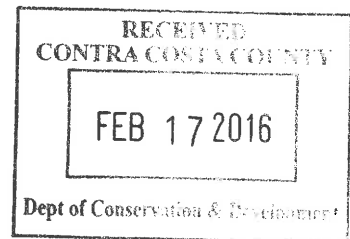


Geotechnical Investigation  
Date Received February 17, 2016

**PRELIMINARY GEOLOGIC AND GEOTECHNICAL INVESTIGATION  
PROPOSED 9-LOT RESIDENTIAL SUBDIVISION  
APNs 166-200-032 AND 166-210-008  
GLORIA TERRACE  
LAFAYETTE, CALIFORNIA**

**PREPARED FOR:  
MR. DAVID LANGON  
DAVID LANGON CONSTRUCTION, INC.**



SD16-9429

**By**

***GFK & ASSOCIATES, INC.  
Geotechnical Consultants***

**Project No. 1668  
February 4, 2016**

# **GFK & ASSOCIATES, INC.**

Geotechnical Consultants

Project No. 1668  
February 4, 2016

Mr. David Langon  
David Langon Construction, Inc.  
3189 Danville Boulevard, Suite 245  
Alamo, CA 94507

Subject: Proposed 9-Lot Residential Subdivision  
APNs 166-200-032 and 166-210-008  
Gloria Terrace  
Lafayette, California

## **PRELIMINARY GEOLOGIC AND GEOTECHNICAL INVESTIGATION**

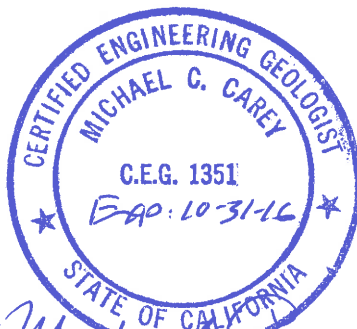
Dear Mr. Langon:

In accordance with your authorization, *GFK & ASSOCIATES, INC.* in association with Michael Carey, CEG of Adobe Geotech has conducted preliminary geologic and geotechnical investigation for the proposed subdivision on the subject site.

This report contains our findings pertaining to the geologic and geotechnical conditions of the site. Based on the data obtained, an evaluation was made for the feasibility of subdividing the subject site and future development of the individual lots. Our findings indicated that from a geologic and geotechnical viewpoint, it is feasible to construct the proposed houses and access driveway at the site provided the conclusions and recommendations in this report are followed.

Should you have any questions, please contact our office at your convenience.

Yours Sincerely,  
*GFK & ASSOCIATES, INC.*



Michael Carey, C.E.G.  
Consulting Engineering Geologist  
Adobe Geotech



Gus Khenaisser, G.E.  
Principal Geotechnical Engineer

Copies: 4 to addressee

## TABLE OF CONTENTS

	<u>Page No.</u>
TRANSMITTAL LETTER.....	2
PRELIMINARY GEOLOGIC AND GEOTECHNICAL INVESTIGATION .....	4
PURPOSE AND SCOPE.....	4
SITE LOCATION AND DESCRIPTION .....	4
PROPOSED DEVELOPMENT .....	5
PREVIOUS WORK .....	5
GEOLOGY AND SEISMICITY .....	6
BEDROCK AND FAULTS .....	6
SLOPE STABILITY .....	6
FIELD EXPLORATION AND SURFACE AND SUBSURFACE CONDITIONS.....	7
FIELD MAPPING AND SUBSURFACE EXPLORATION.....	7
RESULTS OF FIELD EXPLORATION.....	7
LABORATORY TESTING.....	9
DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS.....	9
LIMITATIONS .....	10
REFERENCES.....	11
APPENDIX.....	12
FIGURE 1, SITE LOCATION MAP .....	13
FIGURE 2, GEOLOGIC MAP (DIBBLEE).....	14
FIGURE 3, GEOLOGIC MAP (HAYDON) .....	15
FIGURE 4, GEOLOGIC MAP (CRANE) .....	16
FIGURE 5, LANDSLIDE MAP (NILSEN) .....	17
FIGURE 6, LANDSLIDE MAP (HAYDON).....	18
FIGURE 7, SITE SURFICIAL FEATURES MAP.....	19
LOGS OF TEST PITS .....	20
GFK EXPLORATORY BORING LOGS (2012).....	24
GFK EXPLORATORY BORING LOGS (2013).....	27
TABLE 1, SUMMARY OF LABORATORY TEST RESULTS.....	29

## **PRELIMINARY GEOLOGIC AND GEOTECHNICAL INVESTIGATION**

### **Purpose and Scope**

This report presents the results of a preliminary Geologic and Geotechnical Investigation conducted by *GFK & ASSOCIATES, INC.* in association with Michael Carey, CEG of Adobe Geotech for a proposed 9-Lot residential subdivision on Gloria Terrace in the City of Lafayette, Contra Costa County, California. The purpose of the investigation was to evaluate the feasibility of subdividing the subject site and future development of the individual lots. It should be noted that previously our firm, *GFK & ASSOCIATES* performed design-level reports (two reports) for a proposed residence at two different locations on the southerly portion of the site where now Lots 1, 2, and 3 are proposed. The data in our previous reports have been used for assessing the conditions on proposed Lots 1, 2, and 3. Our new subsurface exploration included the larger portion of the site where Lots 4 through 9 are proposed. Based on the data obtained, conclusions and recommendations were made for evaluating the feasibility of the proposed subdivision as planned.

Our investigation included the following:

- a) Review of available published geologic maps and reports for the site and vicinity;
- b) Review of our previous geotechnical reports for the southerly portion of the site;
- c) Field reconnaissance by the Geotechnical Engineer and Engineering Geologist and mapping of the site surficial conditions. The Geologist observed geomorphic features and mapped possible areas of instability on the slopes;
- d) Excavation of exploratory test pits and sampling of the subsurface soils. The test pits were logged by the Engineering Geologist;
- e) Laboratory testing of the soil samples retrieved from the test pits;
- f) Analysis of the data and formulation of conclusions and recommendations;
- g) Preparation of this written report.

### **Site Location and Description**

The site is a roughly rectangular parcel with an area of approximately 7.5 acres, located at the western end of a southwest-trending subsidiary ridgeline, in the hills immediately west of Pleasant Hill as shown on Figure 1 in the Appendix. The major portion of the site is a

rough rectangle approximately 900 feet long by 400 feet wide, which straddles the top and steep sides of a natural ridgeline. The top of the ridge has an elevation of about 460 feet and moderate to steep natural slopes are present on the northwest, southwest and southeast sides of the ridge. Three residential houses are located along Gloria Terrace immediately west of the site. Several large residential parcels are also located along the south, east, and north sides of the site.

A linear valley approximately 60 feet wide is located along the base of the southeastern slope. This valley begins at an elevation of approximately 330 feet and extends up to an elevation of about 370 feet. Finally, a small panhandle about 200 feet long by 50 feet wide is located on the southwest corner of the site and provides access to Gloria Terrace. The site is covered by natural weeds and grasses, numerous large to small trees are scattered across the site and a few large clumps of brush are present as well.

### **Proposed Development**

We understand that the 9-unit subdivision is currently under consideration by the Contra Costa County Planning Department. A Vesting Tentative Map (VTM) for the proposed subdivision was prepared on November 16, 2015 by Humann Company, Civil Engineers. The VTM indicates that the property will be divided into 9 new Lots and that a paved driveway approximately 22 feet wide will be constructed to provide access to the Lots (see Figure 7). Proposed Lots 5, 6, 7 8 and 9 are grouped around the top of the ridgetop, Lot 4 will be located in the eastern corner of the Parcel, near the base of the slope, and Lots 1, 2 and 3 will be located in the valley on the southeast side of the site. The VTM shows proposed building envelopes for each Lot, as well as the overall site grading and the planned drainage facilities. The most important features for site development are shown on the Site Topographic Plan, Figure 7.

The VTM indicates about 10 to 17 feet of soil will be removed from the top of the ridge, to create a large, nearly level cut pad. The proposed building envelopes for the five ridgetop lots were located partially on the resulting cut pad and partially on the adjacent steep natural slopes (see Figure 7). Soil excavated from the ridgetop will be placed in the linear valley on the southeast side of the site as an engineered fill. Houses on Lots 1, 2 and 3 will be placed on terraced fills up to about 17 feet thick; and minor cuts and fills are planned for Lot 4. About 5 to 7 feet of fill will be placed on the slope above Lot 4, to support the hairpin bend of the driveway.

