evaluate soil liquefaction, the seismic energy from an earthquake is compared with the ability of the soil to resist pore pressure generation, known as the Cyclic Resistance Ratio (CRR). The earthquake energy is termed the cyclic stress ratio (CSR) and is a function of the maximum considered earthquake peak ground acceleration (PGA) and depth. Soil resistance to liquefaction is based on its relative density, and the amount and plasticity of the fines (silts and clays). The relative density of cohesionless soil is correlated with the Cone Penetration Test (CPT) tip resistance and Standard Penetration Test (SPT) blow count data measured in the field and corrected for hammer efficiency, overburden and percent fines.

Based on the available regional liquefaction susceptibility mapping and regional geologic mapping, the project site has a moderate risk of experiencing liquefaction and liquefaction induced ground surface settlement during a future strong earthquake.

Mitigation of Liquefaction Induced Settlement

For low rise commercial structures and light weight residential structures, mitigation of the impacts of liquefaction induced settlement is typically accomplished by the design of stiff, shallow mat slab or post-tensioned slab foundations or stiff, shallow grid foundations designed to resist distortion and wracking due to differential settlement. If predicted differential settlements are significant, utility connections to structures can be designed to be flexible to allow for some differential movement.

In many cases, liquefaction that occurs in relatively thin lenses or at greater depth beneath the ground surface may not result in settlement of the ground surface, and therefore would not have a negative impact on improvements at the ground surface.

Design Level Geotechnical Investigation

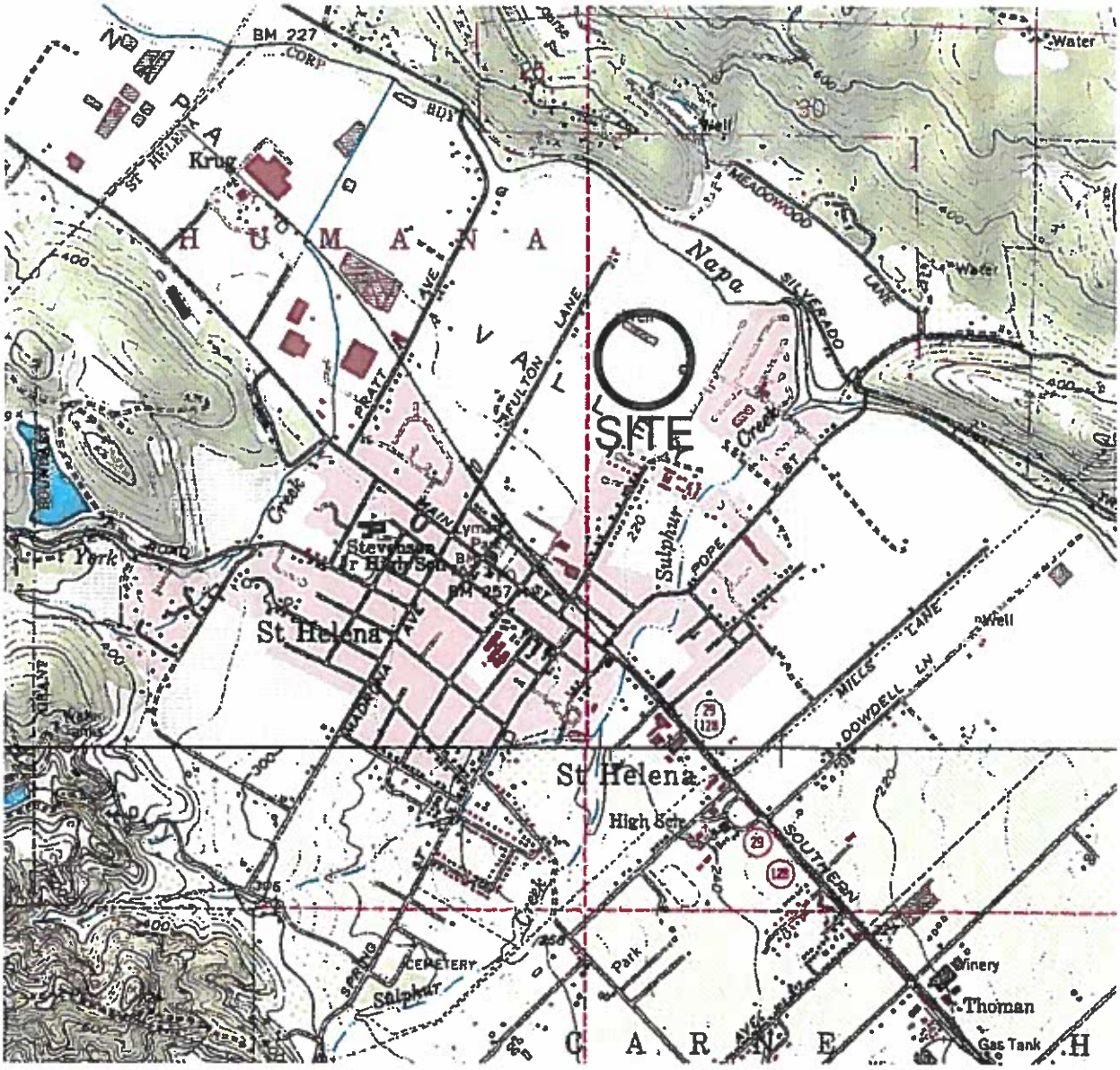
When more detailed plans are available for the proposed residential development, a much more detailed geotechnical study should be undertaken. This study would include much deeper borings and/or Cone Penetration testing, additional soil sampling, laboratory testing, and engineering analyses, including a more detailed evaluation of liquefaction potential and settlement potential based on an evaluation of the deeper soil conditions beneath the site.

