GEOTECHNICAL STUDY
Proposed Three Single-Family Residences
35 Loma Vista Drive
Burlingame, California
for
MR. ALEX FLOCAS
NO. 06-197/7728-01
July 21, 2017
Rev. 5/14/19

Purcell, Rhoades & Associates

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Mr. Alex Flocas
25 Loma Vista Lane
Burlingame, CA 94010

Subject: **GEOTECHNICAL STUDY**
Proposed Three Singe-Family Residences
35 Loma Vista Drive
Burlingame, California

Dear Mr. Flocas:

As requested, we have performed a Geotechnical Study for the proposed three lots at 35 Loma Vista Drive, Burlingame, San Mateo County, California (see Figure 1). The accompanying report presents the results of our site review, document review, exploratory boring excavations, our conclusions, and recommendations. In our opinion, the site is suitable for the proposed construction of three, single-family residences, provided the recommendations in this report are incorporated into the design and followed during construction.

The conclusions and recommendations submitted here are subject to our review of site development plans, including grading and foundation plans, and structural calculations, and observation of site grading, and foundation excavations. We reserve the right to submit supplemental recommendations at any time during construction or site development.

If you have questions, please contact this office at your convenience.

Very truly yours,
PURCELL, RHOADES & ASSOCIATES

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INTRODUCTION

Purpose

The purpose of this study was to evaluate the soil and geologic characteristics relevant to the development of three single-family residences at the subject site. General foundation engineering design and geotechnical recommendations are provided based on the physical characteristics of the subsurface materials and the geotechnical limitations created by the site's surface features.

Proposed Development

The proposed development will consist of the construction of three, wood-framed, single-family dwellings. At the time of preparation of this geotechnical study, a specific house layout and design had not been determined. Figure 2, Site Plan and Boring Locations presents the proposed lot layout and the proposed development area established by City set-back limits.

Grading is anticipated to develop the site, with access to all three homes from Skyline Boulevard. Please contact our office if the conditions of the project change. We may need to revise our recommendations if changes occur in the configuration of the structures, the type of construction, or the proposed loads.

Scope

The scope of work for the proposed development included the following: researching soil and geotechnical data, the logging of six exploratory borings, laboratory testing of relatively undisturbed samples of soil and rock encountered in the borings, analyzing the soil data compiled during the exploration, and reporting our findings and recommendations. This study did not include assessments for environmental concerns, toxic substances or soil or groundwater contamination and is limited to the

immediate vicinity of the location of the planned structures. If additional recommendations are required, please contact this office.

Site Location and Description

The site area is located between Loma Vista Drive on the west and Skyline Boulevard on the east, with a descending slope below the private drive section of Loma Vista Drive. The northern-most lot's upper slope is slightly steeper than 2:1 horizontal to vertical (H:V), with the middle slope area on the order of approximately 3:1, H:V, and the lower slope area generally flat (see Figure 2). It appears from the site plan that the structures will be constructed partly upon the slope and partly on the flat section of the property.

The site is currently vacant, with trees on the sloping ground and native grasses on the flat area. A shallow, rough graded ditch that provides surface drainage through the site is located along the eastern limit of the site (see Figure 2). It was noted during a site review after recent rains that water ponds at the flat portion of the northern lot.

SITE SETTING

General Geologic Setting

The geologic structure of the Bay Area is complex and has been molded by numerous mountain building events. This geologic structure is characterized by extensive folding, faulting, and fracturing of variable intensity. The folds and faults trend northwesterly and comprise the pronounced northwest tending ridge-valley system. The oldest geologic formations in the Bay Area are probably of Jurassic age, 138-205 million years ago, (Kith, et al. 1988). These formations have been subjected to repeated episodes of deformation. By comparison, the youngest formations (Quaternary age - last 2 million years) have been only mildly flexed.

According to Brabb, Graymer, and Jones (1998), the site area is mapped as underlain by greenstone of the Franciscan Complex (see Figure 3, Area Geologic Map). This unit is regionally described by Brabb et al, as including dark-green to red, altered basaltic rocks, including flows, pillow lavas, breccias, tuff breccias, tuffs, and minor related intrusive rocks.

The U.S. Geological Survey Professional Paper entitled, "Relative Slope Stability and Land-Use Planning (1979), indicates that the site area is in a zone listed as, "Category 3", "Generally Stable to Marginally Stable", in "Areas of greater than 15% slope that are not underlain by landslide deposits or bedrock units susceptible to landsliding."

Seismic Considerations

The subject site lies within the San Francisco Bay Area, a region of high seismic activity. The probability is very high for a major earthquake to occur in the Bay Area within the economic lifetime of the proposed structures. Several active and potentially active faults occur in the region. The following active faults are listed with their distance from the site, and their respective moment magnitude earthquake.

Fault	Distance, miles	Moment Magnitude
San Andreas	1/4	8.0
Monte Vista-Shannon	12-1/2	6.7
San Gregorio	6-1/2	7.4
Hayward	18	7.3
Calaveras	26-1/2	6.9

The Serra fault, a series of southwesterly dipping thrust faults are located approximately 1850 feet northeast of the site (Brabb and Olson, 1986). The Serra fault has been shown to displace Pleistocene age materials, but has not been unequivocally

proven to displace Holocene age material, and is not zoned by the California Geologic Survey as being potentially active.

The regional site area would be susceptible to ground shaking and ground failure during a major earthquake on the San Andreas, Monte Vista-Shannon, San Gregorio and Hayward, and Calaveras faults. The seismic risk to a structure depends on the distance from the epicenter; the characteristics of the earthquake; the geologic, groundwater, and soil conditions underlying the structure and its vicinity; and the nature of the construction. A regional U.S. Geological Survey study of slope stability during earthquakes in San Mateo County indicated that the site area would have a, "Very Low" susceptibility to ground failure during an earthquake (Wieczoreck, and others, 1985).

Ground shaking at the site is likely to occur during the life of the project. Ground acceleration values to be considered in design are provided in the Seismic Parameters section of the Recommendations.

Liquefaction Potential

Liquefaction occurs when loose, saturated, granular deposits change from a solid to a liquid state due to increased pore pressure during cyclic seismic loading. Our site review and exploratory borings did not indicate the presence of any loose sand deposits that would be subject to the affects of liquefaction.

SITE EXPLORATION AND LABORATORY TESTING

Site Exploration

Field exploration of the site, conducted on June 6, 2017, consisted of the drilling of six exploratory borings using a truck-mounted B-24 (Borings 1 through 4), and a portable, Minute-Man type drill rig (Borings 5 and 6). All borings were terminated within dense bedrock, with the maximum depth explored approximately 23 feet below existing grade.

Please see Figure 2, Site Plan and Boring Locations for the location of all test borings. The logs of the exploratory borings are presented as Figures 4 through 9.

Relatively undisturbed soil samples for laboratory testing were recovered in a 2.5-inch outside diameter (OD) California sampler or a 2-inch OD split spoon sampler driven by repeated blows of either a 140-pound hammer (Borings 1 through 4), or a 70-pound slide hammer free-falling 30-inches per blow. The number of blows applied to advance the sampler was recorded for each 6 inches of penetration and then converted to Standard Penetration Test values and recorded on the Exploratory Boring Logs (Figures 4 through 9).

Laboratory Testing

Laboratory testing was conducted on selected borehole samples to obtain data on dry density, moisture content, Atterberg Limits, and unconfined compressive strength. Test results are shown on the Exploratory Boring Logs (Figures 4 through 9).

SUBSURFACE CONDITIONS

General

The borings encountered surficial materials of stiff to very stiff clayey silt, and silty clay, and loose to medium dense silty sand, underlain by a dense to very dense bedrock of welded tuff breccia that has the consistency similar to that of a dense fractured sandstone. The borings on the hill slope portion of the site (Borings 2, , 5, and 6) encountered weathered bedrock material on the order of 3 to 5 feet below existing grade. Borings on the flatter portion of the site (Borings 1, and 3) encountered weathered bedrock material on the order of 19 to 21 feet below existing grade. Boring 4 was located within the northern-most lot at the transition from hillside to the flat area and encountered weathered bedrock materials at a depth of approximately 10 feet below existing grade.