### **Previous Work**

GFK & Associates has issued two individual geotechnical reports (dated May 14, 2012 and February 19, 2013) for previously-proposed parcels and houses which were to be located in the alluvial valley. A total of five exploratory borings were drilled and logged during these investigations. The approximate locations of these borings are shown on Figure 7 in the Appendix. Also, the borings logs are shown in the Appendix. We are not aware of any

previous site-specific geologic or geotechnical investigation of the ridgeline or slopes of the proposed subdivision.

## **GEOLOGY AND SEISMICITY**

### **Bedrock and Faults**

Most published geologic maps of the area, including Crane, (1995), Haydon, (1995) and Dibblee, (2005) see Figures 2, 3, and 4; indicate that the site is underlain by interbedded sandstone and minor siltstone of the lower Martinez formation, of Paleocene age. It should be noted that the older detailed geologic map of Saul (1973), indicates that the site is underlain by Cretaceous rocks of the Del Valle Formation. Haydon (1995 describes the Martinez formation as predominantly sandstone with subordinate siltstone with clay. Our field exploration found that the bedrock is composed of sandstone with interbedded siltstone. Additionally, our field observations indicate that a conglomerate bed with large rounded cobbles is present on the site. The rocks are generally moderately to very hard and moderately fractured. Some of the sandstone is cemented with calcium carbonate (Ellen and Wentworth, 1995). Although the sandstone is generally thick-bedded, the siltstone can have thin, laminated bedding.

The local bedrock units have been uplifted and deformed into tight folds by long-term tectonic movements of the rocks. All the beds and fold axes trend to the northwest, perpendicular to the trend of the minor ridgeline of the site, and the beds have near-vertical to very steep dips. The axis of an unnamed anticline is mapped approximately 500 feet northeast of the site, and the detailed map of Crane (1995) indicates that a tight syncline axis is located immediately west of the site.

The northern branch of the inactive Southampton fault is mapped about 2500 feet northeast of the site and the main trace of the Southampton fault is mapped approximately 1500 feet to the southwest. Both of these faults are thrusts that are associated with the uplift and folding of the local beds, but they are not considered to be active by the State Geologist. Known active faults in the vicinity of the site include the Concord Fault, mapped 4 miles to the northeast; the Calaveras Fault, mapped approximately 10 miles to the south; and the Hayward Fault, mapped 9.6 miles to the southwest. The famous San Andreas Fault is mapped 28 miles to the southwest. Like the entire Bay Area, the site may be subjected to moderate to severe ground shaking in the event of a large earthquake on any of these or another local active fault.

### **Slope Stability**

The bedrock underlying the site is dense and well-consolidated, and is not noted for being particularly soft or unstable. Photointerpretative slope stability maps of the area have been prepared by Nilsen, (1975, Figure 5) and more recently by Haydon, (1995, Figure 6).

Nilsen's map shows that colluvial deposits are present in the topographic swale located at the base of the southeast-facing slope. Both maps indicate that no slides were mapped on or near the vicinity of the site.

## **FIELD EXPLORATION AND SURFACE AND SUBSURFACE CONDITIONS**

### **Field Mapping and Subsurface Exploration**

During January, 2016, Michael Carey CEG carefully observed slope conditions on the site, and mapped areas that showed evidence of shallow soil movement. On January 20, 2016, Mr. Carey logged Exploratory Test Pits TP-1 through TP-9, which were dug with a small track-mounted excavator. The Test Pits were intended to evaluate the thickness of soil and bedrock type at each proposed homesite. Mr. Carey observed the excavations, described the soil and bedrock encountered and prepared a lithologic log for each test pit. Test Pit logs are presented in the Appendix.

A total of 6 Test pits were located on the slopes of the ridge near the building envelope for each proposed homesite, and one Test Pit was placed in the major cut slope located near Lot 6. Additionally, TP- 8 was located in Lot 4, located in the upper portion of the southern valley, and TP-9 was on the steep lower slope, where we observed evidence of shallow soil instability. Most of the test pits were excavated through the upper soil and into the underlying sandstone and siltstone bedrock. Bulk soil samples were taken from the test pits and delivered to the laboratory for testing.

### **Results of Field Exploration**

#### **Northwest Slope and Level Area**

Slopes on the northwest side of the ridge are smooth and regular; and have inclinations of approximately 2 horizontal to 1 vertical. A moderate topographic swale extends down the northwest property line; and slopes in this swale have inclinations of about 4 horizontal to 1 vertical. There are no scarps, erosion gullies or other evidence of recent soil movement in this northwest area of the site. Test Pits TP-1 and TP-2 show that the soil on the upper portion of the area is about 3 to 4 feet thick, while TP-3 indicates that the soil near the base of the slope is up to about 5 feet thick. We expect that thicker soil is present along the lower property line in the center of the swale. Test pit TP- 7 was placed on the gentle slopes north of the swale, where a future cut slope will be excavated. The topsoil is approximately 2 feet thick.

Fractured siltstone bedrock was found in TP-1 and TP-7, while sandstone was exposed in TP-2 and TP-3.



### Southwest Slope

The southwest slope extends down to the three properties which are located along Gloria Terrace. A grove of large trees exists in the center of the slope. The lower portion of the slope below the trees has inclinations of about 2 horizontal to 1 vertical, and inclinations near the top of the slope are about 4.5 horizontal to 1 vertical. We observed some minor terracing which was due to earthwork in the past, but there was no evidence of erosion or slumping on the slopes. Test Pit TP-4 found that the soil immediately upslope of the trees is only about 1 foot thick; based on our field observations, we expect that soil on the higher slope is even thinner. Bedrock exposed in TP-4 was hard, medium-grained sandstone with fractures. The southern corner of this slope also contains small outcrops of a distinctive hard, well-cemented conglomerate with very rounded, cobble-sized clasts.

### Southeast Slope

The slope on the southeast side of the ridge has moderate to steep inclination which range up to 1.6 horizontal to 1 vertical. Several individual trees and two larger clumps of trees are located on this slope. Test pits TP-5 and TP-6 were placed in the upper portion of the slope, while TP-9 was placed near the base of the slope. All these test pits found that the soil cover is about 1 foot thick, and the bedrock is composed of medium to fine-grained sandstone.

Much of the ground surface in the center of the area is lumpy and irregular, indicating that the soil has been slumping and/or creeping downslope (see Figure 7). A distinct arcuate scar about 1 foot high is located slightly upslope of a large tree, while lumps and bulges are located further downslope. We saw no open cracks and the scarps and lumps all appeared to be rounded, so we infer that the soil movement is at least several years old. A smaller area of soil creep and possible minor slumping is present in the southern portion of the slope. A steep-sided, subtle swale can be seen, and the surface is somewhat irregular and lumpy. Test Pit TP-9 found that the soil is only about 1 foot thick, and the bedrock is composed of hard, fractured sandstone. We also found a large open fracture about 1 foot wide, at a depth of 3 feet into the bedrock. This fracture was filled with soft damp soil. We expect that this is an old animal burrow, but there is a possibility that this open fracture could be related to the recent soil movement. Because of the steep slopes and wet soil, the excavator was not able to dig additional test pits in the unstable area.

Finally, we observed that the ground surface on the moderate to steep slope in the north end of the site has subtle lumps, which could be caused by soil creep.

### Southern Valley

Our previous exploratory borings in the southern valley encountered soft fill and soft alluvial/colluvial deposits in the central portions of the valley that extended to approximate depth of about 6 feet on the northern portion of the valley and to about 9 or 10 feet on the southern end of the valley. The westerly facing slope above the valley is underlain by shallow sandstone bedrock. The bedrock depth may range between 2 feet up on the slope and becomes deeper in the center of the valley to approximate depth that ranged between 12 and 18 feet at the location of our previous borings.

### **Laboratory Testing**

Laboratory testing was performed on selected soil samples retrieved from the test pits. The tests included moisture content, plasticity index, and sieve analysis tests. A summary of the laboratory test results is presented on the "Logs of Test Pits" and on Table 1 in the Appendix.

