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GEOTECHNICAL STUDY REPORT

RESIDENCE, GUEST HOUSE AND DRIVEWAY
SHANKS PROPERTY IMPROVEMENTS
WOODEN VALLEY ROAD
NAPA, CALIFORNIA

Project Number:

6901.01.04.2

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INTRODUCTION

This report presents the results of our geotechnical study for the proposed residence, guest house and driveways to be constructed for the Good Life Wine Collective at the Shanks property on Wooden Valley Road in Napa, California. The property covers two parcels and extends over a topographic knoll within Wooden Valley. The site location is shown on Plate 1, Appendix A.

We understand it is proposed to construct a residence, guest house and a paved access driveway. Retaining walls will be needed to provide level breaks across the building sites. Auto access will be provided a new driveway, which may require retaining walls, that extends off Wooden Valley Road.

Foundation loads are expected to be typical of the light to moderately heavy type of construction proposed. We anticipate wall loads will range from ¾ to 1½ kips per lineal foot. We understand site grading will be the minimum needed to construct building pads and paved areas with positive drainage. Such grading could include cuts and fills of about 1 to 10 feet.

We assume that the project utilities will extend no deeper than 5 feet below the existing ground surface. If project utilities extend deeper, supplemental exploration may be required to evaluate the soil and bedrock conditions within and below the utility excavations.

SCOPE

The purpose of our study, as outlined in our Professional Service Agreement dated August 28, 2015, was to generate geotechnical information for the design and construction of the project. Our scope of services included reviewing selected published geologic data pertinent to the site; evaluating subsurface conditions with test pits and laboratory tests; analyzing the field and laboratory data; and presenting this report with the following geotechnical information:

1. A brief description of soil, bedrock and groundwater conditions observed during our study;

2. A discussion of seismic hazards that may affect the proposed improvements;

3. Seismic design criteria per guidelines in the 2013 California Building Code; and

4. Specific conclusions and recommendations concerning:

    a. Primary geotechnical engineering concerns and mitigating measures, as applicable;

    b. Site preparation and grading including remedial grading of weak, porous, compressible and/or expansive, creep-prone surface soils and the construction of hillside fills;

    c. Alternative foundation types, design criteria, and settlement behavior;

    d. Lateral forces for retaining wall design, as applicable;

    e. Support of concrete slabs-on-grade;

f. Preliminary pavement thickness based on our experience with similar soils and projects;

g. Utility trench backfill;

h. Geotechnical engineering drainage improvements; and

i. Supplemental geotechnical engineering services.

STUDY

Site Exploration

We reviewed our previous geotechnical studies in the vicinity and selected geologic references pertinent to the site. The geologic literature reviewed is listed in Appendix B.

On October 19 and 20, 2015, we performed a geotechnical reconnaissance of the site and explored the subsurface conditions by excavating 20 test pits to depths ranging from about 4 to 14 feet. The test pits were excavated with a track-mounted excavator at the approximate locations shown on the Exploration Plan, Plate 2. The test pit locations were determined approximately by pacing their distance from features shown on the Exploration Plan and should be considered accurate only to the degree implied by the method used. Our geologist located and logged the test pits and obtained samples of the materials encountered for visual examination, classification and laboratory testing. Disturbed “grab” samples were obtained at selected depths from the test pits and placed in plastic bags.

The logs of test pits showing the materials encountered and sample depths are presented on Plates 4 through 11. The soils are described in accordance with the Unified Soil Classification System, outlined on Plate 12. Bedrock is described in accordance with Engineering Geology Rock Terms, shown on Plate 13.

The test pit logs show our interpretation of subsurface soil and bedrock conditions on the date of exploration and at the locations indicated. Subsurface conditions may vary at other locations and times. Our interpretation is based on visual inspection of soil and bedrock samples, laboratory test results, and interpretation of excavation and sampling resistance. The location of the soil and bedrock boundaries should be considered approximate. The transition between soil and bedrock types may be gradual.

Laboratory Testing

The samples obtained from the test pits were transported to our office and re-examined to verify soil classifications, evaluate characteristics, and assign tests pertinent to our analysis. Selected samples were laboratory tested to determine their classification (Atterberg Limits, percent of silt and clay) and expansion potential (Expansion Index - EI). Results of the classification and expansion potential tests are presented on Plate 14.

SITE CONDITIONS

General

Napa County is located within the California Coast Range geomorphic province. This province is a geologically complex and seismically active region characterized by sub-parallel northwest-trending faults, mountain ranges and valleys. The oldest bedrock units are the Jurassic-Cretaceous Franciscan Complex and Great Valley sequence sediments originally deposited in a marine environment. Subsequently, younger rocks such as the Tertiary-age Sonoma Volcanics group, the Plio-Pleistocene-age Clear Lake Volcanics and sedimentary rocks such as the Guinda, Domengine, Petaluma, Wilson Grove, Cache, Huichica and Glen Ellen formations were deposited throughout the province. Extensive folding and thrust faulting during late Cretaceous through early Tertiary geologic time created complex geologic conditions that underlie the highly varied topography of today. In valleys, the bedrock is covered by thick alluvial soils.

Geology

Published geologic maps (Bezore et al., 2004) indicate the property is underlain by the early Cretaceous and late Jurassic age Great Valley sequence (KJgv). The Great Valley sequence is shown to comprise sandstone, pebble conglomerate, siltstone and shale.

Landslides

Published landslide maps (Dwyer, 1976) depicts small-scale landslides listed as either probable or questionable within all of the swales at the site. We observed one moderately large active landslide in the westerly portion of the site and observed creeping soils within our test pits in the southerly and easterly portions of the site. The observed landslide and areas of soil creep are mapped on Plate 2. A landslide identification chart is presented on Plate 3. A cross section of this landslide is presented on Plate 15.

Surface

The property covers two parcels and extends over a topographic knoll within Wooden Valley. The knoll slopes are generally gently to moderately sloping. The ground surface is covered with seasonal grasses and weeds with mature trees on the flanks of the knolls. Portions of the site contain vineyards.

In general, the ground surface is moderately hard. However, soils in the area that appear hard and strong when dry will typically lose strength rapidly and settle under the loads of fills, foundations and slabs as their moisture content increases and approaches saturation. This typically occurs because the surface soils are weak, porous and compressible. The surface soils are disturbed by randomly arrayed shrinkage cracks generally associated with expansive soils. Locally, expansive soils shrink and swell with the weather cycle. The cyclic shrinking and swelling tends to disturb the upper portion of the expansive clay. On sloping terrain (5:1 or steeper), the weak, expansive surface materials undergo a gradual downhill movement known as creep. Soil creep is inherent to hillsides in the area and its force is directly proportional to slope inclination, the soils plasticity, water content and expansion potential.

Natural drainage consists of sheet flow over the ground surface that concentrates in surface drainage elements such as roadside ditches, canals and gutters, and natural drainage elements such as swales, ravines, and creeks.

Subsurface

Our test pits and laboratory tests indicate that the portion of the site we studied is generally blanketed by ½ to 2½ feet of weak, porous, compressible, clayey soils. Porous soils appear hard and strong when dry but become weak and compressible as their moisture content increases towards saturation. These soils exhibit medium to high plasticity (LL = 40-53; PI = 20-34) and moderate to high expansion potential (EI = 52-97), and are disturbed by ½ to 2 inch wide shrinkage cracks that extend 1 to 4 feet below the ground surface. These surface materials are locally underlain by clayey, completely weathered bedrock, clayey colluvial soils or landslide debris to depths ranging from 1 to 11½ feet. Siltstone and sandstone bedrock was encountered below these surface materials, with the exception of test pits TP-1, TP-15, TP-18 and TP-19. Test pits TP-1, TP-18 and TP-19 were excavated within the alluvial valley where deep soils are to be expected. TP-15 was excavated in deep creeping soils within a swale in the eastern portion of the site. As previously discussed, on hillsides 5:1 or steeper, the surface materials typically creep. In test pits TP-3, TP-4, and TP-5, we encountered 2 to 11½ feet of landslide debris consisting predominantly of clay soils. These soils exhibit medium plasticity (LL = 34; PI = 17) and moderate expansion potential (EI = 69). Landslide debris will also typically creep. A cross section of the landslide is presented on Plate 15.

Siltstone and sandstone bedrock extends from beneath the surface materials (locally) to the maximum depths explored (14 feet). The bedrock is generally closely fractured and moderately weathered. A detailed description of subsurface conditions found in our test pits is given on Plates 4 through 11, Appendix A. Based on Table 20.3-1 of American Society of Civil Engineers (ASCE) Standard 7-10, titled “Minimum Design Loads for Buildings and Other Structures” (2010) we have determined a Site Class of C should be used for the site.

Corrosion Potential

Mapping by the Natural Resources Conservation Service (2015) indicates that the corrosion potential of the near surface soil is moderate to high for uncoated steel and low for concrete. Performing corrosivity tests to verify these values was not part of our requested and/or proposed scope of work. Should the need arise, we would be pleased to provide a proposal to evaluate these characteristics.

Groundwater

Free groundwater was not observed in our test pits at the time of excavation. On hillsides, rainwater typically percolates through the porous surface materials and migrates downslope in the form of seepage at the interface of the surface materials and bedrock, and through fractures in the bedrock. Fluctuations in the seepage rates typically occur due to variations in rainfall intensity, duration and other factors such as periodic irrigation.

DISCUSSION AND CONCLUSIONS

Seismic Hazards

General

We did not observe subsurface conditions within the portion of the property we studied that would suggest the presence of materials that may be susceptible to seismically induced densification or liquefaction within the planned building areas. Therefore, we judge the potential for the occurrence of these phenomena within the planned residence and guest house to be low.

Seismicity

Data presented by the Working Group on California Earthquake Probabilities (2007) estimates the chance of one or more large earthquakes (Magnitude 6.7 or greater) in the San Francisco Bay region within the next 30 years to be approximately 63 percent. Therefore, future seismic shaking should be anticipated at the site. It will be necessary to design and construct the proposed property improvements in strict adherence with current standards for earthquake-resistant construction.

Faulting

We did not observe landforms within the area that would indicate the presence of active faults and the site is not within a current Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). Therefore, we believe the risk of fault rupture at the site is low. However, the site is within an area affected by strong seismic activity. Several northwest-trending Earthquake Fault Zones exist in close proximity to and within several miles of the site (Bortugno, 1982). The shortest distances from the site to the mapped surface expression of these faults are presented in the table below.

ACTIVE FAULT PROXIMITY

Fault	Direction	Distance-Miles
San Andreas	SW	40
Healdsburg-Rodgers Creek	SW	20
Concord-Green Valley	S	4
Cordelia	SE	2½
West Napa	SW	9
Hunting Creek	N	19

Lurching

Seismic slope failure or lurching is a phenomenon that occurs during earthquakes when slopes or man-made embankments yield and displace in the unsupported direction. Provided the foundations are installed as recommended herein, and the proposed fills are adequately keyed into underlying bedrock material, as subsequently discussed, we judge the potential for impact to the proposed improvements from the occurrence of this phenomenon at the site is low. However, some of these secondary earthquake effects are unpredictable as to location and extent, as evidenced by the 1989 Loma Prieta Earthquake.

Geotechnical Issues

General

Based on our study, we judge the proposed residence, guest house and driveway can be built as planned, provided the recommendations presented in this report are incorporated into their design and construction. The primary geotechnical concerns during design and construction of the project are:

1. The presence of unstable slopes along portions of the property;

2. The presence of ½ to 2½ feet of highly expansive, weak, porous, compressible, creep-prone clayey surface soils;

3. The detrimental effects of uncontrolled surface runoff and groundwater seepage on the long-term satisfactory performance of residences, especially those constructed on hillsides, given the erosion potential and porous nature of the surface soils; and

4. The strong ground shaking predicted to impact the site during the life of the project.

Landslide Debris

As discussed previously and shown on Plate 2, a moderately large landslide was mapped in the western portion of the property. This landslide is either actively moving or has experienced movement in the recent past. Landslide debris from these types of features tends to continue to move downslope creating instability for improvements constructed on or below landslide debris. These deposits also tend to naturally consolidate and settle. Fills and foundations deriving support from these materials will be susceptible and contribute to the downslope movement and settlement unless properly embedded in bedrock or buttressed (keyed, benched, drained and compacted).

Weak, Porous Surface Soils

Weak, porous surface soils, such as those found at the site, appear hard and strong when dry but will lose strength rapidly and settle under the load of fills, foundations, slabs, and pavements as their moisture content increases and approaches saturation. The moisture content of these soils can increase as the result of rainfall, periodic irrigation or when the natural upward migration of water vapor through the soils is impeded by, and condenses under fills, foundations, slabs, and pavements. The detrimental effects of such movements can be reduced by strengthening the soils during grading. This can be achieved by excavating the weak soils and replacing them as properly compacted (engineered) fill. Alternatively, satisfactory foundation support could be obtained below the weak surface soils.

Expansive Materials

In addition, the surface soils are moderately to highly expansive and the bedrock is moderately expansive. Expansive materials shrink and swell as they lose and gain moisture throughout the yearly weather cycle. Near the surface, the resulting movements can heave and crack lightly loaded shallow foundations (spread footings) and slabs and pavements. The zone of significant moisture variation (active layer) is dependent on the expansion potential of the soil and the extent of the dry season. In the project area, the active layer is generally considered to range in thickness from about 2 to 3 feet. The detrimental effects of the above-described movements can be reduced by pre-swelling the expansive soils and covering them with a moisture fixing and confining blanket of properly compacted select fill, as subsequently defined. In building areas, the blanket thickness required depends on the expansion potential of the soils and the anticipated performance of the foundations and slabs. In order to effectively reduce foundation and slab heave, given the expansion potential of the site's soils, a blanket thickness of 30 inches will be needed. In exterior slab and paved areas, the select fill blanket need only be 12 inches thick.

Downslope Creep

Weak, creep-prone materials, such as those found at the site, tend to naturally consolidate and settle on sloping terrain that is 5:1 (horizontal to vertical) or steeper. Fills deriving support from these materials will be susceptible and contribute to the downslope creep and settlement unless properly embedded in bedrock or buttressed (keyed, benched, drained and compacted). The settlement causes cracks in the slabs and structural distress in the form of cracked plaster and sticky doors and windows. Therefore, it will be necessary to obtain fill support below the creeping soils.