If you have any questions, or if we can be of further assistance, please call us at your convenience.

Yours very truly,
MILLER PACIFIC ENGINEERING GROUP

Daniel S. Caldwell
Geotechnical Engineer No. 2006
(Expires 9/30/19)

Enclosures: Figures 1 through 4



SITE LOCATION

SCALE

0 1000 2000 4000 FEET

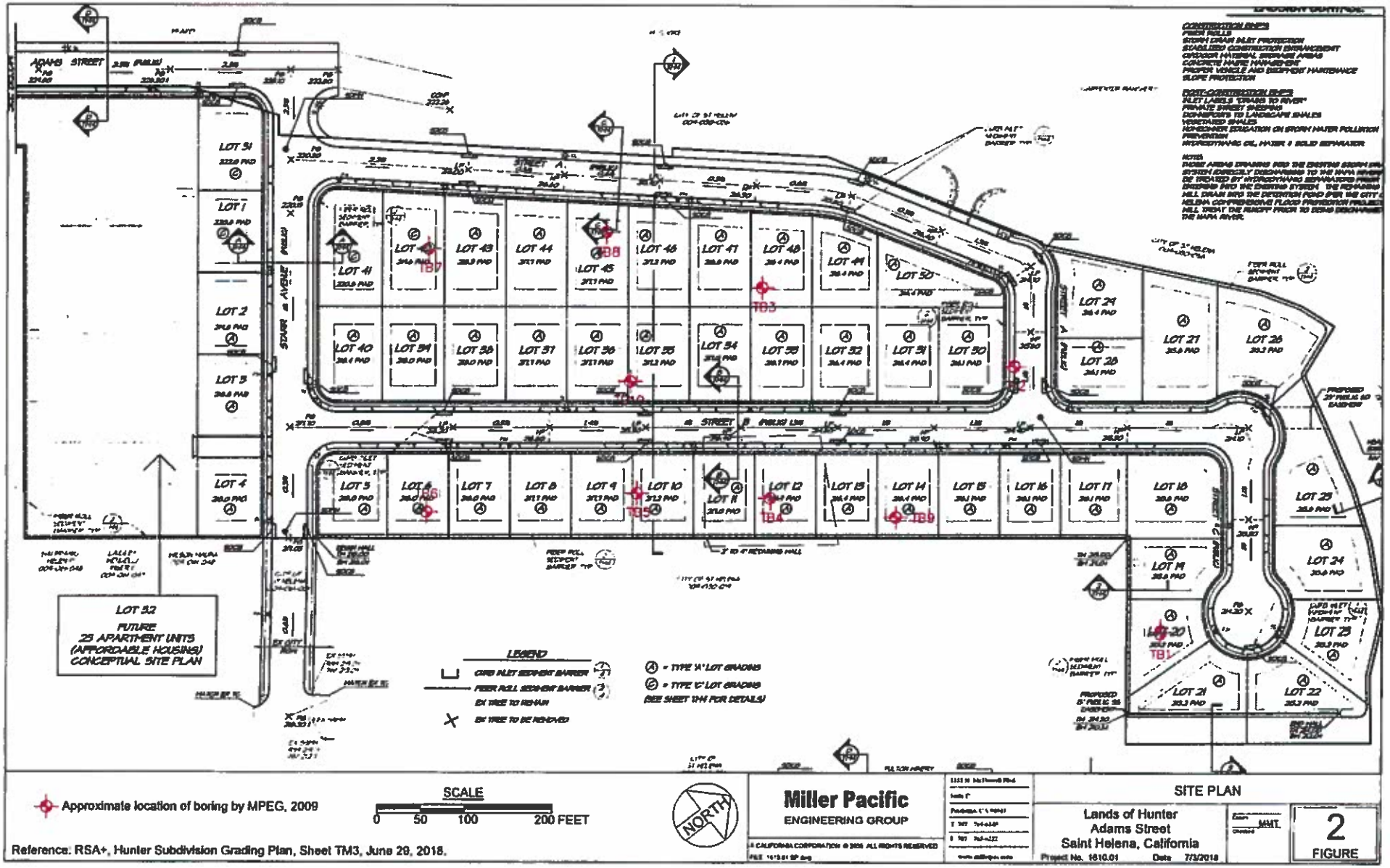
0 500 1000 METERS

NORTH

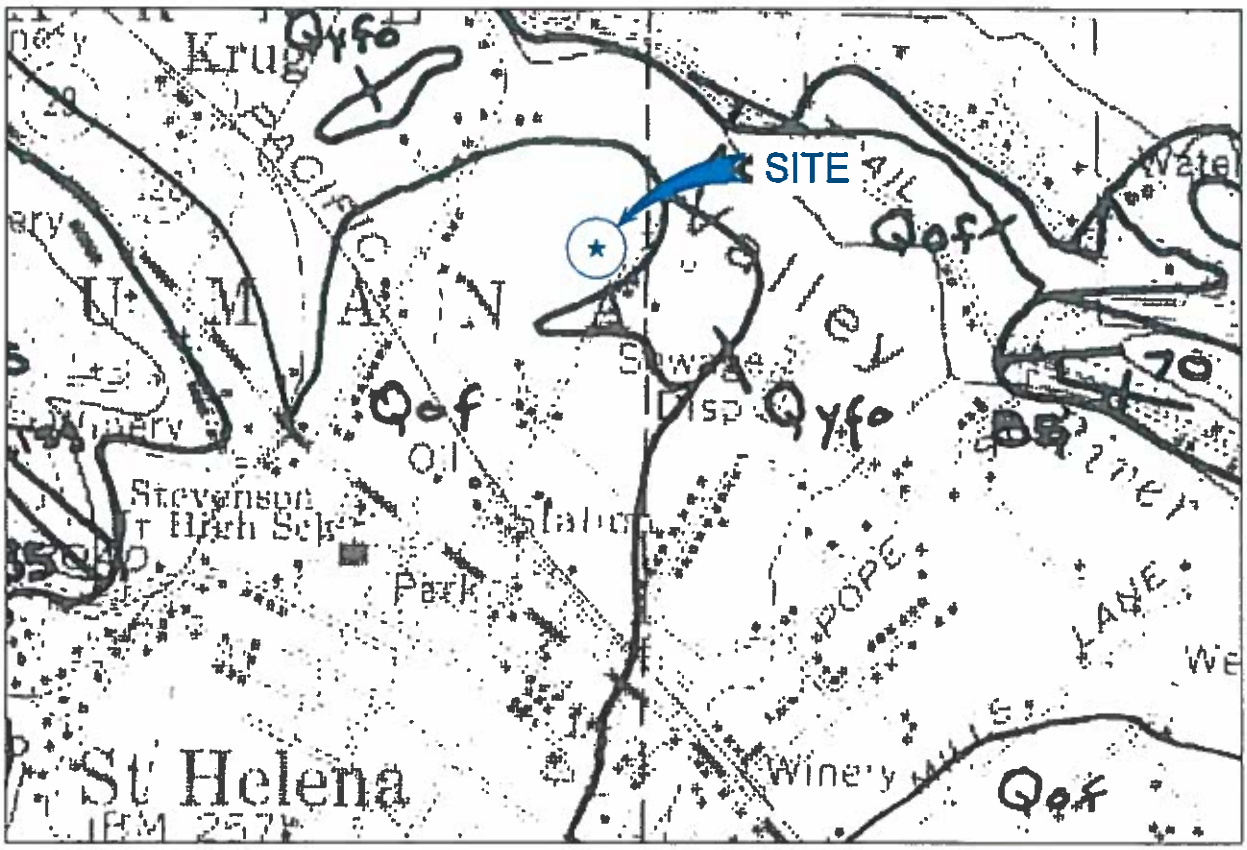
REFERENCE: DeLorme 3D TopoQuads, 1999

Miller Pacific ENGINEERING GROUP	504 Redwood Blvd. Suite 220 Novato, CA 94947 T 415 / 382-3444 F 415 / 382-3450 www.millerpac.com	SITE LOCATION MAP Lands of Hunter Adams Street Saint Helena, California Project No. 1610.01 Date: 7/3/2018	Drawn MMT Checked	1 FIGURE

FILE: 1610.01 SLM.dwg



Reference: RSA+, Hunter Subdivision Grading Plan, Sheet TM3, June 29, 2018.



REGIONAL GEOLOGIC MAP

(NOT TO SCALE)

NORTH

LEGEND:

