Wallace Kuhl & ASSOCIATES

Geotechnical Engineering Report
ECONOMOU RESIDENCE
Stockton, California
WKA No. 9917.01
November 22, 2013

Prepared For:
Mr. Alexandros Economou
10100 Trinity Parkway, 5th Floor
Stockton, California 95219

Geotechnical Engineering Report

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TABLE OF CONTENTS

Wallace Kuhl & ASSOCIATES

CORPORATE OFFICE
3050 Industrial Boulevard
West Sacramento, CA 95691
916.372.1434 phone
916.372.2565 fax

STOCKTON OFFICE
3422 West Hammer Lane, Suite D
Stockton, CA 95219
209.234.7722 phone
209.234.7727 fax

Geotechnical Engineering Report
ECONOMOU RESIDENCE
6030 Huntingdale Circle
Stockton, California
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INTRODUCTION

We have completed a geotechnical engineering investigation for the planned building additions to the existing residential structure located at 6030 Huntingdale Circle in Stockton, California. The purposes of our work have been to explore the existing site, soil, and groundwater conditions within the area of the planned additions, and to provide geotechnical engineering conclusions and recommendations regarding foundation support for the additions.

Scope of Work

Our scope of work included the following:

1. Review of available topographic information, recent aerial photographs of the site, and available geologic references;
2. Subsurface investigation, including the drilling and sampling of four exploratory test borings to a maximum depth of approximately 10 feet below the existing site grades.
3. Laboratory testing of selected soil samples;
4. Engineering analyses; and,
5. Preparation of this report.

Figures and Attachments

This report contains a Vicinity Map as Figure 1; a Site Plan showing approximate test boring locations as Figure 2; and Logs of Soil Borings as Figures 3 through 6. An explanation of the symbols and classification system used on the logs is included as Figure 7. Appendix A contains information of a general nature regarding project concepts, exploratory methods used during the field exploration phase of our investigation, an explanation of laboratory testing accomplished, and laboratory test results.

Project Description

The planned additions to the existing two-story wood-framed home include expansion of the kitchen and expansion of the second story master suite toward the rear of the home. A future expansion may include enlarging the residence to the north (left side of home). The expansion areas currently are covered in exterior concrete slabs-on-grade. Deep foundations are being considered for support of the additions.

Previous Investigations

We were provided the following documents to assist us in the performance of this investigation.

- June 3, 1992, Kleinfelder, Inc., "Report, Geotechnical Investigation, Proposed Southwest Area Brookside Development, Stockton, California," consultant's report prepared for Grupe Development of Northern California.
- October, 29, 1992, Kleinfelder, Inc., "Addendum to Geotechnical Investigation Dated June 3, 1992, Proposed Huntingdale Subdivision, Brookside Development, Stockton, California," consultant's report prepared for Grupe Development.
- August 19, 1994, Kleinfelder, Inc., "Post Tensioning Stressing Observations, Lot 836, Huntingdale Subdivision, Brookside Development – Stockton, CA," consultant's report to Grupe of Northern California.

FINDINGS

Site Description

The existing two-story structure was constructed in 1994 on a post-tensioned slab foundation at 6030 Huntingdale Circle in the Brookside Development of Stockton, California (see Figure 1). The planned addition sites currently are covered in exterior slab-on-grade concrete at the rear and left sides of the home. A former swimming pool at the northeast corner of the lot was recently demolished and filled with soil. The front yard is landscaped with a mature oak tree near the entrance to the home. The rear yard is covered with typical residential landscape lawn and vegetation.

The interior wall surfaces and exterior stucco are reasonably free of significant cracking leading us to believe that the structure has not been subjected to unusual total or differential settlement.

Soil Conditions

The surface and near-surface soils revealed in our exploratory borings indicate the upper soil layer to consist of approximately three feet of light brown silty fine sandy clays. The surface soils are stiffer in the two borings (D2 and D3) drilled near the existing home perimeter. The surface soils are markedly softer (easier to penetrate) in the borings (D1 and D4) drilled away from the perimeter of the home. The upper surface soils are underlay by soft, black, silty clay to a depth of about seven feet below existing surface grades. The soils transition to stiffer, greenish-gray, silty clays that are present to the maximum depth explored of 10 feet below existing grades.

Please refer to the Logs of Soil Borings, Figures 3 through 6, for further details regarding the soil conditions at a particular boring location.

Groundwater

Groundwater was encountered in Boring D1 drilled in a landscape planter at the front of the home at a depth of about 7½ feet below grade. Groundwater was not encountered in the remaining three test borings performed at the site on October 21, 2013, to the maximum depth explored of approximately 10 feet below existing site grades.

Based on the previous geotechnical work in this area, it is likely that groundwater is located at or near the bottom of our exploration, and would rise and fall in response to the flow stage of the nearby river and delta water courses.

CONCLUSIONS

Bearing Capacity

It appears that the upper three feet of soil supporting the existing post-tensioned slab foundation, including the zone extending three to five feet beyond the building footprint, is composed of compacted imported soil. The soil beyond the existing building footprint and underneath the engineered fill is soft, potentially compressible, low density silty clay.

In our opinion, the near surface soils at the planned addition areas are not capable of supporting conventional foundation loads without experiencing damaging differential settlement. Use of a post-tensioned slab mat foundation or conventional mat foundation to support building additions would result in a relatively low bearing pressure, but would still be subject to some settlement relative to the existing structure.