Laboratory tests indicated the surface soil has a Liquid Limit of 39 and a Plasticity Index of 16. This would indicate a low to moderate expansive condition with varying moisture content. Using the statistical methods of Attom and Barakat (2000), the average anticipated uplift pressure against a grade berm or footing during a wetting cycle may be on the order of 1,500 pound per square foot (psf).

Groundwater

Free water was encountered in Borings 1 and 3 at an approximate depth of 19 and 20 feet below grade, respectively. The remaining borings did not extend to a depth that would be anticipated to encounter groundwater. Due to the nature of the subsurface materials encountered, zones of limited, perched groundwater may be seasonally encountered within the matrix of the bedrock unit. Water levels will vary due to climatic conditions, and the works of man.

DISCUSSION

The exploratory borings indicate that the site is underlain by moderately expansive surficial materials, with an underlying dense to very dense, weathered and fractured volcanic tuff breccia bedrock unit that has a consistency similar to that of a fractured sandstone. Due to the chaotic nature of the Franciscan Complex, bedrock types and consistency can vary within short distances, and depth.

Site development will require grading, and will likely include the construction of retaining walls. Since the house footprint will likely be placed partially upon the slope and partially upon the flat area of the site, a pier and grade beam foundation system is recommended to provide a uniform bearing area and reduce the potential for excessive differential foundation movement. Groundwater may be encountered in piers drilled in the flat areas.

Surface drainage controls will be necessary for site development. Ponding was noted at the northern lot limits after a rain period, and drainage improvements will be needed at this location.

The site is near the active San Andreas fault and will be subject to very strong to violent ground shaking in the event of a near-source maximum moment earthquake event.

CONCLUSIONS

The following conclusions are based on the results of our study for the proposed development.

1. It is our opinion that proposed construction is feasible from a geotechnical viewpoint provided the recommendations contained in this report are followed.

2. Site observations and published information indicate that portions of the shallow soil veneer may be characterized as moderately expansive. The weathered bedrock unit is a mix of silty sand with blebs of silty clay with fractured rock fragments. Due to potential localized variations in underlying bedrock type, soil and bedrock materials of higher expansion potential, are possible at this site.

3. The hazard of seismic shaking is common to the geographic area; therefore, very strong to violent seismic ground shaking should be expected to occur within the economic life of the proposed structures. The potential for structural damage as a result of ground shaking depends on the structural design of the structures.

4. It is our opinion that a low liquefaction hazard exists at the project site.

5. It is our opinion that the proposed single-family, wood-framed structures may be supported on a pier and grade beam foundation system

6. Based upon our review of published information and site reconnaissance, it is our opinion that there is presently no indication of landslides that would be an impact to the proposed construction.

7. It is our opinion that construction of this proposed structures, if constructed in accordance with the recommendations provided herein, will not result in an adverse impact to the soils, slope stability and drainage of the project site area.

RECOMMENDATIONS

Geotechnical Hazards

Risk of geotechnical hazards will always exist due to uncertainties of geologic conditions and the unpredictability of seismic activity in the Bay Area. However, in our opinion, based on available data, there are no indications of geotechnical hazards that would preclude use of the site for the proposed development. The proposed structures should be designed to meet current *California Building Code* (CBC) requirements to limit potential damage from ground shaking.

A representative of this office must perform a Plan Review of construction plans and structural calculations to confirm that the recommendations to be provided in the Geotechnical Study are considered in the design and construction of the project.

During construction, a representative of this office must observe grading operations, and foundation excavations, and to perform field density compaction testing to verify confirm that the geotechnical aspects of the construction was performed in accordance with the recommendations of the Geotechnical Study. PRA reserves the right to provide supplemental recommendations at any time during site planning and construction.

Seismic Parameters

The following seismic shaking criteria is provided for consideration by the Project Structural Engineer in the foundation design of the proposed development. The nearest known seismic source is the San Andreas fault (Type A), at a distance of approximately 0.4 km. Using the U. S. Geological Survey interactive website for acceleration parameters, we recommend the following near-source seismic values:

SEISMIC CRITERIA	VALUE
Site Class	C
S_s Short Period 0.2-second Spectral Acceleration	2.603g
S_1 1.0 Second Spectral Acceleration	1.250g
Site Coefficient F_a	1.0
Site Coefficient F_v	1.3
Max. Short Period Spectral Response Acceleration	
$SM_s = F_a \times S_s$	2.603g
Max. Spectral Response Acceleration 1-second period	
$SM_1 = F_v \times S_1$	1.625g
Damped Design Spectral Response - Short Period	
$SD_s = 2/3 \times SM_s$	1.735g
Damped Design Spectral Response - 1-second Period	
$SD_1 = 2/3 \times SM_1$	1.083g

Grading

No grading plans were submitted to this office for consideration, however, we expect site development will require moderate grading for site development. The foundation and driveway will need to be stripped of vegetation and scarified to receive any fill. The organic material must be removed, and the loose soils subexcavated to firm material acceptable to the Geotechnical Engineer and then compacted per the recommendations provided below and in Appendix A to design finish grade.

Preliminary grading plans must be reviewed by our office in order to provide written supplemental recommendations as needed for grading permit application and prior to starting the grading operations.

All grading must conform to the specific recommendations of this report. However, because of the potential for variability in encountered subsurface conditions on a property, all conditions which may become exposed during grading cannot be foreseen at this time. Therefore, it is recommended that site preparation and grading operations must be performed under the observations of Purcell, Rhoades & Associates so that actual conditions can be evaluated in the field as the job progresses. The Geotechnical Engineer must be notified at least 48 hours prior to commencement of any grading operations so that arrangements can be made to provide observation and testing services.

Due to the variability of bedrock types in the site area, all cut slopes must be evaluated by an Engineering Geologist from this office during grading. If necessary, supplemental slope mitigation recommendations would be provided depending upon the material and structural features (e.g., bedding, joints, and fractures) exposed by the cut slopes.

For compaction specifications, the upper 18 inches of subgrade below driveway sections, and fill placed within keyways should be moisture conditioned to 3 to 5 percent over the optimum moisture content and compacted to a minimum of 95 percent relative compaction in accordance with ASTM D1557. All other areas of fill should be placed at a minimum of 3 to 5 percent over the optimum moisture content and a minimum of 90 percent relative compaction, except the top 24 inches of material underlying concrete flatwork or concrete slabs where expansive soils may be present. At these locations, the subgrade should be moisture conditioned to a minimum of 5 percent over the optimum moisture content and the compaction should range from 85 percent to a maximum of 90 percent. On-site soil generated by site grading may be

used as fill provided that the soil is free of deleterious and organic materials and that it has been approved for use as fill by the Geotechnical Engineer. Samples of any proposed import fill planned for use on this project should be submitted to the Geotechnical Engineer for approval and appropriate testing no less than four working days before the expected delivery to the job site. See also Appendix A for Recommended Grading Specifications for implementation in the development of this site.

Foundations

Any proposed dwelling must be supported upon a rigid foundation system that is supported upon piers with a grid of interlocking structural grade beams. The foundation contractor should be informed of the anticipated nature of the underlying bedrock, in order to provide the appropriate excavation method to achieve design depth. It is anticipated that the residence will be constructed using typical wood framing in conjunction with wood diaphragms in order to distribute seismic and wind shear to the foundation system. Structural loads for this type of construction are expected to be low to moderate.

The following geotechnical design criteria should be implemented at the discretion of the Structural Engineer based upon his review and design in conformance with current industry standards and the Geotechnical recommendations of this Geotechnical Study.

