REALM
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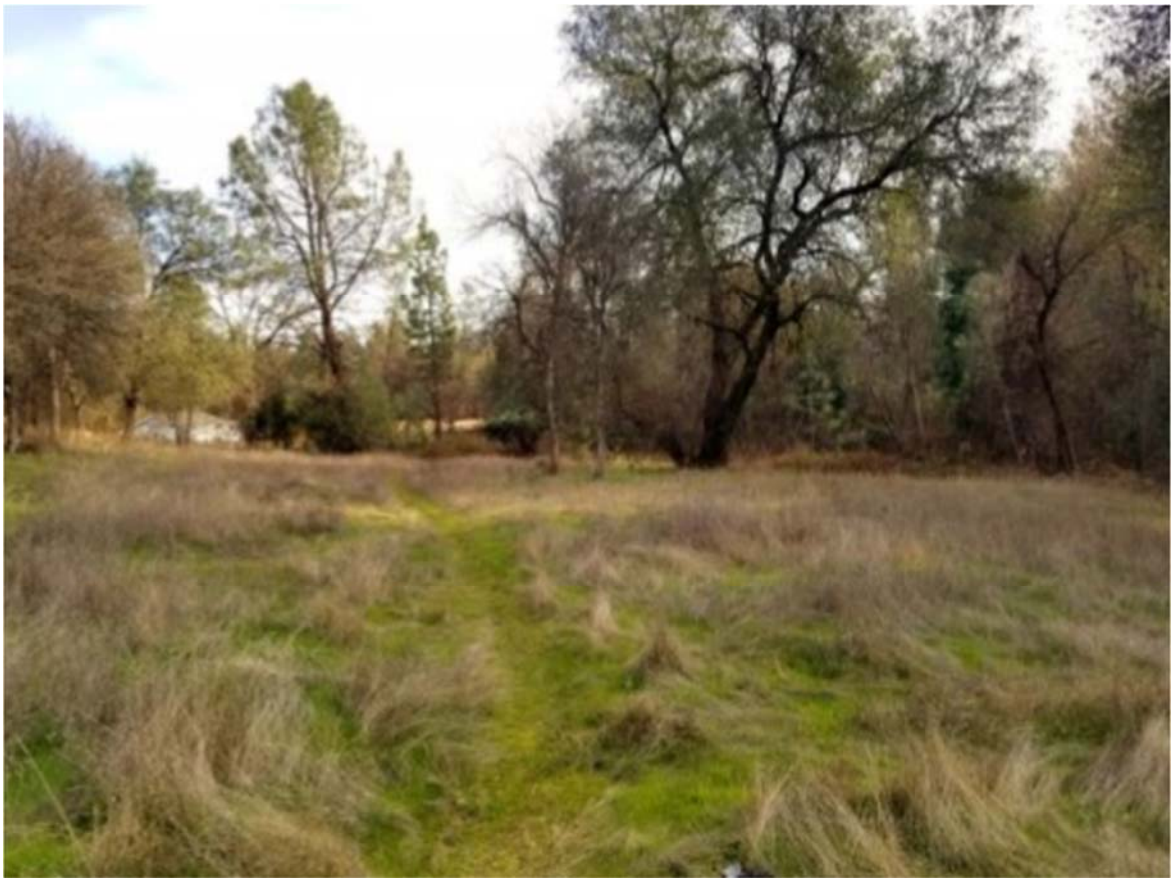
# GEOTECHNICAL REPORT

## ASHBY ROAD, SHASTA LAKE, CA



## APN# 006-020-056 & 006-020-057

*July 27, 2020*

# Contents

# 1.0 General

This report, generated by Realm Engineering, presents the results of our findings for parcels #006-020-056 & 006-020-057 located on Ashby Road in Shasta Lake, Shasta County, California, hereby referred to as "Site". The results will be used to show the evaluated subsurface conditions and to provide construction recommendations at the Site, as well as to describe the geologic and seismic setting of the Site. Issues addressed will be risks associated with geological hazards found within the general vicinity.

## 1.1 Project Purpose and Scope

The purpose of this study is to evaluate the subsurface conditions and make recommendations for the proposed 15 structures totaling 90,320 square feet. An access road will be included.

## 1.2 Previous Studies at Site

There are currently no known previous geotechnical studies that have been performed at the Site. However, there have been recent studies done on at least one neighboring parcel, conducted by ENGINEER OF RECORD for a proposed retention pond at the bordering northern parcel owned by Sierra Pacific Industries (SPI).

## 1.3 California Building Code Requirements

Section 1803 of the California Building Code (CBC), state that Geotechnical investigations shall be conducted where required by the building official or where geotechnical investigations involve in-situ testing, laboratory testing, or engineering calculations. Section 1803.1.1.1 states that each city, county, or city and county shall enact an ordinance which requires a preliminary soil report, prepared by a civil engineer who is registered by the state. The report shall be based upon adequate test boring or excavations. This section also states that the preliminary soil report may be waived if the building department of the city, county, or city and county, or other enforcement agency determines if an analysis is not necessary.

## 1.4 Shasta Lake City Requirements

The City of Shasta Lake Development Services Department – Planning Division offers a checklist which outlines their requests of analysis and assessment reports for any project site. On this checklist, a note is included that some services may be rendered not applicable with a given explanation. Also, on this checklist, a Geotechnical Report is requested. This checklist states "A Geotechnical Report shall be provided for all projects requiring discretionary approval by the Planning Commission, or as required pursuant to the California building Code, or as otherwise recommended by the Development Services Director or his/her designee. The Development Services Director or his/her designee may waive the requirements for a geotechnical report when the proposed project is so minor that it does not pose a threat to the public health, safety, and welfare." This project does not fall under this exception and our field test pits and excavations are logged here for use. The engineer of record will be on site to observe all grading, compaction and trenching activities. We will be obtaining the compaction results and making field recommendations weekly as the project is under construction.

# 2.0 Findings

## 2.1 Field Investigation

Realm Engineering conducted a field investigation on Thursday May 10th, 2018 to evaluate surface conditions for the proposed buildings and greenhouses. Field investigations were limited to reconnaissance-level geologic mapping of the project site.

The weather conditions of the site at the time of the assessment were partially cloudy with fits of light wind. The ground was moist, and exposed rock outcrops were easy to spot due to the missing grass cover. All exposed rock outcrops were on the west side of the slope facing the North branch of Churn Creek. The drainage had flowing water where natural erosion periodically exposed outcroppings. There were several previously dug holes for the purpose of perc tests.

The exposed outcrops were all the same rock type with varying forms of extreme weathering. The outcrops in the stream bed had been weathered to a smooth surface with very little jointing and cracking. The exposed outcrops that lied in the sides of the hills were quite hard, had extreme jointing, cracking, and 1 -2 centimeters of discoloration from oxidization on the outer exposed areas of the stones. It had fragmental shattering and a somewhat slatey cleavage when jointed. It lacked any detailed structure. Based on this description, the exposed rock in the outcroppings are thought to be Copley Greenstone.

## 2.2 Surface/Subsurface Conditions

The general topography of the area was knobby and well weathered. The most prominent type of vegetation, besides the native grasses, was thickets of poison oak and blue/live oak. Many areas were generally inaccessible due to the thickness of the oaks, more towards the eastern side of the Site and along the unnamed creek that feeds Churn Creek. Outcrops were few, but generally uniform in appearance: blue in hue, extremely weathered and smooth, large amount of jointing, and covered in various lichens.

The only barren spots in the parcel are where the bedrock was exposed or where there were recently dug gopher holes, and the exposed bedrock at the bottom of the unnamed creek. There were distinct goat trails created by deer and rabbits, and the occasional homeless person.

On May 15th, four test pits were dug using a backhoe to investigate subsurface conditions. These findings can be seen in **Attachment G** labeled “Logs of Test Pits 1-4.” The concurrent locations of the test pits can be seen on **Attachment F**.

## 2.3 Near Surface Conditions

The general surface of the Sacramento Valley is covered by recent and Pleistocene-age alluvium that washed into the bottomlands by streams draining the adjacent highlands. The stream sediments consist of a heterogeneous assemblage of channel gravels, river sands, silt, and clay. In this case, clay would be the dominating shallow surface deposit.