Use of a deep foundation system consisting of helical anchors or drilled cast-in-place reinforced concrete foundations are considered prudent for support of the planned building addition. The foundations would derive their load carrying capacity from the stiffer clay soils located at a depth of about seven feet below existing surface grades.

<u>Seismic Code Parameters</u>

2010 CBC/ASCE 7-05 Seismic Design Criteria

The 2010 edition of the California Building Code (CBC) references American Society of Civil Engineers (ASCE) Standard 7-05 for seismic design. The following seismic parameters were determined based on the site latitude and longitude using the public domain computer program developed by the USGS. The following parameters summarized in the table below may be used for seismic design of the proposed building additions.

Table 1a –2010 CBC/ASCE 7-05 Seismic Design Parameters

Latitude: 37.9763° N Longitude: 121.3690° W	ASCE 7-05 Table/Figure	2010 CBC Table/Figure	Factor/ Coefficient	Value
Short-Period MCE at 0.2s	USGS[1]	USGS[1]	S_S	0.911 g
1.0s Period MCE	USGS[1]	USGS[1]	S_1	0.313 g
Soil Profile	Table 20.3-1	Table 1613.5.2	Site Class	D
Site Coefficient	Table 11.4-1	Table 1613.5.3(1)	F_a	1.136
Site Coefficient	Table 11.4-2	Table 1613.5.3(2)	F_v	1.773
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-36	S_{MS}	1.035 g
	Equation 11.4-2	Equation 16-37	S_{M1}	0.556 g
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-38	S_{DS}	0.690 g
	Equation 11.4-4	Equation 16-39	S_{D1}	0.370 g
Seismic Design Category	Table 11.6-1	Section 1613.5.6	Occupancy I to IV	D
	Table 11.6-2	Section 1613.5.6	Occupancy I to IV	D

2013 CBC/ASCE 7-10 Seismic Design Criteria

Section 1613 of the 2013 edition of the CBC references ASCE Standard 7-10 for seismic design. The following seismic parameters were determined based on the site latitude and longitude using the public domain computer program developed by the USGS. The following parameters summarized in the table below may be used for seismic design of the proposed building additions.

Table 1b –2013 CBC/ASCE 7-10 Seismic Design Parameters

Latitude: 37.9763° N Longitude: 121.3690° W	ASCE 7-10 Table/Figure	2013 CBC Table/Figure	Factor/ Coefficient	Value
Short-Period MCE at 0.2s	Figure 22-1	Figure 1613.3.1(1)	S_S	0.966 g
1.0s Period MCE	Figure 22-2	Figure 1613.3.1(2)	S_1	0.351 g
Soil Class	Table 20.3-1	Section 1613.3.2	Site Class	D
Site Coefficient	Table 11.4-1	Table 1613.3.3(1)	F_a	1.114
Site Coefficient	Table 11.4-2	Table 1613.3.3(2)	F_v	1.697
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-37	S_{MS}	1.076 g
	Equation 11.4-2	Equation 16-38	S_{M1}	0.596 g
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-39	S_{DS}	0.717 g
	Equation 11.4-4	Equation 16-40	S_{D1}	0.398 g
Seismic Risk Category	Table 11.6-1	Section 1613.3.5(1)	Risk Category I to IV	D
	Table 11.6-2	Section 1613.3.5(2)	Risk Category I to IV	D

Excavation Conditions

Our borings indicate the soils encountered within the project area should be readily excavatable with conventional earthmoving and trenching equipment typically used in the area. Excavations likely will stand at a near-vertical inclination for short periods of time required for construction. Excavations/trenches deeper than five feet that will be entered by workers should be shored, sloped or braced in accordance with current Cal/OSHA regulations.

Fill Material Suitability

The on-site soils are considered suitable for use as engineered fill materials, provided these materials are free from concentrations of organics, over-size rock, rubble, or other deleterious materials and are at the proper moisture content for compaction.

The native clay soils should not be used as fill within one foot of interior or exterior slab-on-grade concrete.

Expansive Soil

Laboratory tests indicate the near surface on-site clays possess a medium expansion potential when tested in accordance with ASTM D4829 test method (Figure A2). Based on our experience, on-site clays are considered capable of exerting significant expansion pressures upon building foundations and slabs-on-grade concrete. Specific recommendations to reduce the effects of expansive soils on the planned improvements are presented in later sections of this report.

Soil Corrosion Potential

One representative soil sample was submitted to Sunland Analytical Lab, Inc. for testing to determine pH, resistivity, and sulfate and chloride concentrations to help evaluate the potential for corrosive attack upon reinforced concrete and buried metal. Results of these tests reveal a minimum resistivity value of 1070 ohm-centimeters (Ω-cm), a soil pH value of 8.02, chloride concentration of 11.0 parts per million (ppm) and sulfate concentration of 21.9 ppm for the sample tested. A copy of the analytical report is provided on Figure A3.

