Project No. S9235-05-23
September 9, 2022

VIA ELECTRONIC MAIL

Melanie Mathews
Designated Agent
Taormino & Associates
429 F Street, Suite 5
Davis, CA 95616
Melanie_mathews@springlakedevelopment.org

Subject: GEOTECHNICAL UPDATE
PALOMINO PLACE (AKA WILDHORSE RANCH)
APN 071-140-11
DAVIS, CALIFORNIA

Reference: *Geotechnical Investigation – Wildhorse Ranch, APN 071-140-11, East Covell Boulevard, Davis, California,* prepared by Geocon Consultants, Inc. (Project No. S9235-06-01), April 18, 2007.

Ms. Mathews:

In accordance with your request, we herein submit our geotechnical report update for the Palomino Place (formerly Wildhorse Ranch) residential development located at East Covell Boulevard and Monarch Lane in Davis, California. The approximate site location is shown on the Project Location Map, Figure 1.

BACKGROUND AND PURPOSE

Geocon prepared the referenced geotechnical design report for the project in 2007. Since the issuance of our report, the project has remained undeveloped. We understand that Taormino & Associates has acquired the site and is planning development consisting of single- and multi-family residential development. The purpose of our services was to review our previous 2007 geotechnical report and provide updated geotechnical recommendations and design parameters specific to the current project, site conditions, and current California Building Code (CBC) criteria (2019 or 2022 CBC). A copy of our previous geotechnical report is attached as Appendix A.

SCOPE OF SERVICES

We performed the following scope of services:

- Reviewed our 2007 geotechnical report
- Reviewed available design/grading plans for the current project.
- Performed a site visit to observe current site conditions.
- Prepared this geotechnical report update.

DISCUSSION

Site Description

The site consists of the Former Wildhorse Horse Ranch located adjacent and north of East Covell Boulevard adjacent to the easternmost residential development north of East Covell Boulevard in the City of Davis, Yolo County, California. The site has associated addresses of 3003, 3027, 3051 and 3075 East Covell Boulevard. The site further includes a narrow easement owned by the City of Davis that extends from the northeast corner of the site and extends northerly to the northern limit of the Wildhorse golf course property. A sewer line will be installed within the easement as part of the proposed Palomino Place development. The approximate site configuration is depicted on Figure 2.

The site contains three single-family residences, two horse barns, corrals, and grazing/pasture land. The Easement contains a public trail. Residential development is located south, west and north of the site. A public trail and agricultural buffer are located adjacent and easterly of the site. The site is currently accessed from East Covell Boulevard from a gated, asphalt-paved entrance drive that extends through the parcel to the main residence (Photo No. 1). Fenced grazing/pasture fields with corrals and a few shade structures are located to either side of the entrance drive (Photo Nos. 2 and 3), and east, north and west of the centrally located residences and horse barns (Photo No. 4). Debris piles including asphalt/concrete, metal/wood, electrical service, metal pipe former hay barn foundations, and railroad ties were observed in the pasture west of the residences. In general, the site appears to be substantially similar to the conditions observed by Geocon in 2007 when we prepared the original geotechnical report.

Proposed Project

At this time, final development plans have not been completed. However, we understand that the project will likely consist of redeveloping the site with approximately 90 lots for single-family residential development and large lots for future community amenity development. We assume that the proposed residential buildings will be one- and two-story, wood-framed buildings supported on shallow foundation systems. Other improvements will include interior streets and underground utility infrastructure.

Soil Conditions

As outlined in our 2007 geotechnical report, soils at the site consist of alluvium generally consisting of interbedded layers of lean clay and sandy lean clay (CL), fat clay (CH), and silty sand (SM). Although not encountered in our previous borings, isolated areas of undocumented fill may also existing at the site, likely associated with the existing improvements.

We collected two near-surface soil samples (EI-1 and EI-2) and performed laboratory Expansion Index testing in general accordance with ASTM D4820. Test Results are presented in Table 1.

TABLE 1
EXPANSION INDEX TEST SUMMARY

Sample ID	USCS Classification	Expansion Index	Expansion Classification[1]
EI-1	Sandy SILT (ML)	40	Low
EI-2	Lean CLAY (CL)	55	Medium

Notes:
Expansion Classification based on ASTM D4829: 0–20: Very Low; 21–50: Low; 51–90: Medium; 91–130: High; >130: Very High

Expansion Index testing indicates that expansion potential ranges from low to medium. Mitigation alternatives with respect to foundation design will be necessary. Specific recommendations are provided in this report.

CONCLUSIONS AND UPDATED RECOMMENDATIONS

Based on our recent observations, site conditions appear to be substantially similar to the conditions observed by Geocon in 2007. The following recommendations and design parameters are intended to supplement and/or supersede the recommendations contained in our 2007 geotechnical report.

Code-Based Seismic Design Parameters

Seismic design of the proposed structures will be performed in accordance with the provisions of the 2019 or 2022 CBC, the seismic provisions of which are based on the American Society of Civil Engineers (ASCE)/Structural Engineering Institute (SEI) publication: *ASCE/SEI 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE/SEI, 2017). We used the *Structural Engineers Association of California* (SEAOC) and *Office of Statewide Health Planning and Development* (OSHPD) web application *Seismic Design Maps* (https://seismicmaps.org/) to evaluate site-specific seismic design parameters in accordance with ASCE 7-16.

For seismic design purposes, sites are classified as Site Class "A" through "F" as follows:

- Site Class A – Hard Rock
- Site Class B – Rock
- Site Class C – Very Dense Soil and Soft Rock
- Site Class D – Stiff Soil
- Site Class E – Soft Clay Soil
- Site Class F – Soils Requiring Site Response Analysis

Based on the subsurface conditions at the site, the Site Classification is Site Class "D" per Table 20.3-1 of ASCE/SEI 7-16. For the purposes of evaluating code-based seismic parameters for design, we assumed a seismic Risk Category I, II, or III (per the CBC) for the project. Results are summarized in Table 2.

TABLE 2
ASCE 7-16 (CODE-BASED) SEISMIC DESIGN PARAMETERS
SITE CLASS "D" – STIFF SOIL

Parameter	Value	ASCE 7-16 Reference
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.798g	Figure 22-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.311g	Figure 22-2
Site Coefficient, F_A	1.181	Table 11.4-1
Site Coefficient, F_V	1.989	Table 11.4-2
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.942g	Eq. 11.4-1
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.929g*	Eq. 11.4-2
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.628g	Eq. 11.4-3
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.619g*	Eq. 11.4-4

* Per Supplement 3 of ASCE7-16 (effective November 5, 2021), a ground motion hazard analysis (GMHA) shall be performed for projects on Site Class "D" sites with 1-second spectral acceleration (S_1) greater than or equal to 0.2g, which is true for this site. However, Supplement 3 of ASCE 7-16 provides an exception stating that that the GMHA may be waived provided that the parameter S_{M1} is increased by 50% for all applications of S_{M1}. The values for parameters S_{M1} and S_{D1} presented above have been increased in accordance with Supplement 3 of ASCE 7-16.

Table 3 presents additional seismic design parameters for projects with Seismic Design Categories of D through F in accordance with ASCE 7-16 for the mapped maximum considered geometric mean (MCE_G).

TABLE 3
ASCE 7-16 SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.335g	Figure 22-7
Site Coefficient, F_{PGA}	1.265	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.424g	Section 11.8.3 (Eq. 11.8-1)

Conformance to the criteria presented in Tables 2 and 3 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid structural damage, since such design may be economically prohibitive.

Site Preparation and Earthwork Recommendations

The following site preparation and earthwork recommendations supersede the recommendations contained in Section 6.9 of our 2007 geotechnical report.

- References to optimum moisture content in this report are based on the ASTM D1557 test procedure, latest edition. Structural building pad areas should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of buildings, including footings or overhangs carrying structural loads.

- Site preparation should begin with removal of existing vegetation, trees and associated root systems, debris, surface/subsurface structures (fences, pavements, slabs, footings, etc.), underground utilities (irrigation pipes, etc.) and associated backfill/pipe materials (where present), leach fields/septic systems, and organic material. The grading contractor should perform a reasonable search for existing undocumented fill and former improvements at the site (typically performed in conjunction with site preparation).
- Existing drainage drainages/swales and similar low-lying areas should be drained and cleared of vegetation, organics, and loose/wet unstable soil to expose firm, undisturbed materials. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with engineered fill in accordance with the recommendations of this report.
- Surface vegetation consisting of annual grasses/weeds should be stripped and removed. Based on our recent observations, stripping depths of about one inch or less will likely be necessary to effectively remove surface vegetation and loose material. The actual stripping depth should be determined based on-site conditions prior to moisture conditioning.
- Alternatively, surface vegetation may be mowed such that 1 to 2 inches of stubble remains. After removing mowed vegetation, the ground surface should be thoroughly disced in two perpendicular directions to a depth of 12 inches to blend the remaining grass and roots into the surface soil. The resulting soil should be thoroughly mixed such that vegetation segments longer than 1 inch are not visually discernable and the overall organic content is 3% by dry weight or less.
- After site preparation and over-excavation, the bottom of cut areas, areas left at grade, and areas to receive fill, should be scarified at least 12 inches, uniformly moisture-conditioned at least 2% to 3% above optimum moisture content and compacted to at least 90% relative compaction. Scarification and re-compaction operations should be performed in the presence of our representative to evaluate performance of the subgrade under compaction equipment loading and to identify any areas that may require additional removals.
- Engineered fill should be compacted in horizontal lifts not exceeding 8 inches (loose thickness) and brought to final subgrade elevations. Each lift should be moisture-conditioned at least 2% to 3% above optimum moisture content and compacted to at least 90% relative compaction. The top 12 inches of building pads, whether completed at-grade, by excavation, or filling should be uniformly moisture-conditioned at least 3% or above optimum moisture content and compacted to at least 90% relative compaction.
- The top 6 inches of final pavement subgrade, whether completed at-grade, by excavation, or by filling, should be uniformly moisture-conditioned at or above optimum moisture content and compacted to at least 95% relative compaction. Final pavement subgrade should be finished to a smooth, unyielding surface. We further recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify the stability of the subgrade prior to placing aggregate base (AB).
- Underground utility trenches should be backfilled with properly compacted material. Pipe bedding, shading, and backfill should conform to the requirements of the appropriate utility authority. Material excavated from trenches should be adequate for use as general backfill above shading provided it does not contain deleterious matter, vegetation, or cementations larger than 6 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches. Lifts should be compacted to a minimum of 90% relative compaction at or above optimum moisture content. Compaction should be performed by mechanical means only; jetting of trench backfill should not be allowed.

Foundation Recommendations

Based on the soil conditions at the site and our experience with residential developments with similar soil conditions, we recommend using either post-tensioned (PT) slabs or conventional reinforced slab-on-grade foundations with deepened continuous perimeter footings for the proposed residential structures. PT slabs have been used extensively for single-family residential development, in similar soil conditions in the area and are designed to withstand pressures exerted by expansive soils. Deepened, conventional reinforced foundation systems have also been used extensively in similar soil conditions in the area; however, the long-term performance of conventional slabs is more dependent on proper grading, moisture conditioning, and maintaining adequate site drainage throughout the life of the project.

The following foundation, PT slab, and slab-on-grade recommendations presented in this report assume that the soil within the top 3 feet of building pads will have a "medium" or less expansion potential (EI of 90 or less). We should confirm expansion potential of finished pads and/or building locations after grading.

Post-Tensioned Slabs

PT slab foundations should be designed by a structural engineer experienced in PT slab design and design criteria of the Post-Tensioning Institute (PTI) DC 10.5-12 *Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils* or WRI/CRSI *Design of Slab-on-Ground Foundations*, Third Edition, as required in Section 1808.6 of the 2019 CBC. PT foundation design should incorporate the geotechnical parameters presented in Table 4.

TABLE 4
POST-TENSIONED SLAB DESIGN PARAMETERS

Design Parameter (PTI 3rd Edition)		Recommended Value
1.	Thornthwaite Index	-20
2.	Equilibrium Suction	3.9 pF
3.	Edge Lift Moisture Variation Distance, e_M	5.1 feet
4.	Edge Lift, y_M	1.1 inches
5.	Center Lift Moisture Variation Distance, e_M	9.0 feet
6.	Center Lift, y_M	0.5 inches
	Minimum Slab Thickness	10 inches

Allowable bearing capacity for PT slabs should not exceed 2,000 pounds per square foot (psf) for dead plus live load conditions. This value may be increased by one-third to evaluate all transient loads, including wind or seismic forces. The structural engineer should determine slab thickness and reinforcing based on anticipated use and loading of the slab.