Fill Support - Hillside fills need to be constructed on level keyways and benches excavated entirely on rock. However, regardless of the care used during grading, buttressed fills of uneven thickness such as those typically built on hillsides, will settle differentially. Satisfactory performance of structural elements constructed on hillside fills, such as pools, pool decks, garage slabs, and driveways will require the use of specialized grading techniques discussed in the following sections of this report. These include excavating all creeping soils and replacing these materials as a buttressed fill of even thickness or constructing the improvements entirely on cut. For the purpose of this discussion, fills with a differential thickness of less than 5 feet can be assumed to have equal thickness. In order to provide the equal thicknesses, it may be necessary to overexcavate at least a few feet in cut areas. Where the total fill thickness is less

than 3 feet, the fill can be placed at 95 percent relative compaction in lieu of overexcavation in cut areas.

Foundation Support - After remedial grading, satisfactory foundation support for the residence and guest house can be obtained from spread footings that bottom on select engineered fill. The residence, not the guest house, can be supported on spread footings extending into bedrock provided raised wood floors or structurally supported slabs are used for the interior floor system. Foundation support for retaining walls and site walls outside of building areas can be supported on firm, undisturbed bedrock.

Floor Systems - The options for interior floor systems will depend on the planned remedial grading. The grading options also vary between interior living space and interior slabs such as those required for a garage. Provided the building pad is underlain by 30 inches of select fill, concrete slabs-on-grade can be used for the interior floor system. As an alternative to the grading required for these options, raised wood floors supported above grade on joists that span the spread footing foundations or structurally supported slabs will perform well. Slab-on-grade floors can be used in garages provided that:

1. The subgrade materials comprise at least 12 inches of select fill and are pre-swelled by soaking prior to installation of the slabs;

2. The slabs are cast separate from foundations and framing to allow differential settlement or heave to occur without distressing the slabs or framing;

3. The slabs are reinforced to reduce cracks;

4. The slabs are grooved to induce cracking in a non-obtrusive manner; and

5. Some heave and cracking is acceptable to the user.

We estimate that the slabs will undergo from 1 to 3 inches of differential heave if they are constructed directly on the expansive soils.

Exterior Slabs and Pavements

Exterior slabs and pavements will heave and crack as the expansive soils shrink and swell through the yearly weather cycle. Slab and pavement cracking and distress are typically concentrated along edges where moisture content variation is more prevalent within subgrade soils. Slab and pavement performance and the incidence of repair can be reduced, but not eliminated, by covering the pre-swelled expansive soils with at least 12 inches of select fill (see “On-Site Soil Quality” section) prior to constructing the slab or pavement required to carry the anticipated traffic.

On-Site Soil Quality

All fill materials used in the upper 30 inches of the building area and the upper 12 inches of garage and exterior slab and pavement subgrade must be select, as subsequently described in “Recommendations.” We anticipate that, with the exception of organic matter and of rocks or

lumps larger than 6 inches in diameter, the excavated material will be suitable for re-use as general fill, but will not be suitable for use as select fill unless stabilized with lime.

Select Fill

The select fill can consist of approved on-site soils or import materials with a low expansion potential. The geotechnical engineer must approve the use of on-site soils as select fill during grading.

Settlement

Provided grading is performed as recommended herein and foundations are installed as recommended herein, we estimate that post-construction differential settlements across each building will be about ½-inch.

Surface Drainage

Because of topography and location, the site will be impacted by surface runoff from the upgradient slopes. In addition, the site soils are susceptible to erosion and sloughing. Surface runoff typically sheet flows over the ground surface slopes but can be concentrated by the planned site grading, landscaping, and drainage. The ensuing erosion can create sloughing and promote slope instability or the surface runoff can pond against structures and cause deeper than normal soil heave and/or seep into the crawl space and/or slab rock. Therefore, strict control of surface runoff is necessary to provide long-term satisfactory performance of projects constructed on or near hillsides. It will be necessary to divert surface runoff around slopes and improvements, provide positive drainage away from structures, and install energy dissipaters at discharge points of concentrated runoff. This can be achieved by constructing the building pad several inches above the surrounding area and conveying the runoff into man made drainage elements or natural swales that lead downgradient of the site.

Groundwater

We anticipate that rainwater will percolate through the porous surface soils and migrate downslope at the interface of the surface soil and bedrock and through fractures in the bedrock and seep into the crawl space and/or slab rock. Groundwater will also seep into excavations exposing the water migration zone or into hillside fills. Therefore, it will be necessary to intercept, collect and divert groundwater outside of the proposed improvements. This can be accomplished by installing perimeter foundation drains and slab underdrains as recommended herein.

RECOMMENDATIONS

Seismic Design

Seismic design parameters presented below are based on Section 1613 titled “Earthquake Loads” of the 2013 California Building Code (CBC). Based on Table 20.3-1 of American Society of Civil Engineers (ASCE) Standard 7-10, titled “Minimum Design Loads for Buildings and Other Structures” (2010), we have determined a Site Class of C should be used for the site. Using a site latitude and longitude of 38.3751°N and 122.1873°W, respectively, and the U.S. Seismic

Design Maps from the United States Geological Survey (USGS) website (http://geohazards.usgs.gov/designmaps/us/application.php), we recommend that the following seismic design criteria be used for structures at the site.

2013 CBC Seismic Criteria	
Spectral Response Parameter	**Acceleration (g)**
S_S (0.2 second period)	2.160
S_1 (1 second period)	0.763
S_{MS} (0.2 second period)	2.160
S_{M1} (1 second period)	0.992
S_{DS} (0.2 second period)	1.440
S_{D1} (1 second period)	0.661

Grading

Site Preparation

Areas to be developed should be cleared of vegetation and debris. Trees and shrubs that will not be part of the proposed development should be removed and their primary root systems grubbed. Cleared and grubbed material should be removed from the site and disposed of in accordance with County Health Department guidelines. We did not observe septic tanks, leach lines or underground fuel tanks during our study. Any such appurtenances found during grading should be capped and sealed and/or excavated and removed from the site, respectively, in accordance with established guidelines and requirements of the County Health Department. Voids created during clearing should be backfilled with engineered fill as recommended herein.

Stripping

Areas to be graded should be stripped of the upper few inches of soil containing organic matter. Soil containing more than two percent by weight of organic matter should be considered organic. Actual stripping depth should be determined by a representative of the geotechnical engineer in the field at the time of stripping. The strippings should be removed from the site, or if suitable, stockpiled for re-use as topsoil in landscaping.

Excavations

Following initial site preparation, excavation should be performed as planned or recommended herein. Excavations extending below the proposed finished grade should be backfilled with suitable materials compacted to the requirements given below.

Within fill and interior slab-on-grade areas, the weak, porous, compressible, expansive, creep-prone surface soils should be excavated to within 6 inches of their entire depth (from about 1 to greater than 12½ feet in our pits). Additional excavation should be performed, as necessary, to allow space for the installation of a blanket of select fill, at least 30 inches thick, beneath

finished building pad grade. The excavation of weak, compressible, expansive soils should also extend at least 12 inches below exterior slab and pavement subgrade where planned excavations do not completely remove the expansive soils to allow space for the installation of the select fill blanket discussed in the conclusions section of this report. On sloping terrain 5:1 or steeper, fills should be constructed by excavating level keyways that expose undisturbed bedrock. The keyways should be at least 10 feet wide, extend at least 2 feet below the bedrock surface on the downhill side and should be sloped to drain to the rear. Keyway excavations should extend laterally to at least a 1:1 imaginary line extending down from the toe of the fill. Keyway subdrains are discussed hereinafter in “Subsurface Drainage.”

The excavation of weak, porous, compressible, expansive, creep-prone surface materials should extend at least 5 feet beyond the outside edge of the exterior footings of the proposed buildings and 3 feet beyond the edge of exterior slabs and pavements. The excavated materials should be stockpiled for later use as compacted fill, or removed from the site, as applicable. Excavation of hard resistant bedrock at the site may require heavy ripping and/or jack hammering. The grading contractor should review this report, become familiar with site conditions as they pertain to his operation and draw his own conclusions regarding excavation difficulty and suitable grading equipment.

At all times, temporary construction excavations should conform to the regulations of the State of California, Department of Industrial Relations, Division of Industrial Safety or other stricter governing regulations. The stability of temporary cut slopes, such as those constructed during the installation of underground utilities, should be the responsibility of the contractor. Depending on the time of year when grading is performed, and the surface conditions exposed, temporary cut slopes may need to be excavated to 1½:1, or flatter. The tops of the temporary cut slopes should be rounded back to 2:1 in weak soil zones.

Subsurface Drainage

A subdrain should be installed at the rear of the keyways and/or where evidence of seepage is observed. The subdrain should consist of a 4-inch diameter (minimum) perforated plastic pipe with SDR 35 or better embedded in Class 2 permeable material. The permeable material should be at least 12 inches thick and extend at least 48 inches above the bottom of the keyway (see Plate 16) and/or 12 inches above and below the seepage zone.

The depth and extent of subdrains should be determined and approved by the geotechnical engineer in the field during construction. In addition, subdrains should be installed at a minimum slope of 1 percent and should have cleanouts located at their ends and at turning points. “Sweep” type elbows and wyes should be used at all turning points and cleanouts, respectively. Subdrain outlets and riser cleanouts should be fabricated of the same material as the subdrain pipe as specified herein. Outlet and riser pipe fittings should not be perforated. A licensed land surveyor or civil engineer should provide “record drawings” depicting the locations of subdrains and cleanouts.

Fill Quality

All fill materials should be free of perishable matter and rocks or lumps over 6 inches in diameter and must be approved by the geotechnical engineer prior to use. The upper 30 inches of fill beneath and within 5 feet of finish building pad grade, and the upper 12 inches of fill beneath and within 3 feet of exterior slabs and pavement edges should be select fill. We judge the on-site soils are generally suitable for use as general fill but will not be suitable for use as select fill unless they are stabilized with lime. Lime stabilized soils may prevent the growth of landscape vegetation due to the inherent elevated pH level of the soil. The suitability of the on-site soils for use as select fill should be verified during grading.

Select Fill

Select fill should be free of organic matter, have a low expansion potential, and conform in general to the following requirements:

SIEVE SIZE	PERCENT PASSING (by dry weight)
6 inch	100
4 inch	90 – 100
No. 200	10 – 60

Liquid Limit – 40 Percent Maximum
Plasticity Index – 15 Percent Maximum
R-value – 30 Minimum (pavement areas only)

Expansive on-site soils may be used as select fill if they are stabilized with lime. In general, imported fill, if needed, should be select. Material not conforming to these requirements may be suitable for use as import fill; however, it shall be the contractor's responsibility to demonstrate that the proposed material will perform in an equivalent manner. The geotechnical engineer should approve imported materials prior to use as compacted fill. The grading contractor is responsible for submitting, at least 72 hours (3 days) in advance of its intended use, samples of the proposed import materials for laboratory testing and approval by the soils engineer.

Lime Stabilization

For preliminary planning purposes, we estimate that high calcium lime mixed at a minimum of 5½ percent (dry weight) will stabilize the expansive site soils. This percentage of lime needs to be verified prior to construction with engineering analysis and laboratory Atterberg Limits and/or pH testing using lime from the same source as that planned for use on the project and a sample of the soil to be treated. Laboratory test results and engineering analysis may indicate that a higher percentage of lime is required. The contractor should allow a minimum of 5 business days for the laboratory tests to be completed.

The lime stabilization should be performed in accordance with Section 24 of the Caltrans Standard Specifications except that a curing seal will not be required, provided the moisture content of the lime-stabilized material is maintained at or above optimum moisture content until it is permanently covered with subsequent construction. Lime stabilized materials are generally not suitable for reuse as general fill, select fill or backfill after compaction has taken place.

Fill Placement

The surface exposed by stripping and removal of weak, compressible, expansive, creep-prone surface soils should be scarified to a depth of at least 6 inches, uniformly moisture-conditioned to at least 4 percent above optimum and compacted to at least 90 percent of the maximum dry density of the materials as determined by ASTM Test Method D-1557. Moisture conditioning should be sufficient to completely close all shrinkage cracks for their full depth within pavement, exterior slab and building areas. If grading is performed during the dry season, the shrinkage cracks may extend to a few feet below the surface. Therefore, it may be necessary to excavate a portion of the cracked soils to obtain the proper moisture condition and degree of compaction. Approved fill material should then be spread in thin lifts, uniformly moisture-conditioned to near optimum and properly compacted. All structural fills, including those placed to establish site surface drainage, should be compacted to at least 90 percent relative compaction. Expansive soils used as fill should be moisture-conditioned to at least 4 percent above optimum. Only approved select materials should be used for fill within the upper 30 inches of interior slab subgrades and within the upper 12 inches of exterior slabs and pavement subgrades. Fills placed on terrain sloping at 5:1 or steeper should be continually keyed and benched into firm, undisturbed bedrock. The benches should allow space for the placement of select fill of even thickness under settlement sensitive structural elements supported directly on the fill. An illustration of this grading technique is shown on Plate 16.

SUMMARY OF COMPACTION RECOMMENDATIONS	
Area	Compaction Recommendation (ASTM D-1557)
Preparation for areas to receive fill	After preparation in accordance with this report, compact upper 6 inches to a minimum of 90 percent relative compaction.
General fill (native or import)	Compact to a minimum of 90 percent relative compaction.
Structural fill beneath buildings, extending outward to 5' beyond building perimeter	Compact to a minimum of 90 percent relative compaction. Compact to a minimum of 95 percent where building pad transitions between bedrock and fill.
Structural fill beneath building pads that transition between bedrock and fills less than 3 feet thick	Compact to a minimum of 95 percent relative compaction.
Trenches	Compact to a minimum of 90 percent relative compaction. Compact the top 6 inches below vehicle pavement subgrade to a minimum of 95 percent relative compaction.
Retaining wall backfill	Compact to a minimum of 90 percent relative compaction, but not more than 95 percent. Retaining wall backfill should not include expansive soils.
Pavements, extending outward to 3' beyond edge of pavement	Compact upper 6 inches of subgrade to a minimum of 95 percent relative compaction.
Concrete flatwork and exterior slabs, extending outward to 3' beyond edge of slab	Compact subgrade to a minimum of 90 percent relative compaction. Where subject to vehicle traffic, compact upper 6 inches of subgrade to at least 95 percent relative compaction.
Aggregate Base	Compact aggregate base to at least 95 percent relative compaction.