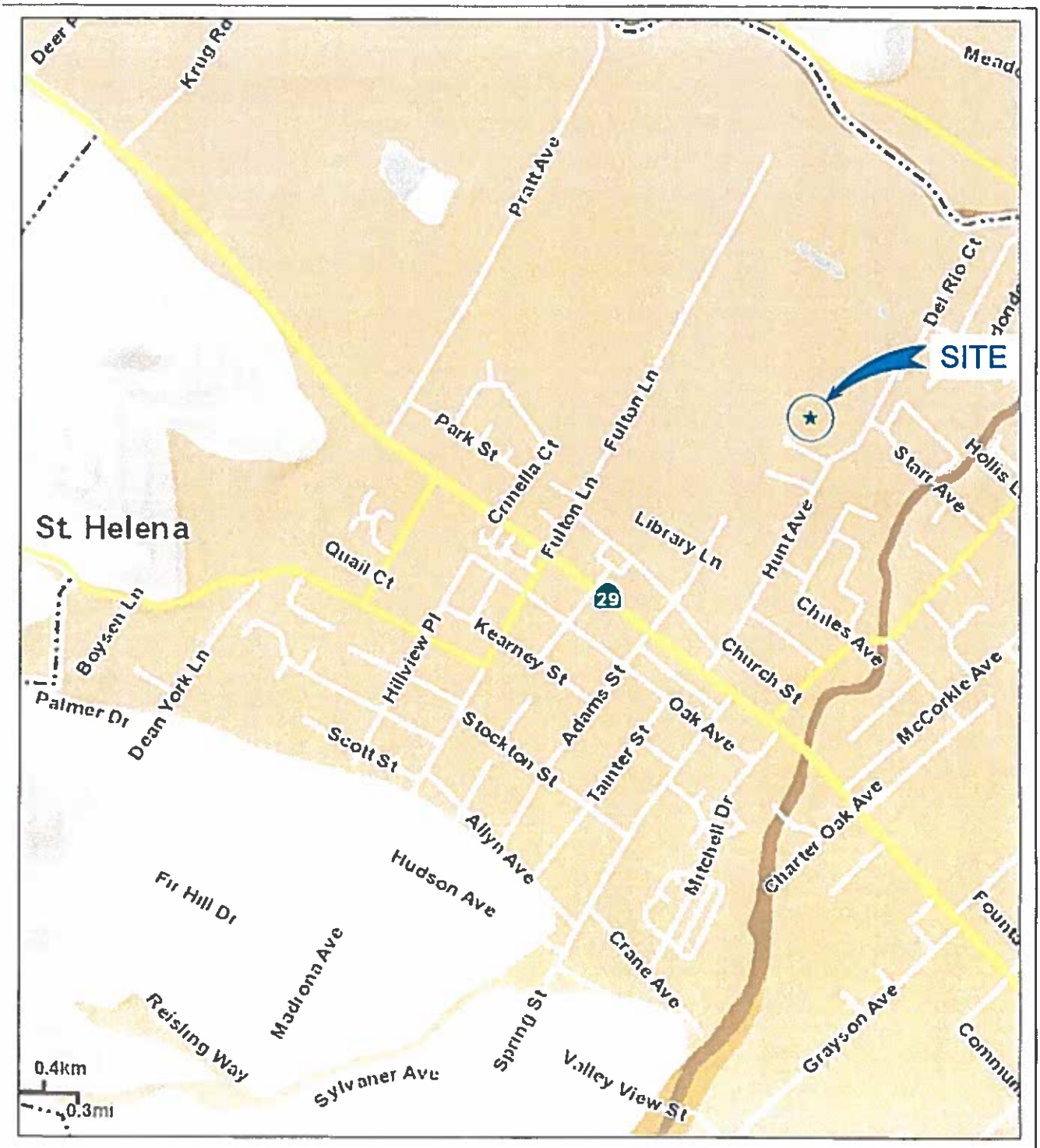
Qof: Alluvial fan deposits bordering uplands; heads of fans incised by channels partly filled by terraced deposits of younger alluvium; mainly deeply weathered poorly sorted coarse sand and gravel.

Qyfo: Fluvial deposits at the outer edge of alluvial fans; forms levees between basin deposits; characterized by fine, but variable, grain size; composed mainly of fine sand, silt, and silty clay.

Reference: K.F. Fox, Jr., J.D. Sims, J.A. Bartow and E.J. Helley, "Preliminary Geologic Map of Eastern Sonoma County and Western Napa County, California, Sheet 3 of 4, 1973.

Miller Pacific ENGINEERING GROUP	1333 N. McDowell Blvd. Suite C Petaluma, CA 94954 T 707 / 765-6140 F 707 / 765-6222 www.millerpac.com	REGIONAL GEOLOGIC MAP Lands of Hunter Adams Street Saint Helena, California Project No. 1610.01 Date: 7/3/2018	Drawn MMT Checked	3 FIGURE

FILE: 1610.01 SP.dwg



Susceptibility Level:

Very High | Moderate | Very Low | Local Road

High | Low | Major Road

No Scale

NORTH

Map Reference: ABAG Geographic Information System.

Miller Pacific
ENGINEERING GROUP

1333 N. McDowell Blvd.
Suite C
Petaluma, CA 94954
T 707 / 765-6140
F 707 / 765-6222
www.millerpac.com

FILE: 1610.01 SP.dwg

LIQUEFACTION SUSCEPTIBILITY MAP

Lands of Hunter
Adams Street
Saint Helena, California

Project No. 1610.01 Date: 7/3/2018

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Checked

4
FIGURE