Previous well logs from neighboring parcels drilled in the late 70’s was referenced. However, they offered very little useful descriptions of rock types and oftentimes only mentioned rock color and water

depth. By far, the most mentioned rock type was “blue” (the well-log rock descriptions were simple, three-words or less), which generally matches the appearance of the exposed rock crops.

There were several 36” perk-test holes dug, and when inspected for horizons, there was only the dark brown top soil, about 3 cm in depth, followed by a uniform color and texture of the soil. This was true for each test hole.

## 2.4 Soil

### 2.4.1 NRCS WSS

The Site, according to the NRCS Web Soil Survey (WSS), has a dominantly (92 percent by area) AnD (Auburn) soil series group and a small area (8 percent by area) of BkD (Boomer) soil series. The Auburn series is described as typically being formed on the flanks of mountainous regions and is generally derived from residuum of weathered metavolcanics. For this profile, the soil is expected to be loam down to 8”, followed by gravelly loam to 24”, and then hitting lithic bedrock. The Auburn soil series is a well-drained soil with medium runoff and little to no ponding properties. The water table is expected to be more than 80” below the surface.

The Boomer series is described as typically being formed on mountain flanks and is generally derived from the residuum of weathered metavolcanics. For this profile, the soil is expected to be gravelly loam down to 3”, gravelly sandy clay loam from 3 to 23”, clay loam from 23 to 45”, and then hitting weathered bedrock down to 49”. The water table is expected to be more than 80” below the surface.

Please see **Attachment A** for soil group distributions, **Attachment B** for NRCS WSS descriptions, and **Attachment C** for UC Davis taxonomy description of the Auburn series.

### 2.4.2 USDA Soil Series

The Auburn series consists of shallow to moderately deep, well drained soils formed in material weathered from amphibolite schist. Auburn soils are on foothills and have slopes of 2 to 75 percent. The mean annual precipitation is about 24 inches and the mean annual temperature is about 60 degrees F. The Boomer series consists of shallow to moderately deep, well drained soils. Boomer soils are formed on mountains with slopes of 15 to 30 percent. The mean annual precipitation is about 45 inches and the mean annual temperature is about 57 degrees F.

### 2.4.3 Notes

It should be noted that the WSS and UC Davis Soil Series descriptions offer a *general* profile. Further tests and observations for confirmation or corrections of this description were conducted. It should also be noted that the hydrologic profile for this area is considered class “C”, however the general rating for AnD soils in differing portions of the state are considered “D”, thus the difference in rating between the NRCS WSS description and the UC Davis soil taxonomy description found in the attachments.

It should also be noted that the USDA Soil Series description is generally describing the soil samples that were taken in the Auburn, California area as depicted in the sample location areas from the NRCS Soil Data Explorer on **Attachment B**. Soil samples obtained by NRCS near the Site are not listed, so it is unclear how samples were obtained or described originally.

# 3.0 Geologic Conditions

The Site is in the northern Sacramento Valley near the northern margin of the Great Valley Physiographic province. The Great valley province is bordered to the North by the Klamath and Cascade mountain ranges, to the east by the Cascade and Sierra Nevada mountains, to the west by the Klamath and Coastal Ranges, and to the south by the Transverse Ranges.

The Great Valley, popularly known as "The Valley", is about 50 miles wide and 430 miles long. The northern portion extends up and contacts with the Klamath Mountains on the west, the Modoc Plateau to the east, and the Sierra Nevada Metamorphic Belt runs south along the eastern side with the Great Valley Sequence that runs along the western side of the Valley.

Based on the previous well log descriptions and the general vicinity of the Site, it is suspected that the general geology of the area has much to do with the Klamath Mountain range and the greenstone that is associated with it.

In general, the Klamath Mountain region consists of numerous oceanic terranes representing fragments of crustal material that were embedded into the western margin of North American since Early Paleozoic time. The fragment includes metamorphosed volcanic and sedimentary rocks that represent volcanic island arcs, submarine plateaus, reeflike bodies of limestone, and the deep ocean sediments that were intensely deformed during accretion. Of relevance, the Klamath regions have extensive exposures of mafic and ultramafic rocks, known as ophiolites, which are sequences of igneous rocks that represent disrupted oceanic lithosphere. Ophiolites consist of upper mantle peridotite, overlain by layered and massive gabbro, sheeted basalt dikes, and basaltic pillow lavas. These sequences can be emplaced on land during plate convergence simultaneously with the accretion process. The Site is known to be underlain by the Copley Greenstone sequence, derived from the ophiolites.

The Early Devonian volcanic sequence of the eastern Klamath Mountains consists of the Copley Greenstone, a basalt–andesite series and have been metamorphosed to the greenschist facies. The Copley Greenstone consists of massive flows and pyroclastic deposits in the lower part that are overlain by pillow lavas.

# 4.0 Geological Hazards

## 4.1 Seismic Hazards Zonation Program

California Building Code (CBC) requires analysis of liquefaction and slope-stability for various categories of construction and prescribes alternative methods to obtain the ground motion inputs used in these analyses. These provisions must be adhered to for certain seismic structural design categories specified in the CBC. Ground motions used to evaluate liquefaction or slope stability for projects defined under the Seismic Hazards Mapping Act (SHMA). The purpose of the SHMA is to minimize loss of life and property through the identification, evaluation and mitigation of seismic hazards. The SHMA was passed by the legislature following the 1989 Loma Prieta earthquake.

## 4.2 Alquist-Priolo Act

In 1972, the California State Legislature enacted the Alquist-Priolo Earthquake Fault Zoning Act (California Public Resources Code Section 2691), which requires the State Geologist to delineate Earthquake Fault Zones around all known traces of potentially and recently active faults in California. For

the purposes of the Alquist-Priolo Act, active faults are faults which have caused surface rupture within the Holocene Period, which is defined as the last 11,000 years.

The Alquist-Priolo Act requires withholding of construction permit approval until geologic investigation has determined that the building site is not threatened by surface fault displacement. The Earthquake Fault Zones are usually one-quarter mile or less in width. The California Division of Mines and Geology (CDMG) has prepared maps which identify Alquist-Priolo Earthquake Fault Zones in Shasta County. These maps were adopted in November 1991 by the CDMG and affect some rural areas in northeastern Shasta County, however, the Site is not located within these Fault Zones. See **Attachment D** for proximity of faults to the Site.

## 4.3 Seismicity

Although not as active as some areas of the State, Shasta County is a seismically active region. The seismicity of a region is described as the distribution, recurrence, and intensity of earthquakes over a period. Earthquake activity has not been a serious hazard in Shasta County's history, nor is it probable that it will become a serious hazard in the future.

During an earthquake, ground rupture with horizontal and/or vertical displacement may occur. Usually, the width of surface faulting is narrow in rock and much wider in saturated soils. Ground rupture also tends to occur along lines of previous faulting. With detailed investigation, surface faulting usually can be recognized and avoided. However, not all fault traces have been mapped, and some active faults have no surface expression.

The Site has two pre-quaternary faults with one 2 miles directly north, and the other approximately 4 miles south west of the Site. See **Attachment D** for proximity to the Site. Quaternary faults are those with the latest movement within the last two to three million years. The State of California (California Division of Mines and Geology) considers Quaternary faults to be potentially active. After an on-site investigation, there were no signs of active faulting or previous overgrown fault scarps. Based on the proximity of the pre-quaternary faults, a seismic hazard for the Site is low.

## 4.4 Landslides

Landslides tend to occur in weak soil and rock on sloping terrain. The Zone of Required Investigation for earthquake-induced landslides generally indicate areas characterized by steep slopes composed of weak materials that may fail when shaken by an earthquake. The process for zonation of earthquake-induced landslides incorporates expected levels of future earthquake shaking, evidence of existing landslides, slope gradient and strength of hillslope materials.

Shasta County is not normally subject to landslides except for the immediate areas of the Klamath Mountains and the Cascades. The Site is not located in a vicinity that is subject to landslides, or within the Zone of Required Investigation. Furthermore, the rolling knobby-like topography of the site would not allow for any landslide activity.

## 4.5 Liquefaction

Liquefaction occurs when loose, water-saturated sediments lose strength and fail during strong ground shaking. Liquefaction is defined as the transformation of granular material from a solid state into a liquefied state because of increased pore-water pressure. The process of zonation for liquefaction

combines Quaternary geologic mapping, historical ground-water information and subsurface geotechnical data. The liquefaction hazard Zone of Required Investigation boundaries are based on the presence of shallow (< 40 feet depth) historic groundwater in uncompacted sands and silts deposited during the last 15,000 years and sufficiently strong levels of earthquake shaking expected during the next 50 years.