Permanent Cut and Fill Slopes

In general, cut and fill slopes should be designed and constructed at slope gradients of 3:1 (horizontal to vertical) or flatter, unless otherwise approved by the geotechnical engineer in specified areas. Where steeper slopes are required, retaining walls should be used. Fill slopes steeper than 3:1 will require the use of geogrid to increase stability. Providing recommendations for grid type and spacing was not part of our requested and/or proposed scope of work. Should the need to use geogrid arise, additional laboratory testing and stability analyses will be required. Fill slopes should be constructed by overfilling and cutting the slope to final grade. “Track walking” of a slope to achieve slope compaction is not an acceptable procedure for slope construction. Permanent cut slopes should be observed in the field by the geotechnical engineer to verify that the exposed soil or bedrock conditions are as anticipated. The geotechnical engineer is not responsible for measuring the angles of these slopes. Denuded slopes should be planted with fast-growing, deep-rooted groundcover to reduce sloughing or erosion. The cut and fill slope inclinations recommended herein address only the stability of the slopes. It should not be inferred that they address the feasibility of landscaping and weed control. Where these are concerns, the slopes should be flattened accordingly.

Wet Weather Grading

Generally, grading is performed more economically during the summer months when on-site soils are usually dry of optimum moisture content. Delays should be anticipated in site grading performed during the rainy season or early spring due to excessive moisture in on-site soils. Special and relatively expensive construction procedures, including dewatering of excavations and importing granular soils, should be anticipated if grading must be completed during the winter and early spring or if localized areas of soft saturated soils are found during grading in the summer and fall.

Open excavations also tend to be more unstable during wet weather as groundwater seeps towards the exposed cut slope. Severe sloughing and occasional slope failures should be anticipated. The occurrence of these events will require extensive clean up and the installation of slope protection measures, thus delaying projects. The general contractor is responsible for the performance, maintenance and repair of temporary cut slopes.

Foundation Support

Spread Footings

Spread footings can be used for support of the residence and guest house provided the building pad is capped with 30 inches of select fill. Spread footings extending into bedrock can also be used for the residence provided raised wood or structurally supported slab floors are used. Spread footings bearing in bedrock can also be used for site retaining walls and site walls.

Spread footings should be at least 12 inches wide and should bottom on select engineered fill or on undisturbed bedrock, as applicable, at least 12 inches below pad subgrade or lowest adjacent grade. Additional embedment or width may be needed to satisfy code and/or structural requirements. On ungraded sloping terrain, the footings should be stepped as necessary to

produce level tops and bottoms. Footings should be deepened as necessary to provide at least 7 feet of horizontal confinement between the footing bottoms and the face of the nearest slope. Confinement in bedrock can be reduced to 5 feet.

The bottoms of all footing excavations should be thoroughly cleaned out or wetted and compacted using hand-operated tamping equipment prior to placing steel and concrete. This will remove the soils disturbed during footing excavations, or restore their adequate bearing capacity, and reduce post-construction settlements. Footing excavations should not be allowed to dry before placing concrete. If shrinkage cracks appear in soils exposed in the footing excavations, the soil should be thoroughly moistened to close all cracks prior to concrete placement. The moisture condition of the foundation excavations should be checked by the geotechnical engineer no more than 24 hours prior to placing concrete.

Bearing Pressures - Footings installed in accordance with these recommendations may be designed using allowable bearing pressures of 2000, 3000 and 4000 pounds per square foot (psf), for dead loads, dead plus code live loads, and total loads (including wind and seismic), respectively. For footings bottomed entirely on bedrock, the above pressures can be increased to 3000, 4500 and 6000 psf.

Lateral Pressures - The portion of spread footing foundations extending into undisturbed bedrock or select engineered fill may impose a passive equivalent fluid pressure and a friction factor of 350 pcf and 0.35, respectively, to resist sliding. Passive pressure on ungraded weak surface soil should be reduced to 150 pcf. Passive pressure should be neglected within the upper 6 inches, unless the soils are confined by concrete slabs or pavements.

Retaining Walls

Retaining walls constructed at the site must be designed to resist lateral earth pressures plus additional lateral pressures that may be caused by surcharge loads applied at the ground surface behind the walls. Retaining walls free to rotate (yielding greater than 0.1 percent of the wall height at the top of the backfill) should be designed for active lateral earth pressures. If walls are restrained by rigid elements to prevent rotation, they should be designed for “at rest” lateral earth pressures.

Retaining walls should be designed to resist the following earth equivalent fluid pressures (triangular distribution):

EARTH EQUIVALENT FLUID PRESSURES		
Loading Condition	**Pressure (pcf)**	**Additional Seismic Pressure (pcf)***
Active - Level Backfill	40	16
Active - Sloping Backfill 3:1 or Flatter	51	39
At Rest - Level Backfill	60	41

* If required

These pressures do not consider additional loads resulting from adjacent foundations or other loads. If these additional surcharge loadings are anticipated, we can assist in evaluating their effects. Where retaining wall backfill is subject to vehicular traffic, the walls should be designed to resist an additional surcharge pressure equivalent to two feet of additional backfill.

Retaining walls will yield slightly during backfilling. Therefore, walls should be backfilled prior to building on, or adjacent to, the walls. Backfill against retaining walls should be compacted to at least 90 and not more than 95 percent relative compaction. Over-compaction or the use of large compaction equipment should be avoided because increased compactive effort can result in lateral pressures higher than those recommended above.

Foundation Support

Retaining walls should be supported on spread footings designed in accordance with the recommendations presented in this report. Retaining wall foundations should be designed by the project civil or structural engineer to resist the lateral forces set forth in this section.

Wall Drainage and Backfill

Retaining walls should be backdrained as shown on Plate 17, Appendix A. The backdrains should consist of 4-inch diameter, rigid perforated pipe embedded in Class 2 permeable material. The pipe should be PVC Schedule 40 or ABS with SDR 35 or better, and the pipe should be sloped to drain to outlets by gravity. The top of the pipe should be at least 8 inches below lowest adjacent grade. The Class 2 permeable material should extend to within 1½ feet of the surface. The upper 1½ feet should be backfilled with compacted soil to exclude surface water. Expansive soils should not be used for wall backfill. Where expansive soils are present in the excavation made to install the retaining wall, the excavation should be sloped back 1:1 from the back of the footing. The ground surface behind retaining walls should be sloped to drain. Where migration of moisture through retaining walls would be detrimental, retaining walls should be waterproofed.

Slab-On-Grade

Provided grading is performed in accordance with the recommendations presented herein, living area, exterior, and garage slabs should be underlain by select engineered fill. Because of expansive soils, slab-on-grade floors should not be used in living areas that are not underlain by at least 30 inches of select fill. Slabs-on-grade can be used in garages and exterior flatwork areas provided the slabs are underlain by at least 12 inches of select fill (not counting the slab rock).

Slab-on-grade subgrade should be rolled to produce a dense, uniform surface. The future expansion potential of the subgrade soils should be reduced by thoroughly presoaking the slab subgrade prior to concrete placement. The moisture condition of the subgrade soils should be checked by the geotechnical engineer no more than 24 hours prior to placing the capillary moisture break. The slabs should be underlain with a capillary moisture break consisting of at least 4 inches of clean, free-draining crushed rock or gravel (excluding pea gravel) at least ¼-inch and no larger than ¾-inch in size. Interior slabs subject to vehicular traffic may be underlain by Class 2 aggregate base. The use of Class 2 aggregate base should be reviewed on a case

by case basis. Class 2 aggregate base can be used for slab rock under exterior slabs. Interior area slabs should be provided with an underdrain system. The installation of this subdrain system is discussed in the “Geotechnical Drainage” section.

Slabs should be designed by the project civil or structural engineer to support the anticipated loads, reduce cracking and provide protection against the infiltration of moisture vapor. Garage slabs should be separated from foundations and framing elements with low friction material.

A vapor barrier should be placed under all slabs-on-grade that are likely to receive an impermeable floor finish or be used for any purpose where the passage of water vapor through the floor is undesirable. RGH does not practice in the field of moisture vapor transmission evaluation or mitigation. Therefore, we recommend that a qualified person be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person should provide recommendations for mitigation of the potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

Utility Trenches

The shoring and safety of trench excavations is solely the responsibility of the contractor. Attention is drawn to the State of California Safety Orders dealing with “Excavations and Trenches.”

Unless otherwise specified by the County, on-site, inorganic soil may be used as general utility trench backfill. Where utility trenches support pavements, slabs and foundations, trench backfill should consist of aggregate baserock. The baserock should comply with the minimum requirements in Caltrans Standard Specifications, Section 26 for Class 2 Aggregate Base. Trench backfill should be moisture-conditioned as necessary, and placed in horizontal layers not exceeding 8 inches in thickness, before compaction. Each layer should be compacted to at least 90 percent relative compaction as determined by ASTM Test Method D-1557. The top 6 inches of trench backfill below vehicle pavement subgrades should be moisture-conditioned as necessary and compacted to at least 95 percent relative compaction. Jetting or ponding of trench backfill to aid in achieving the recommended degree of compaction should not be attempted.

Pavements

As described previously, the subgrade soils at the site are expansive. Because of the expansion potential of the soil at the site and the difficulty in controlling seasonal moisture variation beneath and adjacent to the driveways and roadways, significant cracking may develop in the asphalt pavement even if 12-inches of select fill is installed. Increasing the thickness of select fill or installing moisture cutoffs may reduce but not eliminate the potential for cracks to develop. It should be understood that pavements will likely require regular maintenance including crack sealing and the aesthetics may not be desirable. Therefore, we are providing pavement sections for three subgrade conditions. These include on-site native soils, import select fill, and lime stabilized on site soils. Based on these conditions, we have computed pavement sections for Traffic Indices (TI) ranging from 5.0 to 7.0 in the table below.

PAVEMENT SECTIONS WITH NATIVE SOILS		
TI	ASPHALT CONCRETE (feet)	CLASS 2 AGGREGATE BASE (feet)
7.0	0.35	1.25
6.0	0.25	1.15
5.0	0.20	0.90

PAVEMENT SECTIONS WITH IMPORTED SELECT FILL SUBGRADE			
TI	ASPHALT CONCRETE (feet)	CLASS 2 AGGREGATE BASE (feet)	IMPORTED SELECT FILL* (feet)
7.0	0.35	0.95	1.0
6.0	0.25	0.90	1.0
5.0	0.20	0.75	1.0

* R-value ≥ 30

PAVEMENT SECTIONS WITH LIME STABILIZED SELECT FILL SUBGRADE			
TI	ASPHALT CONCRETE (feet)	CLASS 2 AGGREGATE BASE (feet)	LIME STABILIZED SELECT FILL* (feet)
7.0	0.35	0.50	1.0
6.0	0.30	0.50	1.0
5.0	0.20	0.50	1.0

* R-value ≥ 50

Pavement thicknesses were computed using Caltrans CalFP v1.1 design software and are based on a pavement life of 20 years. These recommendations are intended to provide support for traffic represented by the indicated Traffic Indices. They are not intended to provide pavement sections for heavy concentrated construction storage or wheel loads such as forklifts, parked truck-trailers and concrete trucks.

In areas where heavy construction storage and wheel loads are anticipated, the pavements should be designed to support these loads. Support could be provided by increasing pavement sections or by providing reinforced concrete slabs. Alternatively, paving can be deferred until heavy construction storage and wheel loads are no longer present.

Prior to placement of aggregate base, the upper 6 inches of the pavement subgrade soils (excluding on-site soils and lime stabilized soils) should be scarified, uniformly moisture-

conditioned to near optimum, and compacted to at least 95 percent relative compaction to form a firm, non-yielding surface. On-site soils should be uniformly moisture-conditioned to at least 3 percent over optimum and compacted to at least 93 percent relative compaction. Lime stabilized select fill subgrade soils should be compacted as specified in Section 24 of the Caltrans Standard Specifications.

Aggregate base materials should be spread in thin layers, uniformly moisture-conditioned, and compacted to at least 95 percent relative compaction to form a firm, non-yielding surface. The materials and methods used should conform to the requirements of the County of Napa and the current edition of the Caltrans Standard Specifications, except that compaction requirements should be based on ASTM Test Method D-1557. Aggregate used for the base course should comply with the minimum requirements specified in Caltrans Standard Specifications, Section 26 for Class 2 Aggregate Base.

Wet Weather Paving

In general, the pavements should be constructed during the dry season to avoid the saturation of the subgrade and base materials, which often occurs during the wet winter months. If pavements are constructed during the winter, a cost increase relative to drier weather construction should be anticipated. Unstable areas may have to be overexcavated to remove soft soils. The excavations will probably require backfilling with imported crushed (ballast) rock. The geotechnical engineer should be consulted for recommendations at the time of construction.

Geotechnical Drainage

This section presents recommendations for surface and subsurface drainage. For the discussion of subsurface drainage related to grading, especially on hillsides, refer to the “Subsurface Drainage” section.

Surface

Surface water should be diverted away from slopes, foundations and edges of pavements. Surface drainage gradients should slope away from building foundations in accordance with the requirements of the CBC or local governing agency. Where a gradient flatter than 2 percent for paved areas and 4 percent for unpaved areas is required to satisfy design constraints, area drains should be installed with spacing no greater than about 20 feet. Roofs should be provided with gutters and the downspouts should be connected to closed glued Schedule 40 PVC or ABS with SDR of 35 or better conduits discharging well away from foundations, onto paved areas, erosion resistant natural drainages or into the site’s surface drainage system. Roof downspouts and surface drains must be maintained entirely separate from the perimeter foundation drains and slab underdrains recommended hereinafter.

Water seepage or the spread of extensive root systems into the soil subgrade of footings, slabs or pavements could cause differential movements and consequent distress in these structural elements. Landscaping should be planned with consideration for these potential problems.

Perimeter Foundation Drains

Where interior crawl spaces are lower than adjacent exterior grade, subdrains should be installed adjacent to perimeter foundations, except on the downhill side, to prevent surface runoff from entering the crawl space. Foundation drains should consist of trenches that are at least 10 inches below the crawl space surface and are sloped to drain by gravity. Four-inch diameter perforated pipe sloped to drain to outlets by gravity should be placed in the bottom of the trenches. The top of subdrain pipes should be at least 12 inches lower than the adjacent crawl space. The perimeter subdrain trenches should be backfilled to within 6 inches of the surface with Class 2 permeable material. The upper 6 inches should be backfilled with compacted soil to exclude surface water. An illustration of this system is shown on Plate 18. Where perimeter foundation drains are not used, water ponding in the crawl space should be anticipated. Where retaining walls are used for perimeter foundations, retaining wall backdrains may be used in lieu of foundation drains.