## **DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS**

### **Bedrock and Soil Thickness**

Hard sandstone and siltstone bedrock will be exposed in the large cut pad located at the top of the hill. The proposed building envelope for Lot 6 is entirely within this cut area, while the building envelopes for Lots 5, 7, 8 and 9 are partially on the large pad and partially on the adjacent slopes. The natural slopes of the site have moderate to steep inclinations and the soil cover is generally thin, although the soil on the lower portion of the northwest slope is at least 5 feet thick.

We observed no evidence of erosion or slumping on or near Lots 6, 7, and 8. The slopes below these lots range from moderately steep to very steep, and the maximum thickness of soil on Lot 7 is up to about 5 feet. Although no instabilities were noted on these slopes, care should be exercised in the design of the project (drainage, grading, erosion control, and foundations) as typical for any hillside development as not to create adverse conditions that could cause instabilities on the slopes. In particular, concentrated surface water should not be allowed to flow over the slope ground surface.

The steepest slopes on the property occur below Lots 5 and 9, and these slopes contain clear evidence of recent shallow slumping and soil creep. Our preliminary observations suggest that there is a moderate to high risk that future movement could occur in the thin soil mantling this slope and that this movement could affect the houses above and the driveway below. More detailed subsurface exploration and analysis should be done to evaluate the risk of future soil movement on this portion of the slope. It is possible that earthwork or other methods may be needed for mitigating this hazard.

### **Earthwork and Building Foundations**

The VTS indicates that earthwork at the top of the slope will consist of excavation and soil removal. Soil removed from the top of the hill will be placed as an engineered fill in the swale located on the south side of the site. Some fill will also be placed on side-slopes in the northern portion of the site. All these fills will need to be founded on firm, stable subgrade materials. The fills placed on the side-slopes will require keyways which are excavated into firm bedrock, and proper placement of subdrains. In the southern valley over-excavation of the soft soil should be performed and a swale subdrain to be constructed prior to placing new fill. Tentatively, a keyway and subdrain may also need to be provided at the toe of the fill slope between Lots 2 and 1 and another keyway on the downhill side of Lot 1. In addition, there is a possibility of providing a keyway between Lots 3 and 2.

Foundation considerations for the buildings on Lots 1, 2, and 3 may include pier and grade beam foundation system, or structural concrete slab-on-grade (mat foundations). The piers may derive support in the engineered fill with consideration of the potential of differential settlement due to the anticipated differential thicknesses in the proposed engineered fill, or alternatively the piers may be deepened to extend into the bedrock. These specific recommendations should be addressed in the site specific recommendation report. For these three lots (Lots 1, 2, and 3) our previous design-level reports may be updated for providing design level report(s) once the grading plan for these three lots is finalized.

The planned houses located along the top of the ridge will probably need to be supported by drilled cast-in-place concrete piers that are embedded into the bedrock. The site-specific geotechnical investigations should contain detailed recommendations for these lots. The recommendations should include, but is not limited to grading, foundations, retaining walls, and drainage for each house site as applicable.

Proposed Driveway: At the time the grading/improvement plans become available additional subsurface exploration may need to be performed on the slope above the driveway where the probable unstable areas are mapped on Figure 7 on the downhill side of Lots 5 and 9. The report should include recommendations for mitigating the hazard against the potential of soil creep or slumps that may affect the driveway and the houses above.

### **LIMITATIONS**

This report was prepared in accordance with generally accepted procedures of geologic and geotechnical engineering practices and current standard of care. No other warranty is either expressed or implied.

The use of this report by others presumes that they have verified all information and assume full responsibility for the total project.

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**APPENDIX**

**Site Location Map**

**Geologic Map (Dibblee)**

**Geologic Map (Haydon)**

**Geologic Map (Crane)**

**Landslide Map (Nilsen)**

**Landslide Map (Haydon)**

**Site Surficial Features Map**

**Exploratory Test Pit Logs**

**GFK Previous Exploratory Boring Logs (2012)**

**GFK Previous Exploratory Boring Logs (2013)**

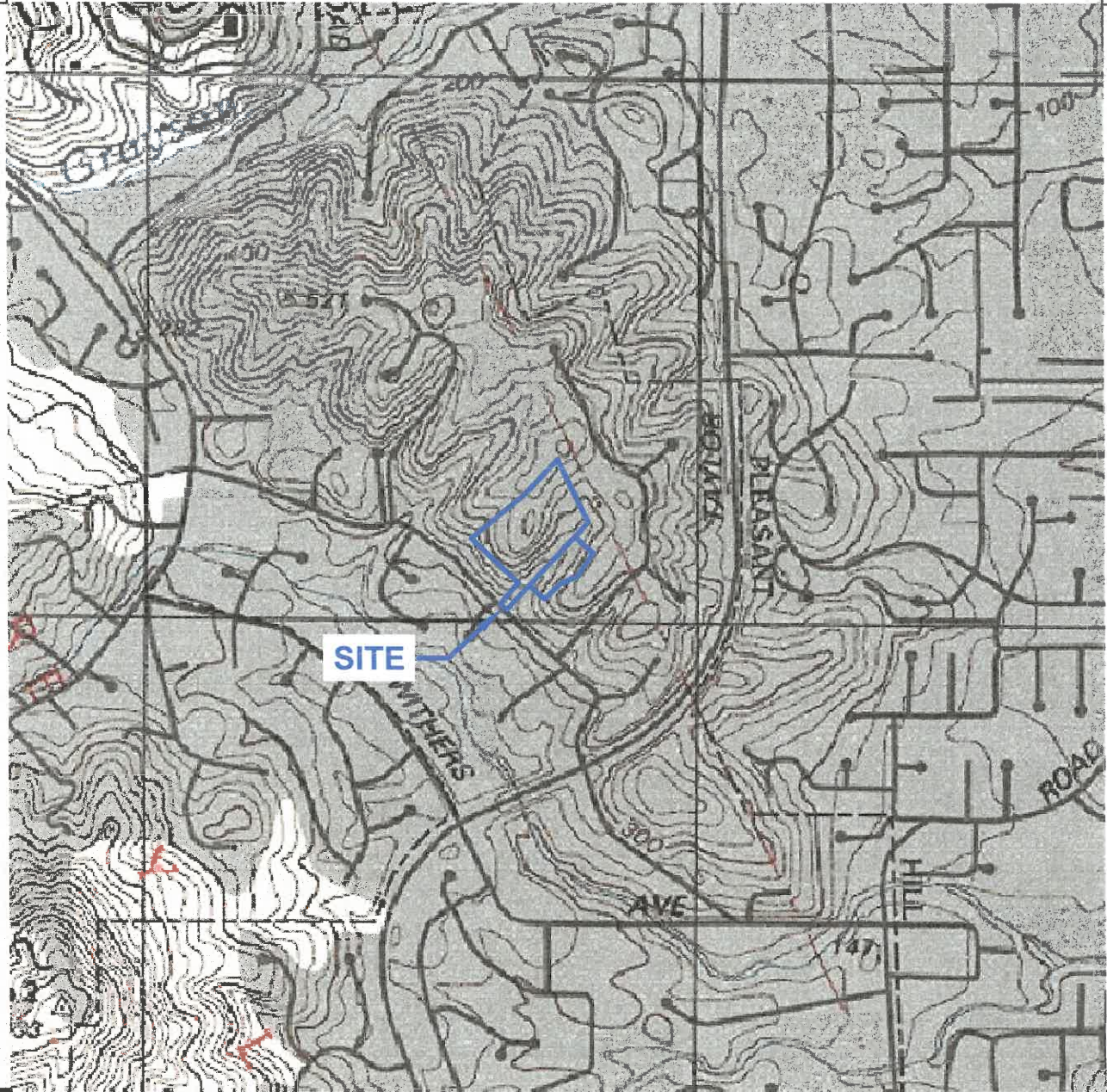
**Summary of (Test Pit) Laboratory Test Results**