The allowable coefficient of friction to resist sliding is 0.30 for concrete against soil/aggregate and 0.20 for concrete against a vapor retarder membrane. Since PT slab foundations are typically not embedded into the building pad, resistance to sliding from passive soil resistance does not apply. If a uniform-thickness PT mat foundation system is planned (most common in Northern California), the slab should include thickened edges extending below the crushed rock underlayment layer.

Assuming the PT slabs are 10 inches thick (or thicker), the slabs should be underlain by a minimum of 2 inches of ½-inch or ¾-inch crushed rock with no more than 5 percent passing the No. 200 sieve to serve as a capillary break. The crushed rock should be subjected to several passes with a walk-behind vibratory compactor or similar equipment prior to placing a vapor barrier or reinforcement/PT tendons for the slab.

Migration of moisture through concrete slabs or moisture otherwise released from slabs is not a geotechnical issue. However, for the convenience of the owner and design team, we are providing the following general suggestions for consideration by the owner, architect, structural engineer, and contractor. The suggested procedures may reduce the potential for moisture-related floor covering failures on concrete slabs-on-grade, but moisture problems may still occur even if the procedures are followed. If more detailed recommendations are desired, we recommend consulting a specialist in this field.

In areas where floor coverings are planned, a minimum 10-mil-thick vapor retarder meeting ASTM E1745 Class C requirements may be placed directly below the slab provided the water-cement ratio of the concrete is 0.45 or less. To reduce the potential for punctures, a higher quality vapor barrier (15 mil, Class A or B) may be used. The vapor retarder, if used, should extend to the edges of the slab, and should be sealed at all seams and penetrations.

The concrete water/cement ratio should be as low as possible. The water/cement ratio should not exceed 0.45 for concrete placed directly on the vapor retarder. This is critically important to reduce the potential for differential curing and subsequent excessive shrinkage cracking. Midrange plasticizers could be used to facilitate concrete placement and workability.

Proper finishing, curing, and moisture vapor emission testing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

Our experience indicates PT slabs are potentially susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings/thickened edges and the interior stiffener beams may reduce this potential. Current PTI design procedures primarily address the potential center lift of slabs but, because of the placement of the reinforcing tendons near the top of the slab, the resulting eccentricity after tensioning reduces the ability of the system to reduce edge lift.

During the construction of the PT foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints be allowed to form.

The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building (such as covered porches), are not recommended. Where this condition cannot be avoided, the isolated footings should be embedded at least 18 inches below pad grade and be connected to the building foundation with reinforced concrete grade beams. In addition, consideration should be given to connecting/doweling patio slabs to the building foundation to reduce the potential for future separation to occur.

Prior to placing the vapor barrier, pad subgrade soil should be moisture-conditioned to at least 3% above optimum moisture content to a depth of at least 12 inches. Geocon should confirm the moisture content of the subgrade soils at least 24 hours prior to placing the moisture retarder.

Deepened Shallow Foundations

Alternatively, the proposed structures may be supported on deepened, reinforced, conventional shallow foundations bearing on engineered fill or undisturbed native soil.

To reduce potential for moisture variations beneath the buildings, foundations should consist of continuous perimeter footings with interior continuous or spread footings. Perimeter footings should be continuous around the entire structure without breaks or discontinuities. Attached garage areas should also have a continuous perimeter strip footing including a trenched grade beam beneath garage door entrances.

Continuous perimeter footings should be at least 12 inches wide and interior spread footings should be at least 18 inches square. All footings should be embedded at least 18 inches below pad grade Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom of the footing.

Continuous footings should be reinforced with at least four No. 4 reinforcement bars, two each placed near the top and bottom of the footing to reduce the effects of expansive clay soils and to allow footings to span isolated soil irregularities. Consideration should be given to using slab tie reinforcing bars between the perimeter foundation and the interior slab. The reinforcement recommended above is for soil characteristics only and is not intended to replace reinforcement required for structural considerations. The project structural engineer should evaluate the need for additional reinforcement.

Foundations may be designed using an allowable bearing capacity of 2,000 psf for dead plus live load conditions with a one-third increase for short-term transient loading such as wind and seismic.

Allowable passive pressure used to resist lateral movement of the footings may be assumed to be equal to a fluid weighing 300 pounds per cubic foot (pcf). The coefficient of friction to resist sliding is 0.30 for concrete against soil. Combined passive resistance and friction may be utilized for design provided that the frictional resistance is reduced by 50%.

Foundations designed in accordance with the recommendations above should experience total post-construction settlement due to building loads of less than one inch and differential settlement of ½ inch or less over a horizontal distance of 30 feet due to the building loads. The majority of settlement will be immediate and occur as the building is constructed.

A Geocon representative should observe foundation excavations prior to placing reinforcing steel or concrete to observe that the exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

Interior Slabs-on-Grade in Conjunction with Deepened Footings

Conventional interior concrete slabs-on-grade are suitable for use in conjunction with conventional shallow foundations with deepened footings.

Slab thickness and reinforcement should be determined by the structural engineer based on anticipated loading. However, based on our experience, slabs are typically at least 4 inches thick and reinforced with at least No. 4 reinforcing bars placed 18 inches on center, each way. Control joints should be provided at periodic intervals in accordance with American Concrete Institute (ACI) or Portland Cement Association (PCA) recommendations, as appropriate.

If near-surface soils of building pads become dry prior to constructing the slab-on-grade, the building pads should be re-moistened by soaking or sprinkling such that the upper 12 inches of soil is at least 3% above optimum moisture content at least 24 hours before concrete placement. Our representative should verify moisture conditions prior to slab-on-grade construction.

Other Recommendations

The remainder of the recommendations provided in our 2007 geotechnical report remain valid as presented.

FURTHER GEOTECHNICAL SERVICES

As of the date of this letter, we have not performed geotechnical borings within the sewer line easement north of the site. We recommend performing 3 to 4 borings to sufficient depths (at least 5 feet below proposed pipe invert) within the easement area prior to finalizing the improvement plans. We should also We should also review the updated development plans, when available, to determine if additional geotechnical exploration and evaluation is necessary. In addition, we should review the foundation plans prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

The recommendations provided here are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for other's interpretation of our recommendations.

CLOSURE

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices used in this area at this time. We make no warranty, express or implied.

Please contact us if you have any questions concerning the contents of this report or if we may be of further service.

Sincerely,

GEOCON CONSULTANTS, INC.

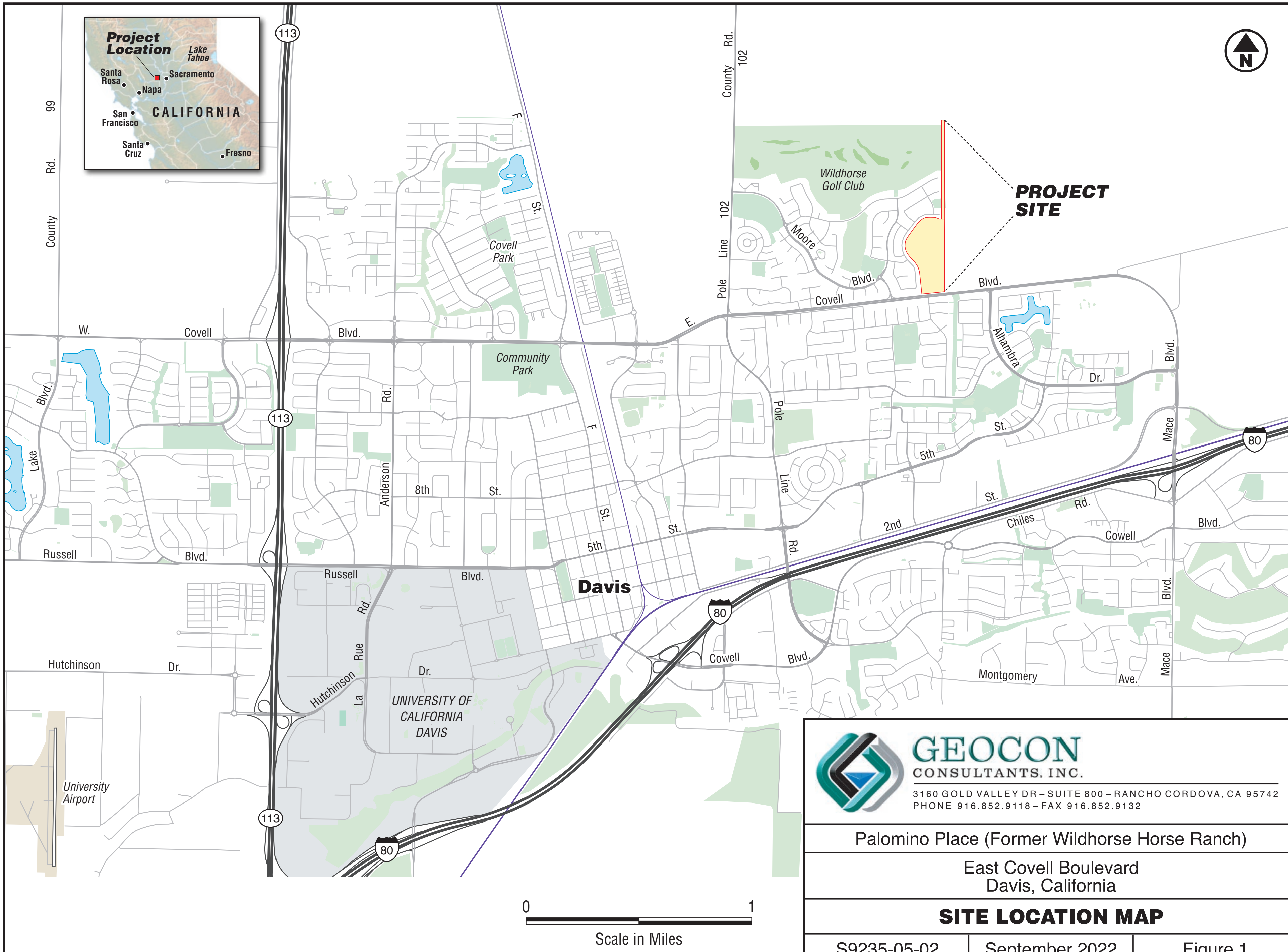
REGISTERED PROFESSIONAL ENGINEER
JEREMY J. ZORNE
No. 2636
GEOTECHNICAL
STATE OF CALIFORNIA

Jeremy J. Zorne, PE, GE
Senior Engineer

Brenda P. Fernandez, EIT
Senior Staff Engineer

Attachments: Figure 1, Site Location Map
Figure 2, Site Plan
Photos Nos. 1 through 4

Appendix A - *Geotechnical Investigation – Wildhorse Ranch, APN 071-140-11, East Covell Boulevard, Davis, California,* prepared by Geocon Consultants, Inc. (Project No. S9235-06-01), April 18, 2007.



GEOCON CONSULTANTS, INC.