Published literature[1] defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, or has a pH of less than 5.5. The corrosivity test results suggest that the native soils are not highly corrosive to steel reinforcement properly embedded within Portland cement concrete for the samples tested, but could be corrosive to exposed buried metal. Table 4.3.1 – *Requirement for Concrete Exposed to Sulfate-Containing Solutions*, American Concrete Institute (ACI) 318, Section 4.3, as referenced in section 1904.3 of the 2007 CBC, indicates the sulfate exposure for the samples tested is *Negligible*. Ordinary Type I-II Portland cement is considered suitable for use on this project, assuming a minimum concrete cover is maintained over the reinforcement.

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[1] California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch, *Corrosion Guidelines,* version 1.0, September 2003.

Wallace-Kuhl & Associates are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site, or to determine the need or design parameters for cathodic protection or grounding systems, a corrosion engineer should be consulted.

Groundwater

Groundwater should be expected within 10 feet of the ground surface. This could affect the installation of underground utilities or deep foundation systems. Contractors should be prepared for groundwater in excavations and wet soil regardless of the time of year of construction.

Seasonal Moisture

During the wet season, infiltrating surface water can create a saturated or perched water condition within the surface soils. Grading operations attempted following the onset of winter rains and prior to prolonged drying periods will be hampered by high soil moisture contents. Such soils, intended for use as engineered fill, will require considerable aeration and/or drying to reach a moisture content that will permit the soils to be properly compacted. This should be considered in the construction schedule for the project.

The soils present beneath existing slab-on-grade concrete, and soils present in existing landscaped areas will be wet regardless of the time of year of construction.

RECOMMENDATIONS

Site Clearing and Site Preparation

Initially, the site should be cleared of the existing slabs and underground utilities to be abandoned. Excavations or depressions resulting from the removal of these items should be restored with engineered fill in accordance with the recommendations of this report.

Engineered Fill Construction

Engineered fill should be placed in horizontal lifts not exceeding six inches in compacted thickness. Each layer should be uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 90 percent of the maximum dry density, as defined above. Fill materials should be uniformly moisture conditioned to the full depth of each lift. Compactive effort should be applied uniformly across the full width of the fill.

Deeper fills can be made using on site soils if free of rubble, rubbish, or concentrations of organics and are at a moisture content that will allow the specified compaction. Imported fill materials, if required, should be compactable granular soils with an Expansion Index of 20 or less and be free of particles greater than three inches in maximum dimension. Aggregate road base (Caltrans Class 2 AB) would be suitable for use as fill. Imported soils should be approved by the geotechnical engineer prior to being transported to the site.

Utility Trench Backfill

Excavation conditions are described in a previous section of this report. Utility trenches should be sloped or shored in accordance with Cal/OSHA standards. In general, utility trench backfill materials should consist of on-site soils or approved imported materials. Initial backfill should comply with applicable standards and specifications, or with the pipe manufactures' recommendations.

We recommend that underground utility trenches that are aligned nearly parallel with foundations be set no closer than three feet from the outer edge of foundations. As a general rule, trenches should not encroach into the zone extending outward at a 1:1 inclination from the bottom edge of foundations. Additionally, trenches near foundations should not remain open longer than 72 hours to prevent drying and potential shrinkage cracks. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.

Utility trench backfill within structural areas should be compacted to at least 90 percent of the maximum dry density (ASTM D1557) at two percent above the optimum moisture content in six-inch thick lifts if the backfill material consists of soils with particle sizes that are predominantly less than ¾-inch. Jetting of trench backfill as the sole means to achieve compaction is not recommended.

Foundation Design

The proposed residential building addition structures may be supported upon a perimeter grade beam supported by deep foundations. The deep foundation can consist of helical anchors or drilled, cast-in-place reinforced concrete friction piers. Grade beams should be at least 12 inches wide and embedded at least 18 inches below lowest adjacent soil grade. Interior columns may be supported on a reinforced concrete cap cast over the anchor or pier. Reinforcement of the grade beam and caps should be determined by the structural engineer.

Helical Anchors

Helical anchors should be installed by a contractor with a minimum of at least five years of experience with similar installations. Anchors should be installed to an ultimate capacity of 20 kips and allowable dead plus live load capacity of 10 kips per anchor. The allowable capacity can be increased by one-third for evaluation of wind or seismic loads. Uplift capacity of the anchor can be assumed to be equal to the allowable 10 kips per anchor.

Helical anchors must be installed at least 15 feet below existing grade, but deeper installation may be required to achieve the design capacity. The helical pier installer must prepare a submittal for approval by the owner and geotechnical engineer describing the equipment and methods to be used and documentation of past load testing to correlate installation torque to vertical load capacity.

Resistance to lateral displacement of the grade beam or anchor cap may be computed using an allowable passive earth pressure against the vertical projection of the grade beam or cap equal to an equivalent fluid pressure of 250 psf per foot of depth. Where the soil adjacent to the grade beam or cap is exposed to weather (uncovered by concrete), the upper 18 inches of passive resistance should be neglected due to the potential that the soil could desiccate and shrink away from the foundation.

Drilled Piers

Drilled, cast-in-place reinforced concrete piers should be a minimum of 12 inches in diameter and must be embedded at least 10 feet below existing grade. Vertical compression and tension capacity of the piers can be determined using an allowable dead plus live load skin friction resistance of 600 psf applied over the portion of the pier embedded within the stiffer clays located seven feet below grade. We estimate that an embedment depth of at least 12½ feet below existing grade would be necessary to achieve an allowable 10 kip capacity. Increased capacity of the pier can be achieved by increasing the depth and/or diameter of the pier.