Pier Foundation System

Pier Size	Minimum diameter 18 inches with vertical forces acting in both directions using a skin friction value of 750 psf. Piers must have a minimum of 6 feet into non-yielding bedrock material as determined by the Geotechnical Engineer or his representative

Passive Value	400 pcf-efw acting over 1-1/2 pier diameters, initiating at a depth of 4 feet below surface grade.
Active Value	55 pcf-efw acting over twice the pier diameter to a depth of 4 feet below surface grade.

To reduce the potential for settlement, we recommend that the pier excavations be cleaned of slough and loose material prior to placing steel reinforcement and concrete. Grade beams should be embedded a minimum of 6-inches below surface grade and designed to resist an uplift pressure of 1,500 psf.

A representative from our firm must be present to observe the pier drilling excavation to confirm the uniformity and the competence of the materials and embedment into acceptable non-yielding material.

Concrete Slab-On-Grade, Floors

We recommend that the minimum slab-on-grade floor thickness for the garage be 5-inches, underlain by 6 inches of capillary break material. The capillary break material can consist of 6 inches of 3/4-inch uniform graded rock, or 2 inches of sand, a 10 mil visqueen and 4 inches of 3/4-inch capillary break rock material. Reinforcement should be as directed by the Structural Engineer with the minimum reinforcement of No. 4 reinforcing bars spaced at 18-inches on-center in a grid pattern, or with an alternate reinforcement system as required by the Project Structural Engineer. The slabs shall be floated to allow for soil expansion and contraction. The reinforcement should be supported by concrete dobies to support the steel prior to the concrete placement in order to position the steel for the greatest efficiency in minimizing the cracking of the slab. The moisture retarder membrane, if used, should be placed in accordance with the manufacturer's specifications. Any punctures or damage to the membrane that may occur must be repaired in accordance with the manufacturer's specifications. Some moisture transmission should be expected where a membrane vapor retarder is

not utilized. Prior to membrane placement, the soil subgrade must be moisture conditioned as approved by the Geotechnical Engineer.

Crack control joints should be located as directed by the Structural Engineer. The subgrade in the slab area must be moisture conditioned by extended sprinkling prior to placement of the concrete.

Recommendations presented in the American Concrete Institute should be complied with for all concrete placement and curing operations. Improper curing techniques and/or excessive slump (water-cement ratio) could cause excessive shrinkage, cracking, or curling.

Miscellaneous Flatwork

Concrete slab-on-grade access facilities should consist of a minimum 5 inch slab reinforced with no. 4 bar, 18 inches on-center, underlain by a 4 inch cushion of granular materials A deepened edge around the slab exterior 6 inches into the subgrade is recommended to prevent storm water from entering the granular subbase materials.

The owners must be advised that, due to the expansive nature of the site's surface materials, some vertical displacement of exterior flatwork, sidewalks, driveways, and pavements should be anticipated. Proper site drainage, maintenance and controlling landscape irrigation is recommended to reduce the amount of vertical displacement that may occur.

Retaining Walls

The following recommendations are for a retaining wall founded on piers extended into the bedrock encountered during our subsurface investigation. The retaining wall should be designed for a fully-drained condition. Table 1 presents our design criteria

recommendations for up to a maximum 8-foot high retaining wall. Design pressures are expressed as equivalent fluid pressures.

TABLE 1

RETAINING WALL DESIGN CRITERIA

Lateral Pressures: Gradient of Backfill	Active Pressure (pcf)	Passive Pressure* (pcf)
2:1 (maximum or less)	55	See concrete pier lateral loads for minimum depth and loading condition

Walls restrained at the top should be designed with a 100 psf uniform lateral surcharge load in addition to the lateral earth pressures given above. Any wall structurally connected at the top to the structure should be considered a restrained wall.

The design criteria are applicable for walls which have fully-drained conditions and are no greater than 8 feet in height. To provide fully-drained conditions, a gravel drainage system should be constructed behind the walls and have a minimum width of 12 inches. We recommend that the drainage system commence behind and at the bottom of the retaining structure's heel and extend up the retaining wall to 1 foot below grade. The drainage system should consist of Cal Trans Class 2 permeable material drain rock and approved by our geotechnical engineer or the engineer's representative. A 4-inch diameter, perforated rigid drainpipe should be installed at the bottom of the drainage system with holes facing down. The pipe should be sloped at a minimum of 2 percent and discharged to a suitable drainage facility away from all structural improvements.

For backfill behind retaining structures, the zone between the structure's drainage system and the limits of excavation may be backfilled with on-site soil; however, granular material is recommended for lower lateral earth pressures. Should on-site soils be used in the zone between the structure's drainage system and the limits of excavation, the backfill materials should be compacted to 90 percent of the maximum dry density at 2 to 4 percent above optimum moisture content as determined by American Society of Testing Materials (ASTM) D1557 test methods. Over-compaction behind retaining structures tends to increase the lateral pressure against the structures and, therefore, should be avoided.

Any retaining walls must be designed for a fully-drained condition. Structural retaining walls must be supported upon piers similar in design for the house piers. The retaining wall design must be performed by the project Structural Engineer.

In general, all retaining walls must be free draining with a 4-inch diameter perforated pipe (SDR 35 or equivalent) placed upon 1-inch of CalTrans Class II permeable drain rock at the base of the wall and a minimum of 6 inches below any cold joint or where potential seepage through the wall would be objectionable. The trench and pipe should be sloped a minimum of 1 percent and discharged into a suitable outlet, with clean outs at the start and every 100 foot of drain line. A 12-inch wide minimum section of CalTrans permeable material should then be backfilled to within 1 foot of the surface then capped with compacted clay material up to the finish surface.

To reduce the potential for moisture transmission through the retaining wall, where the retaining wall is used as part of a building or where moisture transmission would be objectionable, it is recommended that the appropriate face be hot-mopped in accordance with the manufacturer's specifications and an impermeable membrane be placed over the hot-mopped surface to protect the surface from damage during drain rock placement. It is important that the surface drainage controls also be installed to

reduce the potential for moisture transmission. Where retaining walls form part of the building, deflection calculations or allowance for wall movement should be included in the final planning for the structure.

Seismic Surcharge

For the purpose of providing a seismic surcharge to be considered in the design of the retaining walls in excess of 6 feet in height at this site, the methodology proposed by Seed and Whitman (1970), provides a simplified dynamic lateral force component for yielding walls as:

$$\Delta P_{AE} \sim (½)\ (3/4)\ k_h \gamma H^2 = (3/8)\ k_h \gamma H^2$$

It has been recommended that k_h be taken as equal to the site acceleration that is consistent with the design motions of $k_h = S_{DS}/2.5$, where S_{DS} is the design, 5-percent-damped, spectral response acceleration parameter at short periods (i.e., period of 0.2 seconds). The unit weight of soil (γ) should be assumed as 120 pcf. Seed and Whitman recommended that the resultant dynamic thrust be applied at 0.6H above the base of the wall (i.e., similar to an inverted triangular pressure distribution.

Therefore, the wall design includes the active soil lateral pressure values as provided in this report, with the resultant acting at a distance of H/3 from the base of the wall; and the seismic surcharge value, as discussed above, with the resultant acting at a distance of (0.6*H) from the base of the wall. This assumes a fully drained condition. Any superimposed loads other than retained earth, shall be considered as surcharges. Loads applied within a horizontal distance equal to wall stem height, measured from the back face of the wall shall be considered as a surcharge.

Utility Trenches

Utility trenches that parallel the sides of the buildings should be placed so that they do not extend below a line sloped down and away at a slope of 2H:1V (horizontal to vertical) from the bottom outside edge of the perimeter foundations.

All trenches should be backfilled with native materials compacted uniformly to a minimum 90% relative compaction, or as specified by local codes. If local building codes require use of sand as the trench backfill, all utility trenches entering the building should be provided with an impervious seal of either cohesive soil or lean concrete where the trench passes under the building perimeter. The impervious plug should extend 4 feet into, and out of, the building perimeter. Jetting of trench backfill is not recommended as it may result in an unsatisfactory degree of compaction.