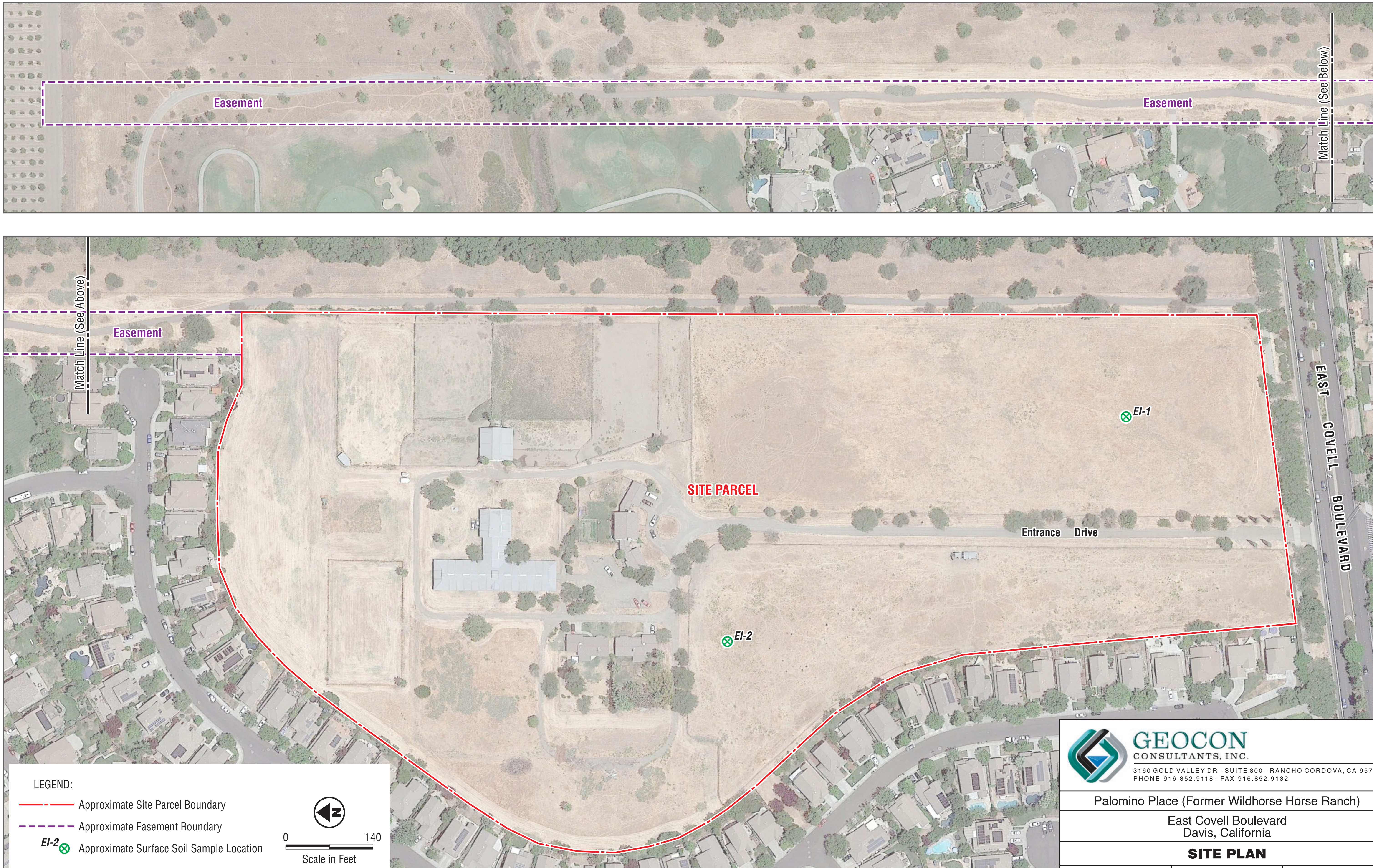
3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

Palomino Place (Former Wildhorse Horse Ranch)

East Covell Boulevard
Davis, California

SITE LOCATION MAP

S9235-05-02	September 2022	Figure 1



GEOCON CONSULTANTS, INC.

3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

Palomino Place (Former Wildhorse Horse Ranch)

East Covell Boulevard
Davis, California

SITE PLAN

S9235-05-02	September 2022	Figure 2

Photo No. 1   Gated entrance to Site Parcel

Photo No. 2   Southwestern Pasture

PHOTOS NO. 1 & 2

GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

Palomino Place (Former Wildhorse Horse Ranch)

East Covell Boulevard
Davis, California

GEOCON Project No. S9235-05-03 | September 2022

Photo No. 3   Southeastern Pasture

Photo No. 4   East Pasture

PHOTOS NO. 3 & 4

GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

Palomino Place (Former Wildhorse Horse Ranch)

East Covell Boulevard
Davis, California

GEOCON Project No. S9235-05-03 | September 2022

APPENDIX A

GEOTECHNICAL INVESTIGATION

Wildhorse Ranch
APN 071-140-11
East Covell Boulevard
Davis, California

PREPARED FOR:

PARLIN WILDHORSE, LLC
11351 WHITE ROCK ROAD
RANCHO CORDOVA, CALIFORNIA

PREPARED BY:

GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DRIVE, SUITE 800
RANCHO CORDOVA, CALIFORNIA 95742

GEOCON

GEOCON PROJECT NO. S9235-06-01

APRIL 2007

GEOCON

CONSULTANTS, INC.

GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. S9235-06-01
April 18, 2007

Ms. Lorry Clark
Parlin Wildhorse, LLC
11351 White Rock Road
Rancho Cordova, California 95742

Subject: WILDHORSE RANCH
APN 071-140-11
EAST COVELL BOULEVARD
DAVIS, CALIFORNIA
GEOTECHNICAL INVESTIGATION

Dear Ms. Clark:

In accordance with your authorization, we performed a geotechnical investigation for the proposed residential subdivision project located on the north side of East Covell Boulevard at the intersection of Monarch Lane in Davis, California.

The accompanying report presents our findings, conclusions, and recommendations regarding geotechnical aspects of developing the site as presently proposed. In our opinion, no adverse geotechnical conditions are present that would preclude development at the site provided recommendations of this report are incorporated into the design and construction of the project.

Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,

GEOCON CONSULTANTS, INC.

REGISTERED PROFESSIONAL ENGINEER
LANCE O. ABLANG
No. C70380
Exp. 09/30/08
CIVIL
STATE OF CALIFORNIA

Lance O. Ablang, PE
Project Engineer

Jeremy J. Zorne, PE, GE
Senior Project Engineer

LOA:JJZ:RGN:jaj

(3) Addressee

CONTENTS

GEOTECHNICAL INVESTIGATION Page

GEOTECHNICAL INVESTIGATION

1.0 PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed residential subdivision project. The project includes constructing 191 single- and multi-family residential units and related infrastructure on an approximate 26-acre parcel located on the north side of East Covell Boulevard at the intersection of Monarch Lane in Davis, California. Approximate site location is depicted on the Vicinity Map, Figure 1.

The purpose of our geotechnical investigation was to observe and sample the prevailing subsurface conditions encountered at the site and provide conclusions and recommendations relative to the geotechnical aspects of developing the site as presently proposed.

Our scope of services included:

- Performing a limited geologic literature review to aid in evaluating the geologic and geotechnical conditions present at the site. A list of referenced material is included in Section 9.0 of this report.
- Reviewing available development plans of the proposed project to select areas of exploration.
- Notifying subscribing utility companies via Underground Service Alert at least 48-hours (as required by law) prior to performing exploratory excavations at the site.
- Excavating ten exploratory borings (B1 through B10) with a truck-mounted drill rig equipped with solid-stem augers to depths ranging from approximately 9 to 40 feet. Upon completion, borings were backfilled with neat cement grout.
- Logging the exploratory borings in accordance with the Unified Soil Classification System (USCS).
- Obtaining relatively undisturbed and disturbed soil samples from the exploratory borings.
- Performing laboratory tests on selected soil samples to evaluate pertinent geotechnical parameters.
- Preparing this report summarizing our findings, conclusions and recommendations regarding the geotechnical aspects of developing the site as presently proposed.

Details of our field exploration program including exploratory boring logs are presented in Appendix A. Approximate locations of the exploratory borings are shown on the Site Plan, Figure 2. Details of our laboratory testing program and test results are summarized in Appendix B.

2.0 SITE AND PROJECT DESCRIPTION

The project site consists of approximately 26 acres of agricultural land located on the north side of East Covell Boulevard at the intersection of Monarch Lane in Davis, California. The site is bordered by residential development on the west and north, a greenbelt on the east, and East Covell Boulevard on the south. Existing site configuration is depicted on the Site Plan, Figure 2.

Current land use at the site is agricultural. Site topography is generally flat and level. Based on the referenced topographic map, site elevations range from approximately 35 to 40 feet above mean sea level (MSL). Site vegetation primarily consists of sparse annual grasses and mature trees. Existing improvements include residential structures, stables, outbuildings, equestrian pens and arenas, and other equestrian-related improvements.

Based on information provided, we understand the parcel will be subdivided for approximately 191 single- and multi-family residential lots. Single-family residential structures will likely be one- to two-story, wood-framed structures supported on conventional shallow foundation systems with concrete slabs-on-grade. Multi-family residential structures will be two to three stories high. We assume relatively light to moderate structural loading typical for this type of construction. Other development will include underground utility infrastructure, paved parking areas, flatwork, landscaping, open areas, and bike paths. Roadway pavement will likely consist of asphalt concrete (AC) over aggregate base (AB). Planned improvements are depicted on theProposed Development Plan, Figure 3.

Grading plans are not available at this time; however, based on the relatively flat site topography, we anticipate grading will consist of minor cuts and fills on the order of 5 feet or less. Some underground utilities may require deeper excavations.

3.0 SOIL AND GEOLOGIC CONDITIONS

We identified soil and geologic conditions by observing exploratory excavations and reviewing referenced geologic literature (Section 9.0). Soil descriptions provided below include the USCS symbol where applicable.

Site soils consist of materials mapped in the geologic literature as "Alluvium." Alluvium extends from the ground surface to below our maximum depth of exploration of 40 feet. Alluvium generally consists of interbedded layers of lean clay and sandy lean clay (CL), fat clay (CH), and silty sand (SM). Laboratory Plasticity Index (PI) tests on five near-surface soil samples indicated PIs ranging from 15 to 31, indicating moderate to high plasticity and corresponding moderate to high expansion potential. Consistency of cohesive soil ranges from stiff to hard. Relative density of granular soil ranges from medium dense to dense.

Soil conditions described in the previous paragraph are generalized. Therefore, the reader should consult the exploratory boring logs included in Appendix A for soil type, color, moisture, consistency, and USCS classification of the soils encountered at specific locations and elevations.

4.0 GROUNDWATER

We encountered groundwater in Boring B2 at an approximate depth of 20 feet during drilling. We did not encounter groundwater in the remaining borings.

We reviewed groundwater elevation data for nearby sites listed on the online Geotracker database maintained by the California State Water Resources Control Board. Groundwater elevation data from three sites within about 2 miles of the site indicate average minimum depth to groundwater is approximately 14 feet.

We also reviewed an online database operated by the California Department of Water Resources. Groundwater level data indicates the depth to groundwater in an area well (08N02E01K001M) located approximately 0.7 mile east of the site ranged from approximately 8 to 96 feet during a period of 1960 to 2006. Depth to groundwater in a well (08N02E03J001M) located approximately one mile to the west of the site ranged from approximately 14 to 78 feet during a period of 1977 to 2006.

With respect to proposed site development, grading will likely be confined to the upper 10 feet; therefore, groundwater should not adversely impact site grading. It should be noted that fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors. Depth to groundwater can also vary significantly due to localized pumping, irrigation practices, and seasonal fluctuations. Therefore, it is possible that groundwater may be higher or lower than the levels observed during our investigation.

5.0 GEOLOGIC HAZARDS

5.1 Seismicity – Faulting

Based on our reconnaissance, observation of the exploratory borings, and review of geologic maps and reports, the site is not located on any known "active" fault trace. In addition, the site is not contained within an Alquist Priolo Earthquake Fault Zone.

In order to determine the distance of known active faults within 30 miles of the site, we used the computer program *EQFAULT*, (Version 3, Blake, 2000). Principal references used within *EQFAULT* are Jennings (1975), Anderson (1984) and Wesnousky (1986). Results are summarized in Table 5.1.

TABLE 5.1
REGIONAL ACTIVE FAULTS

Fault Name	Distance From Site (miles)	Maximum Moment Magnitude (M_W)
Great Valley, Segment 4	15.3	6.6
Great Valley, Segment 3	17.3	6.8
Great Valley, Segment 5	20.8	6.5
Hunting Creek - Berryessa	27.3	6.9
Concord-Green Valley	27.3	6.9

The results of the *EQFAULT* query indicate the Great Valley Fault System (Segment 4) is the closest source of potential ground motion at the site. According to the California Geological Survey (CGS), the Great Valley Fault System consists of blind thrust faults whose rupture surfaces during an earthquake do no extend to the ground surface. Therefore, they have been intentionally excluded from site seismic coefficient calculations. Accordingly, the Hunting Creek-Berryessa Fault should be used for seismic design. Based on the published slip rate and Maximum Moment Magnitude, this fault is classified as a "Type B" source in accordance with Table 16-U of the California Building Code (CBC). The CGS maintains a web-based computer model that estimates probabilistic seismic ground motions for any location within California. The computer model estimates the "Design Basis Earthquake" ground motion which is defined in the CBC as the Peak Ground Acceleration (PGA) with a 10% chance of exceedance in 50 years (475-year return period). For an alluvial soil type, the estimated PGA is approximately 0.26g.