Crawl Space Drains

Crawl spaces are inherently damp and humid. In addition, groundwater seepage is unpredictable and difficult to control and, regardless of the care used in installing perimeter foundation drains, can find its way into crawl spaces. The ground surface within the crawl space should be sloped to drain away from foundations and toward a 12 inch square drain trench that is excavated through the longitudinal axis of the crawl space. A 4-inch diameter perforated drain pipe (SDR 35 or better) should be embedded in Class 2 permeable materials near the bottom of the trench. The drain rock should extend to the surface of the crawl space (see Plate 18). Piped outlets should be provided to allow drainage of the collected water through foundations and discharge into the storm drain system. Additional protection against water seepage into crawl spaces can be obtained by compacting fill placed adjacent to perimeter walls to at least 90 percent relative compaction.

Slab Underdrains

Where living area slab subgrades are less than 6 inches above adjacent exterior grade and where migration of moisture through the slab would be detrimental, slab underdrains should be installed to dispose of surface and/or groundwater that may seep and collect in the slab rock. Slab underdrains should consist of 6-inch wide trenches that extend at least 6 inches below the bottom of the slab rock and slope to drain by gravity. The slab underdrain trenches should be spaced no further than 15 feet, both ways. Additional drain trenches should be installed, as necessary, to drain all isolated under slab areas. Four-inch diameter perforated pipe (SDR 35 or better) sloped to drain to outlets by gravity should be placed in the bottom of the trenches. Slab underdrain trenches should be backfilled to subgrade level with clean, free draining slab rock. An illustration of this system is shown on Plate 18. If slab underdrains are not used, it should be anticipated that water will enter the slab rock, permeate through the concrete slab and ruin floor coverings.

Maintenance

Periodic land maintenance, especially on hillsides, will be required. Surface and subsurface drainage facilities should be checked frequently, and cleaned and maintained as necessary or

at least annually. A dense growth of deep-rooted ground cover must be maintained on all slopes to reduce sloughing and erosion. Sloughing and erosion that occurs must be repaired promptly before it can enlarge.

Supplemental Services

Pre-Bid Meeting

It has been our experience that contractors bidding on the project often contact us to discuss the geotechnical aspects. Informal contacts between RGH and an individual contractor could result in incomplete or misinterpreted information being provided to the contractor. Therefore, we recommend a pre-bid meeting be held to answer any questions about the report prior to submittal of bids. If this is not possible, questions or clarifications regarding this report should be directed to the project owner or their designated representative. After consultation with RGH, the project owner or their representative should provide clarifications or additional information to all contractors bidding the job.

Plan and Specifications Review

Coordination between the design team and the geotechnical engineer is recommended to assure that the design is compatible with the soil, geologic and groundwater conditions encountered during our study. RGH Consultants (RGH) recommends that we be retained to review the project plans and specifications to determine if they are consistent with our recommendations. In the event we are not retained to perform this recommended review, we will assume no responsibility for misinterpretation of our recommendations.

Construction Observation and Testing

Prior to construction, a meeting should be held at the site that includes, but is not limited to, the owner or owner's representative, the general contractor, the grading contractor, the foundation contractor, the underground contractor, any specialty contractors, the project civil engineer, other members of the project design team and RGH. This meeting should serve as a time to discuss and answer questions regarding the recommendations presented herein and to establish the coordination procedure between the contractors and RGH.

In addition, we should be retained to monitor all soils related work during construction, including:

- Site stripping, over-excavation, grading, and compaction of near surface soils;
- Placement of all engineered fill and trench backfill with verification field and laboratory testing;
- Observation of all foundation excavations; and
- Observation of foundation and subdrain installations.

If, during construction, we observe subsurface conditions different from those encountered during the explorations, we should be allowed to amend our recommendations accordingly. If different conditions are observed by others, or appear to be present beneath excavations, RGH should be advised at once so that these conditions may be evaluated and our recommendations

reviewed and updated, if warranted. The validity of recommendations made in this report is contingent upon our being notified and retained to review the changed conditions.

If more than 18 months have elapsed between the submission of this report and the start of work at the site, or if conditions have changed because of natural causes or construction operations at, or adjacent to, the site, the recommendations made in this report may no longer be valid or appropriate. In such case, we recommend that we be retained to review this report and verify the applicability of the conclusions and recommendations or modify the same considering the time lapsed or changed conditions. The validity of recommendations made in this report is contingent upon such review.

These supplemental services are performed on an as-requested basis and are in addition to this geotechnical study. We cannot accept responsibility for items that we are not notified to observe or for changed conditions we are not allowed to review.

LIMITATIONS

This report has been prepared by RGH for the exclusive use of The Good Life Wine Collective and their consultants as an aid in the design and construction of the proposed improvements described in this report.

The validity of the recommendations contained in this report depends upon an adequate testing and monitoring program during the construction phase. Unless the construction monitoring and testing program is provided by our firm, we will not be held responsible for compliance with design recommendations presented in this report and other addendum submitted as part of this report.

Our services consist of professional opinions and conclusions developed in accordance with generally accepted geotechnical engineering principles and practices. We provide no warranty, either expressed or implied. Our conclusions and recommendations are based on the information provided to us regarding the proposed construction, the results of our field exploration, laboratory testing program, and professional judgment. Verification of our conclusions and recommendations is subject to our review of the project plans and specifications, and our observation of construction.

The test pits represent subsurface conditions at the locations and on the date indicated. It is not warranted that they are representative of such conditions elsewhere or at other times. Site conditions and cultural features described in the text of this report are those existing at the time of our field exploration on October 19 and 20, 2015, and may not necessarily be the same or comparable at other times.

It should be understood that slope failures including landslides, debris flows and erosion are on-going natural processes which gradually wear away the landscape. Residual soils and weathered bedrock can be susceptible to downslope movement, even on apparently stable sites. Such inherent hillside and slope risks are generally more prevalent during periods of intense and prolonged rainfall, which occasionally occur, in northern California and/or during earthquakes. Therefore, it must be accepted that occasional, unpredictable slope failure and

erosion and deposition of the residual soils and weathered bedrock materials are irreducible risks and hazards of building upon or near the base of any hillside or any steeper slope area throughout northern California. By accepting this report, the client and other recipients acknowledge their understanding and acceptance of these risks and hazards, and the terms and conditions herein.

The scope of our services did not include an environmental assessment or a study of the presence or absence of toxic mold and/or hazardous, toxic or corrosive materials in the soil, surface water, groundwater or air (on, below or around this site), nor did it include an evaluation or study for the presence or absence of wetlands. These studies should be conducted under separate cover, scope and fee and should be provided by a qualified expert in those fields.

APPENDIX A - PLATES

LIST OF PLATES

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Plate 2	Exploration Plan
Plate 3	Landslide Identification Chart
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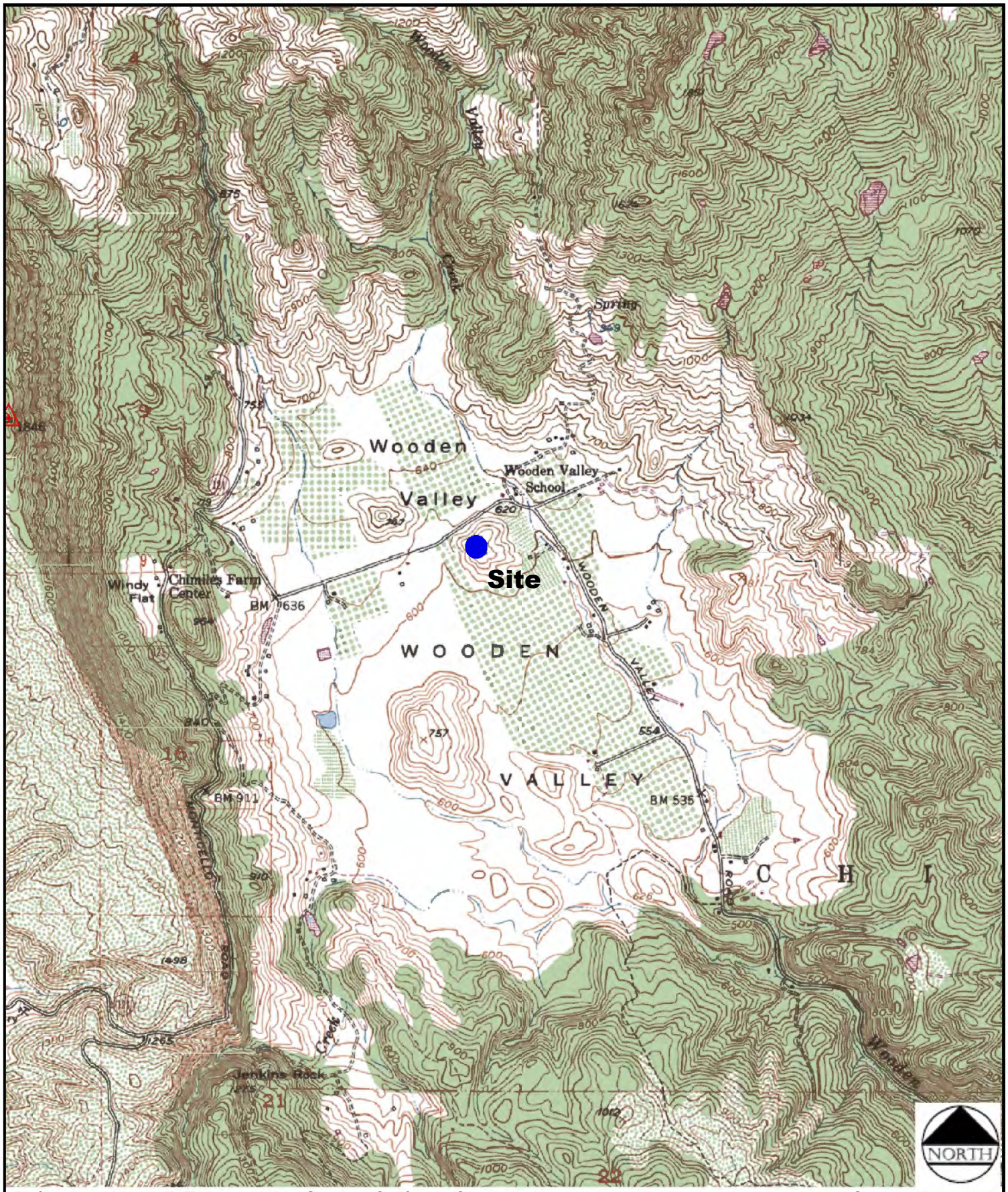
Plate 12	Soil Classification Chart and Key to Test Data
Plate 13	Engineering Geology Rock Terms
Plate 14	Classification Test Data
Plate 15	Geologic Cross Section
Plate 16	Hillside Grading Illustration
Plate 17	Retaining Wall Backdrain Illustration
Plate 18	Typical Subdrain Details Illustration



Reference: Maptech Topoquad, Mt. George, California Quadrangle

Scale: 1" = 2000'

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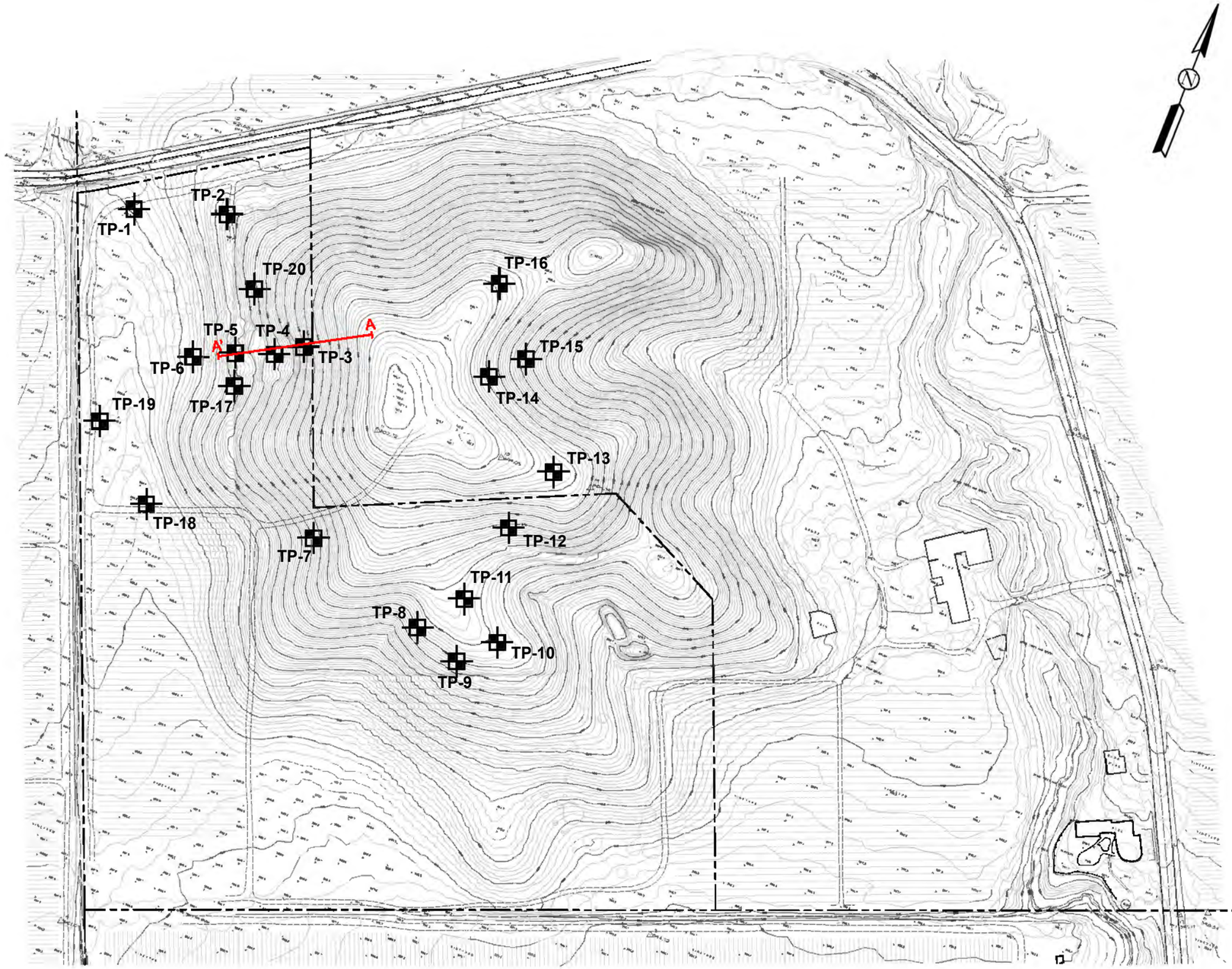
Job No: 6901.01.04.2 | Date: DEC 2015

SITE LOCATION MAP

Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE

1



Explanation

TP-16 — Test Pit Location and Number

Survey Control Station

A' — A — Cross Section Location

Property Line

Qls — Recent Landslide with Arrow Indicating Direction of Movement

Qols — Older - Dormant Landslide with Arrow Indicating Direction of Movement

200 0 200 400 600 feet

Reference: Topographic Map of the Lands of George Shanks Jr, RSA+, NOV 2015, Sheet 1

Scale: 1" = 200'

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Job No: 6901.01.04.2 | Date: NOV 2015

EXPLORATION PLAN

Job Name
Address
City, California

PLATE 2

Landslide Identification Nomenclature *

Type of Landslide Movement

1	Rotational (Earth Slump)	Movement due to forces that cause a turning moment about a point above the center of gravity of the unit.
2	Translational	Movement predominantly along more or less planar or gently undulatory surfaces.
3	Debris Flow	Rapid movement (50 to 80 kph) within displaced mass such that the form taken by moving material or the apparent distribution of velocities and displacements resemble those of viscous fluids.
4	Earth Flow	Downslope viscous flow of fine grained materials that have been saturated and moves under the pull of gravity. Typically slow moving (a few meters per day or less).
5	Debris Slide	Unconsolidated rock and soil moved downslope along a relatively shallow failure plane
6	Rock Fall	Fragments of rock detached by toppling or falling that falls along a vertical or sub-vertical cliff.
C	Many landslides consist of one or more type of movement. The listed type of movement is modified with a "C" to indicate a Complex of landslides.	