The Site is not located within a Zone of Required Investigation.

## 4.6 Expansive Soil

Expansive soils, known as vertisols, are prone to large volume changes (swelling and shrinking) that are directly related to changes in water content. Soils with a high content of expansive minerals can form deep cracks in drier seasons or years. A high clay content severely affects the expansivity of a soil. The WSS shows the AnD unit to be approximately 20% clay. The NRCS has a Calculated Coefficients of Linear Extensibility (COLE) table for 20-69% clay by use of the regression equation, which shows us that the COLE value of the AnD soil to be 0.01 – the lowest possible score. Therefore, the extensibility possibility of the Site is considered extremely low. Please see **Attachment E** for table of COLE values. These studies when paired to test data confirms the

## 4.7 Percolation Rates for Stormwater

According to field tests the disposal material has been determined to comply with both required characteristics having an adequate percolation rate and depth to the high-water table. On June 12th, 2019 three percolation tests were conducted by the method specified in the Manual of Septic Tank Practice on the proposed disposal area. See the Appendix for the exact test locations. As shown in the Appendix, percolation rates were found to be (80, 120, 80) minutes/inch which is within the specified range of greater than 5 and less than 120 minutes per inch. It was also determined with the profile pit that the depth to a seasonal high-water table, as determined by the procedures in typical drainage standards, exceeded four feet, the minimum for this commercial application.

According to field results a test pit was also excavated with the absence of groundwater. The high groundwater has not been previously found in the vicinity and the test pit did not show cracked or creviced formations and did show a clear delineation that the top of the water table did not come up to the bottom of the pit. Therefore, as a result groundwater monitoring was not deemed necessary.

Based upon the percolation tests that were performed on the above mentioned date and the tests were within the proposed disposal area on this property, along with evidence of no standing water in the excavated soil profile pit we feel the proposed drainage system design on this property meets the regulations of the Shasta County/City of Shasta Lake Code and Storm Disposal Standards. The three test holes located in the proposed leaching area yielded an average percolation rate of 80 to 120 minutes per inch which is within the minimum percolation rates allowed. In summary we consider this project is ready to move forward onto the next stage of storm water development and design.

Please see **Attachment F** for percolation pit locations and **Attachment H** for logs of the percolation pits.

# 5.0 Conclusions and Recommendations

Based on the above findings, the surface and subsurface conditions, and the scope of the project, Realm Engineering concludes that the Site is suitable for the proposed construction project.

# 6.0 CBC/IBC Information

This section presents relevant information regarding soils as pertaining to Chapter 18 of the 2015 IBC and the 2016 CBC. Chapter 18 in each of these documents are identical, thus, we will refer to the CBC only throughout the remainder of this report. Potential geologic hazards consisting of land sliding, and liquefiable soils, as noted in Section 1802 of the CBC, are discussed above in Sections 2.5and2.7, respectively, of this report. The following sections present soils information from the CBC that could impact design of the project. Recommendations presented, herein, are based upon discussion with project owner along with stated assumptions. Changes in the configuration from those studied during this investigation may require supplementalrecommendations.3.1.1 Class of Materials as previously noted, the bearing soils on site consist of moderately stiff to very stiff, clayey sand to sandy clay with gravel with weathered Copley Greenstone beneath. In our opinion, those materials (if properly placed and compacted) correspond to at least a Class of Materials Type 4 as noted in Table 1806.2 of the CBC (allowable bearing capacity: 2,000 pound per square foot). That table presents presumptive foundation design information associated with Class of Materials types. If foundations are located on rock (Copley Greenstone) then allowable bearing pressure of3,500psf can be used to design foundations. Prior to placing steel or concrete, foundation excavations should be cleaned of all debris, loose or disturbed soil, and any water. It is our recommendation that a representative of the engineer of record observe all foundation excavations prior to concrete placement.

## 6.1 Excavation

The bottom of all over-excavations should be ripped and cross-ripped to a minimum depth of six inches, we need to excavate all topsoil and contaminated soil then compact the subsurface to at least 90 percent of the ASTM D1557 maximum dry density. All areas to remain at-grade, to receive fill, or obtained by excavation should be scarified to a depth of six inches. Compaction should be performed using a heavy, self-propelled, sheepsfoot compactor and or a bobcat roller compactor. Compaction operations should be performed in the presence of our representative who will evaluate the performance of the sub grade under a capacitive load.

## 6.2 Utility Trench Backfill

Utility trench backfill should be mechanically compacted in maximum six-inch lifts. Trench backfill should be brought to uniform moisture content above the optimum moisture and each lift mechanically compacted to at least 90 percent of the maximum dry density. The upper six inches of trenches in pavement areas should be compacted to at least 95 percent of the maximum dry density. Jetting of trench backfill as a means of compaction is not acceptable. We recommend that native soil be used as trench backfill within the perimeter of the foundations to help minimize soil moisture variations beneath the slab. The native soil backfill should extend at least three feet horizontally beyond perimeter foundation lines. Utility trenches within the equipment pad perimeter should be backfilled with compactable material matching the upper 12 inches of subgrade material.

We recommend that underground utility trenches that are aligned nearly parallel with foundations be at least three feet laterally from the outer edge of foundations, wherever possible. Generally, trenches should not encroach into the zone extending outward at a 1:1 (horizontal to vertical) inclination below

the bottom of the foundations. In addition, trenches parallel to foundations should not remain open longer than 72 hours. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.
Pipe bedding, shading and trench backfill and compaction within municipal streets should conform to jurisdictional requirements.

## 6.3 Fill for All Infrastructure

All engineered fill should be placed in lifts that to not exceed six inches in compacted thickness. All engineered fill should be brought to optimum moisture content and compacted to at least 90 percent of the maximum dry density as determined by ASTM D1557. Any fill deeper than 5 feet should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. The upper 12 inches of the final equipment pad and exterior flatwork subgrades must consist of approved on-site or imported granular, non-expansive soils. The upper six inches of final equipment pad and exterior flatwork subgrades should be scarified, brought to at least the optimum moisture content and uniformly compacted to not less than 90 percent of the maximum dry density as determined by ASTM D1557.

The upper six inches of exterior slab subgrades supporting vehicle loadings should be scarified, moisture conditioned to at least the optimum moisture content and uniformly compacted to at least 95 percent of the ASTM D1557 maximum dry and must be stable under construction traffic prior to placement of aggregate base. Final subgrade processing and compaction should be performed just prior to placement of aggregate base, after construction of underground utilities is complete.

## 6.4 Foundation Design

The proposed facilities may be supported upon continuous and/or isolated spread foundations extending a minimum of 12 inches into the prepared equipment pad or at least 12 inches below adjacent soil grade, whichever is deeper. Continuous foundations should be at least 12 inches wide, isolated foundations should be at least 14 inches wide. Foundations should be sized for a maximum allowable soil pressure of 2,000 pounds per square foot (psf) for the dead load plus live load condition with a 1/3 increase in allowable soil pressure for consideration of seismic or wind forces. At a minimum, all continuous foundations should contain at least two No. 4 steel reinforcing bars placed one each, near the top and bottom of the foundations. Foundation excavations should be observed by a representative of Realm Engineering.

## 6.5 Concrete Slab Design/Exterior Flatwork Construction

Thicker slabs with an increase in reinforcing will be needed in areas supporting higher loads or where increased performance is desired, especially within equipment areas. All concrete slabs should be at least four inches thick and, as a minimum, should be reinforced with chaired No. 3 reinforcing bars on 18-inch center-to-center spacing, located at mid-slab depth. For increased support, floor slabs should be underlain by at least six inches of Class 2 aggregate base compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. All concrete slaps require protection against moisture or moisture vapor penetration. For this protection a concrete moisture protection specialist should be consulted.

For increased support and performance, the exterior slabs may be underlain by a minimum four inches of class 2 aggregate compacted to 95 percent relative compaction. The structural engineer (REALM) will determine the final thickness, strength, reinforcement, and joint spacing of exterior slab-on-grade

concrete. However, exterior flatwork should be at least four inches thick and be constructed independent of adjacent concrete foundations and isolated column foundation by the placement of a layer of felt material between the flatwork and the foundation. Thicker slabs constructed with thickened edges to at least twice the slab thickness should be constructed where light wheeled traffic or intermittent light loading is expected over the slabs.