122°06'17" W

WGS84 122°04'56" W

37°56'49" N

37°56'49" N

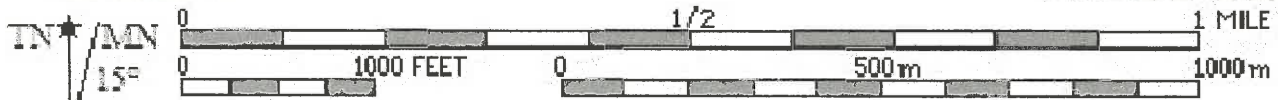


37°55'44" N

37°55'44" N

122°06'17" W

WGS84 122°04'56" W



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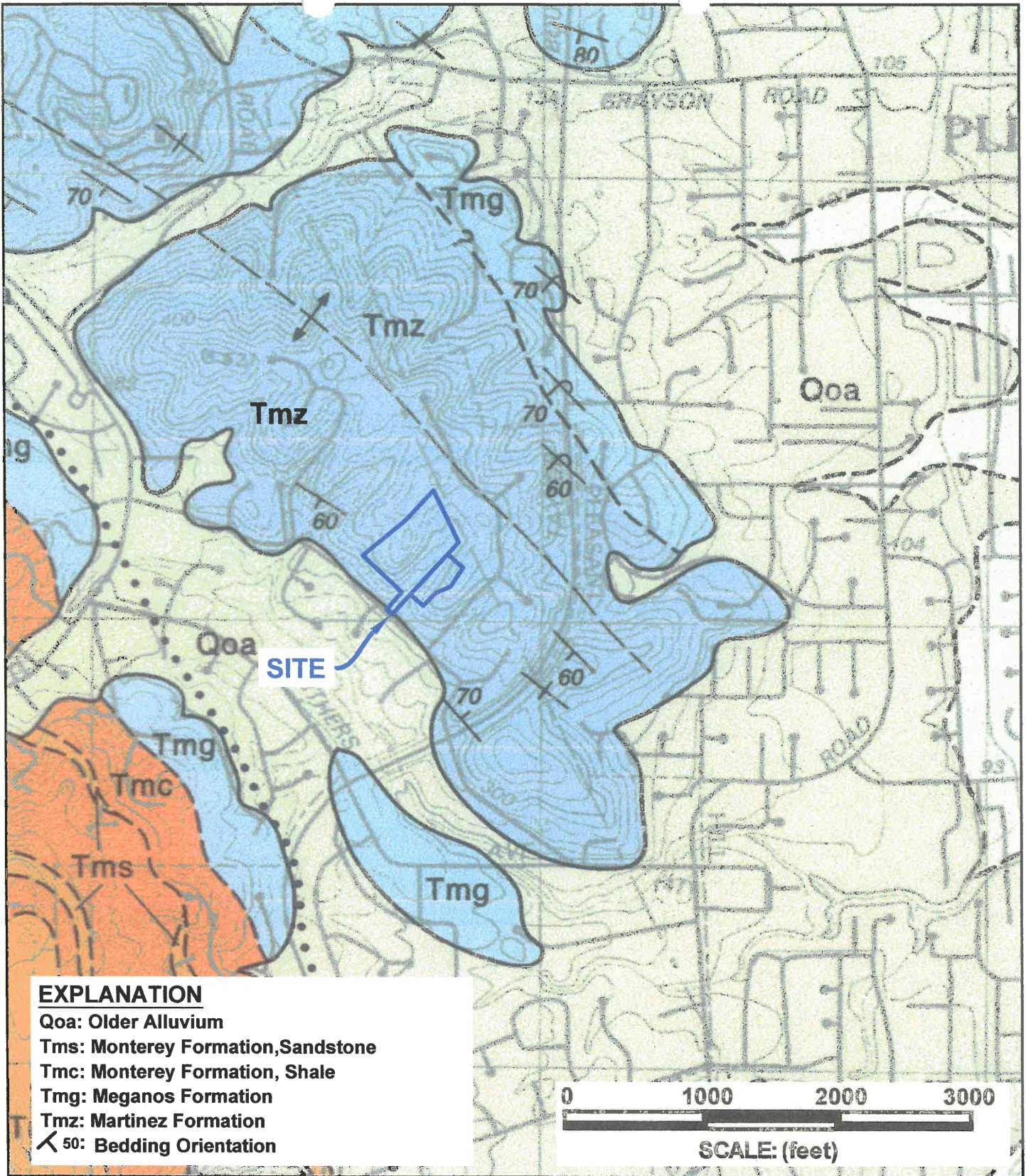
**SITE LOCATION MAP**

Proposed 9-Lot Subdivision  
APNs 166-200-032 and 166-210-008  
Gloria Terrace, Lafayette, CA

Project No.  
1668

Date  
February 4, 2016

**FIGURE**  
**1**



**GFK & ASSOCIATES**

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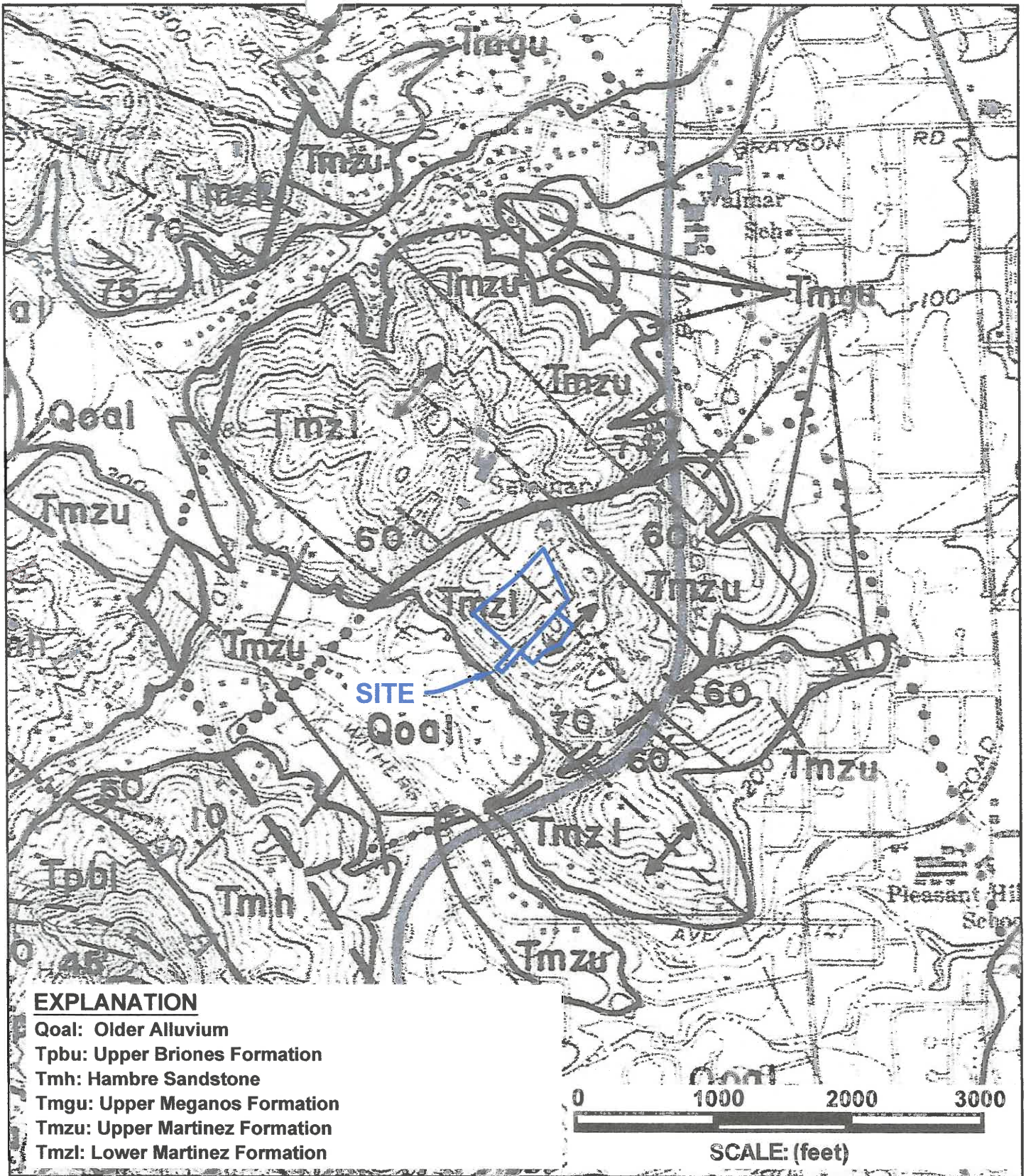
**GEOLOGIC MAP (DIBBLEE)**