While listing PGA is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including frequency and duration of motion and soil conditions underlying the site. The site could be subjected to ground shaking in the event of a major earthquake along the faults mentioned above or other area faults. However, the seismic risk at the site is not considered to be significantly greater than that of other developments in the Davis area.

5.2 Seismicity – Liquefaction

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary loss of shear strength due to pore pressure buildup under the cyclic shear stresses associated with intense earthquakes. Based on the subsurface conditions encountered at the site, including predominantly very stiff to hard cohesive soils, anticipated seismic and groundwater conditions, the potential for liquefaction is expected to be low during seismic events.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 No soil or geologic conditions were encountered during our investigation that would preclude development of the site as planned, provided the recommendations contained in this report are incorporated into the design and construction of the project.

6.1.2 Conclusions and recommendations provided in this report are based on our review of referenced literature, analysis of data obtained from our exploratory field exploration program, laboratory testing program, and our understanding of proposed land uses at this time.

6.2 Geotechnical Constraints

6.2.1 The primary geotechnical constraint identified in our investigation is the presence of moderate to highly expansive near-surface clay soils at the site. If not mitigated, this soil can cause differential movement (either shrink or swell) and significant damage to overlying structures. Specific recommendations for site grading, including moisture conditioning and compaction control, and designing foundations to resist differential movement, are provided in this report. Foundation recommendations include post-tensioned (PT) slabs and conventional reinforced slabs-on-grade underlain by a layer of low-expansive fill with deepened footings.

6.2.2 Expansive soil and its ability to absorb moisture and soften can impact grading costs especially if grading is conducted in the winter and early spring months. Rainfall and wet soil conditions may prohibit efficient grading and limit productive grading operations to the drier portions of the year. Conversely, dry clay soils may require additional grading effort to attain proper moisture conditioning.

6.2.3 Soft wet clays, if exposed in street right-of-ways, may require removal, drying back and recompaction, and/or lime stabilization to achieve suitable subgrade for support of structural pavement if paving operations are planned during wet weather periods.

6.2.4 Due to the expansive nature of near-surface clays, finished graded subgrade that is left undeveloped during dry periods may develop desiccation cracks. Desiccation cracking reduces soil unit density and may lead to differential settlement, or heaving upon wetting. To reduce the potential for this condition, finished subgrade will require periodic watering to maintain moist soil conditions prior to constructing foundations, slabs-on-grade, and pavements. Constructing improvements over desiccated subgrade soils should be avoided.

6.2.5 Special procedures may be required to stabilize soil beneath proposed surface improvements such as sidewalks and concrete flatwork. These procedures may include pre-saturation of subgrade soil, lime treatment, extra reinforcement and control joints in concrete and/or placement of a layer of low-expansive soil or AB at subgrade. Specific recommendations are provided in this report.

6.3 Seismic Design Criteria

6.3.1 There are no known surface expressions of active faults underlying the site. Potential seismic hazards at the site will likely be associated with possible ground shaking from an event along regional active faults. Structures should be designed in accordance with the seismic requirements contained in the 2001 CBC.

6.3.2 The following table summarizes site-specific seismic design criteria obtained from the 2001 CBC. The values listed in Table 6.3 are based on a "Type B Source" (CBC Table 16-U) considering the Hunting Creek-Berryessa Fault is the closest applicable source of potential seismic ground motion at the site.

TABLE 6.3
CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	CBC Reference
Seismic Zone Factor	0.3	Table 16-I
Soil Profile Type	S_D	Table 16-J
Seismic Coefficient, C_a	0.36	Table 16-Q
Seismic Coefficient, C_v	0.54	Table 16-R
Near-Source Factor, N_a	1.0	Table 16-S
Near-Source Factor, N_v	1.0	Table 16-T
Seismic Source	B	Table 16-U

6.4 Soil Corrosion Potential

6.4.1 We performed laboratory testing (minimum resistivity, pH, chloride and sulfate content) on a composite soil sample anticipated to be in contact with improvements at the site (results presented in Appendix B). Based on resistivity test results, the soil sample is considered corrosive. The tests for pH, chloride and sulfate ion content do not indicate a significant corrosive potential. In accordance with Table 19-A-4 of the 2001 CBC, sulfate concentrations are "negligible"; therefore, Type II cement may be used.

6.4.2 Geocon does not practice corrosion engineering. Our conclusions are based on general screening criteria. Corrosion-sensitive buried improvements (uncoated cast iron, steel, ductile iron, etc.) should be constructed in accordance with local requirements with regard to corrosion prevention measures.

6.5 Soil Excavation Characteristics and Stability

6.5.1 In our opinion, grading and excavations at the site may be accomplished with moderate effort using heavy-duty grading/excavation equipment. We do not anticipate cobbles or boulders that would require special handling or placement.

6.5.2 Temporary excavations, such as footing excavations or utility trench sidewalls should remain near-vertical to depths of at least 5 feet, although some sloughing and caving may occur, particularly if clean sand layers are encountered. It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements. Excavation operations should comply with applicable Occupational Safety and Health Administration (OSHA) and California OSHA requirements.

6.5.3 Permanent cut and fill slopes should be constructed no steeper than 2:1 (horizontal to vertical). To mitigate potential erosion, slopes should be vegetated as soon as possible and surface drainage should be directed away from the tops of slopes.

6.6 Materials for Fill

6.6.1 Excavated soils generated from cut operations at the site are suitable for use as general fill in structural areas provided they do not contain deleterious matter, organic material, or cementations larger than 6 inches in maximum dimension.

6.6.2 Import and low-expansive fill material should be primarily granular with a "very low" or "low" expansion potential (CBC Expansion Index less than 50), a Plasticity Index less than 15, be free of organic material and construction debris, and not contain rock larger than 6 inches in greatest dimension. Low-expansive fill may also consist of lime-treated native soils.

6.6.3 Environmental characteristics and corrosion potential of import soil materials should also be considered. Proposed import materials should be sampled, tested, and approved by Geocon prior to its transportation to the site.

6.7 Groundwater and Dewatering

6.7.1 We do not anticipate groundwater to significantly affect grading operations if conducted during the summer and/or fall seasons. Significant groundwater infiltration within excavations less than 5 feet deep is not anticipated. However, groundwater and soil moisture conditions could be significantly different during the winter and spring seasons as groundwater conditions can develop.

6.7.2 We encountered groundwater during our investigations at a depth of approximately 20 feet. Based on our observations and our knowledge of local groundwater conditions, dewatering may be necessary for excavations extending below about 15 feet.

6.7.3 The contractor should be prepared to accommodate seepage and/or groundwater in deeper project excavations. To attain firm and stable excavation bottoms, groundwater levels should be lowered at least 5 feet below excavation depths. Typical dewatering systems consist of periodically spaced wells augmented with sump pumps within excavations.

6.7.4 Alternatively, sloping excavation bottoms to periodically-spaced sumps with high capacity pumps can be utilized. In this case, a 1- to 2-foot-thick layer of freely draining gravel or crushed rock on the excavation bottom would enable groundwater to flow toward the sump as well as provide a working pad. If excavation bottoms are unstable, geotextile fabric may be required.

6.7.5 Dewatering systems should be designed and operated by a qualified dewatering contractor with local experience.

6.8 Wet Weather Grading Conditions

6.8.1 If grading commences in winter or spring, surface soils will likely be wet. Earthwork contractors should be aware of moisture sensitivity of clayey and fine-grained soils and potential compaction/workability difficulties.

6.8.2 Earthwork and pad preparation operations in these conditions will likely be difficult with low productivity. Often, a period of at least one month of warm and dry weather is necessary to allow the site to dry sufficiently so that heavy grading equipment can operate effectively. Conversely, during dry summer and fall months, dry clay soils may require additional grading effort (discing or other means) to attain proper moisture conditioning.

6.9 Grading

6.9.1 All earthwork operations should be observed and all fills tested for recommended compaction and moisture content by a representative of our firm.

6.9.2 References to relative compaction and optimum moisture content in this report are based on the American Society for Testing and Materials (ASTM) D1557 Test Procedure, latest edition. Structural building pad areas should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of buildings, including footings and overhangs carrying structural loads.

6.9.3 Prior to commencing grading, a pre-construction conference with representatives of the client, grading contractor, and Geocon should be held at the site. Site preparation, soil handling and/or the grading plans should be discussed at the pre-construction conference.

6.9.4 Site preparation should begin with removal of existing surface/subsurface structures and underground utilities (if present), debris, and existing fill. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with engineered fill in accordance with the recommendations of this report.

6.9.5 At the time of our investigation, vegetation primarily consisted of annual grasses and some mature trees. Existing trees and associated root systems within proposed building and pavement areas should be removed. Tree roots larger than 1 inch in diameter should be completely removed. Smaller roots may be left in-place as conditions warrant as determined by a representative of Geocon. Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. We estimate required stripping depths will range from approximately 2 to 3 inches. The actual stripping depth should be determined based on site conditions prior to grading. Material generated during stripping is not suitable for use within 5 feet of building pads or within pavement areas but may be placed in landscaped or non-structural areas or exported from the site.

6.9.6 Alternatively, surface vegetation may be mowed such that 1 to 2 inches of stubble remains. After removing mowed vegetation, the ground surface should be thoroughly disced in two perpendicular directions to a depth of 12 inches to blend remaining grass and roots into the surface soil.

6.9.7 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

6.9.8 Areas to receive fill, structures, or pavements should be scarified at least 12 inches, uniformly moisture-conditioned to at least 3% above optimum moisture content and compacted to at least 90% relative compaction. Scarification and recompaction operations should be performed in the presence of a Geocon representative to evaluate performance of the subgrade under compaction equipment loading.

6.9.9 Engineered fill should be compacted in horizontal lifts not exceeding 8 inches (loose thickness) and brought to final subgrade elevations. Each lift should be moisture-conditioned to at least 3% above optimum and compacted to at least 90% relative compaction.

6.9.10 If conventional reinforced slab-on-grade foundation systems are used, the upper 8 inches of building pads (not including the 4-inch rock section below the slab) should be comprised of low-expansive fill meeting the requirements of Paragraph 6.6.2 of this report. Low-expansive fill should be moisture-conditioned at or near optimum moisture content and compacted to at least 90% relative compaction.

6.9.11 If PT slabs are used, the 6-inch layer of low-expansive fill within building pads is not required. The upper 12 inches of building pad subgrade should be uniformly moisture-conditioned to at least 3% over optimum moisture content and compacted to at least 90% relative compaction.

6.9.12 The upper 6 inches of final pavement subgrade comprised of clayey materials should be uniformly moisture-conditioned at least 3% over optimum and compacted to at least 92% relative compaction. If final pavement subgrade consists of silty or sandy soil, the soil should be moisture-conditioned at or above optimum and compacted to a minimum of 95% relative compaction. Final pavement subgrade should be finished to a smooth, unyielding surface. We recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify stability of subgrade prior to placing AB.

6.9.13 Underground utility trenches within structural areas (building pads, pavement areas) should be backfilled with properly compacted native, cohesive material. Use of this material as backfill (rather than imported granular material) will help reduce soil variations beneath structures and discourage utility lines from becoming conduits for subsurface water flow.

6.9.14 Pipe bedding and initial trench backfill should conform to the requirements of the appropriate utility authority. Material excavated from trenches should be adequate for use as general backfill above shading provided it does not contain deleterious matter, vegetation or cementations larger than 6 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches. Lifts should be compacted to a minimum of 90% relative compaction at least 3% above optimum moisture content.

6.10 Residential Foundation Design Alternatives

Based on soil conditions at the site and our experience with residential developments with similar soil conditions, we recommend using either PT slabs or conventional reinforced slab-on-grade foundations with deepened continuous perimeter footings for the proposed residential structures. As previously discussed, if conventional slab-on-grade foundations are used, the upper 6 inches of building pads should be comprised of low-expansive fill meeting the requirements of Paragraph 6.6.2 of this report.

PT slabs have been used extensively in similar soil conditions in the area and are designed to withstand pressures exerted by expansive soils. Deepened, conventional reinforced foundation systems have also been used extensively in similar soil conditions in the area; however, the long-term performance of conventional slabs is more dependent on proper grading and maintaining adequate site drainage throughout the life of the project. Additionally, we recommend using a low-expansive fill cushion below slabs to reduce potential for slab distress.