Groundwater should be expected within the pier excavations. Where pier excavations will not stay open to allow cleaning, installation of rebar, and placement of concrete, appropriate casing should be used. The contractor should assume that the softer clay soils in the upper seven feet will be unstable, soils below the water table will slough, and the pier excavations will require casing.

Sizing of piers to resist lateral loads can be evaluated using Section 1807.1 of the 2010 California Building Code (CBC). A value of 150 pcf for lateral bearing as defined in Table 1806.2 of the CBC may be used for the coefficients S_1 and S_3 for the nonconstrained and constrained conditions, respectively. Per Table 1804.2 of the 2010 CBC, an increase of 1/3 is permitted when using the alternate load combinations in Section 1605.3.2 that include wind or earthquake loads.

Due to the presence of expansive soils at this site, overspill of concrete at the top of the foundation piers must be avoided.

Foundation excavations should be observed by a representative of this firm to evaluate the need for any modifications to these recommendations as may be required by specific circumstances. The observations should take place prior to placement of reinforcing steel but following cleaning of the excavations.

Exterior Flatwork

Exterior slab-on-grade concrete (e.g. sidewalks, patios, etc.) should be supported on at least 12 inches of compacted, imported granular soil, unless seasonal vertical movement of the slabs is acceptable. The native soils beneath the non-expansive layer should be uniformly compacted to at least 90 percent relative compaction and thoroughly moisture conditioned to at least two percent above the optimum moisture, and maintained in that moisture condition until covered by the non-expansive soil layer. Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of the perimeter building foundation and isolated column foundations by the placement of a layer of felt material between the flatwork and the foundation.

Slab reinforcement for crack control, if desired, should consist of No. 3 reinforcing bars at 18-inch centers each way, located at the mid-depth of the concrete.

Consideration should be given to thickening the edges of sidewalks and other exterior flatwork to at least twice the slab thickness. Areas adjacent to new exterior flatwork should be landscaped to maintain more uniform soil moisture conditions adjacent to and under the flatwork. We recommend that final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork.

Practices recommended by the Portland Cement Association for proper placement, curing, joint depth and spacing, construction, and placement of concrete should be followed during exterior concrete flatwork construction.

Site Drainage

Lot drainage should be accomplished to provide positive drainage of surface water away from the home. The grade adjacent to the home should be sloped away from foundations at a minimum two percent. Proper control of surface water drainage is essential to the performance of foundations, slabs-on-grade and pavements. Downspouts from roof drains should be connected to rigid non-perforated piping directed to an appropriate drainage point away from the home, or discharging onto paved surfaces leading away from the house and foundations. Concentrated storm water discharge collected from roof downspouts or surface drains should not be allowed to drain on unprotected slopes adjacent to structures. The ground should be graded to drain positively away from all pavements, slabs, and the residence. Ponding of surface water should be avoided near foundations, slabs, and pavements.

Future Services

We recommend that our firm be given the opportunity to review the final plans and specifications to verify that the intent of our recommendations has been implemented in those documents.