Utility trench safety is the responsibility of the underground utility contractor. It is their responsibility to ensure that all Cal/OSHA regulations regarding site safety and trench stability are adhered to during trenching, placement of utilities and placement of compacted trench backfill. The contractor's designated Competent Person must monitor the soil conditions as required by Cal/OSHA.

Pavement Design

It is our understanding that it is intended to use concrete pavers to construct a common courtyard at the middle lot leading off Skyline Boulevard that will service the respective individual private driveways. Pavers are typically constructed using a sequence of materials recommended by the manufacturer. It is recommended that the sequence of materials be placed upon a subbase that is prepared by subexcavating approximately 18 inches, scarifying the base and recompacting the base and replacement fill that is moisture-conditioned to between 3 and 5 percent over optimum moisture content and compacted to minimum 95 percent relative compaction. It is

recommended that this office receive a description of the respective thickness and material types that will comprise the paver system.

We recommend that the owners be advised that some vertical displacement of exterior flatwork, sidewalks, pavers, driveways, and pavements be anticipated. We also recommend pre-soaking of all exterior flatwork areas be performed to the satisfaction of the Geotechnical Engineer or his representative prior to the placement of concrete or other covers.

Drainage

Surface waters must not be allowed to pond or saturate soils adjacent to the building foundations. To preclude this, it will be necessary to direct all water collected from roof down spout into tightlines that will direct the collected drainage away from the building foundation and into suitable discharge points.

We recommend that a minimum slope gradient of 5 percent down and away from the structure perimeters be applied to the finished subgrade (including topsoil) for a distance of at least 5 feet. A drainage swale or positive slope must be provided on the uphill side of the structures in order to remove surface water from the pad areas to an acceptable discharge point or storm drain inlet.

Undrained planted areas located immediately adjacent to the structures must be avoided. If vegetation must be planted adjacent to a structure, plants that require very little moisture should be used. The drip line of all trees should fall at least 10 feet from the perimeter of any foundation element. Sprinkler heads should not be placed where they would saturate the foundation soil; a drip irrigation system is preferred. No flatwork should be used adjacent to the foundation where a trapped water condition could occur. The use of drop-inlets in such areas are necessary to control the discharge of irrigation or storm water at these locations.

Surface waters must not be allowed to pond or saturate soils adjacent to the foundation. To preclude this, it will be necessary to direct all water away from the foundation and into suitable storm water control systems. We recommend that a positive slope gradient of 3 to 5 percent down and away from the structure perimeter be applied to the finished subgrade (including topsoil) for a distance of at least 5 feet.

Miscellaneous

Our site review did not reveal the presence of buried items such as leaching fields, and storage tanks, etc. in the proposed site area. It is possible, however, that such items may be present. If such buried items are encountered during excavations of foundations, our firm should be notified immediately to provide recommendations for proper procedures. Also, this study did not include investigations for toxic substances or groundwater contamination of any type, the potential for corrosive soils, or soils with reactivity to concrete. If such conditions are encountered during site development, additional studies will be required.

Plan Review

Before submitting design drawings and construction documents to the appropriate local agency for approval, copies of the documents must be reviewed by our firm to ensure that the recommendations in this report have been effectively incorporated, and to provide supplemental recommendations, where needed.

Site Safety

All excavations and site work must comply with applicable local, state, and federal safety regulations. Construction site safety is the responsibility of the contractor, who shall be solely responsible for the means, methods, and sequencing of construction operations. Our services and recommendations for site safety are advisory and not supervisory.

Construction Observations

A representative of this firm must be present during grading operations and foundation excavation to observe that the work performed is in conformance with specifications and recommendations provided here. Records will be maintained of our site visits and test results.

At the completion of grading, and foundation excavation, we will submit a summary of our observations along with any necessary supplemental recommendations.

To assure that our personnel are at the site when needed, we require that you notify us at least 2 working days before the task begins.

LIMITATIONS

This report has been prepared for the exclusive use of Alex Flocas and his consultants for specific application to the proposed development. If changes occur in the nature, design location, or configuration of the proposed development, the conclusions and recommendations contained here shall not be considered valid. Changes must be reviewed by our firm.

The analysis, opinions, conclusions and recommendations submitted in this report are based in part on the referenced materials, site visit and evaluation, and subsurface exploration. The nature and extent of variation among exploratory test borings may not become evident until construction. If variations appear, it will be necessary to re-evaluate or revise recommendations made in this report.

The recommendations in this report are contingent on conducting an adequate testing and monitoring program during construction of the proposed development. Unless the construction monitoring and testing program is provided by or coordinated with our firm, Purcell, Rhoades & Associates, inc. will not be held responsible for compliance with design recommendations presented in this report and other supplemental reports submitted as part of this report.

Our services have been provided in accordance with generally accepted geotechnical engineering practices. No warranties are made, express or implied, as to the professional opinions or advice provided. Recommendations contained in this report are valid for a period of 2 years; after 2 years they must be reviewed by this firm to determine whether or not they still apply.