### 6.6 Depth and Width of Foundations

We recommend that minimum foundation depths and widths, unless noted elsewhere herein, be designed in accordance with specified widths and depths noted in Table 1809.7 of the CBC. We recommend that foundations be founded either entirely in cut or entirely in engineered fill material to reduce differential settlement potentials. Foundations should not span both cuts and fills. If proposed foundations span both cuts and fills, and fill materials exceed 1 foot beneath the planned bottom of foundations, we recommend that the area of cuts supporting the proposed foundations should be over excavated below the planned bottom of footings to a depth of at least 3 times the width of the foundation. Engineer of record should observe and approve the over excavated area once exposed. Over excavation limits should extend throughout the cut area and to a minimum of five horizontal feet past the perimeter foundations of the structure. The over excavated area should then be backfilled in accordance with recommendations presented in Engineering Fill of this report; or Proposed foundations should be deepened to extend through engineered fill materials to be supported on competent undisturbed native soils, so that the entire foundation system for the structure rests on undisturbed native soils. If this depth is less than 5 feet below the planned bottom of the foundation, then a two-sacks and-cement slurry can be used as backfill in lieu of structural concrete, from the excavation bottom up to the planned bottom of the proposed foundation. The engineer of record should observe and approve the deepened foundation excavation prior to placement of slurry or structural concrete. If foundations do not span both cuts and fills, then neither of the two alternatives recommended noted above should be necessary.

### 6.7 Earthwork Testing and Observation

A final report by the “Geotechnical Engineer or Engineer of Record, that is qualified” should be prepared upon completion of the project indicating compliance with or deviations from this report and the project plans and specifications.

## 7.0 Frost Penetration

Frost heave is not typically a hazard in the Redding area and is generally not considered in design of foundation systems. Therefore, no recommendations for frost protection have been provided herein.

## 8.0 Site Preparation and Grading

### 8.1 Stripping

Prior to general site grading and/or construction of planned improvements, vegetation, organic topsoil, debris, ashes, and deleterious materials should be stripped and disposed of off-site or outside the construction limits. Any tree or shrub root balls encountered during stripping could extend deep below grade and should be removed during stripping. Stripped topsoil (less any debris, boulders or large tree roots) may be stockpiled and reused for landscape purposes; however, this material should not be incorporated into any engineered fill.

### 8.2 Existing Utilities, Wells, and/or Foundations

Below-grade utility lines, cesspools, wells, irrigation ponds and/or foundations encountered during construction should be removed and disposed of off-site. Buried tanks, if present, should be removed in compliance with applicable regulatory agency requirements. Existing, below-grade utility pipelines (if any) that extend beyond the limits of the proposed construction and will be abandoned in-place should be plugged with lean concrete or grout to prevent migration of soil and/or water. All excavations resulting from removal and demolition activities should be cleaned of loose or disturbed material prior to placing any fill or backfill.

## 8.3 Scarification and Compaction

Following site stripping and over excavation, areas to receive engineered fill should be scarified to a depth of 6 inches, uniformly moisture-conditioned to near optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined using standard test method ASTM D15571. This test procedure applies wherever relative compaction, maximum dry density, or optimum moisture content is referenced within this report.

Wet/unstable soil conditions occur if site preparation or grading is performed in the winter, spring, or early summer seasons, or shortly after significant precipitation, near-surface on-site soils may be significantly over optimum moisture content. This condition could hinder equipment access as well as efforts to compact site soils to a specified level of compaction. In addition, perched water can be present in subsurface layers throughout the year and contribute to wet soil conditions. If over optimum soil moisture content conditions are encountered during construction, disking to aerate, replacement with imported material, chemical treatment, stabilization with a geotextile fabric or grid, and/or other methods will likely be required to facilitate earthwork operations. The applicable method of stabilization is the contractor's responsibility and will depend on the contractor's capabilities and experience, as well as other project-related factors beyond the scope of this investigation. Therefore, if over-optimum moisture within the soil is encountered during construction, the EOR should review these conditions (as well as the contractor's capabilities) and, if requested, provide recommendations for their treatment.

## 8.4 Site Drainage

All grade adjacent to structures should be sloped away from the foundations at a minimum two percent slope for a distance of at least five feet of hardscape. The ponding of water should not be allowed adjacent to structures or fill slopes. Surface runoff should be directed toward engineered collection systems or suitable discharge areas. Roof downspouts should also be collected, conveyed, and discharged away from all structures and into engineered systems, such as storm drains as proposed on the drainage sheets. Overall drainage of the site is south-southwest with an approximate elevation range of 810 to 760 ft mean sea level (msl).

## 8.5 Over Excavation & Subgrade Preparation

The upper layer of the onsite soil appears to be qualified to be used for fill/disturbed material. It should be noted that in order to create a flat pad, it is recommended that any deleterious materials or soft soil that are encountered at the project site be removed. Areas that are over excavated should be backfilled with engineered fill materials, in accordance with recommendations presented in Section 6.3 of this report. If soft soil material is not removed within slab area, there is a risk that slab cracking may occur due to differential settlement, unless the slab is reinforced structurally.

## 8.6 Temporary & Permanent Slopes

Temporary construction slopes can be constructed at ½:1 inclination if the temporary cut slopes are less than 6 feet in height. All other temporary slopes should be constructed no steeper than 1:1. This section explicitly excludes trench slopes for buried utilities. Permanent slopes (cut and fill) should be constructed at inclinations of 2:1 or flatter. In isolated areas where a cut slope is less than 8 feet tall, is adequately protected from erosion, and is not intended to support structures or surcharges, then the cut slope can be constructed at inclinations of 1.5:1 or flatter, per Section J106 of the 2016 CBC. In order to comply with CBC regulations, minimum setbacks for proposed structures should be equivalent to the height of the slope divided by 3 but need not exceed 40 feet. Minimum setbacks for proposed pools should be equivalent to height of the slope divided by 6, but not to exceed 20 feet. If the desired setbacks are less than these requirements, then the foundations of the structures should be deepened or opt for alternate setbacks in accordance with requirements of section 1808.7.5of 2016CBC.3.3

## 8.7 Placement and Compaction

Soil and/or soil-aggregate mixtures used for fill should be uniformly moisture-conditioned to within 2 percent of optimum moisture content, placed in horizontal lifts less than 8 inches in loose thickness, and compacted to at least 90 percent relative compaction. It is recommended that the fill slopes be overbuilt by at least one horizontal foot then trimmed to expose a firm, compacted surface. Testing should be performed to verify that the relative compaction is being obtained as recommended herein. Compaction testing, at a minimum, should consist of one test per every 500 cubic yards of soil being placed or at every 1.5-foot vertical fill interval, whichever comes first. In general, a “bobcat roller”, “sheep’s foot” or “wedge foot” compactor should be used to compact fine-grained fill materials. A vibrating smooth drum roller could be used to compact granular fill materials and final fill surfaces.

## 9.0 Conclusion

In conclusion with the positive test holes and field results the probability of passing compaction requirements on the roads, trenches and building pads are high with appropriate construction methods. The completed testing per ASTM Standard D4829 “Test for Expansion Index of Soils” on the soil obtained from the proposed building area. The native soils that will be used in the constructing the building pad are very uniform in soil type. It is our judgement that the sample obtained for testing representative of the worst case for expansive soils on the project. The soil has an EI of less than 20 and therefore does not meet the definition of expansive soil per the California Building Code (CBC) section 1803.5.3. REALM does not represent that these tests results and/or recommendations are suitable whether modified, for any other site or structure on this site than the one for which they were specifically prepared. REALM does represent these findings to constitute as a soils report for the purposes of determining allowable bearing values of above 1,500 psf for the foundation design parameters that were used. REALM disclaims responsibility for these tests results and/or recommendations if they are used whole or in part at any other site or structure on this site. Please feel free to contact me with any questions that you might have regarding this geotechnical report.


Sincerely,
Jason Vine
R.C.E. 67800

## REFERENCES AND RESOURCES

California Department of Conservation. 2017. CGS Seismic Hazard Zonation Program. [ONLINE] Available at: http://www.conservation.ca.gov/cgs/shzp/. [Accessed May 2018].