LIMITATIONS

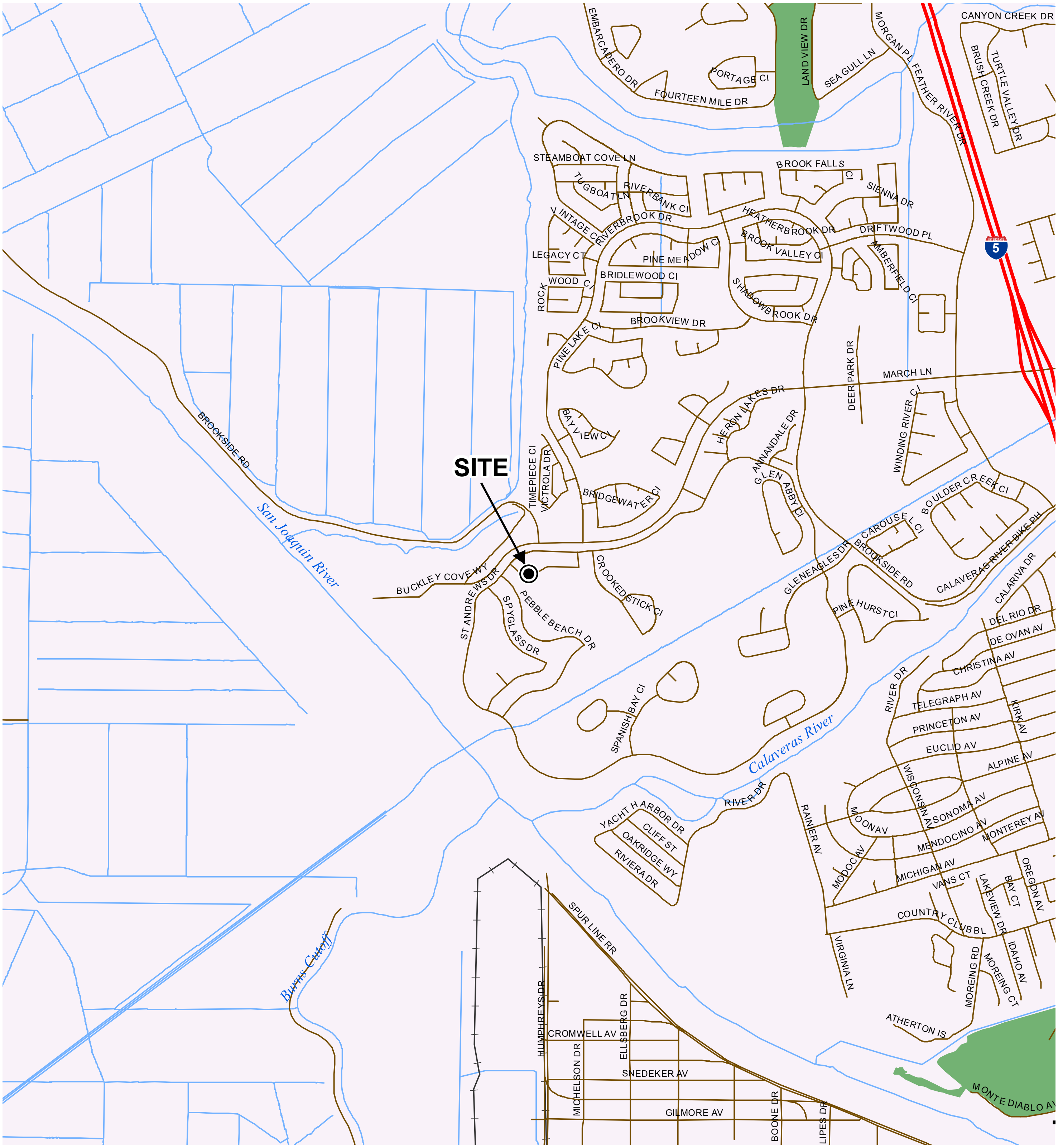
Our recommendations are based upon the information provided regarding the proposed development combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used our best engineering judgment based upon the information provided and the data generated from our investigation. If the proposed construction is modified or re-sited; or, if it is found during construction that subsurface conditions differ from those we encountered at the boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We emphasize that this report is applicable only to the proposed development and the investigated site and should not be utilized for construction on any other site. This report is considered valid for the proposed construction for a period of two years following the date of this report. If construction has not started within two years, we must re-evaluate the recommendations of this report and update the report, if necessary.

Wallace - Kuhl & Associates

REGISTERED PROFESSIONAL ENGINEER
DAVID R. GIUS, JR.
NO. 2318
Exp. 9/30/14
GEOTECHNICAL
STATE OF CALIFORNIA

David R. Gius, Jr.
Senior Engineer



Street data courtesy of San Joaquin County.
Hydrography courtesy of the U.S. Geological Service
acquired from the GIS Data Depot, December, 2007.
Projection: NAD 83, California State Plane, Zone III

N

0 1,000 2,000
Feet

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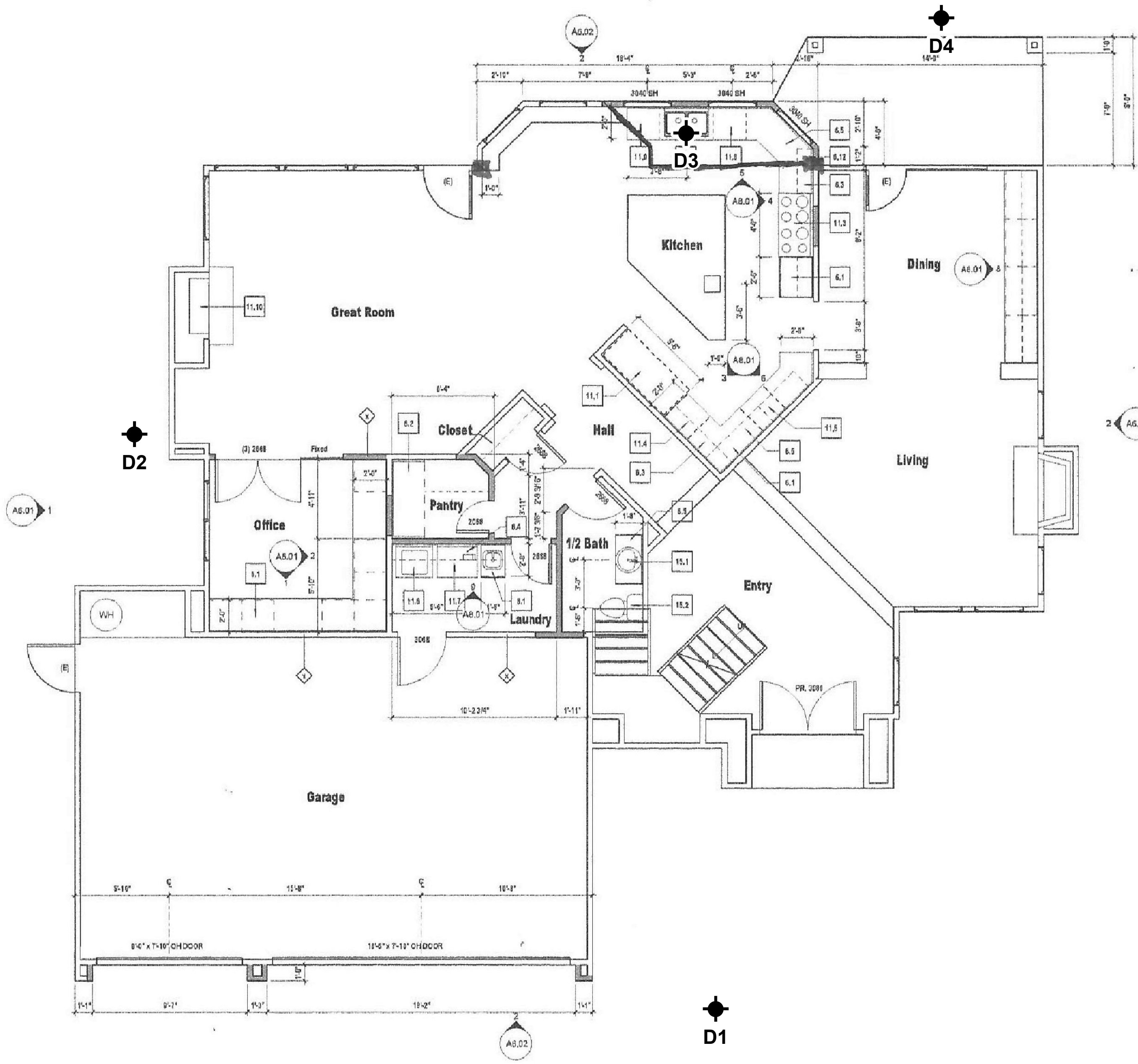
VICINITY MAP
ECONOMOU RESIDENCE ADDITIONS
6030 Huntingdale Circle
Stockton, California