Post-Tensioned Slabs

6.10.1 PT slabs should be designed by a structural engineer experienced in PT slab design and design criteria of the Post-Tensioning Institute (CBC Standard No. 1816). The PT design should incorporate the geotechnical parameters presented in Table 6.10.

TABLE 6.10
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

DESIGN PARAMETER	RECOMMENDED VALUE	
Thornthwaite Moisture Index	-20	
Predominant Clay Type	Montmorillonite	
Plasticity Index (Range)	15 – 31	
Plastic Limit (Range)	19 – 21	
Percent Passing No. 200 Sieve (Range)	70 – 90%	
Assumed Clay Portion	50%	
Approximate Depth to Constant Soil Suction	7.0 ft.	
Approximate Soil Suction	3.6 pF	
Approximate Moisture Velocity	0.7 in./mo.	
	SWELLING MODE	
	CENTER LIFT	**EDGE LIFT**
Average Edge Moisture Variation Distance (e_m)	5.0 ft.	2.5 ft.
Anticipated Differential Swell (y_m)	2.63 in.	0.75 in.

6.10.2 Allowable bearing capacity for PT slabs should not exceed 3,000 pounds per square foot (psf) for dead plus live load conditions. This value may be increased by one-third to evaluate all loads, including wind or seismic forces. The structural engineer should determine slab thickness and reinforcing based on anticipated use and loading of the slab.

6.10.3 The allowable passive pressure used to resist lateral movement of foundations may be assumed to be equal to a fluid weighing 300 pounds per cubic foot (pcf). The allowable coefficient of friction to resist sliding is 0.30 for concrete against soil. The upper 12 inches of soil should not be included in the design for lateral resistance; therefore, passive resistance should be neglected for PT slab foundations.

6.10.4 Prior to placing the moisture barrier, pad subgrade soil should be moisture-conditioned to at least 3% above optimum moisture content to a depth of at least 12 inches. Geocon should confirm the moisture content of the subgrade soils no more than 48 hours prior to placing the moisture barrier.

Conventional Foundations

6.10.5 Alternatively, proposed residential structures can be supported by conventional reinforced foundations within building pads prepared in accordance with the recommendations of this report. The upper 6 inches of building pads should be comprised of low-expansive fill meeting the requirements of Paragraph 6.6.2 of this report.

6.10.6 To reduce potential for moisture variations beneath buildings and associated soil expansion, foundations should consist of continuous perimeter strip footings with isolated interior spread footings. Perimeter strip footings should be continuous around the entire perimeter of the structure without breaks or discontinuities. Attached garage areas should also have a continuous perimeter strip footing including a trenched grade beam beneath garage door entrances.

6.10.7 Strip footings should be at least 12 inches wide; plan dimensions of spread footings should be at least 18 inches. Continuous perimeter strip footings and isolated interior spread footings should be embedded at least 18 inches below pad grade. Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom of the footing.

6.10.8 Continuous footings should be reinforced with at least four No. 4 reinforcement bars, two each placed near the top and bottom of the footing to minimize effects of expansive clay soils and to allow footings to span isolated soil irregularities. Consideration should be given to using slab tie reinforcing bars between the perimeter foundation and the interior slab. The reinforcement recommended above is for soil characteristics only and is not intended to replace reinforcement required for structural considerations. The project structural engineer should evaluate the need for additional reinforcement.

6.10.9 Foundations proportioned as recommended above may be designed for an allowable soil bearing capacity of 3,000 psf for combined dead plus live loads. This value may be increased by one-third to evaluate all loads, including wind or seismic forces.

6.10.10 The allowable passive pressure used to resist lateral movement of the footings may be assumed to be equal to a fluid weighing 300 pcf. The allowable coefficient of friction to resist sliding is 0.30 for concrete against soil. Combined passive resistance and friction may be utilized for design provided that the frictional resistance is reduced by 50%.

6.11 Slabs-on-Grade

6.11.1 Conventional concrete slabs-on-grade are suitable for the building pads prepared as recommended in this report. As previously recommended, the upper 6 inches of the building pads should be comprised of low-expansive fill meeting the requirements of Paragraph 6.6.2 of this report. This recommendation is based on the assumption that slabs will be at least 4 inches thick, and supported on a 4-inch-thick rock section. If a thinner or thicker slab or rock section is planned, we should be consulted to provide revised recommendations.

6.11.2 Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We assume slabs will reinforced with at least No. 3 reinforcing bars placed 24 inches on center, each way.

6.11.3 If the near-surface soils of building pads become dry prior to constructing concrete slabs-on-grade, building pads should be re-moistened by soaking or sprinkling such that the upper 12 inches of soil is at least 3% above optimum moisture content at least 24 hours before concrete placement.

6.12 Slab-on-Grade Moisture Protection Considerations

6.12.1 Migration of moisture through concrete slabs or moisture otherwise released from slabs is not a geotechnical issue. However, for the convenience of the owner, we are providing the following general suggestions for consideration by the owner, architect, structural engineer, and contractor. The suggested procedures may reduce the potential for moisture-related floor covering failures on concrete slabs-on-grade, but moisture problems may still occur even if the procedures are followed. If more detailed recommendations are desired, we recommend consulting a specialist in this field.

6.12.2 A minimum 10-mil-thick vapor barrier meeting ASTM E1745-97 Class C requirements may be placed directly below the slab, without a sand cushion. To reduce the potential for punctures, a higher quality vapor barrier (15 mil, Class A or B) may be used. The vapor barrier, if used, should extend to the edges of the slab, and should be sealed at all seams and penetrations.

6.12.3 At least 4 inches of ½- or ¾-inch crushed rock, with no more than 5 percent passing the No. 200 sieve, may be placed below the vapor barrier to serve as a capillary break.

6.12.4 The concrete water/cement ratio should be as low as possible. The water/cement ratio should not exceed 0.45 for concrete placed directly on the vapor barrier. Midrange plasticizers could be used to facilitate concrete placement and workability.

6.12.5 Proper finishing, curing, and moisture vapor emission testing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

6.13 Retaining Walls and Lateral Loads

6.13.1 Lateral earth pressures may be used in the design of retaining walls and buried structures. Lateral earth pressures against these facilities may be assumed to be equal to the pressure exerted by an equivalent fluid. The unit weight of the equivalent fluid depends on the design conditions. The following table summarizes the weights of the equivalent fluid based on the different design conditions.

TABLE 6.13
RECOMMENDED LATERAL EARTH PRESSURES

Condition	Equivalent Fluid Density
Active	45 pcf
At-Rest	60 pcf

6.13.2 Unrestrained walls should be designed using the active case. Unrestrained walls are those that are allowed to rotate more than 0.001H (where H is the height of the wall). Walls restrained from movement (such as basement walls) should be designed using the at-rest case. The above soil pressures assume level backfill under drained conditions within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall.

6.13.3 Retaining wall foundations with a minimum depth of 18 inches may be designed using the allowable bearing capacity provided in Paragraph 6.10.9 of this report. To resist lateral movement of retaining wall foundations, an allowable passive earth pressure equivalent to a fluid density of 300 pcf for footings or shear keys poured neat against properly compacted engineered fill soils or undisturbed natural soils. This allowable passive pressure is based on the assumption that a horizontal surface extends at least 5 feet or three times the depth of the footing or shear key, whichever is greater, beyond the face of the retaining wall foundation. If this surface is not protected by floor slabs or pavement, the upper 12 inches of material should not be included in the design for lateral resistance. An allowable friction coefficient of 0.30 may be used for resistance to sliding between soil and concrete. Combined passive resistance and friction may be utilized for design provided that the frictional resistance is reduced by 50%.

6.13.4 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. Positive drainage for retaining walls should consist of a vertical layer of permeable material positioned between the retaining wall and the soil backfill. The permeable material may be composed of a composite drainage geosynthetic or a natural permeable material such as crushed gravel at least 12 inches thick and capped with at least 12 inches of native soil. A geosynthetic filter fabric should be placed between the gravel and the soil backfill. Provisions for removal of collected water should be provided for either system by installing a perforated drainage pipe along the bottom of the permeable material which leads to suitable drainage facilities.

6.13.5 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls with a level backfill and having a maximum height of 5 feet. In the event that walls higher than 5 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

6.14 Concrete Sidewalks, Driveways, and Flatwork

6.14.1 Sidewalk, curb, gutter, and driveway encroachments should be designed and constructed in accordance with the latest City of Davis standards and details as applicable.

6.14.2 Due to the presence of moderately to highly expansive near-surface soils, exterior concrete pavements will likely experience seasonal movement. Therefore, some cracking and/or vertical offset should be anticipated. We are providing the following recommendations to reduce distress to concrete flatwork. Recommendations include moisture conditioning subgrade soils, using low-expansive fill underlayment, and providing adequate construction and control joints. It should be noted that even with implementation of these measures, minor slab movement or cracking could still occur.

- Concrete flatwork, sidewalks and residential driveways should be at least 4 inches thick and underlain by at least 4 inches of low-expansive fill. Low-expansive fill may consist of AB or soil meeting the requirements of Paragraph 6.6.2 of this report. Low-expansive fill should be compacted to at least 90% relative compaction.
- The upper 6 inches of subgrade soil for exterior flatwork, sidewalk and residential driveway areas should be uniformly moisture-conditioned at least 3% above optimum content and compacted to at least 90% relative compaction prior to placing low-expansive fill.

- We recommend using a maximum control joint spacing of 8 feet in each direction and construction joint spacing of 10 to 12 feet. Construction joints that abut building foundations should include a felt strip, or approved equivalent, that extends the full depth of the exterior slab. Exterior slabs should structurally independent of building foundations except at doorways, including garage doors.

6.14.3 Concrete pavement in truck traffic areas should be at least 6 inches thick and underlain by at least 6 inches of Class 2 AB compacted to at least 95% relative compaction. Subgrade should be compacted per Section 6.9.13.

6.15 Asphalt Concrete Pavement

6.15.1 We collected bulk samples of near-surface soil from various locations at the estimated elevation of pavement subgrade for Resistance-Value (R-Value) testing in accordance with California Department of Transportation Test Method 301. Testing resulted in an R-Value of 10.

6.15.2 To improve subgrade support characteristics, subgrade may be chemically treated with high calcium quicklime. Lime-treatment will reduce expansion potential of the clay subgrade and increase pavement support characteristics. Therefore, thinner pavement structural sections may be used. Lime-treatment of soil subgrade (LTS) would be subject to approval by the City. For planning purposes, treating the upper 12 inches of subgrade with 5% quicklime (by dry weight) will likely produce an improved pavement section subgrade. If lime-treatment is desired, we can perform additional analyses to confirm the percent lime required to improve subgrade and provide guideline specifications at your request.

6.15.3 We recommend the following alternative AC pavement sections for design. The project civil engineer should determine the appropriate Traffic Index (TI) based on anticipated traffic conditions. Table 6.15 provides alternative pavement sections based on various design TIs. We can provide additional sections based on other TIs if necessary.

TABLE 6.15
FLEXIBLE PAVEMENT SECTIONS

Traffic Index (TI)	Untreated Subgrade (R-Value = 10)		Lime Treated Subgrade (R-Value = 50)	
	Asphalt Concrete (inches)	Aggregate Base (inches)	Asphalt Concrete (inches)	Aggregate Base (inches)
4.5	3.0	9.0	3.0	4.0
5.0	3.0	10.0	3.0	5.0
5.5	3.0	11.5	3.0	6.0
6.0	3.5	12.0	3.5	8.0
6.5	4.0	13.0	4.0	8.0
7.0	4.0	14.5	4.0	9.0
7.5	4.5	16.0	4.0	10.0
8.0	4.5	17.5	4.0	11.0
8.5	5.0	18.5	4.0	12.0

Notes:

1. *Lime-treated subgrade will develop a minimum R-Value of 50.*
2. *Lime-treated subgrade should extend at least 2 feet laterally beyond the edge of pavement.*

6.15.4 The recommended alternative pavement sections are based on the following assumptions:

1. Untreated subgrade soil has an R-Value of 10.
2. Class 2 AB has a minimum R-Value of 78 and meets the requirements of Section 26 of the latest Caltrans Standard Specifications.
3. Class 2 AB is compacted to 95% or higher relative compaction at or near optimum moisture content. Prior to placing AC, the AB should be proof-rolled with a loaded water truck to verify stability.
4. LTS should extend at least 2 feet laterally beyond the edge of pavement.
5. Native soil subgrade should be compacted per Section 6.9.12. If final pavement subgrade consists of LTS, the soil should be moisture-conditioned at or above optimum and compacted to a minimum of 95% relative compaction.
6. Asphalt concrete should conform to Section 39 of the latest Caltrans *Standard Specifications*.