John P. Albers, John H. C. Bain; Regional setting and new information on some critical geologic features of the West Shasta District, California. Economic Geology; 80 (8): 2072–2091. doi: https://doi.org/10.2113/gsecongeo.80.8.2072

UC Davis California Soil Resource Lab. 2018. Soil Taxonomy. [ONLINE] Available at: https://casoilresource.lawr.ucdavis.edu/soil_web/ssurgo.php?action=explain_component&mukey=460380&cokey=14657121. [Accessed May 2018].

US Department of Agriculture, Natural Resources Conservation Service. 2018. Calculated Coefficients of Linear Extensibility. [ONLINE] Available at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/office/ssr10/tr/?cid=nrcs144p2_074840. [Accessed 23 May 2018].

US Geological Survey. 2018. National Geologic Map Database. [ONLINE] Available at: https://ngmdb.usgs.gov/Geolex/UnitRefs/CopleyRefs_5075.html. [Accessed April 2018].

Web Soil Survey. 2006. Auburn Series. [ONLINE] Available at: https://soilseries.sc.egov.usda.gov/OSD_Docs/A/AUBURN.html. [Accessed April 2018]

# Attachment A

Soil Map

## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**
- Streams and Canals

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**
- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Shasta County Area, California
Survey Area Data: Version 15, Jun 1, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 26, 2015—Jun 26, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| AnD | Auburn loam, 8 to 30 percent slopes | 12.2 | 91.6% |
| BkD | Boomer gravelly loam, 15 to 30 percent slopes | 1.1 | 8.4% |
| **Totals for Area of Interest** | | **13.3** | **100.0%** |

# Shasta County Area, California

## AnD—Auburn loam, 8 to 30 percent slopes

### Map Unit Setting

*National map unit symbol:* hfln
*Elevation:* 120 to 3,000 feet
*Mean annual precipitation:* 20 to 40 inches
*Mean annual air temperature:* 55 to 63 degrees F
*Frost-free period:* 175 to 275 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Auburn and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Auburn

#### Setting

*Landform:* Mountains
*Landform position (two-dimensional):* Backslope, shoulder
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Residuum weathered from metavolcanics

#### Typical profile

*H1 - 0 to 8 inches:* loam
*H2 - 8 to 24 inches:* gravelly loam
*H3 - 24 to 28 inches:* unweathered bedrock

#### Properties and qualities

*Slope:* 8 to 30 percent
*Depth to restrictive feature:* 24 to 28 inches to lithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 3.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 4e
*Land capability classification (nonirrigated):* 4e
*Hydrologic Soil Group:* C
*Ecological site:* SHALLOW LOAMY (R015XD093CA)
*Hydric soil rating:* No

### Minor Components

#### Tailings and placer diggings

*Percent of map unit:* 10 percent
*Hydric soil rating:* No

**Auberry**
*Percent of map unit:* 5 percent
*Hydric soil rating:* No

## BkD—Boomer gravelly loam, 15 to 30 percent slopes

### Map Unit Setting
*National map unit symbol:* hfly
*Elevation:* 600 to 5,500 feet
*Mean annual precipitation:* 30 to 60 inches
*Mean annual air temperature:* 54 to 59 degrees F
*Frost-free period:* 120 to 260 days
*Farmland classification:* Not prime farmland

### Map Unit Composition
*Boomer and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Boomer

#### Setting
*Landform:* Mountains
*Landform position (two-dimensional):* Backslope, shoulder
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Concave
*Across-slope shape:* Convex
*Parent material:* Residuum weathered from metavolcanics

#### Typical profile
*H1 - 0 to 3 inches:* gravelly loam
*H2 - 3 to 23 inches:* gravelly sandy clay loam
*H3 - 23 to 45 inches:* clay loam
*H4 - 45 to 49 inches:* weathered bedrock

#### Properties and qualities
*Slope:* 15 to 30 percent
*Depth to restrictive feature:* 45 to 49 inches to paralithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Moderate (about 6.9 inches)

#### Interpretive groups
*Land capability classification (irrigated):* 4e
*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* C
*Hydric soil rating:* No

**Minor Components**

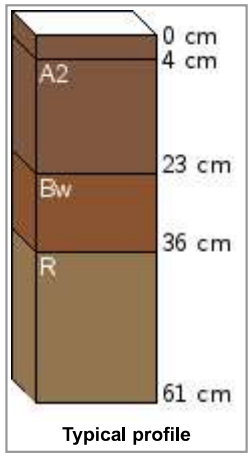
**Goulding**
*Percent of map unit:* 5 percent
*Hydric soil rating:* No

**Neuns**
*Percent of map unit:* 5 percent
*Hydric soil rating:* No

**Stonyford**
*Percent of map unit:* 5 percent
*Hydric soil rating:* No

# Attachment C

Soils Unit Description and Taxonomy



Typical profile

## Soil Taxonomy

| | |
|---|---|
| **Order:** | *Inceptisols* |
| **Suborder:** | *Ochrepts [Map of Suborders]* |
| **Greatgroup:** | *Xerochrepts* |
| **Subgroup:** | *Ruptic-Lithic Xerochrepts* |
| **Family:** | *Loamy, oxidic, thermic Ruptic-Lithic Xerochrepts* |
| **Soil Series:** | *Auburn (Link to OSD) (Soil Series Explorer)* |
| | |
| **Data:** | *[Lab Data]* |
| **Raw Data** | *Component All Horizons* |

## Land Classification

| | |
|---|---|
| **Storie Index** | *Grade 4 - Poor (30.4)* |
| **Land Capability Class [non-irrigated]** | *4-e8* |
| **Land Capability Class [irrigated]** | *4-e8* |
| **Ecological Site Description** | *Thermic Foothills 22-31 PZ* |
| **Forage Suitability Group** | *n/a* |

## Soil Suitability Ratings

| | |
|---|---|
| *Waste Related* | *Engineering* |
| *Urban/Recreational* | *Irrigation* |
| *Wildlife* | *Runoff* |

## Hydraulic and Erosion Ratings

| | |
|---|---|
| **Wind Erodibility Group** | *5* |
| **Wind Erodibility Index** | *56* |
| **T Erosion Factor** | *1* |
| **Runoff** | *High* |
| **Drainage** | *Well drained* |
| **Hydric Rating / Hydrologic Group** | *No [Group D]* |
| **Parent Material:** | *residuum weathered from schist* |
| **Total Plant Available Water (cm):** | *6.88* |

## Geomorphology

| | | |
|---|---|---|
| **Landform** | *hills [Backslope]* | |
| **Landscape** | *foothills* | |