FIGURE	1
DRAWN BY	TJC
CHECKED BY	DRG
PROJECT MGR	DRG
DATE	11/13

WKA NO. 9917.01



Adapted from a drawing prepared by LDA Partners, dated October 11, 2013.
Projection: NAD 83, California State Plane, Zone III

Legend
Approximate soil boring location

0 5 10
Feet

SITE PLAN
ECONOMOU RESIDENCE ADDITIONS
6030 Huntingdale Circle
Stockton, California

FIGURE	2
DRAWN BY	TJC
CHECKED BY	DRG
PROJECT MGR	DRG
DATE	11/13
WKA NO. 9917.01	

Project: Economou Residence Project Location: Stockton, California WKA Number: 9917.01	LOG OF SOIL BORING D1 Sheet 1 of 1

Date(s) Drilled	10/21/13	Logged By	DRG	Checked By	DRG
Drilling Method	Solid Flight Auger	Drilling Contractor	WKA	Total Depth of Drill Hole	9.5 feet
Drill Rig Type	Giddings Drill Rig mounted on Gator UTV	Diameter(s) of Hole, inches	4"	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	7.5	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	70-lb slide hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, slightly moist, silty fine sand (SM)						
			Light brown, slightly moist, fine to medium sandy clay (CL)						
			Black, moist, silty clay (CL)		D1-1I		45.4	65	
	5		some olive mottling						
					D1-2I		103.1	45	
			Greenish gray, wet, fine sandy clay (CL)						
					D1-3I				

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FIGURE 3

Project: Economou Residence **Project Location:** Stockton, California **WKA Number:** 9917.01	**LOG OF SOIL BORING D2** Sheet 1 of 1

Date(s) Drilled	**10/21/13**	Logged By	**DRG**	Checked By	**DRG**
Drilling Method	**Solid Flight Auger**	Drilling Contractor	**WKA**	Total Depth of Drill Hole	**10.0 feet**
Drill Rig Type	**Giddings Drill Rig mounted on Gator UTV**	Diameter(s) of Hole, inches	**4"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	**Not Encountered**	Sampling Method(s)	**California Modified**	Drill Hole Backfill	**soil cuttings**
Remarks				Driving Method and Drop	**70-lb slide hammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			4" Concrete Slab						
			Brown, moist, fine to medium sandy clay (CL)						
				■	D2-1I		22.4	100	
			Black, moist, silty clay (CL)						
				■	D2-2I		54.4	62	
	5								
			greenish gray						
				■	D2-3I		23.0	98	
	10								

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FIGURE 4

Project: Economou Residence **Project Location:** Stockton, California **WKA Number:** 9917.01	**LOG OF SOIL BORING D3** Sheet 1 of 1

Date(s) Drilled	10/21/13	Logged By	DRG	Checked By	DRG
Drilling Method	Solid Flight Auger	Drilling Contractor	WKA	Total Depth of Drill Hole	10.5 feet
Drill Rig Type	Giddings Drill Rig mounted on Gator UTV	Diameter(s) of Hole, inches	4"	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	Not Encountered	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	70-lb slide hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: SAMPLE NUMBER	SAMPLE DATA: NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			4" Concrete Slab						
			Light brown, moist, very stiff, fine to medium sandy clay (CL)		D3-1I		21.7	103	UCC 2.7 (tsf)
			Black, moist, silty clay (CL)						
	5				D3-2I		56.5	58	
			Greenish gray, moist, fine to medium sandy clay (CL)						
	10				D3-3I				

Project: Economou Residence
Project Location: Stockton, California
WKA Number: 9917.01