Proposed 9-Lot Subdivision  
 APNs 166-200-032 and 166-210-008  
 Gloria Terrace, Lafayette, CA

Project No.  
1668

Date  
February 4, 2016

**FIGURE**  
2



**EXPLANATION**

- Qoal: Older Alluvium
- Tpbu: Upper Briones Formation
- Tmhu: Hambre Sandstone
- Tmgu: Upper Meganos Formation
- Tmzu: Upper Martinez Formation
- Tmzi: Lower Martinez Formation

**GEOLOGIC MAP (HAYDON)**

Proposed 9-Lot Subdivision  
 APNs 166-200-032 and 166-210-008  
 Gloria Terrace, Lafayette, CA

**GFK & ASSOCIATES**

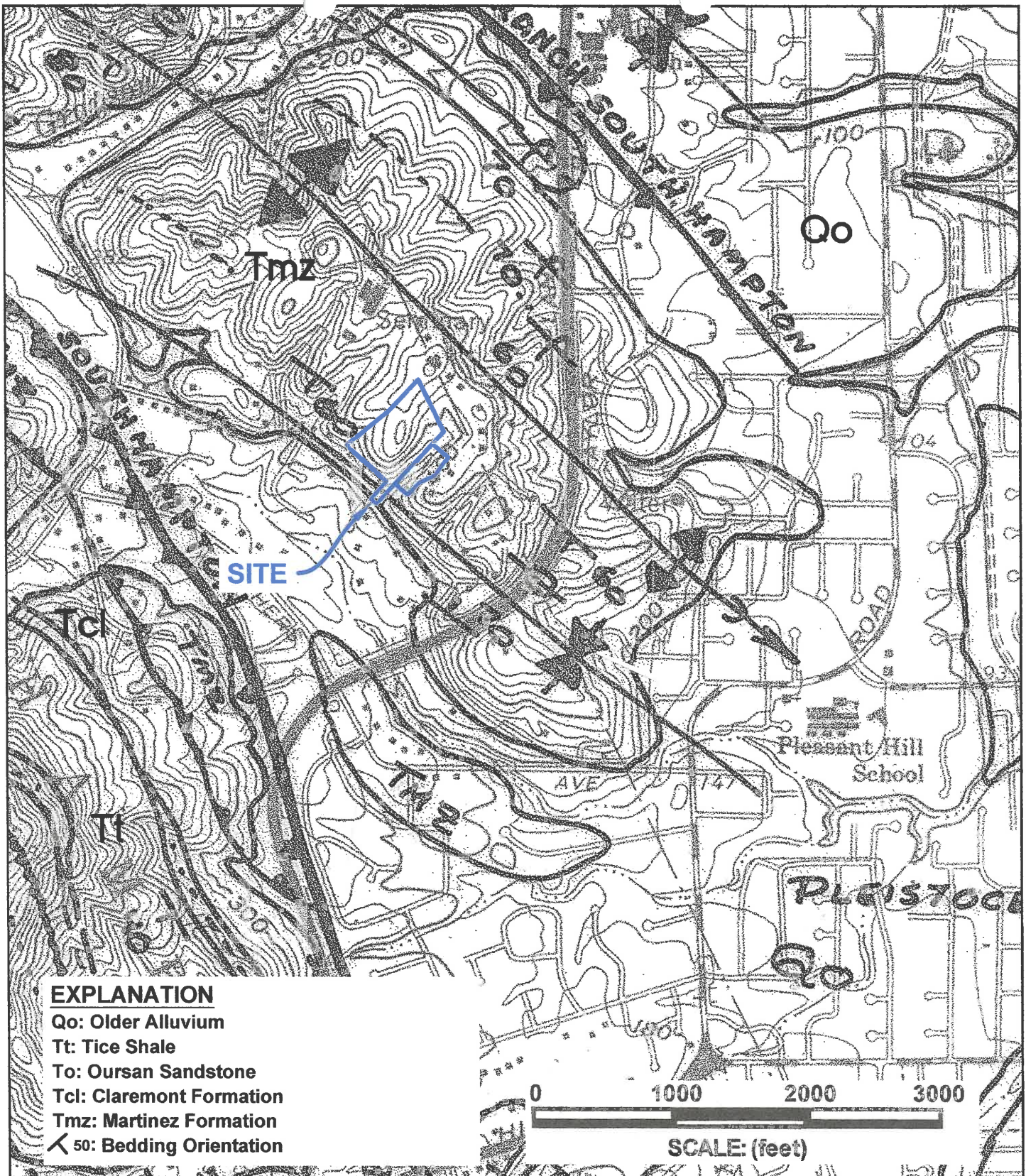
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1668

Date  
February 4, 2016

**FIGURE**  
3





**GFK & ASSOCIATES**

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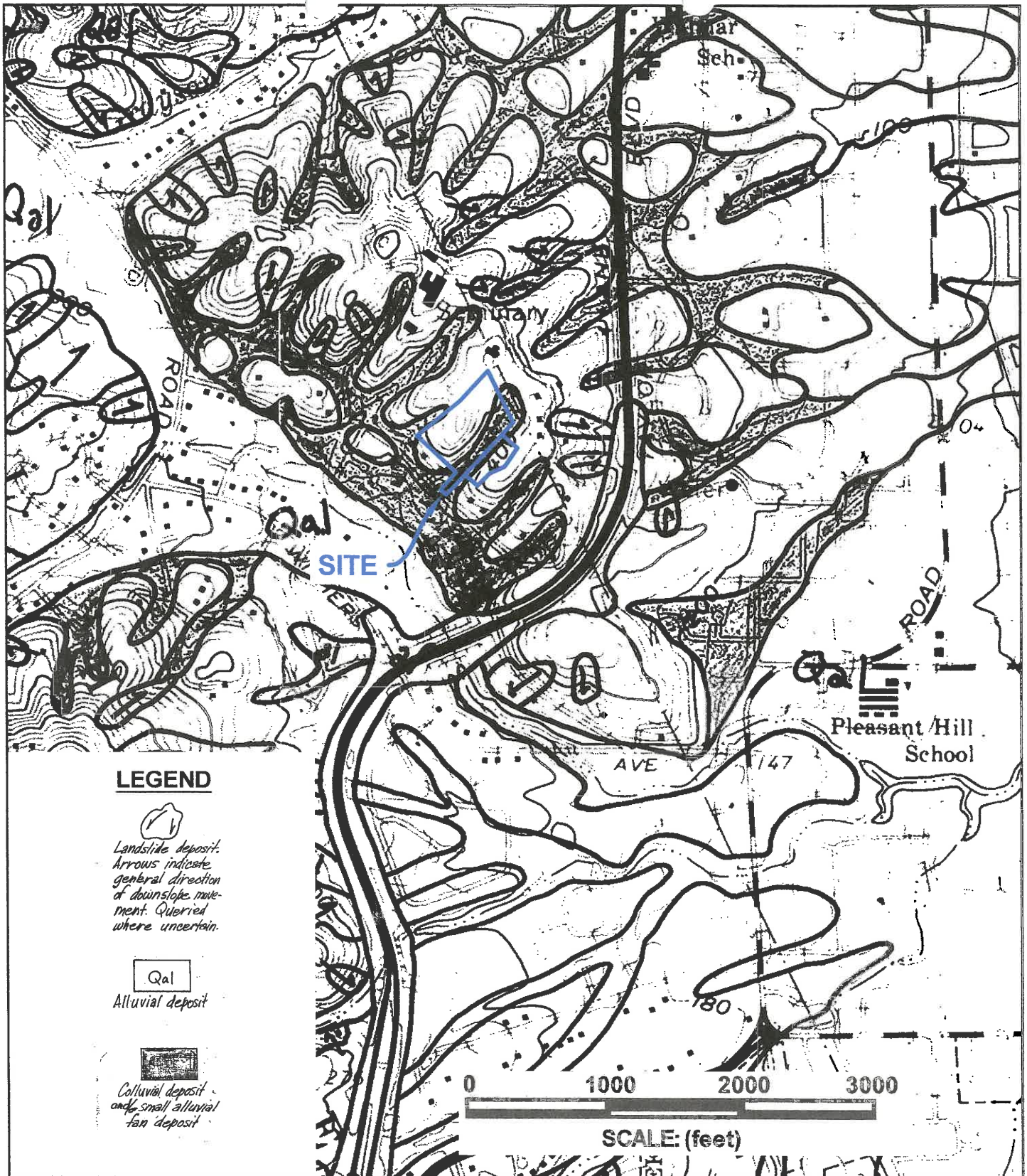
**GEOLOGIC MAP (CRANE)**

Proposed 9-Lot Subdivision  
 APNs 166-200-032 and 166-210-008  
 Gloria Terrace, Lafayette, CA


Project No.  
1668


Date  
February 4, 2016

**FIGURE**  
**4**



**LEGEND**

 Landslide deposit.  
Arrows indicate  
general direction  
of downslope move-  
ment. Queried  
where uncertain.