Certainty of Landslide Identification

1	Definite
2	Probable
3	Questionable

Estimated Thickness of Landslide Deposits

1	Less than 5 feet
2	5 to 20 feet
3	20 to 50 feet
4	Greater than 50 feet

State of Landslide Activity

1	Recently Active	Currently moving or estimated movement within recent years.
2	Dormant	Marginally stable with mature and subdued expression of the landslide. Mostly re-vegetated.
3	Ancient	Most landslide features are eroded. Heavily vegetated.

* The landslide identification mapping is designed for planning purposes only and should not be used in lieu of a detailed site specific investigation. Our mapping should be considered preliminary and for feasibility and planning purposes only. A subsurface study may reveal conditions different from those inferred by surface observations and data review only. Such subsurface study may warrant a revision to our preliminary mapping.

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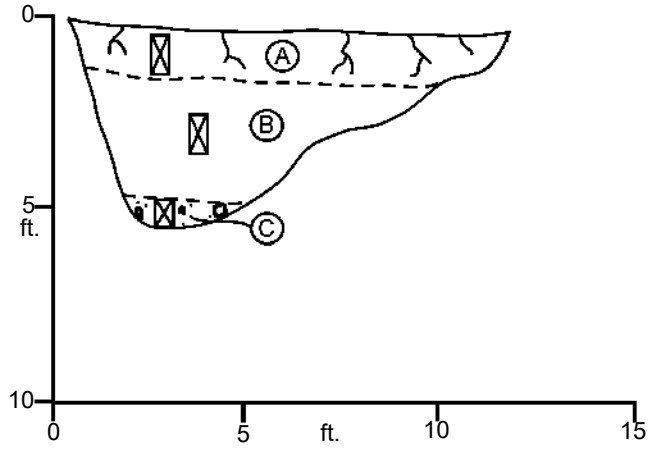
LANDSLIDE IDENTIFICATION CHART
Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE
3

TP-1
N50°W

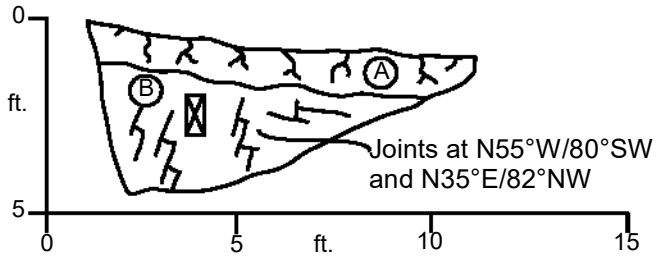


Ⓐ BROWN SILT (SL), hard, dry, porous to two feet, some rootlets.

Ⓑ MOTTLED OLIVE-BROWN TO RED-BROWN CLAY (CL), hard, dry, blocky texture.

Ⓒ MOTTLED OLIVE-BROWN TO REDDISH-BROWN CLAY WITH SAND AND GRAVEL (CL), hard, dry, blocky texture.

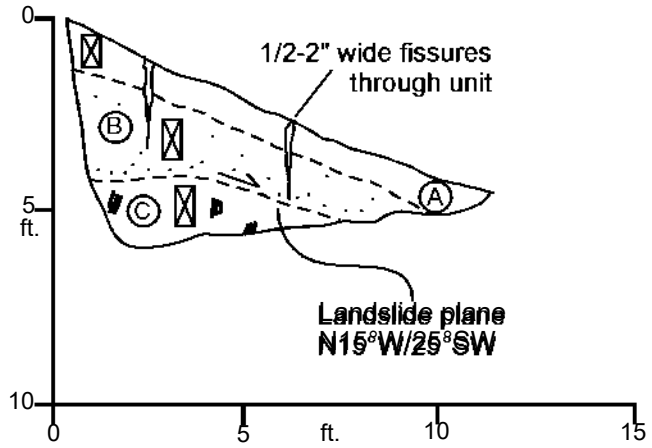
TP-2
S85°W



Ⓐ BROWN SILT (SL), hard, dry, porous to two feet, some rootlets.

Ⓑ BROWN SILTSTONE, dark gray weathering, thinly bedded, closely to extremely closely spaced fractures, firm, moderately strong, moderately weathered (Great Valley Bedrock).

TP-3
N73°W



Ⓐ LIGHT BROWN CLAY (CL), hard, dry, porous to ~12", locally fissures through unit (landslide deposit).

Ⓑ DARK BROWN CLAY WITH SAND (CL), hard, dry, fine sands (landslide deposit).

Ⓒ YELLOW-BROWN SANDSTONE, closely fractured, fractures are tight with no infill, firm, weak, moderately weathered (Great Valley Bedrock).

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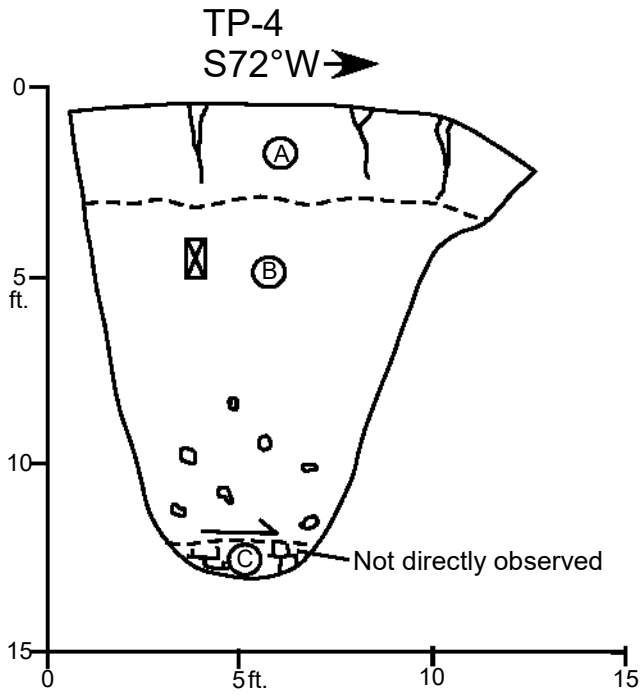
Job No: 6901.01.04.2 | Date: DEC 2015

LOG OF TEST PITS TP-1 THROUGH TP-3
Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

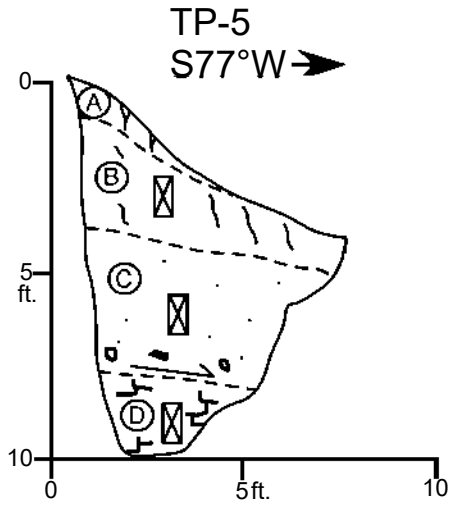
PLATE
4



Ⓐ LIGHT BROWN CLAY (CL), hard, dry, porous to ~12", locally fissures through unit (landslide deposit).

Ⓑ RED BROWN CLAY WITH SAND (CL), very stiff to hard, dry to moist at four feet, gravels at eight feet to bottom of unit (landslide deposit).

Ⓒ YELLOW-BROWN SANDSTONE, closely fractured, fractures are tight with no infill, firm, weak, moderately weathered (Great Valley Bedrock).

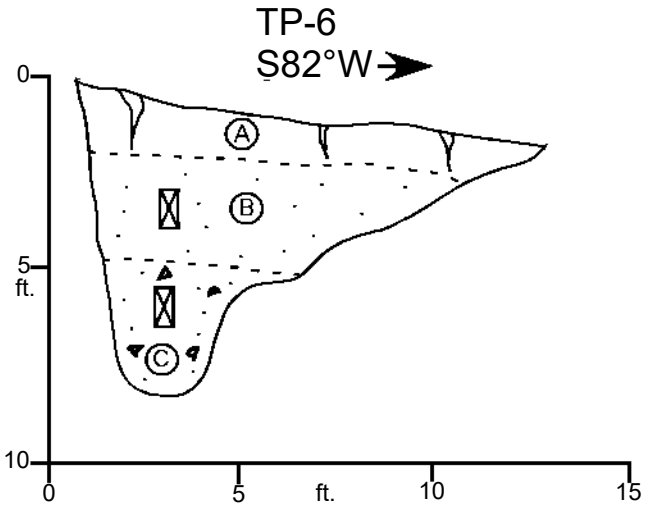


Ⓐ LIGHT BROWN CLAY (CL), hard, dry, porous to ~12", locally fissures through unit (landslide deposit).

Ⓑ MOTTLED BROWN AND YELLOW BROWN CLAY (CL), very stiff, moist, shrinkage cracks through unit (landslide deposit).

Ⓒ BROWN AND RED-BROWN SANDY CLAY (CL), very stiff, dry, fine sand, locally clasts from lower unit at the base of unit (landslide deposit).

Ⓓ OLIVE AND RED-BROWN SANDY SILTSTONE, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).



Ⓐ LIGHT BROWN CLAY (CL), hard, dry, porous to ~12", locally fissures through unit.

Ⓑ GRAY-BROWN SANDY CLAY (CL), very stiff, dry, fine sands.

Ⓒ DARK BROWN-RED CLAY WITH SAND (CL), hard, dry, fine sands, some angular gravels.

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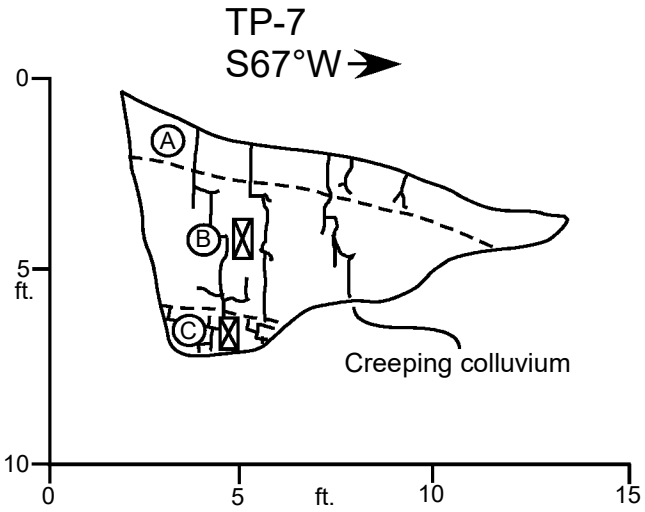
Job No: 6901.01.04.2 | Date: DEC 2015

LOG OF TEST PITS TP-4 THROUGH TP-6

Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE

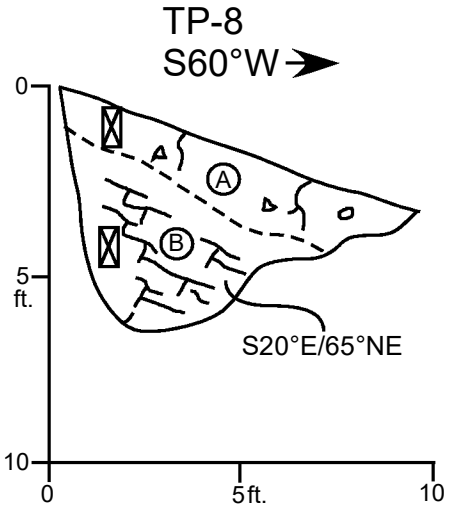
5



Ⓐ LIGHT BROWN CLAY (CL), very stiff, dry, porous, many rootlets.

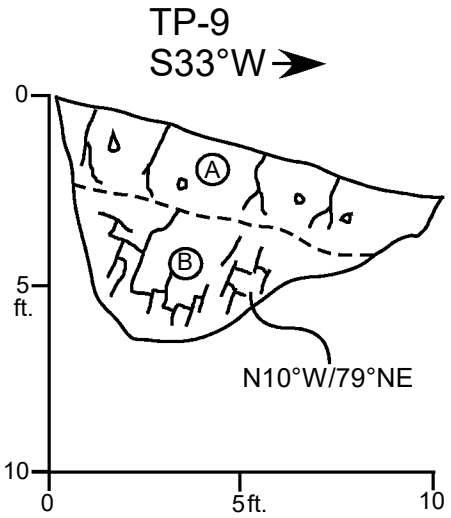
Ⓑ BROWN AND RED-BROWN CLAY WITH SAND (CH), hard, dry to moist at three feet, shrinkage cracks through unit.

Ⓒ RED-BROWN AND DARK GRAY CLAYEY SANDSTONE, extremely closely spaced fractures, firm, friable, moderately weathered (Great Valley Bedrock).



Ⓐ LIGHT BROWN SANDY CLAY (CL), medium stiff, dry, fine to coarse sand, fine to coarse angular gravel to two inch diameter, porous.

Ⓑ RED-BROWN AND LIGHT BROWN SANDY SILTSTONE, closely bedded, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).