LOG OF SOIL BORING D4

Date(s) Drilled	10/21/13	Logged By	DRG	Checked By	DRG
Drilling Method	Solid Flight Auger	Drilling Contractor	WKA	Total Depth of Drill Hole	10.5 feet
Drill Rig Type	Giddings Drill Rig mounted on Gator UTV	Diameter(s) of Hole, inches	4"	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet	Not Encountered	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	70-lb slide hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: SAMPLE NUMBER	SAMPLE DATA: NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			4" Concrete Slab						
			Light brown, moist, fine to medium sandy clay (CL)						
					D4-1I		23.8	94	
			Black, very moist, soft, silty clay (CL)						
	5				D4-2I		59.0	62	UCC 0.7 (tsf)
			Greenish gray, very moist, silty, fine to medium sandy clay (CL)						
	10				D4-3I		28.4	93	

BORING LOG 9917.01 - ECONNOMOU RESIDENCE.GPJ WKA.GDT 11/22/13 8:34 AM

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FIGURE 6

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - clay mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand - clay mixtures
FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size)	SILTS & CLAYS LL < 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		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL ≥ 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils
ROCK		RX		Rocks, weathered to fresh
FILL		FILL		Artificially placed fill material

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler

= Drive Sampler: no recovery

= SPT Sampler

= Initial Water Level

= Final Water Level

— — — = Estimated or gradational material change line

———— = Observed material change line

Laboratory Tests

PI = Plasticity Index

EI = Expansion Index

UCC = Unconfined Compression Test

TR = Triaxial Compression Test

GR = Gradational Analysis (Sieve)

K = Permeability Test

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

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UNIFIED SOIL CLASSIFICATION SYSTEM

ECONOMOU RESIDENCE ADDITIONS

6030 Huntingdale Circle

Stockton, California

FIGURE	7
DRAWN BY	TJC
CHECKED BY	DRG
PROJECT MGR	DRG
DATE	11/13

WKA NO. 9917.01

APPENDIX A

Field and Laboratory Testing Programs

APPENDIX A

A. GENERAL INFORMATION

The performance of a geotechnical engineering investigation at the site of the planned building additions to the existing residential structure located at 6030 Huntingdale Circle in Stockton, California, was authorized by Mr. Alexandros Economou on October 15, 2013. Authorization was for an investigation as described in our proposal letter of October 15, 2013, sent to our client Mr. Alexandros Economou, whose mailing address is 10100 Trinity Parkway, Stockton, California 95219; telephone (209) 955-2514.

In performing this investigation we made reference to a drawing prepared by LDA Partners, dated October 11, 2013.

The structural engineering consultant for this project is Mr. Tim Sloan of Harris and Sloan Consulting Group, Inc., 2295 Gateway Oaks Drive, Suite 165, Sacramento, CA 95833; telephone (916) 921-2800.

B. FIELD EXPLORATION

Four test borings were drilled on October 21, 2013, at the approximate locations indicated on Figure 2 utilizing a John Deere Gator mounted Giddings drill rig. The borings were drilled to maximum depths of approximately 10 feet below existing site grades using four-inch diameter, solid-stem helical flight augers.

At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D. Modified California sampler driven by a hand operated 70-pound slide hammer. The samples were retained in 2-inch diameter by 6-inch long thin-walled brass tubes contained within the sampler. Immediately after recovery, the soils in the tubes were visually classified by the field engineer and the ends of the tubes were sealed to preserve the natural moisture contents. All samples were taken to our laboratory for additional soil classification and selection of samples for testing.

The Logs of Soil Borings, Figures 3 through 6, contain descriptions of the soils encountered in each boring. A Boring Legend explaining the Unified Soil Classification System and the symbols used on the logs is contained on Figure 7.

C. LABORATORY TESTING

Selected undisturbed soil samples were tested to determine dry unit weight (ASTM D2937), natural moisture content (ASTM D4643), and unconfined compressive strength (ASTM D2166). The results of these tests are included on the boring logs at the depth each sample was obtained.