 Qal  
Alluvial deposit

 Colluvial deposit  
and/or small alluvial  
fan deposit

**LANDSLIDE MAP (NILSEN)**

Proposed 9-Lot Subdivision  
APNs 166-200-032 and 166-210-008  
Gloria Terrace, Lafayette, CA

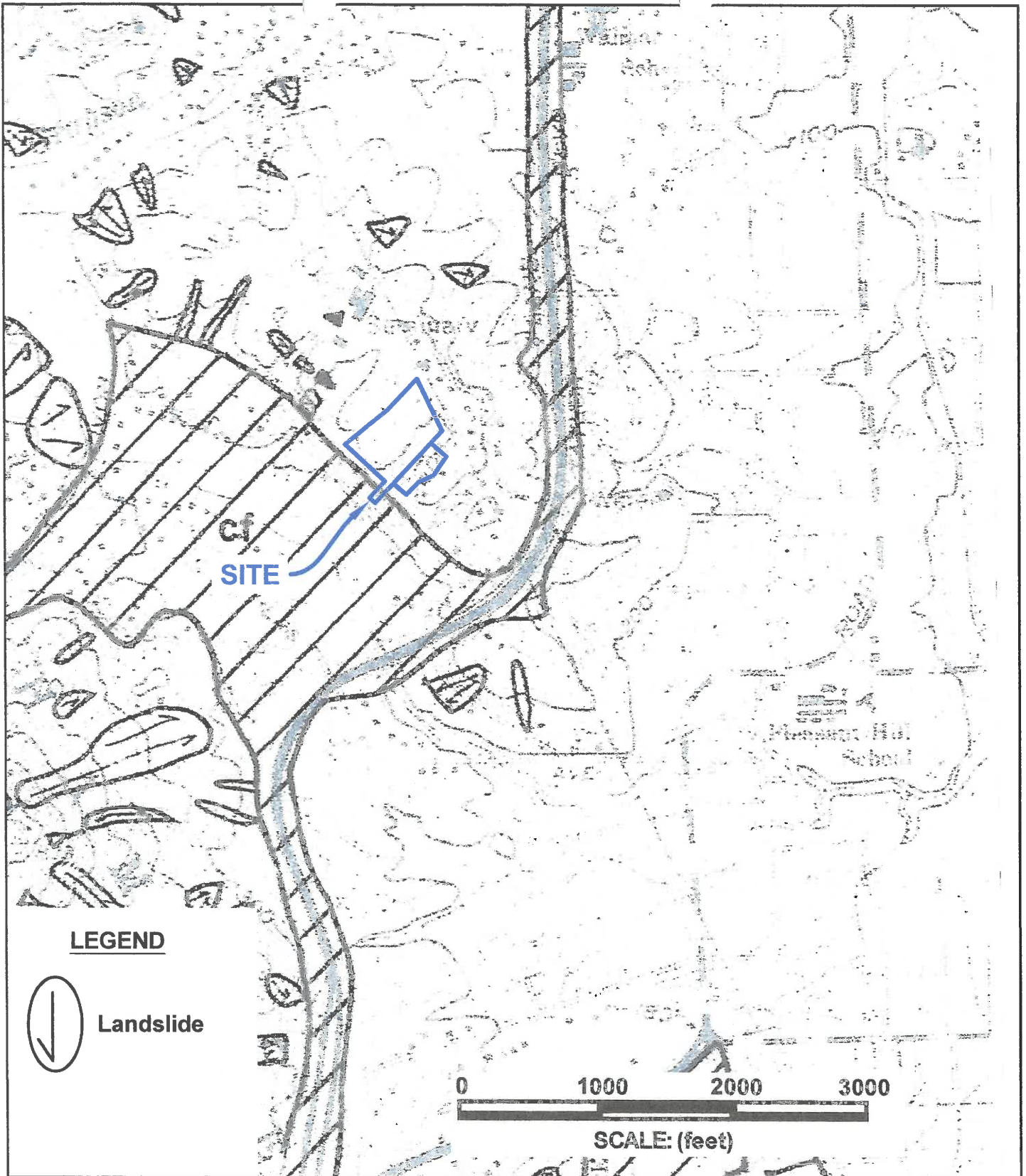
Project No.  
1668

Date  
February 4, 2016

**FIGURE**  
**5**

**GFK & ASSOCIATES**

Geotechnical Consultants



**GFK & ASSOCIATES**

Geotechnical Consultants

**LANDSLIDE MAP (HAYDON)**

Proposed 9-Lot Subdivision  
 APNs 166-200-032 and 166-210-008  
 Gloria Terrace, Lafayette, CA

Project No.  
1668

Date  
February 4, 2016

**FIGURE**  
**6**

## LOGS OF TEST PITS

### Test Pit 1, Pad 6

Date: 1-20-16

#### Depth

(feet)

#### Description

0- 3.0 SANDY CLAY; Reddish brown, medium dense, damp to wet.  
(Sample 1-1 @ ~2 ft.; H<sub>2</sub>O = 27.6%) (TOPSOIL)

Sharp Contact

3.0- 5.0 SILTSTONE; Light grey-brown. Slightly weathered, highly fractured.  
No bedding visible.  
(Sample 1-2 @ 4.5 ft.; H<sub>2</sub>O = 23.7%) (BEDROCK)

FINAL DEPTH: 5.0 ft. Slow seepage through bedrock fractures

---

### Test Pit 2, Pad 7

Date: 1-20-16

#### Depth

(feet)

#### Description

0- 4.0 SANDY CLAY; medium brown, medium dense, damp to wet.  
(Sample 2-1 @ 3 ft.; H<sub>2</sub>O = 22.5%) (TOPSOIL)

Sharp Contact

4.0- 5.5 SANDSTONE with CLAY; Yellow-brown, weathered, no bedding  
visible.  
(Sample 2-2 @ 5 ft.; H<sub>2</sub>O = 18.3%) (BEDROCK)

FINAL DEPTH: 5.5 ft. No obvious seepage

---

**Test Pit 3, Pad 7**

**Date: 1-20-16**

**Depth**

**(feet)**

**Description**

**0- 5.0** SANDY CLAY; medium brown, medium dense, damp to wet.  
(Sample 3-1 @ 3 ft.; H<sub>2</sub>O = 27.2%) **(TOPSOIL)**

**Sharp Contact**

**5.0- 6.5** SANDSTONE with CLAY; Yellow-brown and red-brown, weathered.  
(Sample 3-2 @ 6 ft.; H<sub>2</sub>O = 13.5%) **(BEDROCK)**

**FINAL DEPTH: 6.5 ft.**

**No obvious seepage**

---

**Test Pit 4, Pad 8**

**Date: 1-20-16**

**Depth**

**(feet)**

**Description**

**0- ~1.0** SANDY CLAY; medium brown, medium dense, damp to wet.  
**(TOPSOIL)**

**Sharp Contact**

**1.0- 3.5** SANDSTONE; Reddish yellow-brown with grey mottling, weathered.  
(Sample 4-1 @ 3 ft.; H<sub>2</sub>O = 8.8%) **(BEDROCK)**

**FINAL DEPTH: 3.5 ft.**

**No obvious seepage**

---

**Test Pit 5, Pad 9**

**Date: 1-20-16**

**Depth**

**(feet)**

**Description**

**0- ~1.0** SANDY CLAY; medium brown, medium dense, damp to wet.  
**(TOPSOIL)**

**Sharp Contact**

**1.0- 3.0** SANDSTONE; Reddish yellow-brown with grey mottling, hard.  
(Sample 5-1 @ 2.5 ft.; H<sub>2</sub>O = 13.0%) **(BEDROCK)**