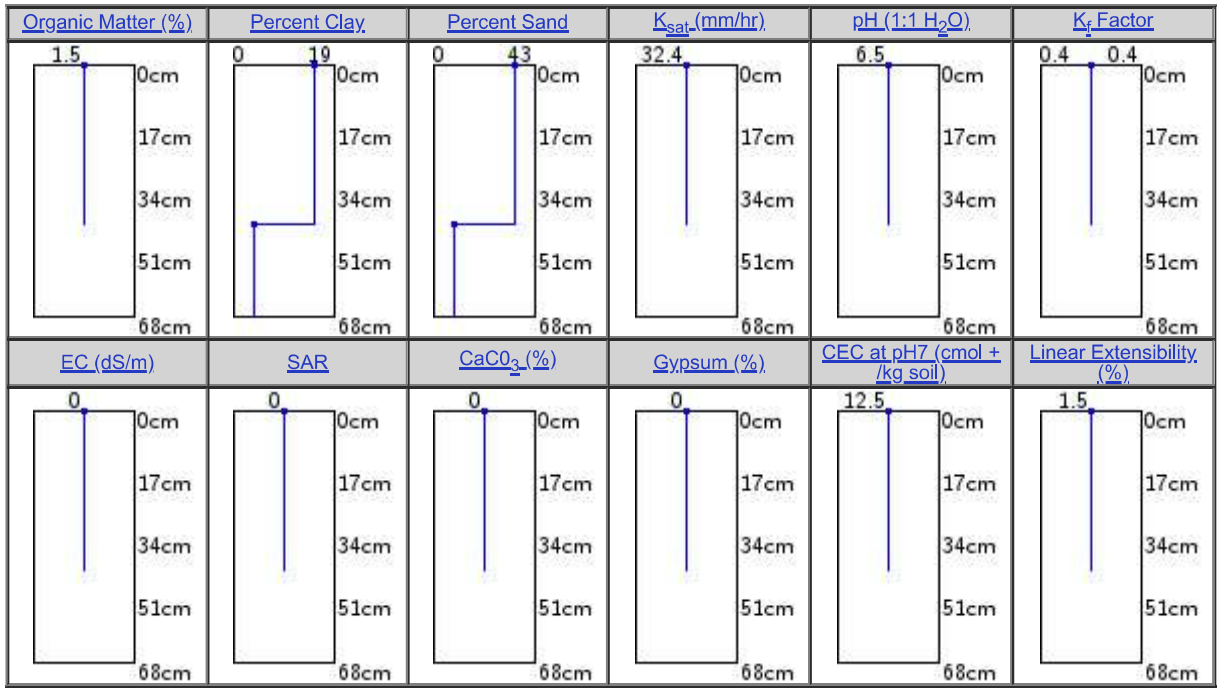
## Plants

| Symbol | Scientific Name | Common Name | Range Prod. |
|---|---|---|---|
| *BRHOH* | *Bromus hordeaceus ssp. hordeaceus* | *soft chess* | *30* |
| *AVFA* | *Avena fatua* | *wild oat* | *15* |
| *BRRU2* | *Bromus rubens* | *red brome* | *5* |
| *ERODI* | *Erodium* | *stork's bill* | *5* |
| *FEME* | *Festuca megalura* | *foxtail fescue* | *5* |

| | | | |
|---|---|---|---|
| HOMAG | Hordeum marinum ssp. gussoneanum | Mediterranean barley | 5 |
| MEHI | Medicago hispida | burclover | 5 |
| TRIFO | Trifolium | clover | 5 |
| BRDI3 | Bromus diandrus | ripgut brome | 5 |

## Forest Productivity

| Symbol | Common Name | Site Index | Site Index Curve Number | Productivity (cu.ft. / ac. / yr.) |
|---|---|---|---|---|
| QUDO | blue oak | | | 0 |
| QUWI2 | interior live oak | | | 0 |



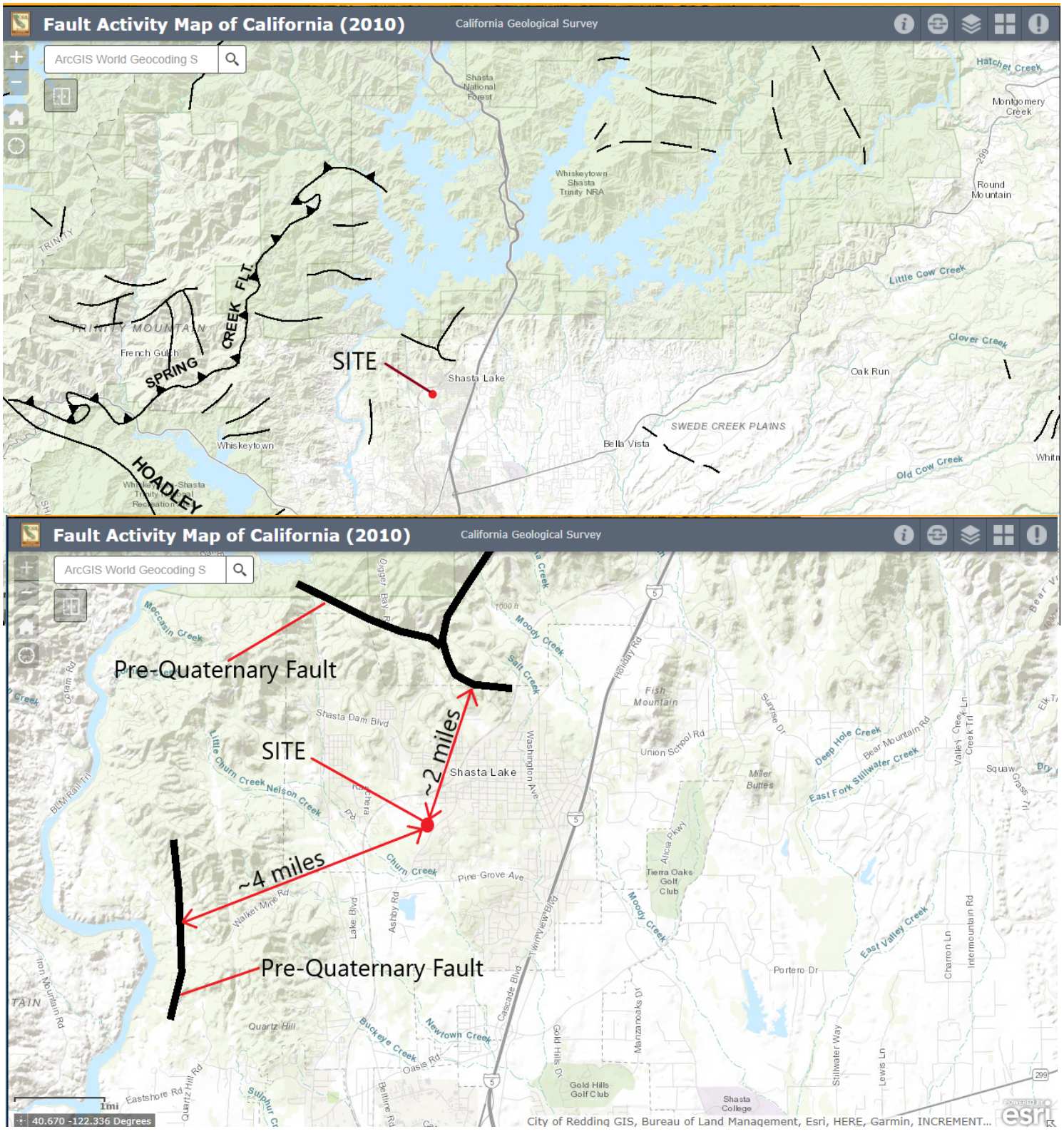

| | |
|---|---|
| **Agriculture** | |
| AGR - California Revised Storie Index (CA) | Grade 4 - Poor [0.3 - 0.3] |
| AGR - Avocado Root Rot Hazard (CA) | Severe [0.75 - 0.75] |
| **Irrigation** | |
| WMS - Excavated Ponds (Aquifer-fed) | Very limited [1 - 1] |
| WMS - Embankments, Dikes, and Levees | Very limited [1 - 1] |
| WMS - Irrigation, Surface (level) | Very limited [1 - 1] |
| WMS - Irrigation, Surface (graded) | Very limited [1 - 1] |
| WMS - Irrigation, Micro (above ground) | Very limited [1 - 1] |
| WMS - Irrigation, Sprinkler (close spaced outlet drops) | Very limited [1 - 1] |
| WMS - Irrigation, Sprinkler (general) | Very limited [1 - 1] |

| | |
|---|---|
| WMS - Irrigation, General | Very limited [1 - 1] |
| WMS - Subsurface Water Management, System Performance | Very limited [1 - 1] |
| WMS - Subsurface Water Management, System Installation | Very limited [1 - 1] |
| WMS - Subsurface Water Management, Outflow Quality | Very limited [1 - 1] |
| WMS - Surface Water Management, System | Very limited [1 - 1] |
| WMS - Irrigation, Micro (subsurface drip) | Very limited [1 - 1] |
| WMS - Pond Reservoir Area | Very limited [1 - 1] |
| | Forestry |
| FOR - Potential Fire Damage Hazard | Low [0 - 0.1] |
| FOR - Potential Seedling Mortality | Low [0 - 0] |
| FOR - Potential Erosion Hazard (Off-Road/Off-Trail) | Moderate [0.5 - 0.75] |
| FOR - Soil Rutting Hazard | Severe [1 - 1] |
| FOR - Road Suitability (Natural Surface) | Poorly suited [1 - 1] |
| FOR - Potential Erosion Hazard (Road/Trail) | Severe [0.95 - 0.95] |
| FOR - Log Landing Suitability | Poorly suited [1 - 1] |
| FOR - Construction Limitations for Haul Roads/Log Landings | Severe [1 - 1] |
| FOR - Harvest Equipment Operability | Moderately suited [0.5 - 0.5] |
| FOR - Mechanical Site Preparation (Surface) | Poorly suited [0.5 - 0.5] |
| FOR - Mechanical Site Preparation (Deep) | Poorly suited [0.5 - 0.5] |
| FOR - Mechanical Planting Suitability | Poorly suited [0.5 - 1] |
| FOR - Hand Planting Suitability | Well suited [0 - 1] |
| | Waste Related |
| AWM - Manure and Food Processing Waste | Very limited [1 - 1] |
| AWM - Land Application of Municipal Sewage Sludge | Very limited [1 - 1] |
| AWM - Rapid Infiltration Disposal of Wastewater | Very limited [1 - 1] |
| AWM - Irrigation Disposal of Wastewater | Very limited [1 - 1] |
| AWM - Slow Rate Process Treatment of Wastewater | Very limited [1 - 1] |
| AWM - Overland Flow Process Treatment of Wastewater | Very limited [1 - 1] |
| | Engineering |
| ENG - Construction Materials; Roadfill | Poor [0 - 0] |
| ENG - Construction Materials; Gravel Source | Poor [0 - 0] |
| ENG - Construction Materials; Sand Source | Poor [0 - 0] |
| ENG - Construction Materials; Topsoil | Poor [0 - 0] |
| ENG - Construction Materials; Reclamation | Poor [0 - 0] |
| ENG - Septic Tank Absorption Fields | Very limited [1 - 1] |
| ENG - Unpaved Local Roads and Streets | Very limited [1 - 1] |
| ENG - Shallow Excavations | Very limited [1 - 1] |
| | |