Ⓐ LIGHT BROWN SANDY CLAY WITH GRAVEL (CL), medium stiff, dry, fine to coarse sand, fine to coarse angular gravels to two inch diameter, porous.

Ⓑ RED-BROWN AND LIGHT BROWN SANDY SILTSTONE, closely bedded, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).

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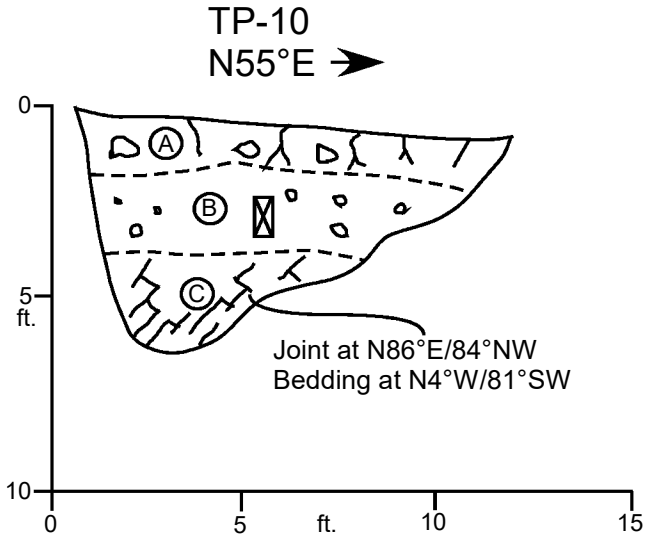
LOG OF TEST PITS TP-7 THROUGH TP-9

Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE

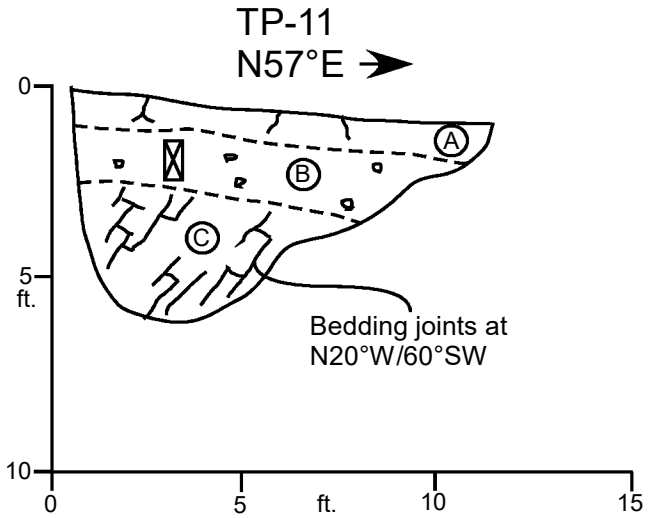
6



Ⓐ LIGHT BROWN SANDY CLAY WITH GRAVEL AND COBBLES (CL), stiff, dry, fine to coarse sand, fine to coarse rounded gravel, rounded cobbles to 12 inch diameter, porous.

Ⓑ OLIVE AND RED-BROWN SILTSTONE, extremely closely spaced fractures, firm, weak, moderately weathered.

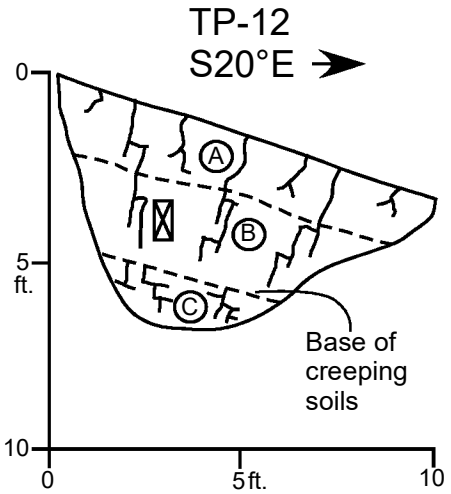
Ⓒ RED-BROWN AND LIGHT BROWN SANDY SILTSTONE, closely bedded, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).



Ⓐ LIGHT BROWN SANDY CLAY WITH GRAVEL (CL), medium stiff, dry, fine to coarse sand, fine to coarse angular gravel to two inch diameter, porous.

Ⓑ LIGHT BROWN SANDY CLAY WITH GRAVEL (CL), stiff, dry, fine to coarse sand.

Ⓒ RED-BROWN AND LIGHT BROWN SANDY SILTSTONE, closely bedded, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).



Ⓐ LIGHT BROWN CLAY (CL), stiff, dry, porous with rootlets.

Ⓑ OLIVE-BROWN CLAY (CH), very stiff, moist, shrinkage cracks to four feet (creeping colluvium).

Ⓒ OLIVE AND RED-BROWN CLAYEY SILTSTONE, extremely closely fractured, firm, weak, moderately weathered (Great Valley Bedrock).

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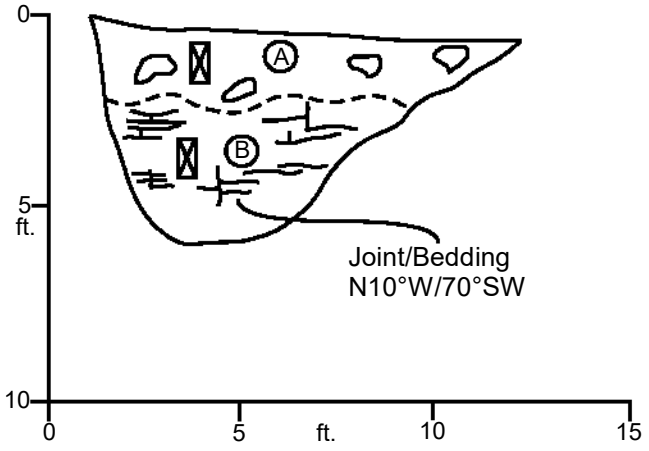
LOG OF TEST PITS TP-10 THROUGH TP-12

Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE

7

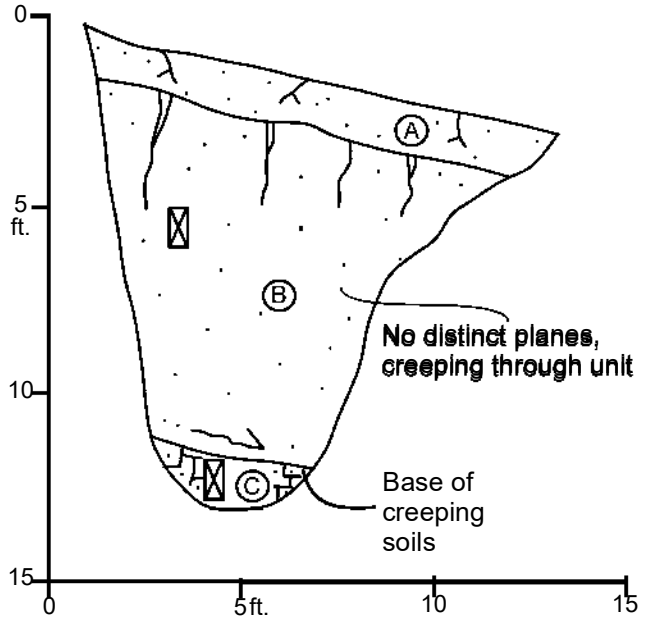
TP-13
S45°E



(A) LIGHT BROWN SANDY CLAY WITH GRAVEL AND COBBLES (CL), moderately stiff, dry, fine to coarse sand, rounded limestone gravel and cobbles to 12 inch diameter, porous to 2 feet.

(B) OLIVE AND DARK BROWN CLAYSTONE, thinly bedded, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).

TP-14
N40°E



(A) LIGHT BROWN CLAY WITH SAND (CL), stiff, dry, porous, some rootlets.

(B) RED-BROWN CLAY WITH SAND (CH), stiff, moist, shrinkage/tension cracks to 4 feet, faint relict texture with depth (creeping bedrock).

(C) YELLOW AND BROWN SANDSTONE, closely fractured, moderately hard, weak, moderately weathered (Great Valley Bedrock).

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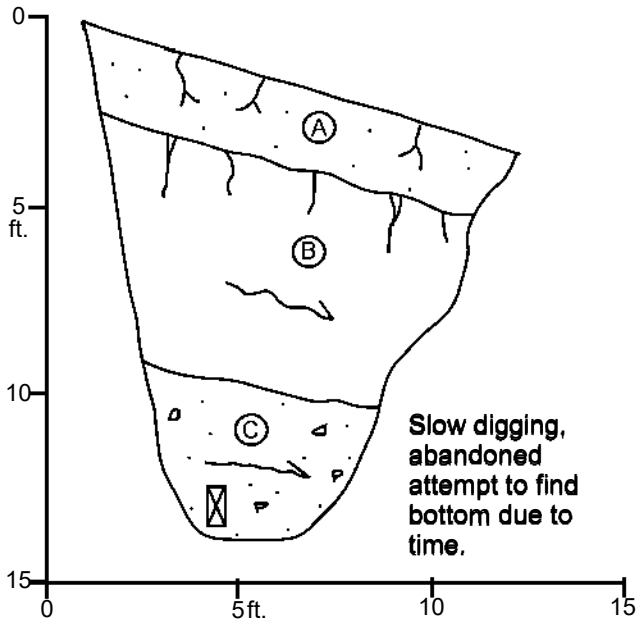
LOG OF TEST PITS TP-13 THROUGH TP-14
Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE
8

TP-15
N75°E

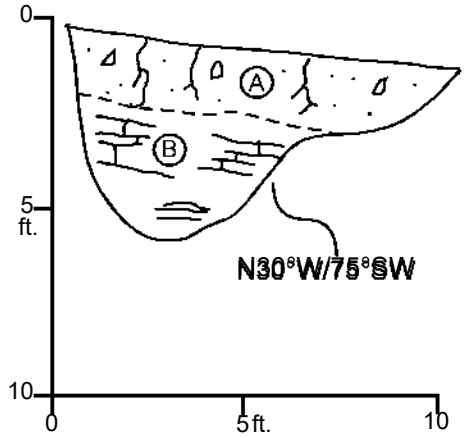


(A) LIGHT BROWN CLAY WITH SAND (CL), stiff, dry, porous, some rootlets.

(B) RED-BROWN CLAY (CH), stiff, moist, shrinkage/tension cracks to 4 feet, faint relict texture with depth (creeping soils).

(C) OLIVE-BROWN AND RED-BROWN SANDY CLAY WITH GRAVEL (CL-CH), stiff, moist, fine to coarse angular sand, angular claystone gravel to 3/4 inch diameter (creeping soils).

TP-16
N60°E



(A) LIGHT BROWN SANDY CLAY WITH GRAVEL AND COBBLES (CL), moderately stiff, dry, fine to coarse sand, rounded limestone gravel and cobbles to 12 inch diameter, porous to 2 feet.

(B) OLIVE AND DARK BROWN CLAYSTONE, thinly bedded, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).

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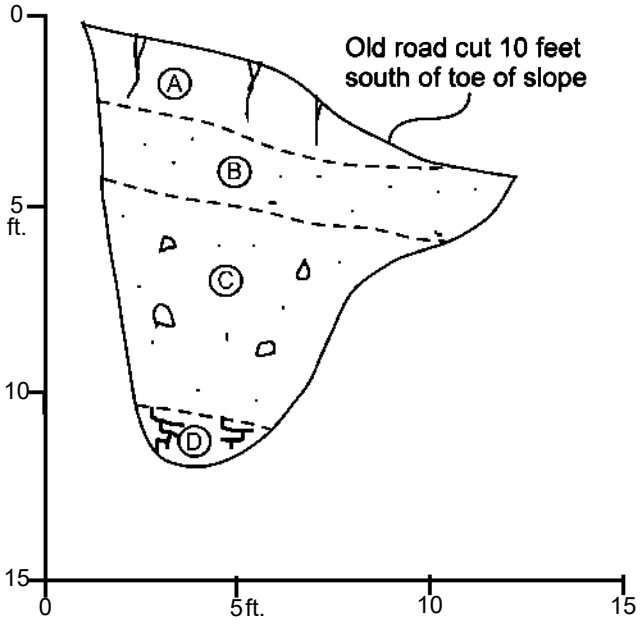
LOG OF TEST PITS TO-15 THROUGH TP-16
Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE
9

TP-17
S75°W



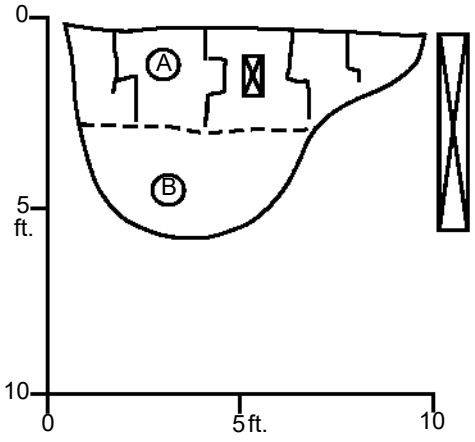
Ⓐ LIGHT BROWN CLAY (CL), hard, dry, porous to ~12", locally fissures through unit.

Ⓑ GRAY-BROWN SANDY CLAY (CL), very stiff, dry, fine sands.

Ⓒ DARK BROWN-RED CLAY WITH SAND (CL), hard, dry, fine sands, some angular gravels.

Ⓓ OLIVE AND RED-BROWN SANDY SILTSTONE, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).

TP-18
N68°E



Ⓐ DARK GRAY CLAY WITH SAND (CH), very stiff, dry, porous.

Ⓑ RED-BROWN CLAY (CL), stiff, moist.

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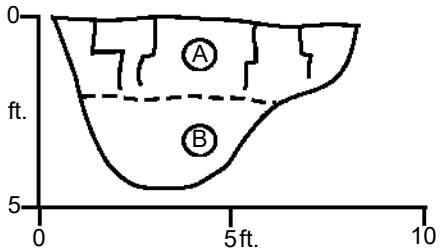
LOG OF TEST PITS TP-17 THROUGH TP-18
Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE
10

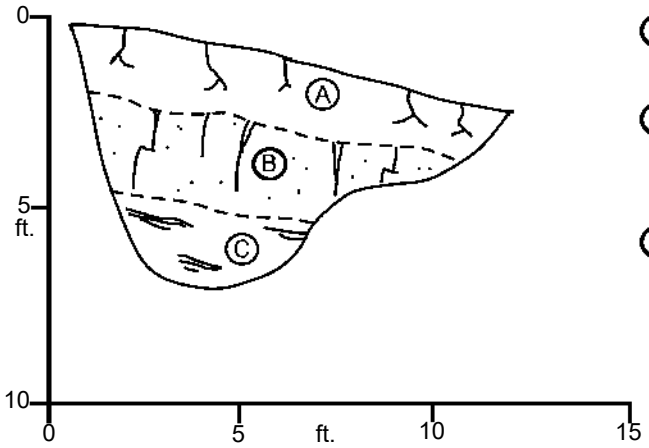
TP-19
S05°E



(A) DARK GRAY CLAY (CH), very stiff, dry, porous.