6.15.5 To reduce the potential for water from landscaped areas migrating under pavement into the AB, consideration should be given to using full-depth curbs in areas where pavement abuts irrigated landscaping. The full-depth curbs should be at least 4 inches wide and extend at least 4 inches or more into the soil subgrade beneath the AB. Alternatively, modified drop-inlets that contain weep-holes may be used to encourage accumulated water to drain from beneath the pavement.

6.16 Drainage

6.16.1 Adequate surface drainage is imperative to reduce potential for differential soil movement, soil expansion, erosion, and subsurface seepage. Care should be taken to properly grade finished surfaces around building pads after structures and other improvements are in place, so that drainage from buildings, lots and adjacent properties is directed away from buildings and toward appropriate drainage facilities. Final grade should slope a minimum of 2% away from structures.

6.16.2 Since near-surface soils at the site are moderately to highly expansive, we recommend implementing measures to reduce infiltrating surface water near buildings and slabs-on-grade. Such measures may include:

- Selecting drought-tolerant plants that require little or no irrigation, especially within 3 feet of buildings, slabs-on-grade, or pavements.
- Using drip irrigation or low-output sprinklers.
- Using automatic timers for irrigation systems.
- Appropriately spaced area drains.
- Hard piping roof downspouts.

The project landscape architect should consider incorporating these measures into the landscaping plans.

6.16.3 Experience has shown that even with these provisions, subsurface seepage may develop in areas where no such water conditions existed prior to site development. This is particularly true where a substantial increase in surface water infiltration has resulted from an increase in landscape irrigation.

7.0 FURTHER GEOTECHNICAL SERVICES

7.1 Plan and Specification Review

7.1.1 We should review the improvement plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

7.2 Testing and Observation Services

7.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer-of-Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. In accordance with 2001 CBC, testing and observation services by the Geotechnical Engineer-of-Record are required to verify that construction has been performed in accordance with this report, approved plans and specifications. If we are not retained for these services, we cannot assume any responsibility for other's interpretation of our recommendations or the future performance of the project.

8.0 LIMITATIONS

The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, we should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials or environmental contamination was not part of our scope of services.

This report is issued with the understanding that it is the responsibility of the owner or their representative to ensure that the information and recommendations contained herein are brought to the attention of the design team for the project and incorporated into the plans and specifications and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

The recommendations contained in this report are preliminary until verified during construction by representatives of our firm. Changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. Additionally, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated partially or wholly by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices used in the site area at this time. No warranty is provided, express or implied.

9.0 REFERENCES

1. Blake, T.F., *EQFAULT, Version* 3.00, 2000.

2. California Department of Transportation, *Highway Design Manual*, July 2004.

3. California Department of Transportation, *Standard Specifications for Construction of Local Streets and Roads*, July 2004.

4. California Department of Water Resources, *Groundwater Level Data*, (http://wdl.water.ca.gov/gw/), 2007.

5. California Division of Mines and Geology Wagner, D.L., Jennings, C.W., Bedrossian, T.L. and Bortugno, E.J. (compilers), *Geologic Map of the Sacramento Quadrangle*, 1987.

6. California Geological Survey, *Probabilistic Seismic Hazard Mapping Ground Motion Page*, (http://www.consrv.ca.gov/CGS/rghm/pshamap/pshamap.asp), 2006.

7. California State Water Resources Control Board, Geotracker Database, (http://www.geotracker.swrcb.ca.gov/), 2007.

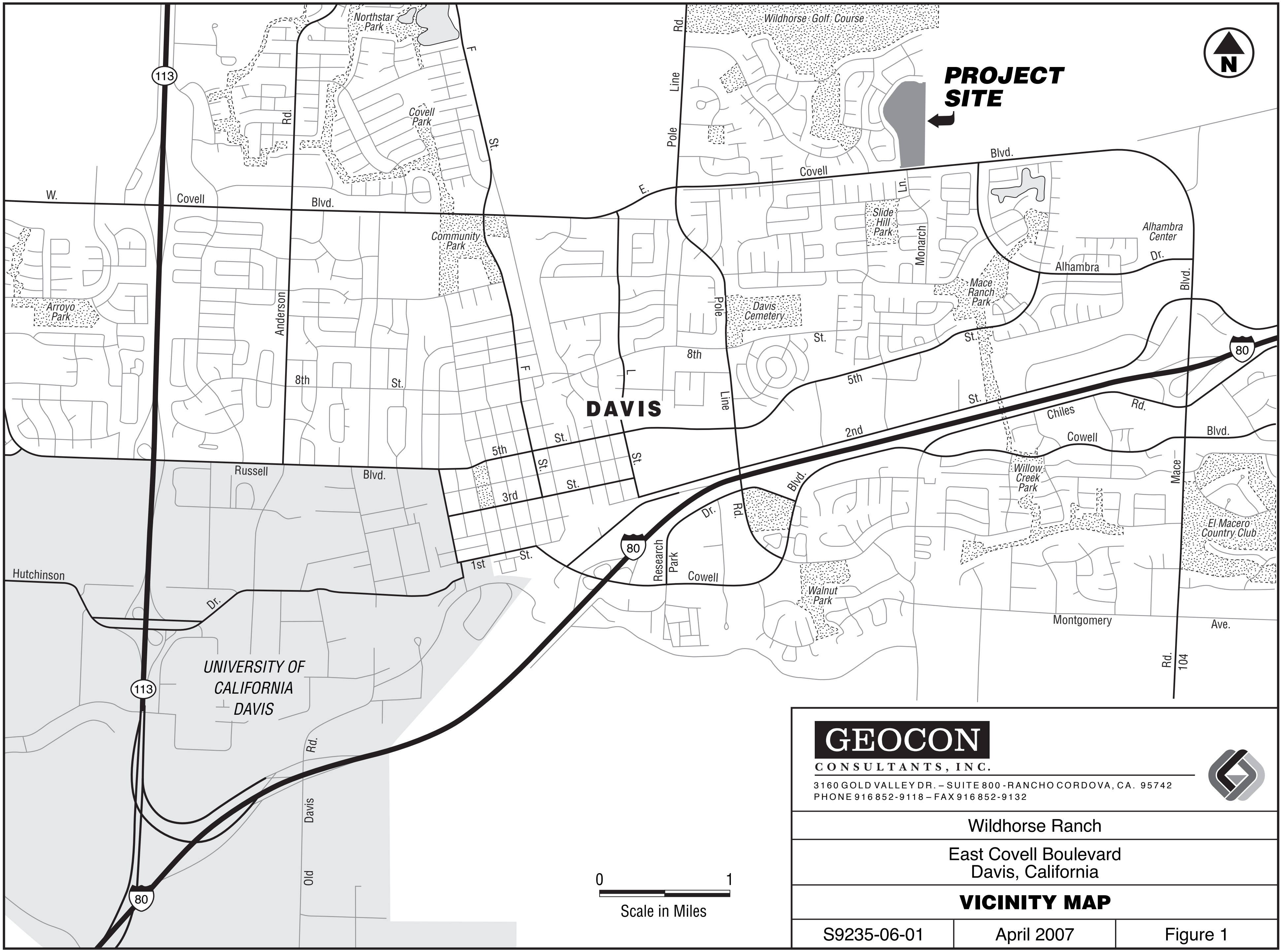
8. Cunningham Engineering, *Wildhorse Ranch Conceptual Site Plan*, March 9, 2006.

9. Cunningham Engineering, *Wildhorse Ranch Existing Site Conditions*, March 9, 2006.

10. Portland Cement Association, *Concrete Floors on Ground,* 2001.

11. United States Geological Survey, 7.5-Minute Series (Topographic), *Davis Quadrangle, California,* 1992.

12. Unpublished reports, aerial photographs, and maps on file with Geocon.



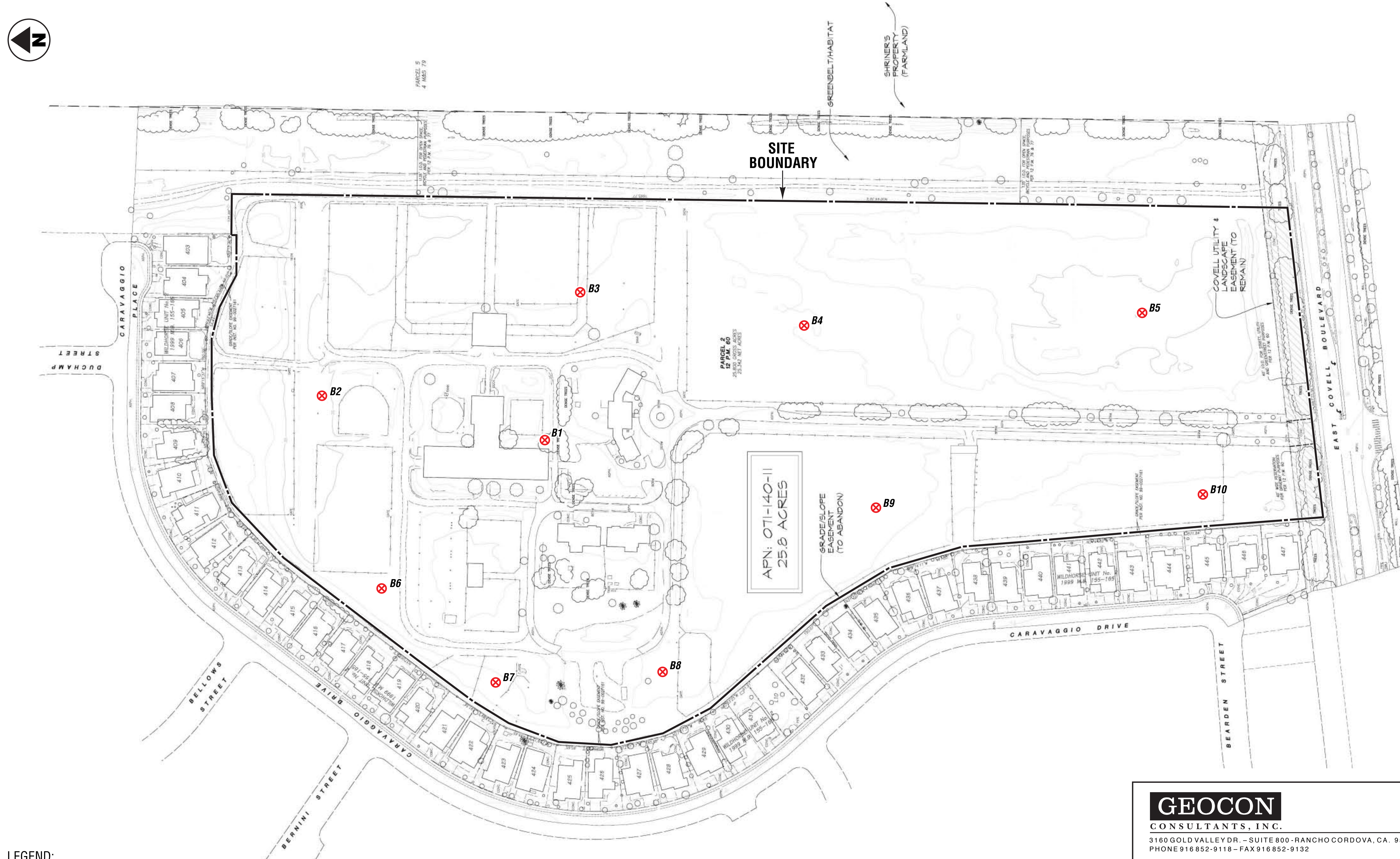
GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Wildhorse Ranch

East Covell Boulevard
Davis, California

VICINITY MAP

S9235-06-01	April 2007	Figure 1



LEGEND:

B10 ⊗ Approximate Exploratory Boring Location

Source: *Wildhorse Ranch Existing Site Conditions*, Cunningham Engineering, March 9, 2006