| | |
|---|---|
| ENG - Dwellings W/O Basements | Very limited [1 - 1] |
| ENG - Dwellings With Basements | Very limited [1 - 1] |
| ENG - Small Commercial Buildings | Very limited [1 - 1] |
| ENG - Local Roads and Streets | Very limited [1 - 1] |
| ENG - Lawn, Landscape, Golf Fairway | Very limited [1 - 1] |
| ENG - Sanitary Landfill (Trench) | Very limited [1 - 1] |
| ENG - Sewage Lagoons | Very limited [1 - 1] |
| ENG - Sanitary Landfill (Area) | Very limited [1 - 1] |
| ENG - Daily Cover for Landfill | Very limited [1 - 1] |
| Urban / Recreational | |
| URB/REC - Off-Road Motorcycle Trails | Very limited [1 - 1] |
| URB/REC - Camp Areas | Very limited [1 - 1] |
| URB/REC - Picnic Areas | Very limited [1 - 1] |
| URB/REC - Paths and Trails | Very limited [1 - 1] |
| URB/REC - Playgrounds | Very limited [1 - 1] |
| DHS | |
| DHS - Rubble and Debris Disposal, Large-Scale Event | Severely limited [1 - 1] |
| DHS - Suitability for Clay Liner Material | Poor [0 - 0] |
| DHS - Site for Composting Facility - Surface | Very limited [1 - 1] |
| DHS - Site for Composting Facility - Subsurface | Very limited [1 - 1] |
| DHS - Suitability for Composting Medium and Final Cover | Poor [0 - 0] |
| DHS - Potential for Radioactive Sequestration | High sequestration potential [0.87 - 0.71] |
| DHS - Potential for Radioactive Bioaccumulation | Low bioaccumulation potential [0.01 - 0.31] |
| DHS - Catastrophic Mortality, Large Animal Disposal, Pit | Very limited [1 - 1] |
| DHS - Catastrophic Mortality, Large Animal Disposal, Trench | Very limited [1 - 1] |
| Wildlife | |
| WLF - Desert Tortoise (CA) | Suited [0.28 - 0.28] |
| Surface Runoff | |

# Attachment D

Alquist-Priolo Act Regional Reference Map



# Attachment E

## Calculated Coefficients of Linear Extensibility

### Calculated Coefficients of Linear Extensibility for 20-69% Clay

**Table 1.** Calculated COLE values for indicated clay percentage using equation:

.60316032 *X* + -.053093 (where *X* = 20, 21, ...70)

**Table 1**

| % Clay | COLE |
|---|---|
| 20 | 0.01 |
| 21 | 0.013 |
| 22 | 0.016 |
| 23 | 0.02 |
| 24 | 0.023 |
| 25 | 0.026 |
| 26 | 0.029 |
| 27 | 0.032 |
| 28 | 0.035 |
| 29 | 0.039 |
| 30 | 0.042 |
| 31 | 0.045 |
| 32 | 0.048 |
| 33 | 0.051 |
| 34 | 0.054 |
| 35 | 0.058 |
| 36 | 0.061 |

| % Clay | COLE |
|---|---|
| 37 | 0.064 |
| 38 | 0.067 |
| 39 | 0.07 |
| 40 | 0.073 |
| 41 | 0.076 |
| 42 | 0.08 |
| 43 | 0.083 |
| 44 | 0.086 |
| 45 | 0.089 |
| 46 | 0.092 |
| 47 | 0.095 |
| 48 | 0.099 |
| 49 | 0.102 |
| 50 | 0.105 |
| 51 | 0.108 |
| 52 | 0.111 |
| 53 | 0.114 |

| % Clay | COLE |
|---|---|
| 54 | 0.118 |
| 55 | 0.121 |
| 56 | 0.124 |
| 57 | 0.127 |
| 58 | 0.13 |
| 59 | 0.133 |
| 60 | 0.137 |
| 61 | 0.14 |
| 62 | 0.143 |
| 63 | 0.146 |
| 64 | 0.149 |
| 65 | 0.152 |
| 66 | 0.155 |
| 67 | 0.159 |
| 68 | 0.162 |
| 69 | 0.165 |

By use of the regression equation, predicted COLE values were calculated for clay contents ranging from 20 to 70% (Table 1). The values generated were used to estimate COLE values for soils when clay data were available but COLE values had not been determined. In general, the data for the soils studied indicate that clay percentages of 25, 35, and 45 have COLE values that correspond to the major COLE value classes given in Section 618.37 of the National Soils Handbook.

**Table 2.** Relationship of shrink-swell classes and extensibility to clay content for selected soils. *

Table 2

| Class | Linear extensibility | COLE | Clay |
|---|---|---|---|
| Low | <3 | <0.03 | <25 |
| Moderate | 3-6 | 0.03-0.06 | 25-35 |
| High | 6-9 | 0.06-0.09 | 35-45 |
| Very high | >9 | >0.09 | >45 |

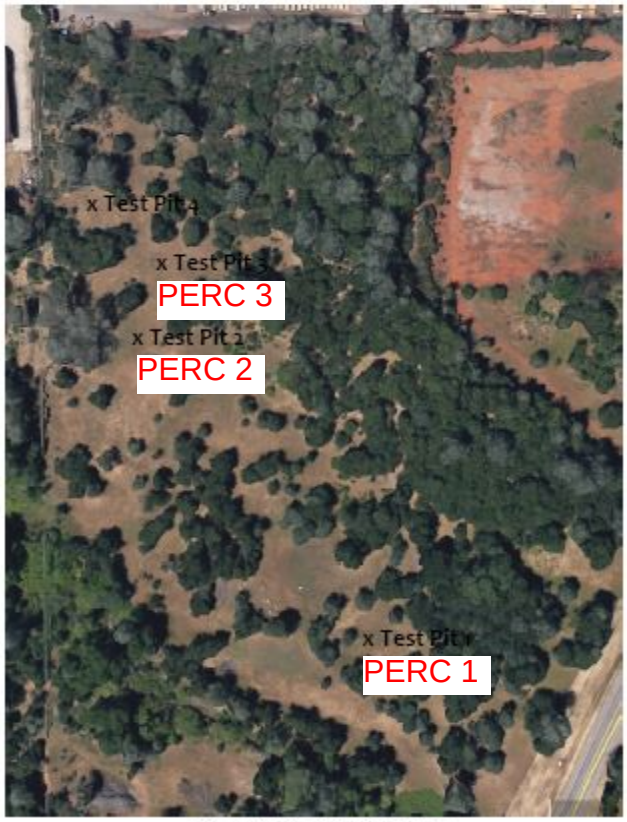
* Class, linear extensibility, and COLE from section 618.37 National Soils Handbook (Soil Survey Staff). Clay percentages are those shown in Table 1 for the relationship determined for the soils studied.