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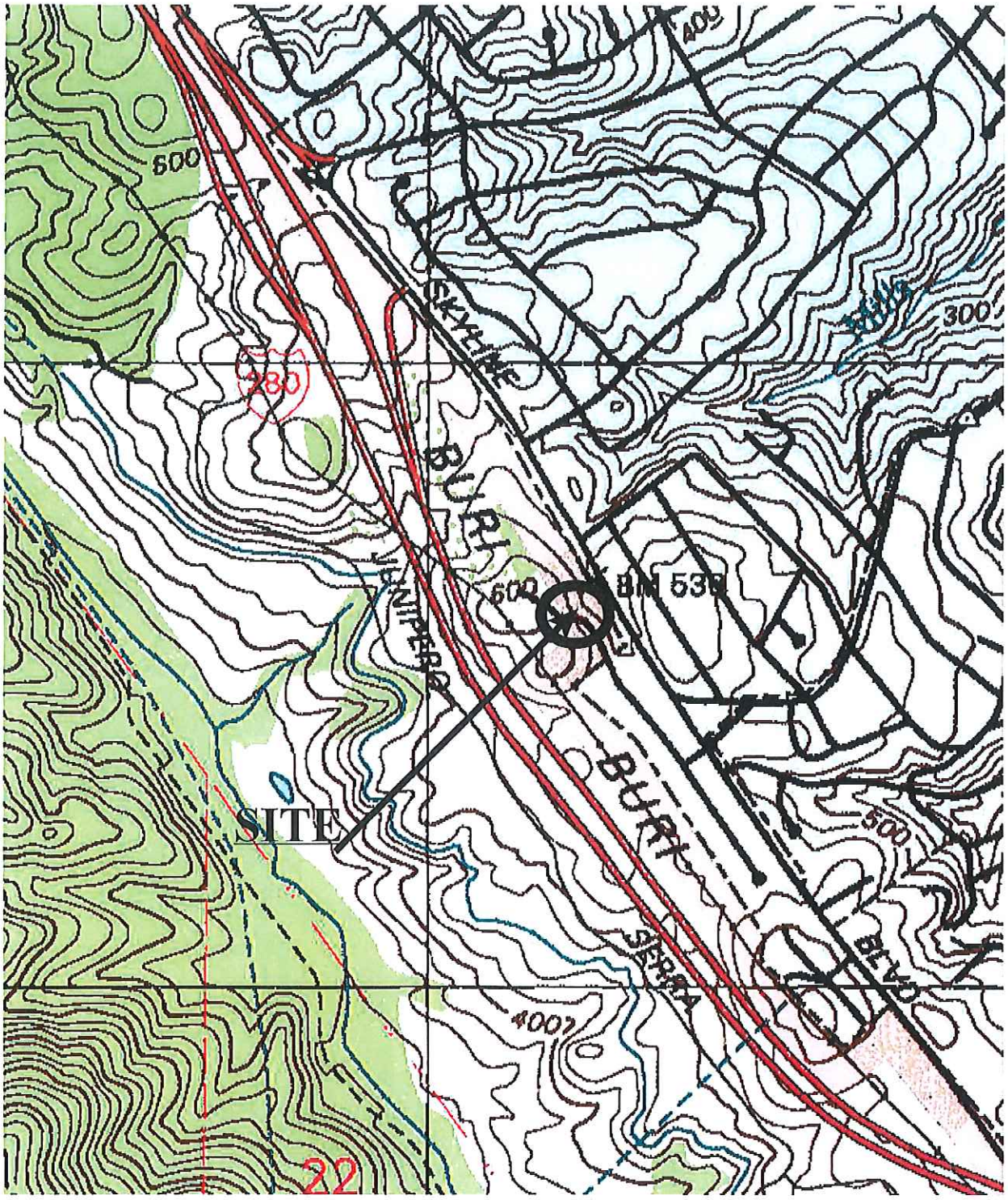
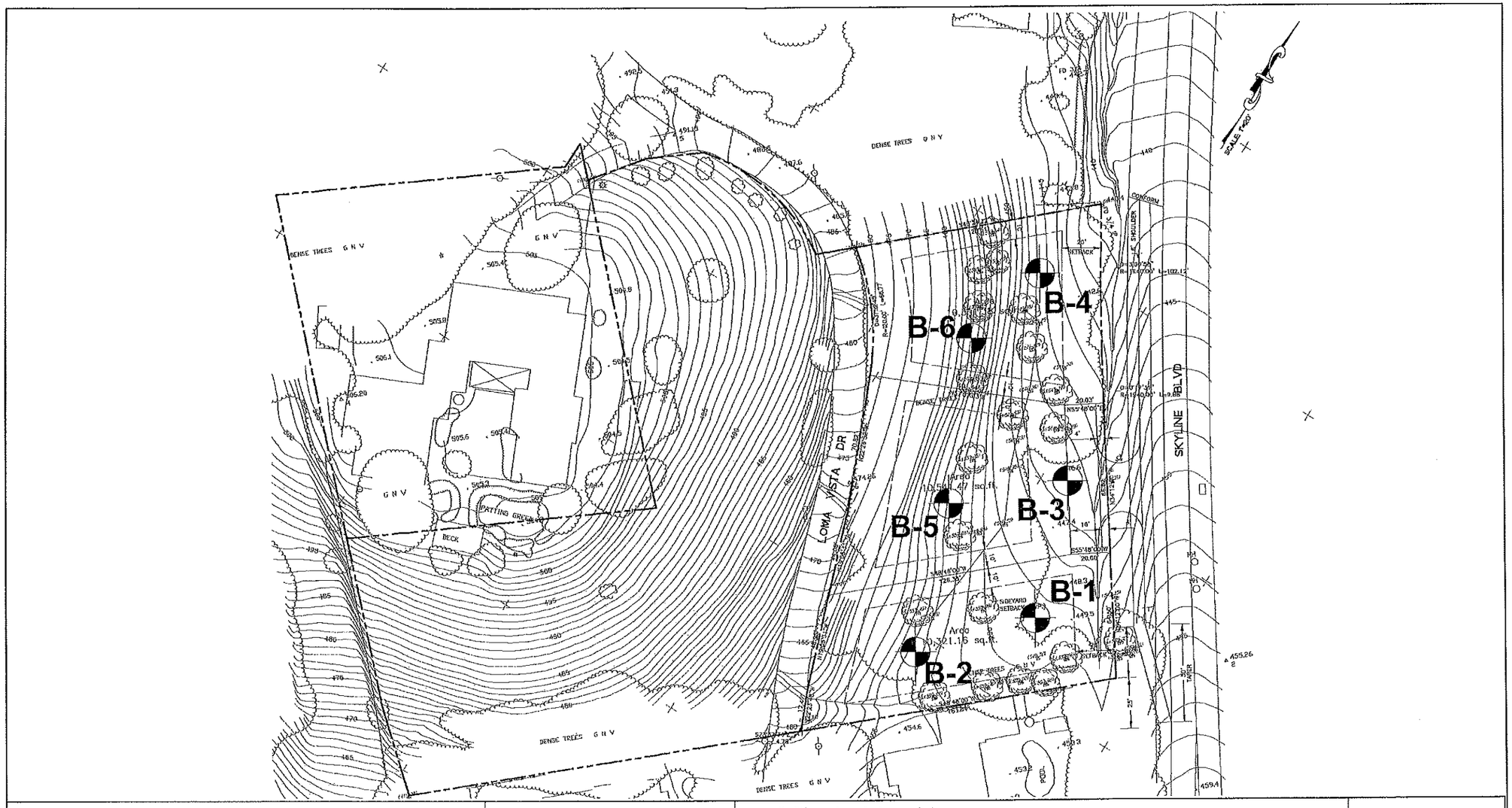


NOTES SOURCE: TOPOZONE, MONTARA MOUNTAIN QUADRANGLE	DATE JULY 2017 JOB NO. 7728-01 DWG NO. F772801.FIG 1 DRAWN IDA CHK'D DJR APP'D DJR	Purcell, Rhoades & Associates Consultants in the Applied Earth Sciences **SITE LOCATION MAP** 35 LOMA VISTA DRIVE BURLINGAME, CALIFORNIA CLIENT ALEX FLOCAS	FIGURE NO. 1 REV. NO.



NOTES

APPROXIMATE BORING LOCATIONS

DATE	JULY 2017
JOB NO.	7728-01
DWG NO.	F772801FIG 2
DRAWN	IDA
CHK'D	DJR
APP'D	DJR

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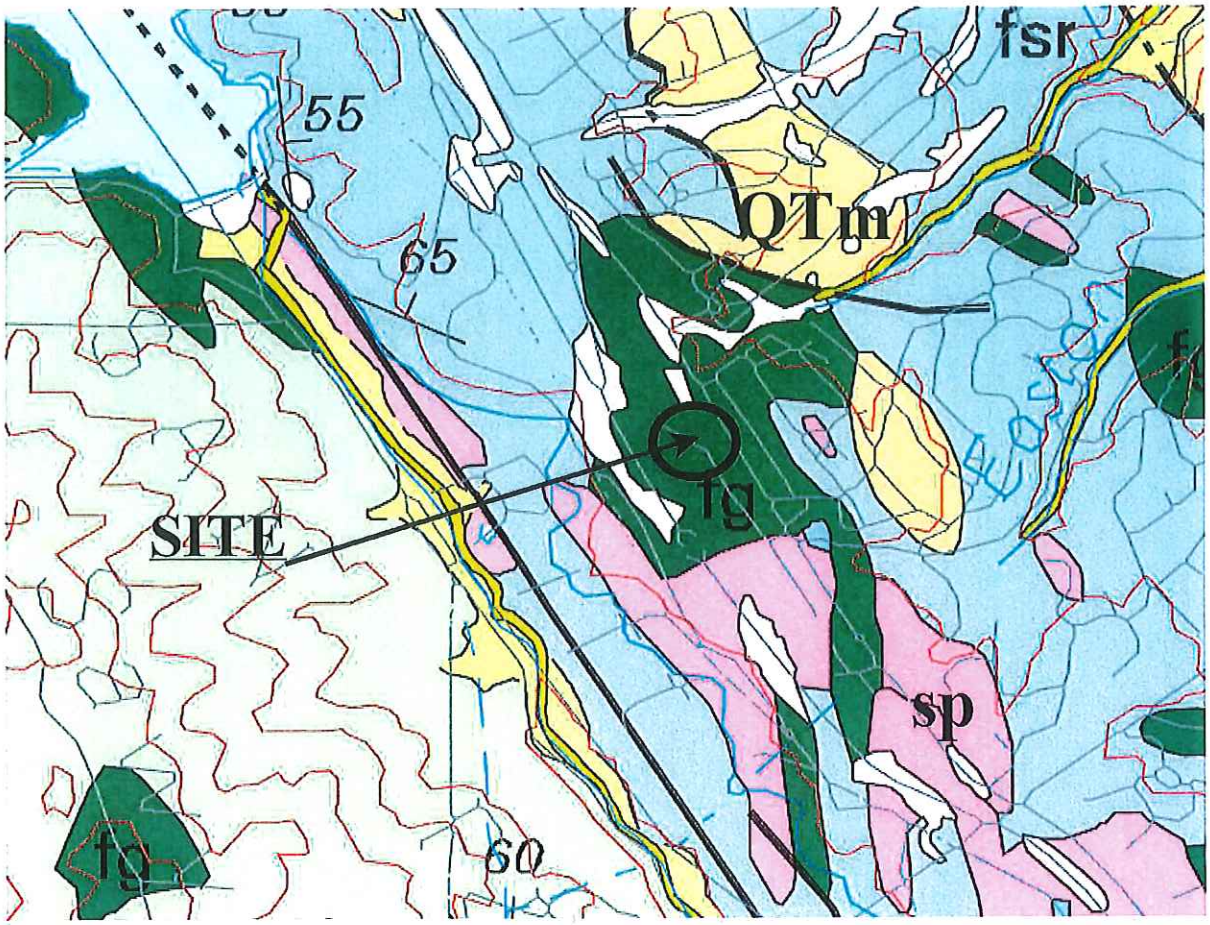
SITE PLAN WITH BORING LOCATIONS
35 LOMA VISTA DRIVE
BURLINGAME, CALIFORNIA