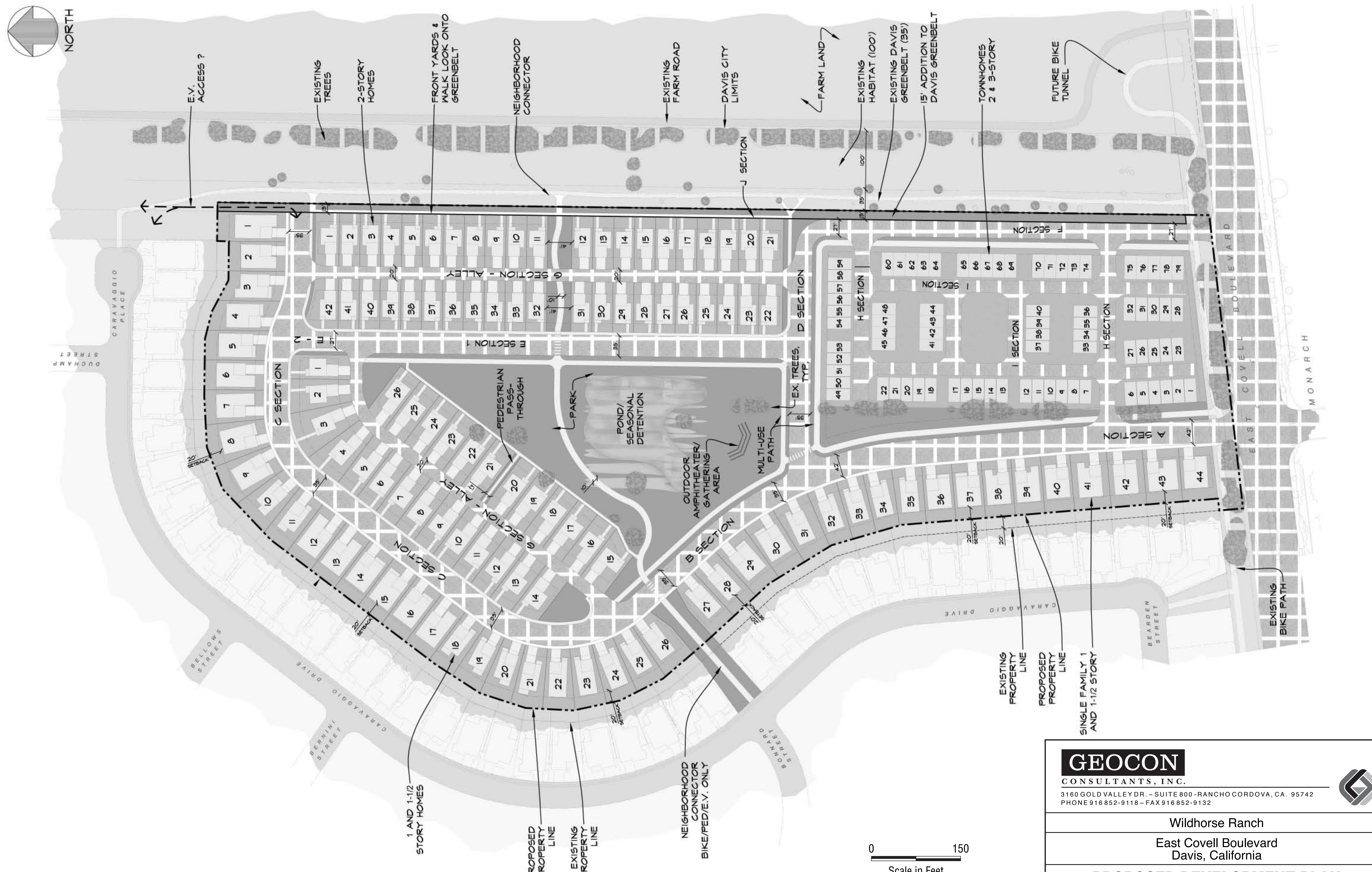
GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Wildhorse Ranch

East Covell Boulevard
Davis, California

SITE PLAN

S9235-06-01	April 2007	Figure 2



Source: *Wildhorse Ranch Conceptual Site Plan*, Cunningham Engineering, March 9, 2006

GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Wildhorse Ranch

East Covell Boulevard
Davis, California

PROPOSED DEVELOPMENT PLAN

S9235-06-01	April 2007	Figure 3

APPENDIX A

APPENDIX A

FIELD EXPLORATION

Our geotechnical field exploration was performed on April 9, 2007, and consisted of drilling ten exploratory borings (B1 through B10) at the site. Approximate locations of exploratory borings are shown on the Site Plan, Figure 2.

Exploratory borings were performed using a truck-mounted Mobile B-24 drill rig equipped with 4-inch outside diameter (OD) solid-stem augers. Sampling was accomplished using a cathead 140-pound hammer with a 30-inch drop. Samples were obtained with a 3-inch OD, split spoon (California Modified) sampler and a 2-inch OD, Standard Penetration Test (SPT) sampler. The number of blows required to drive the sampler the last 12 inches (or fraction thereof) of the 18-inch sampling interval were recorded on the boring logs. Upon completion, the borings were backfilled with neat cement grout.

Subsurface conditions encountered in the exploratory borings were visually examined, classified and logged in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488-90). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the field logs were revised based on subsequent laboratory testing.

PROJECT NO. **S9235-06-01**

BORING B1

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**FILL** Aggregate Base - 9 inches			
2	B1-1.5			CL	**ALLUVIUM** Hard, moist, dark brown, lean CLAY pp > 4.5 tsf	50/3.5"	108.8	18.4
4	B1-4 B1-4.5			CL	Hard, moist, dark yellowish brown, Sandy lean CLAY pp > 4.5 tsf	45	92.7	18.5
6								
8	B1-8.5			CL	Hard, moist, dark brown, lean CLAY pp > 4.5 tsf	55/6"		

BORING TERMINATED AT 9 FEET
NO FREE GROUNDWATER ENCOUNTERED

GEO_NO_WELL S9235-06-01 WILDHORSE RANCH.GPJ 04/17/07

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S9235-06-01**

BORING B2

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B2-0-5			CH	**ALLUVIUM** Hard, dry to moist, dark brown, fat CLAY, high plasticity, upper 9" sandy PI = 31			
2	B2-1.5 B2-2				pp = 3.2 tsf	52	90.0	27.0
4	B2-4 B2-4.5				pp = 2.3 tsf, 75.6% fines	34	100.7	20.7
				CL	Very stiff, moist, dark brown, Sandy lean CLAY			
6								
				CH	Very stiff to hard, moist, yellowish brown, mottled dark reddish brown, fat CLAY, moderate to high plasticity			
8								
10	B2-9 B2-9.5				pp = 3.1 tsf	52	91.1	29.5
12								
14	B2-14 B2-14.5				pp = 2.7 tsf	76	95.58	27.9
16								
18								
20	B2-19 B2-19.5		▼		pp = 3.5 tsf	50/6"		
22				CL	Very stiff, moist to wet, light yellowish brown, Sandy lean CLAY, with some weak cementation			
24	B2-24 B2-24.5					73		

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ▣ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S9235-06-01**

BORING B2

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
26								
28	B2-28.5							
30						61		
32				SM	Dense, wet, dark olive gray, Silty SAND, with gravel			
34	B2-33.5				34.5% fines			
				CL	Hard, moist, olive gray, lean CLAY	36		
36								
38	B2-38.5							
40						65		

BORING TERMINATED AT 40 FEET
GROUNDWATER AS NOTED

GEO_NO_WELL S9235-06-01 WILDHORSE RANCH.GPJ 04/17/07

SAMPLE SYMBOLS ... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED) ... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S9235-06-01**

BORING B3

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B3-0-5			CL	**ALLUVIUM** Hard, moist, dark brown lean CLAY			
2	B3-1.5 B3-2				pp > 4.5 tsf	82	106.6	19.6
4	B3-4 B3-4.5				Very stiff pp = 2.0 tsf	26	88.0	31.6
6								
8				CH	Hard, moist, dark brown, fat CLAY, high plasticity			
10	B3-9 B3-9.5				pp = 3.6 tsf	55	102.3	23.3
12								
14	B3-14				pp = 2.7 tsf	55/6"	97.4	26.5

BORING TERMINATED AT 14.5 FEET
NO FREE GROUNDWATER ENCOUNTERED

Log of Boring B3, page 1 of 1

GEO_NO_WELL S9235-06-01 WILDHORSE RANCH.GPJ 04/17/07

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S9235-06-01**

BORING B4

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B4-0-3			CL	**ALLUVIUM** Hard, slightly moist, dark yellowish brown, lean CLAY PI = 19			
2	B4-1.5 B4-2				pp >4.5 tsf	39	99.6	12.4
4	B4-4 B4-4.5				becomes very stiff, some fine sand pp >4.5 tsf	21	90.9	11.3
6								
8								
10	B4-9 B4-9.5				moist, slightly vesicular, pp = 1.6 tsf	29	89.5	30.2
12				CH	Hard, moist, grayish brown, fat CLAY, high plasticity			
14	B4-14 B4-14.5				pp = 2.75 tsf	54		
					BORING TERMINATED AT15 FEET NO FREE GROUNDWATER ENCOUNTERED			

Log of Boring B4, page 1 of 1

GEO_NO_WELL S9235-06-01 WILDHORSE RANCH.GPJ 04/17/07

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S9235-06-01**

BORING B5

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B5-0-3			CL	**ALLUVIUM** Very stiff, dry to slightly moist, brown, lean CLAY, with sand and gravel PI = 20			
2	B5-1.5 B5-2					33	98.9	11.0
				CL	Stiff to very stiff, slightly moist, brown, Sandy lean CLAY			
4	B5-4 B5-4.5				pp > 4.5 tsf	21	87.4	12.7
6								
8								
	B5-9 B5-9.5				pp = 3.1 tsf			
10					BORING TERMINATED AT 10 FEET NO FREE GROUNDWATER ENCOUNTERED	20		

Log of Boring B5, page 1 of 1

GEO_NO_WELL S9235-06-01 WILDHORSE RANCH.GPJ 04/17/07

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S9235-06-01**

BORING B6

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM** Very stiff to hard, slightly moist, dark yellowish brown, lean CLAY, with sand			
2	B6-1.5 B6-2				pp > 4.5 tsf	28	102.9	19.1
4	B6-4 B6-4.5				pp = 4.2 tsf			
				SM	Medium dense, slightly moist, dark brown, Silty SAND	23	94.3	15.4
6				CH	Very stiff, moist, grayish brown, fat CLAY, moderate to high plasticity			
8								
10	B6-9 B6-9.5				pp = 2.1 tsf	30	90.7	30.0
12								
14	B6-14 B6-14.5				pp = 1.6 tsf	38		

BORING TERMINATED AT 15 FEET
NO FREE GROUNDWATER ENCOUNTERED

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◪ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S9235-06-01**

BORING B7

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B7-0-3			CL	**ALLUVIUM** Very stiff, moist, dark brown, lean CLAY PI = 27			
2	B7-1.5 B7-2				pp = 1.7 tsf	21	88.0	14.2
4	B7-4 B7-4.5				pp > 4.5 tsf	27	91.2	14.5
6								
8								
	B7-9 B7-9.5			CH	Very stiff, moist, grayish brown, fat CLAY, moderate to high plasticity	40		
10					BORING TERMINATED AT 10 FEET NO FREE GROUNDWATER ENCOUNTERED			

GEO_NO_WELL S9235-06-01 WILDHORSE RANCH.GPJ 04/17/07

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ☒ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◣ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

PROJECT NO. **S9235-06-01**

BORING B8

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM** Hard, slightly moist, dark brown, lean CLAY			
2	B8-1.5, B8-2				pp > 4.5 tsf	51	104.4	19.0
4	B8-4, B8-4.5				very stiff, with fine sand, pp = 3.25 tsf	25	102.9	17.4
6								
8				CH	Hard, moist, dark brown, fat CLAY, moderate to high plasticity			
10	B8-9, B8-9.5				pp = 3.1 tsf	51		

BORING TERMINATED AT 10 FEET
NO FREE GROUNDWATER ENCOUNTERED

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. **S9235-06-01**

BORING B9

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B9-0-5			CL	Stiff, dry, yellowish brown, lean CLAY			
2	B9-1.5 B9-2				pp = 4.25 tsf	18	75.2	12.1
4	B9-4 B9-4.5			CL	Very stiff, moist, light grayish yellow, lean CLAY pp > 4.5 tsf	37	87.3	13.0
6								
8								
	B9-9 B9-9.5			CH	Hard, dry to slightly moist, dark brown, fat CLAY, moderate to high plasticity	57		
10					BORING TERMINATED AT 10 FEET NO FREE GROUNDWATER ENCOUNTERED			

GEO_NO_WELL S9235-06-01 WILDHORSE RANCH.GPJ 04/17/07

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

PROJECT NO. **S9235-06-01**

BORING B10

ELEV. (MSL.) **NA** DATE COMPLETED **4-9-07**

EQUIPMENT **MOBILE B-24**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM** Very stiff, dry, light brown, lean CLAY, with sand PI = 15 pp > 4.5 tsf			
2	B10-1.5 B10-2					24	88.9	10.2
4	B10-4 B10-4.5				72.6% fines			
				SM	Medium dense, dry, light brown, Silty SAND	22	104.6	5.7
6				CL	Stiff, moist, light brown, lean CLAY			
8								
10	B10-9 B10-9.5				pp = 2.4 tsf	20		
12				CH	Very stiff, moist, dark brown, fat CLAY, moderate to high plasticity			
14	B10-14 B10-14.5				pp = 2.5 tsf	38	92.2	28.8

BORING TERMINATED AT 15 FEET
NO FREE GROUNDWATER ENCOUNTERED

Log of Boring B10, page 1 of 1

GEO_NO_WELL S9235-06-01 WILDHORSE RANCH.GPJ 04/17/07

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

APPENDIX B

APPENDIX B

LABORATORY TESTING PROGRAM

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected soil samples were tested for their in-place dry density and moisture content, plasticity characteristics, grain size distribution, corrosion potential and pavement support characteristics. The results of the laboratory tests are presented on the following pages.