(B) RED-BROWN CLAY (CL), stiff, moist.

TP-20
S55°W



(A) LIGHT BROWN CLAY (CL), very stiff, dry, porous, many rootlets.

(B) BROWN AND RED-BROWN CLAY WITH SAND (CH), hard, dry to moist at three feet, shrinkage cracks through unit.

(C) OLIVE AND DARK BROWN CLAYSTONE, thinly bedded, extremely closely spaced fractures, firm, weak, moderately weathered (Great Valley Bedrock).

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Job No: 6901.01.04.2 | Date: DEC 2015

LOG OF TEST PITS TP-19 THROUGH TP-20
Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE
11

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL (LITTLE OR FINES)		GW	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVEL WITH FINES (OVER 12% OF FINES)		GM	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GC	CLAYEY GRAVEL, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SAND, GRAVELLY SAND, LITTLE OR NO FINES
				SP	POORLY-GRADED SAND, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (OVER 12% OF FINES)		SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
				SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANICS SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	ORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS AND OTHER SOILS WITH HIGH ORGANIC-CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

KEY TO TEST DATA

Consol - Consolidation
Gs - Specific Gravity
SA - Sieve Analysis
■ - "Undisturbed" Sample
⊠ - Bulk or Disturbed Sample
◪ - Standard Penetration Test
⧄ - Sample Attempt With No Recovery
◧ - Sample Recovered But Not Retained

	Shear Strength, psf	Confining Pressure, psf	
Tx	320	(2600)	- Unconsolidated Undrained Traixial
TxCU	320	(2600)	- Consolidated Undrained Triaxial
DS	2750	(2600)	- Consolidated Drained Direct Shear
UC	2000		- Unconfined Compression
FVS	470		- Field Vane Shear
LVS	700		- Laboratory Vane Shear
SS			- Shrink Swell
EXP			- Expansion
P			- Permeability

Note: All strength tests on 2.8-in. or 2.4-in. diameter sample, unless otherwise indicated.

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SOIL CLASSIFICATION AND KEY TO TEST DATA
Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE
12

LAYERING

MASSIVE	Greater than 6 feet
THICKLY BEDDED	2 to 6 feet
MEDIUM BEDDED	8 to 24 inches
THINLY BEDDED	2½ to 8 inches
VERY THINLY BEDDED	¾ to 2½ inches
CLOSELY LAMINATED	¼ to ¾ inches
VERY CLOSELY LAMINATED	Less than ¼ inch

JOINT, FRACTURE, OR SHEAR SPACING

VERY WIDELY SPACED	Greater than 6 feet
WIDELY SPACED	2 to 6 feet
MODERATELY SPACED	8 to 24 inches
CLOSELY SPACED	2½ to 8 inches
VERY CLOSELY SPACED	¾ to 2½ inches
EXTREMELY CLOSELY SPACED	Less than ¼ inch

HARDNESS

Soft - pliable; can be dug by hand

Firm - can be gouged deeply or carved with a pocket knife

Moderately Hard - can be readily scratched by a knife blade; scratch leaves heavy trace of dust and is readily visible after the powder has been blown away

Hard - can be scratched with difficulty; scratch produces little powder and is often faintly visible

Very Hard - cannot be scratched with pocket knife, leaves a metallic streak

STRENGTH

Plastic - capable of being molded by hand

Friable - crumbles by rubbing with fingers

Weak - an unfractured specimen of such material will crumble under light hammer blows

Moderately Strong - specimen will withstand a few heavy hammer blows before breaking

Strong - specimen will withstand a few heavy ringing hammer blows and usually yields large fragments

Very Strong - rock will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments

DEGREE OF WEATHERING

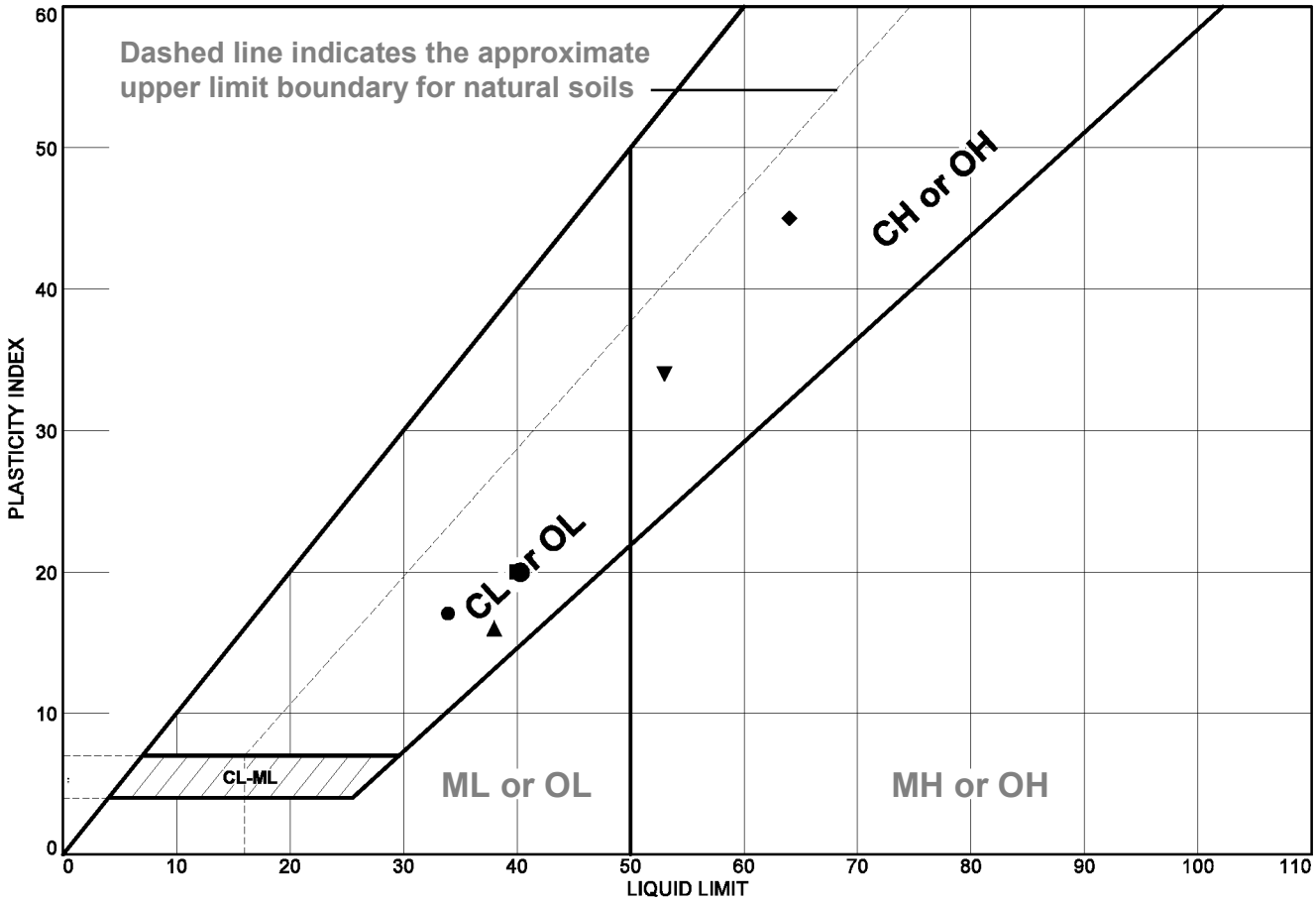
Highly Weathered - abundant fractures coated with oxides, carbonates, sulphates, mud, etc., thorough discoloration, rock disintegration, mineral decomposition

Moderately Weathered - some fracture coating, moderate or localized discoloration, little to no effect on cementation, slight mineral decomposition

Slightly Weathered - a few stained fractures, slight discoloration, little or no effect on cementation, no mineral composition

Fresh - unaffected by weathering agents; no appreciable change with depth

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brn Sandy Clay (CL)	34	17	17		55.6	CL
■	Brn Sandy Clay (CL)	40	20	20			CL
▲	Brn Sandy Clay (CL)	38	22	16			CL
◆	Brn Clay W/ Sand (CH)	64	19	45		84.5	CH
▼	Brn Clay W/ Sand (CH)	53	19	34		76.0	CH

Project No. 6901.01.04.2 **Client:** RGH Consultants

Project: Shanks Property Improvements

●**Source of Sample:** TP-5 **Depth:** 3.0'-7.0' **Sample Number:** Composite

■**Source of Sample:** TP-8 **Depth:** 0-1.0'

▲**Source of Sample:** TP-8 **Depth:** 3.0'-4.0'

◆**Source of Sample:** TP-14 **Depth:** 4.0'-5.0'

▼**Source of Sample:** TP-18 **Depth:** 0.5'-1.5'

Remarks:

●Expansion Index=69

■Expansion Index=52

▲Expansion Index=77

◆Expansion Index=144

▼Expansion Index=97

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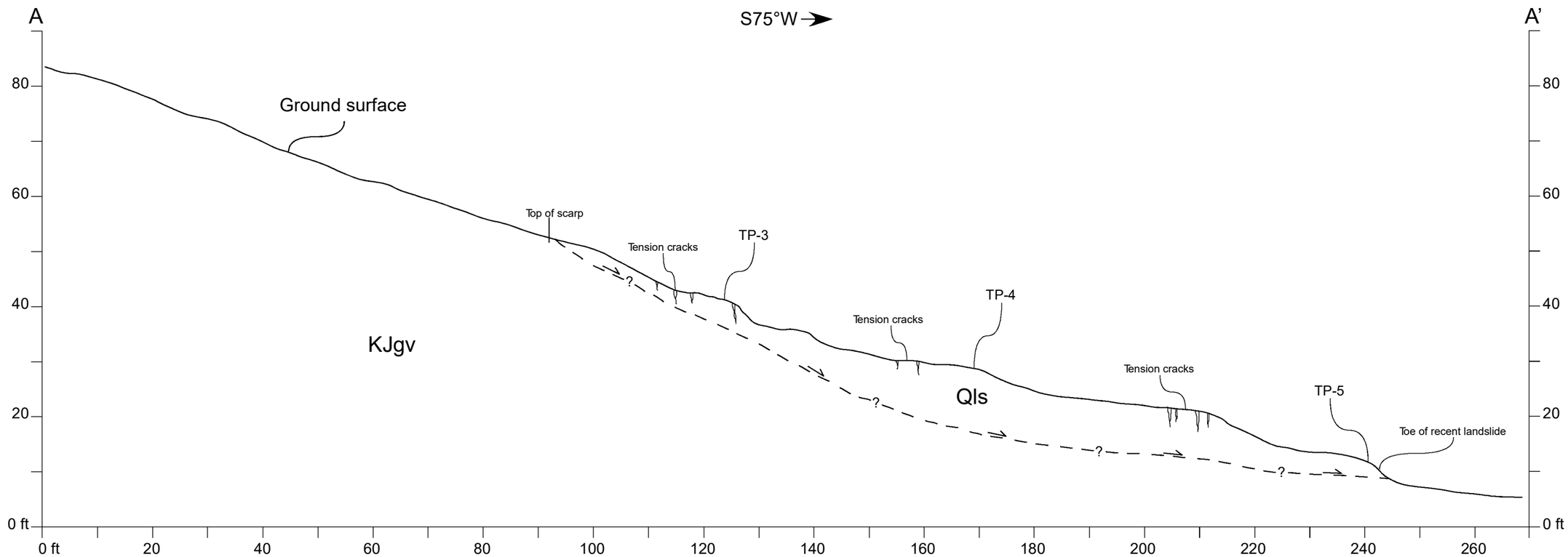
Job No: 6901.01.04.2 | Date: DEC 2015

CLASSIFICATION TEST DATA

Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE

14



Explanation

— ⇒ —?— — ⇒ —?—	Landslide plane, dashed where approximate, queried where unknown, arrows indicate direction of movement.
Qls	Landslide deposits
KJgv	Great Valley Sequence

Scale 1 : 240

20 0 20 40 60 feet

Scale: 1" = 20'

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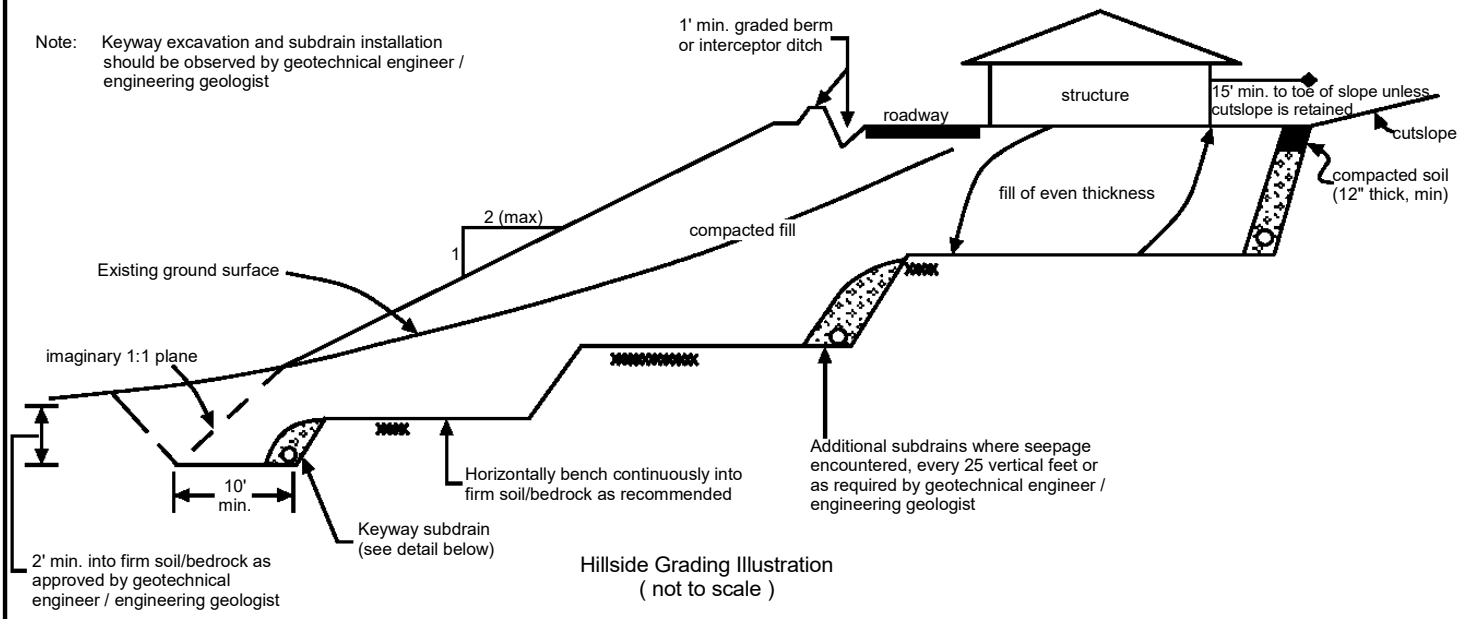
Job No: 6901.01.04.2 | Date: DEC 2015