CLIENT ALEX FLOCAS

FIGURE NO.

2

REV. NO.



Key

af	artificial fill
Qtm	Merced Formation, sandstone, siltstone, and claystone
Kjf	Franciscan Complex
fs	sandstone
fg	greenstone
fsr	sheared rock - melange
sp	Serpentinite

NOTES SOURCE: BRABB, E. E., GRAYMER, R. W., AND JONE, D. L.	DATE JULY 2017 JOB NO. F7728-01 DWG NO. F772801.FIG 3 DRAWN IDA CHK'D DJR APP'D DJR	Purcell, Rhoades & Associates Consultants in the Applied Earth Sciences **AREA GEOLOGY MAP** 35 LOMA VISTA DRIVE BURLINGAME, CALIFORNIA CLIENT ALEX FLOCAS	FIGURE NO. 3 REV. NO.

EXPLORATORY BORING LOG

CLIENT: Mr. Alex Flocas PROJECT NO.: 7728-01	LOGGED BY: IDA	DATE DRILLED: 06/06/17	PAGE 1 OF 1
DRILL RIG: NORTH STAR DRILLING WEIGHT OF HAMMER: 140-POUND DROP: 30 INCHES		BORING ELEV.: E.G. BORING DIAM.: 4 INCHES	BORING NO. B-1

FIELD				DESCRIPTION			LABORATORY					
DEPTH (FT.)	SAMPLE	SAMPLE NO.	BLOWS / FT.	MATERIAL DESCRIPTION AND REMARKS	CONSISTENCY	USCS LETTER SYMBOL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	PERCENT PASSING NO. 200	PLASTICITY INDEX (%)	UNCONFINED COMPRESSIVE STRENGHT (PSF)	POCKET PENETROMETER, TSF
1				DECORATIVE BARK COVER								
4		B1-1	10	CLAYEY SILT, dark brown, moist	STIFF	CL	109	21		LL: 39 PI: 16		PP: 1.5
9		B1-2	15									
10				TRACE OF FINE CLAYEY SAND WITH SOME 1/8-INCH PEBBLES								
14		B1-3	27	CLAYEY SILT, light brown, moist	VERY STIFF	CL	104	22			2600	PP: 4.0
16				VERY STIFF DRILLING AT 16 FEET								
19		B1-4	39	INITIAL WATER AT 19 FEET TUFF BRECCIA, greenish brown, sheared, wet	DENSE	RX						PP: 4.5
21				INCREASING RESISTANCE; VERY DENSE								
23		B1-5	50/6"	TUFF BRECCIA, greenish brown, sheared, near refusal, wet	VERY DENSE	RX						
24		SPT TD		BORING TERMINATED AT APPROXIMATELY 23 FEET. GROUNDWATER ENCOUNTERED AT 19 FEET HOLE BACKFILLED WITH GROUT CUTTINGS DISPOSED ON-SITE								

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EXPLORATORY BORING LOG B-1
35 Loma Vista Drive
Burlingame, CA

ALEX FLOCAS

FIGURE NO.
4

EXPLORATORY BORING LOG

CLIENT: Mr. Alex Flocas PROJECT NO.: 7728-01	LOGGED BY: IDA	DATE DRILLED: 06/06/17	PAGE 1 OF 1
DRILL RIG: NORTH STAR DRILLING		BORING ELEV.: E.G.	BORING NO. B-2
WEIGHT OF HAMMER: 140-POUND DROP: 30 INCHES		BORING DIAM.: 4 INCHES	

FIELD				DESCRIPTION	LABORATORY						
DEPTH (FT.)	SAMPLE	SAMPLE NO.	BLOWS / FT.	MATERIAL DESCRIPTION AND REMARKS	CONSISTENCY	USCS LETTER SYMBOL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	PERCENT PASSING NO. 200	PLASTICITY INDEX (%)	UNCONFINED COMPRESSIVE STRENGHT (PSF)	POCKET PENETROMETER, TSF
1				CLAYEY SILT, reddish brown, dry								
2												
3		B2-1	9	SILTY SAND, mottled yellow and reddish brown, dry	LOOSE	SM	95	16				
4												
5												
6		B2-2	54	WEATHERED TUFF BRECCIA, light yellow brown, sheared	VERY DENSE	RX	117	14			2000	PP: 4.5+
7												
8												
9												
10		B2-3	50/6"	WEATHERED TUFF BRECCIA, light yellow brown, sheared, dry	VERY DENSE	RX						
11	SPT			BORING TERMINATED AT APPROXIMATELY 10-1/2-FEET. NO GROUNDWATER ENCOUNTERED AT TIME OF DRILLING HOLE BACKFILLED WITH GROUT CUTTINGS DISPOSED ON-SITE								
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32												

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EXPLORATORY BORING LOG B-2
35 Loma Vista Drive
Burlingame, CA

ALEX FLOCAS

FIGURE NO.
5

EXPLORATORY BORING LOG

CLIENT: Mr. Alex Flocas PROJECT NO.: 7728-01	LOGGED BY: IDA	DATE DRILLED: 06/06/17	PAGE 1 OF 1
DRILL RIG: NORTH STAR DRILLING WEIGHT OF HAMMER: 140-POUND DROP: 30 INCHES		BORING ELEV.: E.G. BORING DIAM.: 4 INCHES	BORING NO. **B-3**

FIELD				DESCRIPTION	LABORATORY						
DEPTH (FT.)	SAMPLE	SAMPLE NO.	BLOWS / FT.	MATERIAL DESCRIPTION AND REMARKS	CONSISTENCY	USCS LETTER SYMBOL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	PERCENT PASSING NO. 200	PLASTICITY INDEX (%)	UNCONFINED COMPRESSIVE STRENGHT (PSF)	POCKET PENETROMETER, TSF
4		B3-1	11	CLAYEY SILTY SAND, with rock fragments, reddish brown, moist	MEDIUM DENSE	SM						PP: 4.0
6				DRILLING HARD AT 6 FEET								
9		B3-2	25	SILTY CLAY, reddish brown with SANDSTONE fragments, light yellow brown, moist	VERY STIFF	CL	110	19			10,500	PP: 4.5
14		B3-3	21	SILTY CLAY, reddish brown mixed with sheared sandstone fragments	VERY STIFF							PP: 4.5
19		B3-4	23	SILTY CLAY, reddish brown with increasing TUFF BRECCIA fragment volume, sheared	VERY STIFF	CL / RX						PP: 4.5
21				INCREASING RESISTANCE; VERY DENSE								
22				INITIAL WATER AT 22 FEET								
23		B3-5	37	TUFF BRECCIA, fractured with some reddishbrown silty clay, water on barrel	VERY DENSE	RX						PP: 4.5
24		TD		BORING TERMINATED AT APPROXIMATELY 23-1/2-FEET. GROUNDWATER ENCOUNTERED AT 22 FEET HOLE BACKFILLED WITH GROUT CUTTINGS DISPOSED ON-SITE								