TABLE B1
SUMMARY OF CORROSION PARAMETERS
CALIFORNIA TESTS 643, 417 AND 422

Sample No.	Sample Depth (ft.)	pH	Minimum Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
Composite: B3-0-5 and B9-0-5	0 – 5	7.37	1,350	12.1	15.0

TABLE B2
SUMMARY OF R-VALUE TEST

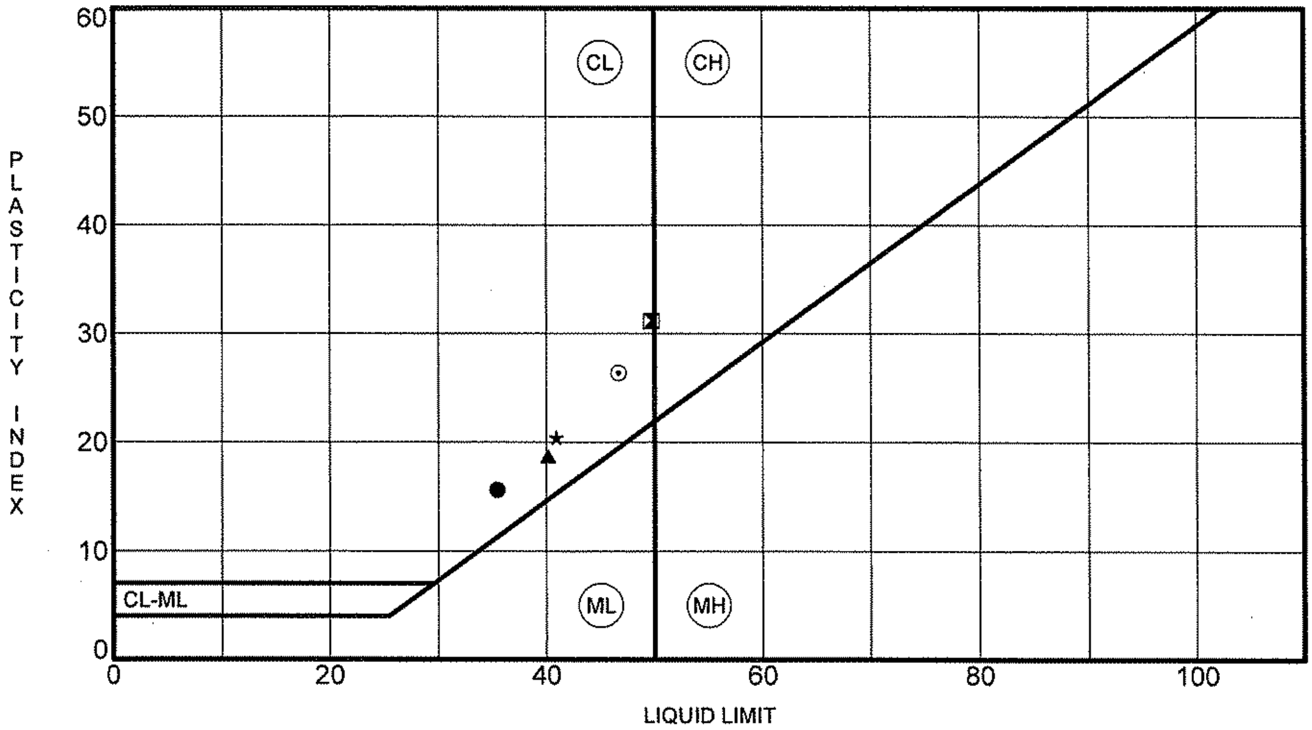
Sample No.	Average Dry Density (pcf)	Average Moisture Content (%)	R-Value at 300 psi Exudation Pressure
Composite: B4, B5, and B7, 0 – 3 Feet	100.5	23.0	10

Borehole	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B1	1.5							18.4	108.8		
B1	4.5							18.5	92.7		
B10	1.5	35	20	15							
B10	2.0							10.2	88.9		
B10	4.0				9.5	73					
B10	4.5							5.7	104.6		
B10	4.0										
B10	14.5							28.8	92.2		
B2	0-5	50	19	31							
B2	2.0							27.0	90.0		
B2	4.5				9.5	76		20.7	100.7		
B2	9.5							29.5	91.1		
B2	14.5							27.9	95.5		
B2	33.5				19	35					
B3	2.0							19.6	106.6		
B3	4.5							31.6	88.0		
B3	9.5							23.3	102.3		
B3	14.0							26.5	97.4		
B4	0-3	40	21	19							
B4	2.0							12.4	99.6		
B4	4.5							11.3	90.9		
B4	9.5							30.2	89.5		
B5	0-3	41	21	20							
B5	2.0							11.0	98.9		
B5	4.5							12.7	87.4		
B6	2.0							18.1	102.9		
B6	4.5							15.4	94.3		
B6	9.5							30.0	90.7		
B7	0-3	47	20	27							
B7	1.5							14.2	88.0		
B7	4.5							14.5	91.2		
B8	2.0							19.0	104.4		
B8	4.5							17.4	102.9		
B9	2.0							12.1	75.2		
B9	4.5							13.0	87.3		

GEOCON
Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Telephone: (916) 852-9118
Fax: (916) 852-9132

Summary of Laboratory Results

Project: Wildhorse Ranch
Location: Davis, California
Number: S9235-06-01
Figure: B1



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description
●	**B10-1.5**	**35**	**20**	**15**		**Lean CLAY**
⊠	**B2-0-5**	**50**	**19**	**31**		**Fat CLAY**
▲	**B4-0-3**	**40**	**21**	**19**		**Lean CLAY**
★	**B5-0-3**	**41**	**21**	**20**		**Lean CLAY**
⊙	**B7-0-3**	**47**	**20**	**27**		**Lean CLAY**

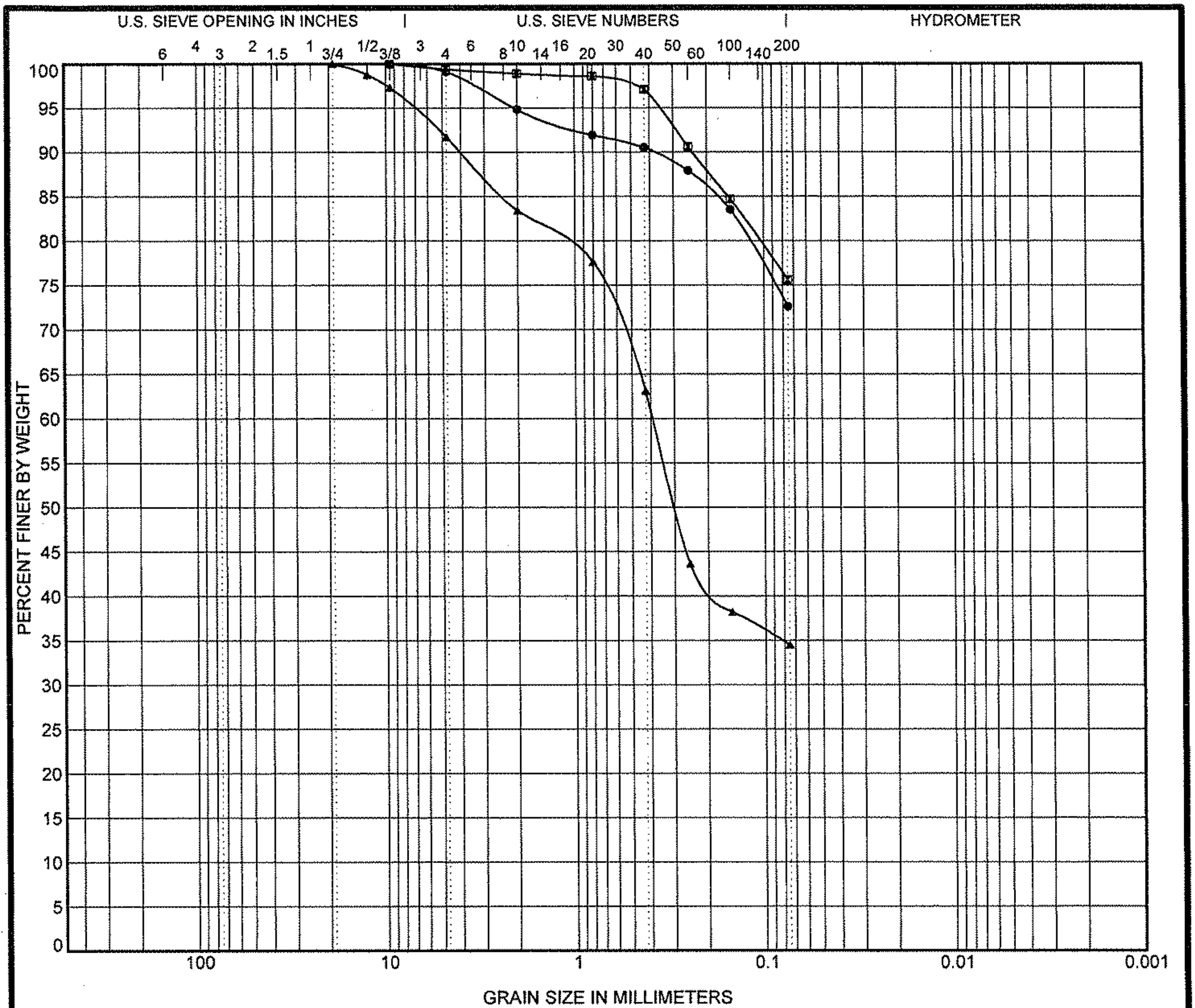
PI COPY 2 S9235-06-01 WILDHORSE RANCH.GPJ US LAB.GDT 4/16/07

GEOCON

Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Telephone: (916) 852-9118
Fax: (916) 852-9132

ATTERBERG LIMITS

Project: Wildhorse Ranch
Location: Davis, California
Number: S9235-06-01
Figure: B2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	**B10-4.0**	**Lean CLAY with sand**					
⊠	**B2-4.5**	**Lean CLAY with sand**					
▲	**B2-33.5**	**Silty SAND**					

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B10-4.0**	**9.5**				**0.9**	**26.5**	**72.6**	
⊠	**B2-4.5**	**9.5**				**0.6**	**23.8**	**75.6**	
▲	**B2-33.5**	**19**	**0.391**			**8.3**	**57.2**	**34.5**	

GEOCON

Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Telephone: (916) 852-9118
Fax: (916) 852-9132

GRAIN SIZE DISTRIBUTION

Project: Wildhorse Ranch
Location: Davis, California
Number: S9235-06-01
Figure: B3

GRAIN SIZE COPY S9235-06-01 WILDHORSE RANCH.GPJ US LAB.GDT 4/16/07