# Attachment F

**LOCATION OF TEST PITS 1-4**

Bobcat E35 Excavator with a 24-inch Bucket

May 15, 2018




Test Pit LOCATION MAP

| | | |
|---|---|---|
| REALM CIVIL ENGINEERING | PERCOLATION TESTS 1-3 & DEEP TEST PITS LOCATIONS 1 - 4<br>Manzanita Ranch Estates, LLC<br>Ashby Road<br>Shasta County, California | SEE ATTACHMENT F<br>Date: 05/18 |

# Attachment G

## LOGS OF TEST PITS 1 and 2

Bobcat E35 Excavator with a 24-inch Bucket

May 15, 2018

**Test Pit 1**

Sandy Clay/Auburn Loam

0 – 1.75' Sandy Clay (CL), reddish brown, dry, moderately stiff, low to medium plasticity, sand fine, roots through up to 1-inch diameter

1.75' – 6' Sandy Clay with trace Gravel (CL), tinge of yellowish brown, dry, moderately to very stiff, low to medium plasticiity, some fine sand, gravel subangular to angular up to 1 inch diameter.

6' - 8' Very weathered Greenstone (RX), brown, dry, moderately to very stiff, breaks along fracture joint plains. Practical refusal at approximately eight feet.

Total depth = 8'feet.
Backfilled with excavated soil. No Groundwater was encountered.

**Test Pit 2**

Sandy Clay/Auburn Loam

0 – 1.5' Sandy Clay (CL), reddish brown, dry, moderately stiff, low to medium plasticity, sand fine, roots through up to 1-inch diameter

1.5' – 6' Sandy Clay with trace Gravel (CL), brown, dry, moderately to very stiff, low to medium plasticiity, gravel subangular to angular up to 1 inch diameter.

6' – 7.5' Very weathered Greenstone (RX), brown, dry, moderately to very stiff, breaks along fracture joint plains.

Total depth = 7.5 feet.
No groundwater encountered.
Backfilled with excavated soil.

| | | |
|---|---|---|
| REALM CIVIL ENGINEERING | LOGS OF TEST PITS 1 and 2<br>Manzanita Ranch Estates, LLC<br>Ashby Road<br>Shasta County, California | SEE ATTACHMENT F<br>Date: 05/18 |

## LOGS OF TEST PITS 3 and 4

Bobcat E35 Excavator with a 24-inch Bucket

May 15, 2018

**Test Pit 3**

Sandy Clay/Auburn Loam

| | |
|---|---|
| 0 – 1.5' | Sandy Clay (CL), reddish brown, dry, moderately stiff, low to medium plasticity, sand fine, roots through up to 1-inch diameter |
| 1.5' – 6' | Sandy Clay with trace Gravel (CL), tinge of yellowish brown, dry, moderately to very stiff, low to medium plasticiity, some fine sand, gravel subangular to angular up to 1 inch diameter. |
| 6' – 9' | Very weathered Greenstone (RX), brown, dry, moderately to very stiff, breaks along fracture joint plains. Practical refusal at approximately 9 feet. |

Total depth = 9 feet.
Backfilled with excavated soil. No ground water was encountered.

**Test Pit 4**

Sandy Clay/Auburn Loam

| | |
|---|---|
| 0 – 1.5' | Sandy Clay (CL), reddish brown, dry, moderately stiff, low to medium plasticity, sand fine, roots through up to 1-inch diameter |
| 1.5' – 6' | Sandy Clay with trace Gravel (CL), brown, dry, moderately to very stiff, low to medium plasticiity, gravel subangular to angular up to 1 inch diameter. |
| 6' – 7.5' | Very weathered Greenstone (RX), brown, dry, moderately to very stiff, breaks along fracture joint plains. Practical refusal at approximately 7.5 feet. |

Total depth = 7.5 feet.
No groundwater encountered.
Backfilled with excavated soil.

| | | |
|---|---|---|
| REALM CIVIL ENGINEERING | LOGS OF TEST PITS 3 and 4<br>**Manzanita Ranch Estates, LLC**<br>Ashby Road<br>Shasta County, California | **SEE ATTACHMENT F**<br>Date: 05/18 |

## UNIFIED SOIL CLASSIFICATION SYSTEM

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

### OTHER SYMBOLS

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

= Hand Driven Sample

=SPT Sampler

= Initial Water Level

= Final Water Level

= Estimated or gradational material change line

= Observed material change line

Laboratory Tests

PI = Plasticity Index
EI =Expansive Index
UCC = Unconfined Compression Test
TR = Triaxial Compression Test
GR = Gradation Analysis (Sieve)
K = Permeability Test

### GRAIN SIZE CLASSIFICATION

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

REALM CIVIL ENGINEERING

**Classification System**
**Manzanita Ranch Estates, LLC**
Ashby Road
Shasta County, California

# Attachment H

Perc Test Pit #1

Perc Test Pit #1 Spoils

Perc Test Pit #2

Perc Test Pit #2 Spoils

Perc Test Pit #3

Perc Test Pit #3 Spoils

CITY OF SHASTA LAKE

**Storm Drainage Percolation Test and Test Pit Soil Profile Data**

Parcel/Lot # 006-020-056&57

Date: June 12th 2019

Property Owner: Frank Chaminte

Weather: Warm

Location: Ashby Road in City of Shasta Lake

Performed by: Jason Vine, P.E. and Shaun S.

| | Number of Fillings | Time of Measure-ment | Water Level From Surface | Drop In Water Level |
|---|---|---|---|---|
| **Hole No:** 1-32" shelf | | | | |
| **Depth:** 6" | | 9:05 | 4.50" | " |
| **Diameter or size:** 12" | | 9:35 | 4.75" | " |
| **Pre-soak start time:** AM/PM | 1 | 10:05 | 5.00" | .5" |
| **Soaked overnight?** yes | | 10:35 | 4.50" | " |
| **Location:** Southeast Hole | | 11:05 | 4.50" | " |
| **Remarks:** moist hole from soak | | 11:35 | 4.75" | " |
| | | 12:05 | 4.75" | " |
| **Results:** 80 minutes/inch | | 12:35 | 5.15" | 0.38" |
| | | | | |
| **Hole No:** 2-40" shelf | | 9:06 | 4.00" | " |
| **Depth:** 6" | | 9:36 | 4.5 " | " |
| **Diameter or size:** 12" | 1 | 10:06 | 4.75" | 0.5 " |
| **Pre-soak start time:** AM | | 10:36 | 4.00" | " |
| **Soaked overnight?** yes | | 11:06 | 4.25" | " |
| **Location:** Middle hole | | 11:36 | 4.50" | " |
| **Remarks:** moist hole from soak | | 12:06 | 4.50" | " |
| | | 12:36 | 4.75" | 0.25 " |
| **Results:** 120 minutes/inch | | | | |
| **Hole No:** 3 -24" shelf | | 9:07 | 3.50" | " |
| **Depth:** 6" | | 9:37 | 3.75" | " |
| **Diameter or size:** 12" | 1 | 10:07 | 3.00" | .50 " |
| **Pre-soak start time:** AM | | 10:37 | 3.00" | " |
| **Soaked overnight?** yes | | 11:07 | 3.25" | " |
| **Location:** Northeast pit | | 11:37 | 3.25" | " |
| **Remarks:** moist hole from soak | | 12:07 | 3.50" | " |
| | | 12:37 | 3.90" | 0.40" |
| **Results:** 80 minutes/inch | | | | |

Percolation
**Test Pit Soil Profile:** **Pit #** 1

| Test Pit Depth (inches) | Soil Strata Profile |
|---|---|
| 0-21" | Sandy Clay (CL)reddish brown silt with fine roots |
| 21"-32" | Sandy Clay, very stiff, some low to medium plasticity. |
| 32"-38" | hard hand digging |

Percolation
**Test Pit Soil Profile:** 30" **Pit #** 2

| Test Pit Depth (inches) | Soil Strata Profile |
|---|---|
| 0-6" | Sandy Clay (CL)reddish brown silt with fine roots |
| 6"-24" | Sandy Clay, very stiff, some low to medium plasticity. |
| 24"-30" | angular cemented clay, very stiff and hard hand digging. |

I hereby certify under penalty of perjury that these data are true and correct, and that correct test procedures have been followed.

REGISTERED PROFESSIONAL ENGINEER JASON B. VINE No. 67800 EXP. 06/30/21 CIVIL STATE OF CALIFORNIA