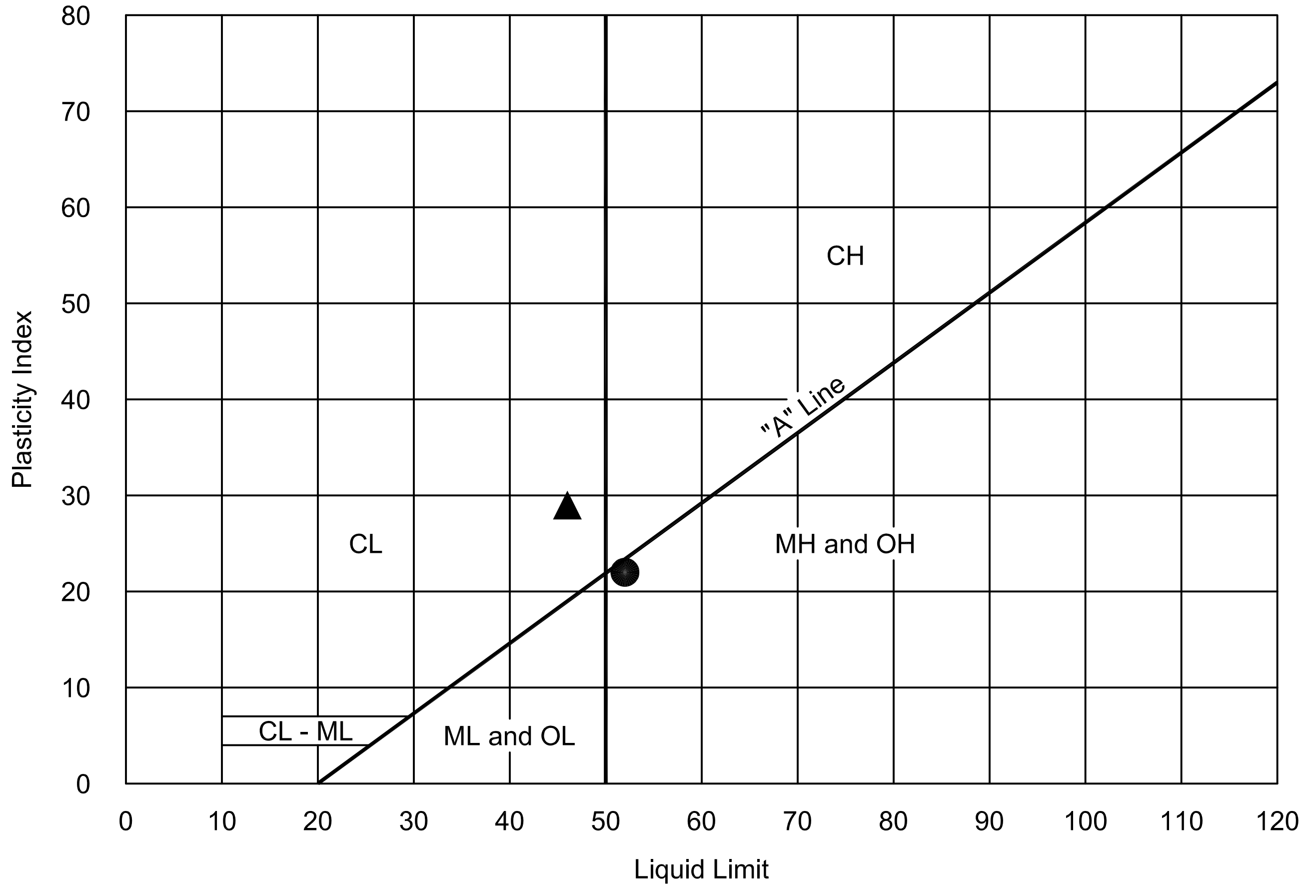
Two representative bulk samples of the near-surface soils within the building addition areas were subjected to Atterberg Limits testing (ASTM D4318). The results of the Atterberg Limits tests are presented on Figure A1.

One representative bulk sample of the near surface soils was subjected to Expansion Index testing (ASTM D4829). The results of the test are presented on Figure A2.

One sample of near-surface soils was submitted to Sunland Analytical to determine the soil pH and minimum resistivity (CT 643), sulfate concentration (CT 417) and chloride concentration (CT 422). Results from these tests are included on Figure A3.

ATTERBERG LIMITS

ASTM D4318



KEY SYMBOL	LOCATION	SAMPLE DEPTH	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		PASSING No. 200 SIEVE (%)	UNIFIED SOIL CLASSIFI-CATION SYMBOL
				LIQUID LIMIT (%)	PLACTICITY INDEX (%)		
●	D2, D3, D4	3' - 7'	---	52	22	---	MH
▲	D2, D3, D4	7' - 10'	---	46	29	---	CL

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ATTERBERG LIMITS
ECONOMOU RESIDENCE ADDITIONS
6030 Huntingdale Circle
Stockton, California

FIGURE	A1
DRAWN BY	TJC
CHECKED BY	DRG
PROJECT MGR	DRG
DATE	11/13
WKA NO. 9917.01	

EXPANSION INDEX TEST RESULTS

ASTM D4829

MATERIAL DESCRIPTION: Brown, silty clay

LOCATION: D2 & D3

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
0'-3'	14.0	26.8	97.3	**57**

CLASSIFICATION OF EXPANSIVE SOIL *

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	Low
51 - 90	**Medium**
91 - 130	High
Above 130	Very High

* From ASTM D4829, Table 1

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EXPANSION INDEX TEST RESULTS
ECONOMOU RESIDENCE ADDITIONS
6030 Huntingdale Circle
Stockton, California

FIGURE	A2
DRAWN BY	TJC
CHECKED BY	DRG
PROJECT MGR	DRG
DATE	11/13
WKA NO. 9917.01	

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 10/30/2013
Date Submitted 10/23/2013

To: David Gius
Wallace-Kuhl & Assoc.
3050 Industrial Blvd.
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 9917.01-ECONONOU Site ID : D2+D3 @ 0-3 FT.
Your purchase order number is 3572.
Thank you for your business.

* For future reference to this analysis please use SUN # 65785-136187.

EVALUATION FOR SOIL CORROSION

Soil pH	8.02		
Minimum Resistivity	1.07 ohm-cm (x1000)		
Chloride	11.0 ppm	00.00110	%
Sulfate	21.9 ppm	00.00219	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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CORROSION TEST RESULTS
ECONOMOU RESIDENCE ADDITIONS
6030 Huntingdale Circle
Stockton, California

FIGURE	A3
DRAWN BY	TJC
CHECKED BY	DRG
PROJECT MGR	DRG
DATE	11/13
WKA NO. 9917.01	