**FINAL DEPTH: 3.5 ft.**

**No obvious seepage**

---

**Test Pit 6, Pad 5**

**Date: 1-20-16**

**Depth**

**(feet)**

**Description**

**0- 1.5** SANDY CLAY; medium brown, medium dense, damp to wet.  
(Sample 6-1 @ 0.5 ft.; H<sub>2</sub>O = 29.6%), LL= 38%, PI= 16, CL  
(TOPSOIL)

**Sharp Contact**

**1.0- 4.0** SANDSTONE; Reddish yellow-brown with grey mottling, moderately hard, fractured.  
(Sample 6-2 @ 3.5 ft.; H<sub>2</sub>O = 17.5%) (BEDROCK)

**FINAL DEPTH: 3.5 ft.**

**Minor seepage in bedrock**

---

**Test Pit 7, Proposed Cut Slope**

**Date: 1-20-16**

**Depth**

**(feet)**

**Description**

**0- 2.0** SANDY CLAY; medium brown, medium dense, damp to wet.  
(TOPSOIL)

**Sharp Contact**

**2.0- 3.5** SILTSTONE; Yellow-brown with light grey mottling, hard, fractured.  
(BEDROCK)

**FINAL DEPTH: 3.5 ft.**

**No obvious seepage**

---

**Test Pit 8, Pad 4**

**Date: 1-20-16**

**Depth**

**(feet)**

**Description**

**0- 3.0** Mixed SAND and CLAY; with large rocks, many roots.  
Yellow-brown and red-brown, medium dense, damp.

**(FILL)**

**Sharp Contact**

**3.0- 5.5** SILT AND CLAY; Medium brown with red-brown mottling, dry, hard.  
(Sample 8-1 @ 4 ft. ; H<sub>2</sub>O = 15.6%) **(TOPSOIL)**  
Pad 4, @4': LL= 33%, PI= 11, CL

**Gradational Contact**

**5.5- 6.0** Fine SAND with CLAY; Dark yellow-brown, dry, hard to dig.  
(Sample 8-2 @ 6 ft. ; H<sub>2</sub>O = 13.4%) **(COLLUVIUM)**

**FINAL DEPTH: 6.0 ft.**

**No obvious seepage**

---

**Test Pit 9, Slide Area**

**Date: 1-20-16**

**Depth**

**(feet)**

**Description**

**0- 1.0** SANDY CLAY; medium brown, medium dense, damp to wet.  
**(TOPSOIL)**

**Sharp Contact**






**1.0- 6.0** Fine-Grained SANDSTONE; Grey-brown, reddish in fractures, hard.  
**Note:** A large open fracture, filled with soft wet soil, is located ~3 feet below the  
top of the sandstone. **(BEDROCK)**


**FINAL DEPTH: 3.5 ft.**

**No obvious seepage**

---

LOGGED BY: GK	BORING DIAMETER: 4.0 inches	BORING NO.: 1
DRILL RIG: Truck-mounted	SURFACE ELEVATION: 365' approximate	DATE DRILLED: May 1, 2012

DEPTH (FT.)	SAMPLE NO.	SAMPLE TYPE	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	USCS CLASSIFICATION	BLOWS/FT ADJUSTED TO SPT	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	REMARKS
				Yellowish brown Silty Clay, moist, medium stiff	CL				
1-1				Mottled yellowish brown and tannish brown Silty Sandstone, fine grained, cannot crush by hand, moist @3' Tan fine to medium grained Sandstone		76/8"	101 106	17.7 13.9	
5	1-2			Mottled tan and orange-brown Sandstone, fine grained, slightly moist, cannot crush by hand		60/5"	109	12.4	
10	1-3			Tan with traces orange-brown mottling Silty Sandstone, slightly moist		50/3"	-	14.0	
15	1-4			Mottled tannish brown and yellowish brown Sandstone, fine grained, slightly moist, cannot crush by hand		50/4"	-	14.9	SPT Sampler
				Bottom of boring at 15'-4" Groundwater not encountered					
20									
25									
30									
35									

 Geotechnical Consultants	<b>EXPLORATORY BORING LOG</b>		
	Proposed Single-Family Residence 3198 Gloria Terrace, Lafayette, CA		
	PROJECT NO. 1446	DATE May 14, 2012	FIGURE 5



LOGGED BY: GK		BORING DIAMETER: 4.0 inches		BORING NO.: 2					
DRILL RIG: Truck-mounted		SURFACE ELEVATION: 362' approximate		DATE DRILLED: May 1, 2012					
DEPTH (FT.)	SAMPLE NO.	SAMPLE TYPE	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	USCS CLASSIFICATION	BLOWS/FT ADJUSTED TO SPT	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	REMARKS
				Medium brown Clayey Silt with sand, moist, medium stiff	ML				
5	2-1			Mottled grey and dark reddish brown Sandy Clay/ Sandy Silt with clay, wet, very soft (Sieve Analysis: Sand 34%, Fines 66%)	CL-ML	2	91 96	23.8 23.7	LL=26% PI=6
	2-2			Mottled grey and reddish brown Sandy Clay, moist, stiff to very stiff (Sieve Analysis: Sand 30%, Fines 70%)	CL	31	108 105	17.2 12.2	LL=32% PI=15 Qu= 6095 psf Strain: 10.0%
10	2-3			Mottled grey and orange-brown weakly cemented Sandy Clay, slightly moist, hard	CL				
				Medium brown with traces grey Silty Clay with traces fine rock fragments, moist, hard (Sieve Analysis: Sand 26%, Fines 74%)	CH	55	102 105	19.9 19.7	LL=60% PI=39 Qu= 14711 psf Strain= 5.0%
15	2-4			Harder at 13' per Driller					
				Mottled orange-brown and grey, weakly cemented Sandy Clay with fine rock fragments, moist, hard (Colluvium)	CL	52	99 -	18.7 19.8	
20	2-5			Harder at 17.5' per Driller					
				Light greyish brown with yellowish brown mottling Silty Sandstone, dry, can be crushed by hand with effort		50/5"	-	17.7	
25				Bottom of boring at 20'-5"					
30				Left hole open for about one hour and no groundwater encountered					
35									

**GFK & ASSOCIATES**

Geotechnical Consultants

**EXPLORATORY BORING LOG**

Proposed Single-Family Residence  
3198 Gloria Terrace, Lafayette, CA

PROJECT NO.


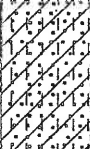

1446

DATE

May 14, 2012

FIGURE

6

LOGGED BY:		GK		BORING DIAMETER:		4.0 inches		BORING NO.:		3		
DRILL RIG:		Truck-mounted		SURFACE ELEVATION:		356' approximate		DATE DRILLED:		May 1, 2012		
DEPTH (FT.)	SAMPLE NO.	SAMPLE TYPE	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION				USCS CLASSIFICATION	BLOWS/FT ADJUSTED TO SPT	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	REMARKS
				Dry at surface, added water Medium brown Silty Clay, ver moist below top foot								
5	3-1			Medium brown with traces grey and reddish brown mottling Sandy Clay, very moist, very soft				CL	4	96 101	23.2 22.2	
				Stiffer at 6.5' per Driller								
10	3-2			Yellowish brown, weakly cemented Sandy Clay, slightly moist, hard (Colluvium)				CL	41	103	11.1	Sieve Analysis Sand 36% Fines: 64%
				Harder at 12' per Driller								
15	3-3			Tan with yellowish brown mottling Silty/Clayey Sandstone, slightly moist					50/5"	105 108	16.8 16.0	
				Bottom of boring at 14.0' Groundwater not encountered						-	15.0	
20												
25												
30												
35												

**GFK & ASSOCIATES**

Geotechnical Consultants

**EXPLORATORY BORING LOG**

Proposed Single-Family Residence  
3198 Gloria Terrace, Lafayette, CA

PROJECT NO.