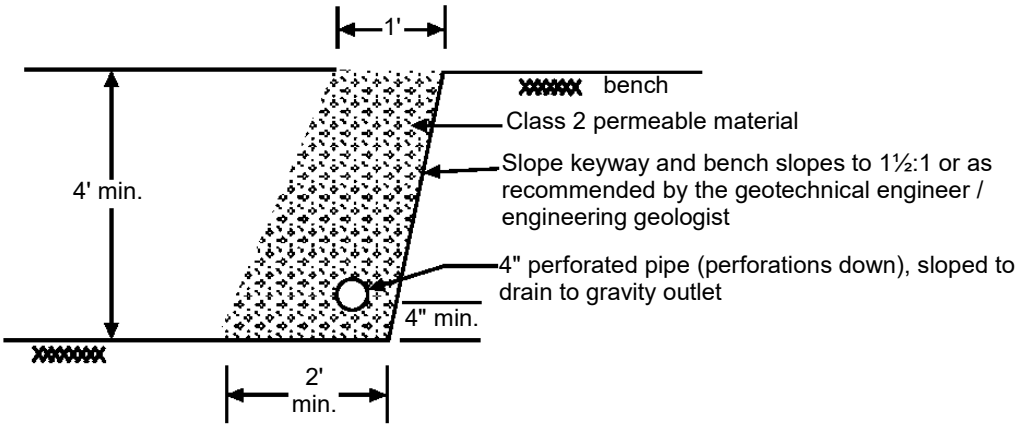
GEOLOGIC CROSS SECTION
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE
15

Note: Keyway excavation and subdrain installation should be observed by geotechnical engineer / engineering geologist



Hillside Grading Illustration
(not to scale)



Keyway Subdrain
(not to scale)

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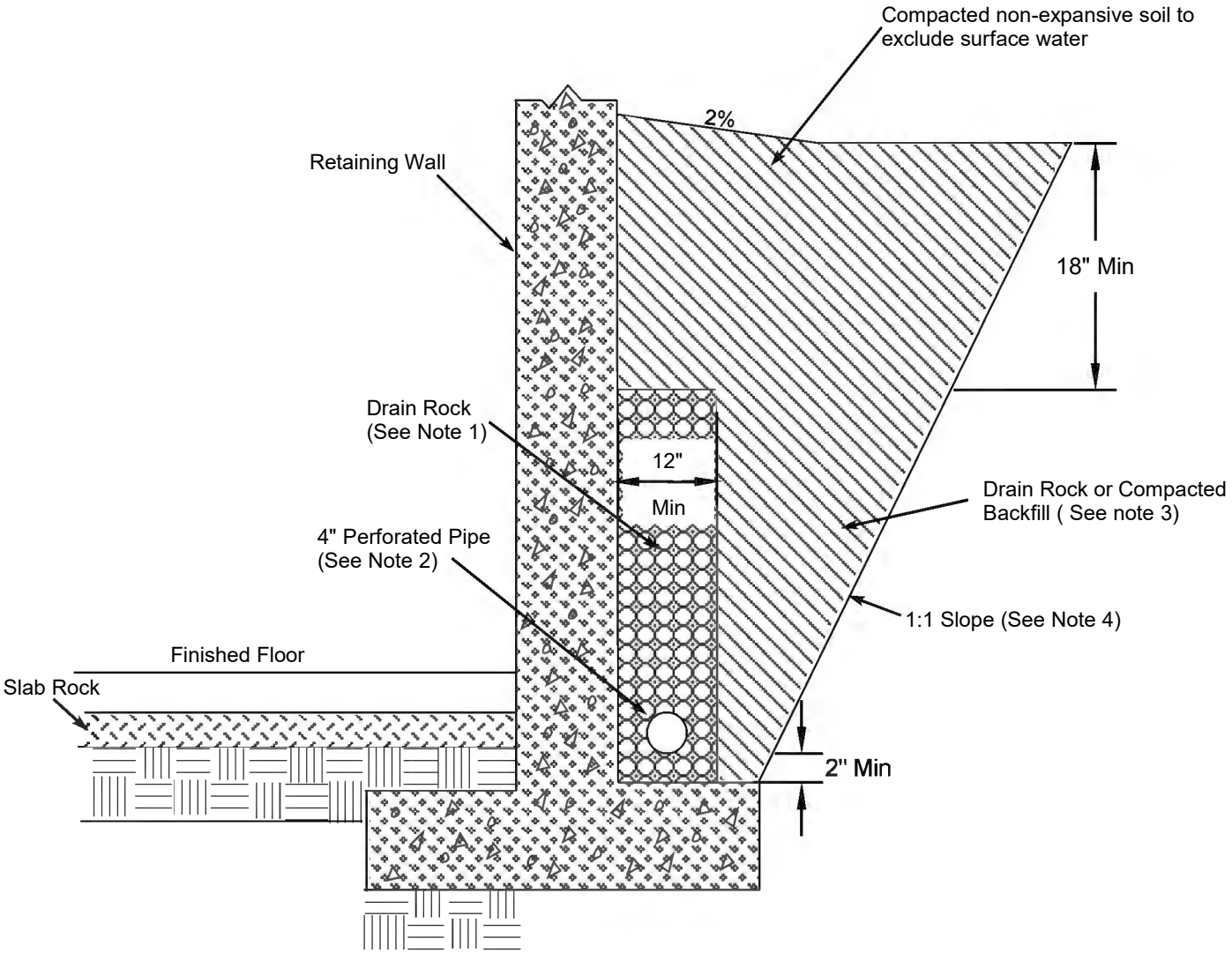
Job No: 6901.01.04.2 | Date: DEC 2015

HILLSIDE GRADING ILLUSTRATION
Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE
16



Notes:

1. Drain rock should meet the requirements for Class 2 Permeable Material, Section 68, State of California "Caltrans" Standard Specification, latest edition. Drain rock should be placed to approximately three-quarters the height of the retaining wall.

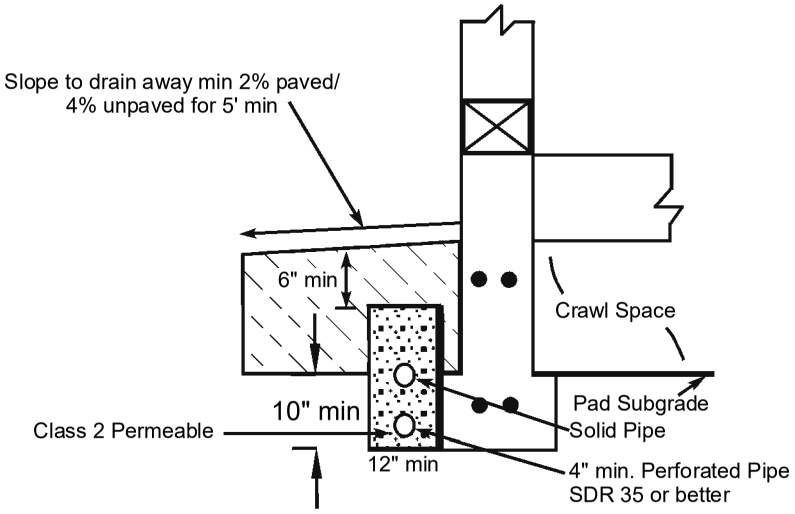
2. Pipe should conform to the requirements of Section 68 of State of California "Caltrans" Standards, perforations placed down, sloped at 1% for gravity flow to outlet or sump with automatic pump. The pipe invert should be located at least 8 inches below the lowest adjacent finished surface.

3. During construction the contractor should use appropriate methods such as temporary bracing and/or light compaction equipment to avoid overstressing the walls. Non-expansive soils to be used as backfill.

4. Slope excavation back at a 1:1 gradient from the back of footing where expansive materials are exposed.

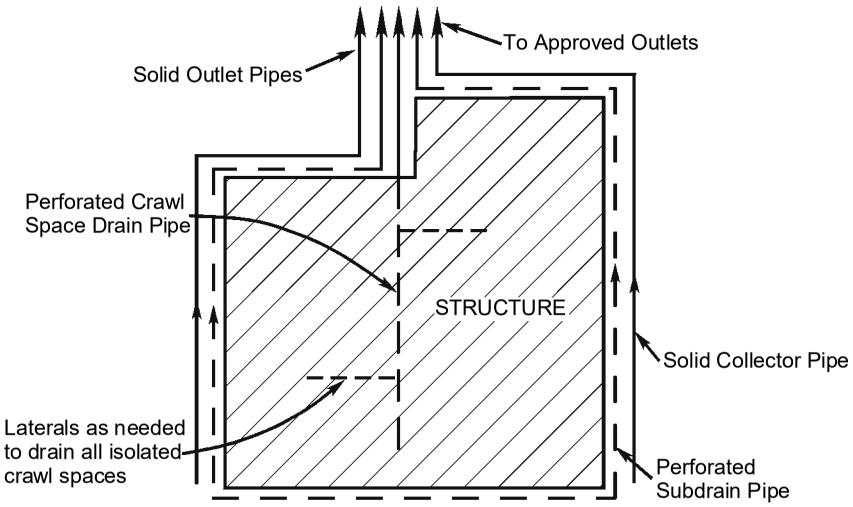
Not to Scale

RGH CONSULTANTS	**RETAINING WALL BACKDRAIN ILLUSTRATION** Residence, Guest House and Driveways Shanks Property Improvements Wooden Valley Road Napa, California	PLATE **17**
Job No: 6901.01.04.2 Date: DEC 2015		

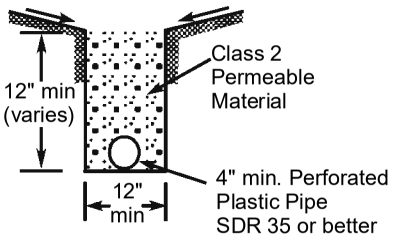


Spread Footing

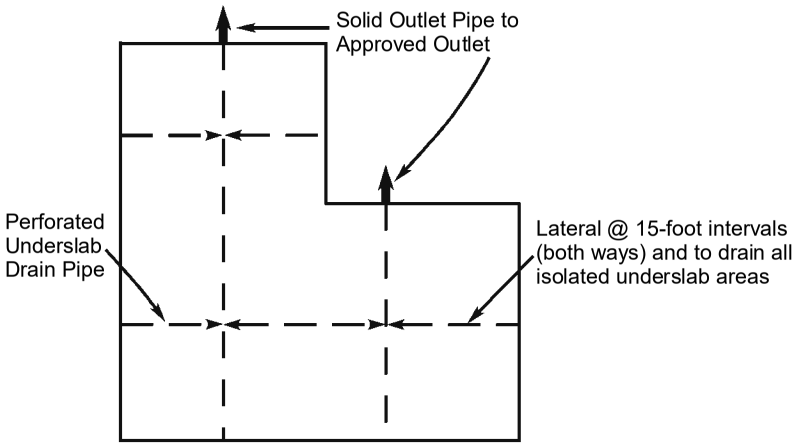
PERIMETER FOUNDATION DRAINS



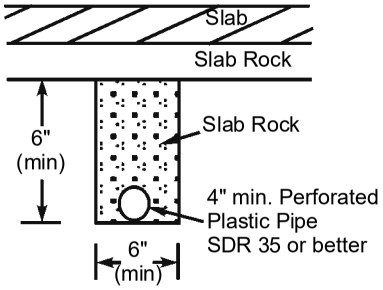
TYPICAL FOUNDATION DRAIN PLAN



CRAWL SPACE DRAIN



TYPICAL UNDERSLAB DRAIN PLAN



SLAB UNDERDRAIN

RGH CONSULTANTS

Job No: 6901.01.04.2 | Date: DEC 2015

TYPICAL SUBDRAIN DETAILS

Residence, Guest House and Driveways
Shanks Property Improvements
Wooden Valley Road
Napa, California

PLATE

18

APPENDIX B - REFERENCES

American Society of Civil Engineers, 2006, Minimum Design Loads for Buildings and Other Structures, ASCE Standard ASCE/SEI 7-05.

Bezore, S.P., Sowers, J.M., and Witter, R.C., 2004, Geologic Map of the Mt. George 7.5' Quadrangle, Napa and Solano Counties, California: A Digital Database.

Bortugno, E.J., 1982, Map Showing Recency of Faulting, Santa Rosa Quadrangle in Wagner and Bortugno, Geologic Map of the Santa Rosa Quadrangle: California Division of Mines and Geology, Regional Geologic Map Series, Map No. 2A, Santa Rosa Quadrangle, Scale 1:250,000.

Bryant, W.A., and Hart, E.W., Interim Revision 2007, Fault-Rupture Zones in California; California Geological Survey, Special Publication 42, p. 21 with Appendices A through F.

California Building Code, 2013, California Building Standard Commission.

Dwyer, M.J., Noguchi, N., and O'Rourke, J., 1976, Reconnaissance Photo-Interpretation Map of Landslides in 24 Selected 7.5-Minute Quadrangles in Lake, Napa, Solano, and Sonoma Counties, California: U.S. Geological Survey OFR 76-74, 25 Plates, Scale 1:24,000.

Natural Resources Conservation Service, United States Department of Agriculture, accessed November 20, 2015. Web Soil Survey, available online at http://websoilsurvey.nrcs.usda.gov/.

Working Group on California Earthquake Probabilities, 2007, Uniform California Earthquake Rupture Forecast (UCERF): Notes on Southern California Earthquake Center (SCEC) Web Site (http://www.scec.org/ucerf/).

APPENDIX C - DISTRIBUTION

The Good Life Wine Collective (3, 0 and electronic)
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Michael@mgandco.com (0, 0 and electronic)

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