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EXPLORATORY BORING LOG B-3
35 Loma Vista Drive
Burlingame, CA

ALEX FLOCAS

FIGURE NO.
6

EXPLORATORY BORING LOG

CLIENT: Mr. Alex Flocas PROJECT NO.: 7728-01	LOGGED BY: IDA	DATE DRILLED: 06/06/17	PAGE 1 OF 1
DRILL RIG: NORTH STAR DRILLING		BORING ELEV.: E.G.	BORING NO. **B-4**
WEIGHT OF HAMMER: 140-POUND DROP: 30 INCHES		BORING DIAM.: 4 INCHES	

FIELD				DESCRIPTION			LABORATORY					
DEPTH (FT.)	SAMPLE	SAMPLE NO.	BLOWS / FT.	MATERIAL DESCRIPTION AND REMARKS	CONSISTENCY	USCS LETTER SYMBOL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	PERCENT PASSING NO. 200	PLASTICITY INDEX (%)	UNCONFINED COMPRESSIVE STRENGHT (PSF)	POCKET PENETROMETER, TSF
4		B4-1	9	CLAYEY SILT, reddish brown with some rock fragments, moist	STIFF	CL	107	22			3,200	PP: 3.5
7				INCREASING RESISTANCE; VERY DENSE								
11		B4-2	55	TUFF BRECCIA, light brown, moist	VERY DENSE	RX						PP: 4.5
16		B4-3	50/5"		VERY DENSE	RX						PP: 4.5
TD				BORING TERMINATED AT APPROXIMATELY 23-1/2-FEET. NO GROUNDWATER ENCOUNTERED AT THE TIME OF DRILLING HOLE BACKFILLED WITH GROUT CUTTINGS DISPOSED ON-SITE								

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EXPLORATORY BORING LOG B-4
35 Loma Vista Drive
Burlingame, CA

ALEX FLOCAS

FIGURE NO.
7

EXPLORATORY BORING LOG

CLIENT: Mr. Alex Flocas PROJECT NO.: 7728-01	LOGGED BY: IDA	DATE DRILLED: 06/06/17	PAGE 1 OF 1
DRILL RIG: NORTH STAR DRILLING - MINUTE-MAN WEIGHT OF HAMMER: 70-POUND DROP: 30 INCHES		BORING ELEV.: E.G. BORING DIAM.: 4 INCHES	BORING NO. **B-5**

FIELD				DESCRIPTION	LABORATORY							
DEPTH (FT.)	SAMPLE	SAMPLE NO.	BLOWS / FT.	MATERIAL DESCRIPTION AND REMARKS	CONSISTENCY	USCS LETTER SYMBOL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	PERCENT PASSING NO. 200	PLASTICITY INDEX (%)	UNCONFINED COMPRESSIVE STRENGHT (PSF)	POCKET PENETROMETER, TSF
1												
2												
3												
4		B5-1	16	CLAYEY SILT, light brown, moist	STIFF	CL						PP: 4.5+
5				INCREASING RESISTANCE								
6												
7		B5-2	40	TUFF BRECCIA, weathered light brown, with some sandy clay, fractured, sheared, moist	DENSE	RX	109	21			5,200	PP: 4.5+
8	TD			BORING TERMINATED AT APPROXIMATELY 7-1/2 - FEET. NO GROUNDWATER ENCOUNTERED AT TIME OF DRILLING HOLE BACKFILLED WITH GROUT CUTTINGS DISPOSED ON-SITE								
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Purcell, Rhoades & Associates
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EXPLORATORY BORING LOG B-5
35 Loma Vista Drive
Burlingame, CA

ALEX FLOCAS

FIGURE NO.
8

EXPLORATORY BORING LOG

CLIENT: Mr. Alex Flocas PROJECT NO.: 7728-01	LOGGED BY: IDA	DATE DRILLED: 06/06/17	PAGE 1 OF 1
DRILL RIG: NORTH STAR DRILLING - MINUTE-MAN WEIGHT OF HAMMER: 70-POUND DROP: 30 INCHES		BORING ELEV.: E.G. BORING DIAM.: 4 INCHES	BORING NO. **B-6**

FIELD				DESCRIPTION	LABORATORY							
DEPTH (FT.)	SAMPLE	SAMPLE NO.	BLOWS / FT.	MATERIAL DESCRIPTION AND REMARKS	CONSISTENCY	USCS LETTER SYMBOL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	PERCENT PASSING NO. 200	PLASTICITY INDEX (%)	UNCONFINED COMPRESSIVE STRENGHT (PSF)	POCKET PENETROMETER, TSF
1				CLAYEY SILTY SAND, dark brown, moist								
2				CLAYEY SILT, light brown with sandstone fragments, moist	STIFF	CL						
3												
4		B6-1	60	TUFF BRECCIA, weathered light brown, fractured, moist	VERY DENSE	RX						PP: 4.5+
	TD			BORING TERMINATED AT APPROXIMATELY 4 FEET. NO GROUNDWATER ENCOUNTERED AT TIME OF DRILLING HOLE BACKFILLED WITH GROUT CUTTINGS DISPOSED ON-SITE								
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Purcell, Rhoades & Associates
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EXPLORATORY BORING LOG B-6
35 Loma Vista Drive
Burlingame, CA

ALEX FLOCAS

FIGURE NO.
9

APPENDIX A

RECOMMENDED GRADING SPECIFICATIONS

PROPOSED THREE SINGLE FAMILY RESIDENCES
35 LOMA VISTA DRIVE
BURLINGAME, CALIFORNIA
PROJECT NO. 06-197/7728-01

APPENDIX A

RECOMMENDED GRADING SPECIFICATIONS

PROPOSED THREE SINGLE FAMILY RESIDENCES
35 LOMA VISTA DRIVE
BURLINGAME, CALIFORNIA
for
MR. ALEX FLOCAS
PROJECT NO. 06-197/7728-01

1. General

1.1 These Recommended Grading Specifications (called "Specifications" here) provide general guidelines for soil engineering aspects of grading for the subject development. The Geotechnical Engineer from Purcell, Rhoades & Associates should be consulted prior to any site work connected with grading. Please refer to the following report(s) for other grading recommendations supporting these Specifications.

1. Purcell, Rhoades & Associates, dated 7/21/17 (rev. 5/14/19), Geotechnical Study, Proposed Three Single-Family Residences, 35 Loma Vista Drive, Burlingame, CA: Job No. 06-197/7728-01.

1.2 These Specifications include the following:

- clearing, stripping, grubbing, and preparing areas to be filled
- selecting materials for fill
- placing, spreading, and compacting fill
- completing subsidiary work necessary to conform to lines, grades, and slopes shown on accepted plans
- protecting the soil in slab and foundation areas from drying out between grading and construction

1.3 Tests and observations shall be made by a representative from Purcell, Rhoades & Associates during the grading so that we can confirm that grading was

performed according to these Specifications. Such confirmation in a Final grading report is often required to obtain a building permit.

1.4 Purcell, Rhoades & Associates shall be notified at least 2 working days prior to placement of fill so arrangements for testing and observation may be made.

1.5 Grading or placement of fill done without the presence of a representative of Purcell, Rhoades & Associates or without prior coordination between Purcell, Rhoades & Associates and the grading contractor shall be at the contractor's risk; Purcell, Rhoades & Associates will accept no responsibility for such work.

2. Testing

2.1 The American Society for Testing and Materials (ASTM) Test Procedure D 1557-78 shall be the standard test to define maximum densities for all compaction of fill. All densities shall be expressed as relative compaction in terms of the maximum dry density obtained in the laboratory by the foregoing standard procedure.