1446

DATE





May 14, 2012

FIGURE

7

LOGGED BY:		GK		BORING DIAMETER:		4.0 inches		BORING NO.:		1	
DRILL RIG:		Truck-mounted		SURFACE ELEVATION:		336' approximate		DATE DRILLED:		2/05/2013	
DEPTH (FT.)	SAMPLE NO.	SAMPLE TYPE	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	USCS CLASSIFICATION	BLOWS/FT ADJUSTED TO SPT	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	REMARKS		
1-5	1-1			Medium brown Silty Clay, very moist, stiff, Fill  Tannish brown Clayey Sand/ Silty Sand with clay binder and yellowish brown sandstone (2"-) fragments, very moist, loose, most likely Fill (Sieve Analysis: Gravel 10%, Sand 54%, Fines 36%) At 4', medium brown Sandy Clay / Clayey Sand, wet, soft Tried sampling at 5', hammer bouncing (hard rock in fill ?)	CL SC SM CL SC	5	98 103	25.5 18.4	LL=29% PI=6		
5-10	1-2			Medium dark brown Silty Clay, very moist, soft to medium stiff (native Topsoil)	CL	7	101 103	22.6 22.0			
10-15	1-3			Mottled reddish brown and grey Silty Clay with traces fine rock fragments, moist to very moist, stiff (Colluvium)	CL	14	101 99	24.8 25.4	Q <sub>u</sub> =2,417 psf Strain= 14.7%		
15-20	1-4			Mottled tan and reddish brown Sandstone, fine to medium grained, moist, can be crushed by hand		52/6"	-	13.6			
20-35				Bottom of Boring at 18.5 feet Groundwater encountered at approximate depth of 13 feet during sampling and at 10.5 feet one-hour after drilling							

<p><b>GFK &amp; ASSOCIATES</b> Geotechnical Consultants</p>	<b>EXPLORATORY BORING LOG</b>		
	3198 Gloria Terrace, Lafayette, CA		
	PROJECT NO. 1446	DATE February 19, 2013	FIGURE <b>5</b>

LOGGED BY:		GK	BORING DIAMETER:		4.0 inches	BORING NO.:		2	
DRILL RIG:		Truck-mounted	SURFACE ELEVATION:		341' approximate	DATE DRILLED:		2/05/2013	
DEPTH (FT.)	SAMPLE NO.	SAMPLE TYPE	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	USCS CLASSIFICATION	BLOWS/FT ADJUSTED TO SPT	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	REMARKS
				Reddish brown Clayey Sand with rock fragments, moist, stiff (most likely Fill)	SC				
5	2-1			Medium dark brown Silty Clay, moist, stiff (native Topsoil), (Sieve Analysis: Gravel 1%, Sand 44%, Fines 55%) At 5' very moist, soft	CL	10	109	17.6	LL=30% PI=12
10	2-2			Same Mottled reddish brown and grey Silty Clay with traces fine rock fragments, moist, stiff (Colluvium) Stiffer at 11' per Driller	CL	12	103	23.5	At 8' Q <sub>u</sub> = 1363 psf At 9' Q <sub>u</sub> = 1869 psf Strain: 20.3%
15	2-3			Mottled yellowish brown and grey Silty Clay with some fine rock fragments, moist, very stiff		28	97 98	26.6 25.2	
20	2-4			Mottled yellowish brown and grey Silty Sandstone, moist					
25				Bottom of boring at 20.5 feet Groundwater encountered at approximate depth of 9 feet during sampling and at 18 feet after drilling		50/6"	117	14.3	
30									
35									

**GFK & ASSOCIATES**

Geotechnical Consultants

**EXPLORATORY BORING LOG**

3198 Gloria Terrace, Lafayette, CA

PROJECT NO.

1446






DATE

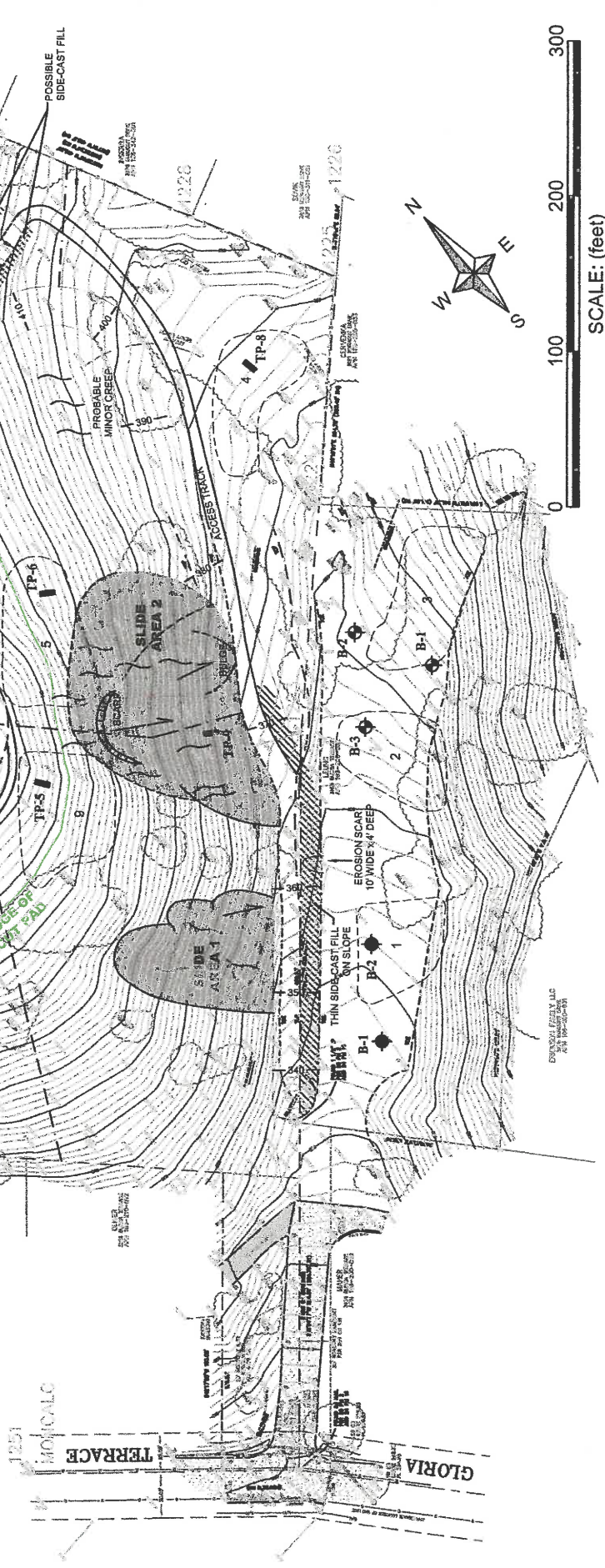
February 19, 2013

FIGURE

6

**EXPLANATION:**

- B-3  Exploratory Borings; 3-14-12
- B-2  Exploratory Borings; 2-19-13
- TP-9  Exploratory Test Pits ; 1-20-16
-  Edge of Proposed Excavated Pad Area And Location of Planned Cut Slope (From Vesting Tentative Map 11-16-15)
-  Probable Unstable Soil Areas (Based on Field Reconnaissance MCC, January 2016)



Proposed 9-Lot Subdivision  
 APNs 166-200-032 and 166-210-008, Lafayette, CA

**SITE PLAN AND SURFICIAL  
 FEATURES MAP**

**GFK & ASSOCIATES**

Geotechnical Consultants

Project No. 1668

February 4, 2016

**FIGURE  
 7**

**TABLE 1**  
**SUMMARY OF (TEST PIT) LABORATORY TEST RESULTS**

Sample No.	Depth (ft.)	Dry Density (p.c.f.)	Moisture Content (%)	Atterberg Limits		Unconfined Compressive Strength	Sieve Analysis
				Liquid Limit (%)	Plasticity Index		
TP1-1	2	-	27.6				Sand 31% Fines 69%
TP1-2	4.5	-	23.7				
TP2-1	3	-	22.5				
TP2-2	5	-	18.3				
TP3-1	3	-	27.2				Sand 32% Fines 68%
TP3-2	6	-	13.5				
TP4-1	3	-	8.8				
TP5-1	2.5	-	13.0				
TP6-1	0.5	-	29.6	38	16		Sand 17% Fines 83%
TP6-2	4	-	17.5				
TP8-1	4	-	15.6	33	11		Sand 19% Fines 81%