2.2 Field density tests shall be performed according to ASTM Test Procedures D 2922-81 and D 3017-88. The locations and number of field density tests shall be selected by the Geotechnical Engineer or the Engineer's Representative.

3. Clearing, Stripping, Grubbing, and Preparing of Areas to Be Filled

3.1 Trees, roots, vegetation, and organic surficial soil shall be removed from structural areas unless specified otherwise by Purcell, Rhoades & Associates. The depth of organic surficial soil to be removed will be recommended by the Geotechnical Engineer or the Engineer's Representative but, in general, will probably vary from about 2 to 4 inches.

3.2 Strippings are defined as surface vegetation and organic surficial soil. Strippings may not be used in fill unless specifically authorized and observed by the Geotechnical Engineer or the Engineer's Representative. Stripping may be stockpiled for landscaping use, with the approval of the landscape architect.

3.3 Soil deemed soft or unsuitable by the Geotechnical Engineer or the Engineer's Representative shall be removed. Loose fills and surface soil sloughs shall also be excavated.

3.4 Underground structures such as old foundations, abandoned pipelines, septic tanks, and leach fields shall be removed from the site.

3.5 The final stripping and excavation shall be approved by the Geotechnical Engineer or the Engineer's Representative before further grading is started.

3.6 The original ground on which the fill, foundation or slabs are to be placed shall be plowed or scarified at least 8 inches and until the surface is free from ruts, hummocks or uneven features which would tend to prevent compaction. The contractor shall observe the following guidelines:

- Where the slope ratio of the original ground is steeper than 5:1 (horizontal to vertical), the bank shall be stepped or benched.
- At the toe of the side slope fills, the base key shall be at least 12 feet in width, cut into firm, natural ground and sloped back into the hillside at a gradient of at least 2 percent.
- Subsequent keys or benches shall be 10 feet wide and placed no more than 4 feet in vertical height from the previous key or bench unless otherwise recommended by the Geotechnical Engineer or the Engineer's Representative.

3.7 The native subgrade soil to receive fill shall be moisture-conditioned and compacted to the requirements specified in the referenced report and below:

Minimum relative compaction:	90	percent
Minimum moisture content:	3	percent over optimum
Special considerations:	85-90	percent compaction in designated expansive soil at 5 percent over optimum moisture condition.

4. Selecting Fill

4.1 The Geotechnical Engineer or the Engineer's Representative shall evaluate suitability of materials for compacted fills. The material shall be a soil or soil-rock mixture, free of organic matter or other deleterious substances. Within 3 feet of finished grade, the compacted fill shall contain no rocks or lumps over 6 inches in diameter and none that are more than 15 percent larger than 2-1/2 inches. Rocks greater than 6 inches in diameter shall be placed in deep fills as approved by the Geotechnical Engineer or the Engineer's Representative so that they are not nested and so compaction may be achieved around them.

4.2 If imported materials are needed, they must be approved by the Geotechnical Engineer or the Engineer's Representative prior to transporting the fill to the project. Unless otherwise exempted by the Geotechnical Engineer, they should meet the following requirements:

1. The plasticity index shall not exceed 15.

2. No rocks shall exceed 6 inches in diameter.

5. Placing, Spreading, and Compacting Fill

5.1 The fill shall be placed in uniform lifts of not more than 8 inches in uncompacted thickness. Each layer shall be spread evenly and shall be thoroughly blade mixed during spreading to obtain uniformity of material. Before compaction begins, the fill shall be brought to a water content (as directed by the Geotechnical Engineer or the Engineer's Representative) that will permit proper compaction by either (1) aerating the material if it is too wet or (2) spraying the material with water if it is too dry.

5.2 After each layer has been placed, mixed, and spread evenly, it shall be compacted as specified in the referenced report and below:

Minimum relative compaction:	90	percent
Minimum moisture content:	3	percent over optimum

See Section 3.7 for expansive soil criteria

5.3 The contractor shall use appropriate equipment to compact the fill to the specified density. Compacting shall be performed while the fill is within the specified range of moisture content. Each layer shall be compacted over its entire area, and the compacting equipment shall make enough passes to achieve the required density.

5.4 Fill placed on slopes shall be compacted by means of suitable equipment. Benching of the slopes should be done in increments of 3 to 5 feet in height until the fill is brought to its specified height or as determined by the Geotechnical Engineer or the Engineer's Representative.

5.5 When sheepsfoot rollers are used for compaction, the density tests shall be taken in the compacted material below the surface disturbed by the roller. When these tests indicate that the density of any layer of fill, or portion thereof, is below the required density, it shall be reworked until the required compaction has been obtained.

5.6 Soil shall not be placed or compacted during periods of rain or on ground which is not drained of water. Soil which has been moistened by rain or other cause shall not be compacted until the moisture content is within the limits specified in the referenced report. Prior approval by the Geotechnical Engineer or the Engineer's Representative shall be obtained before continuing grading.

6. Backfilling Trenches

6.1 Geologic exploratory trenches (or other depressions), if any, within the proposed building or pavement areas, shall be re-excavated and backfilled to meet the requirements for compacted fill, as specified above.

6.2 The utility trenches extending under the perimeter foundation and concrete slabs-on-grade may require backfilling or plugging with impermeable soils at the building line with a 3-foot wide impermeable segment of compacted fill. Requirements will be specified during trench backfilling. Ponding or jetting of trench backfill is not recommended.

7. Removing Subsurface Pipes

7.1 The Geotechnical Engineer or Engineer's Representative shall designate the methods of removal of subsurface pipes. Depending upon depth and location, one of the following methods shall be specified:

- The pipe shall be removed, and the trench shall be filled and compacted according to applicable requirements for compacting native soil (Section 3) or fill (Section 5).
- The pipe shall be crushed in the trench, and the trench shall be filled and compacted according to applicable portions of Sections 3 and 5.
- The ends of the pipes shall be capped with concrete to prevent entrance of water. The length of the cap shall be at least 5 feet.

7.2 Any wells encountered on the site shall be filled, buried and capped according to the requirements of the local regulatory agency. The final elevation of the top of the well casing shall be a minimum of 36 inches below any adjacent grade at the completion of grading or filling. Under no circumstances should structural foundations be placed over the capped wells.

8. Grading Slopes

8.1 Slopes shall be graded at gradients no steeper than 2:1 (horizontal to vertical) for fill and cut, except as noted in the referenced report.

8.2 After the slopes have been graded, they shall be track-rolled, and provisions shall be made for planting the slopes for erosion control. Drainage facilities shall be constructed to prevent water from flowing over slopes. No slope shall be left to stand through a winter season without erosion control.

9. Installing Subdrains

9.1 For subdrains, the contractor shall provide and install perforated pipe Standard Designation Ratio (SDR) 23.5 or equivalent approved by the Geotechnical Engineer or the Engineer's Representative and filter material for subdrains as shown on the plans or as directed by the Purcell, Rhoades & Associates. The following restrictions apply:

9.1.1 Clay drain tile, concrete drain tile and perforated clay pipe shall not be permitted. Use no wyes, tees, or other joints of these materials.

9.1.2 Porous concrete pipe, perforated asbestos-cement pipe, bituminous fiber or pipe of other materials shall be permitted only on written authorization of the Geotechnical Engineer.

9.1.3 The contractor shall use ½ by 3/4 inch drain rock wrapped within a filter fabric approved by our Geotechnical Engineer, unless otherwise permitted by written authorization from the Geotechnical Engineer.

9.1.4 Unless recommended otherwise by the Geotechnical Engineer or the Engineer's Representative, the contractor shall use pipes not less than 4 inches in diameter for lateral drains up to 50 feet in length. Use pipes of not less than 6 inches in diameter for lateral drains greater than 50 feet in length. Larger minimum pipe diameters may be specified by the Geotechnical Engineer or the Engineer's Representative during construction.

10. Unusual Conditions

10.1 If unusual conditions occur during grading, the Geotechnical Engineer shall be immediately notified for recommendations.