PJC & Associates, Inc.
Consulting Engineers & Geologists

December 15, 2022 Job No. 11045.01

City of Healdsburg
Community Services Department
Attn: Mark Themig
1557 Healdsburg Avenue
Healdsburg, CA 95448
mthemig@healdsburg.gov

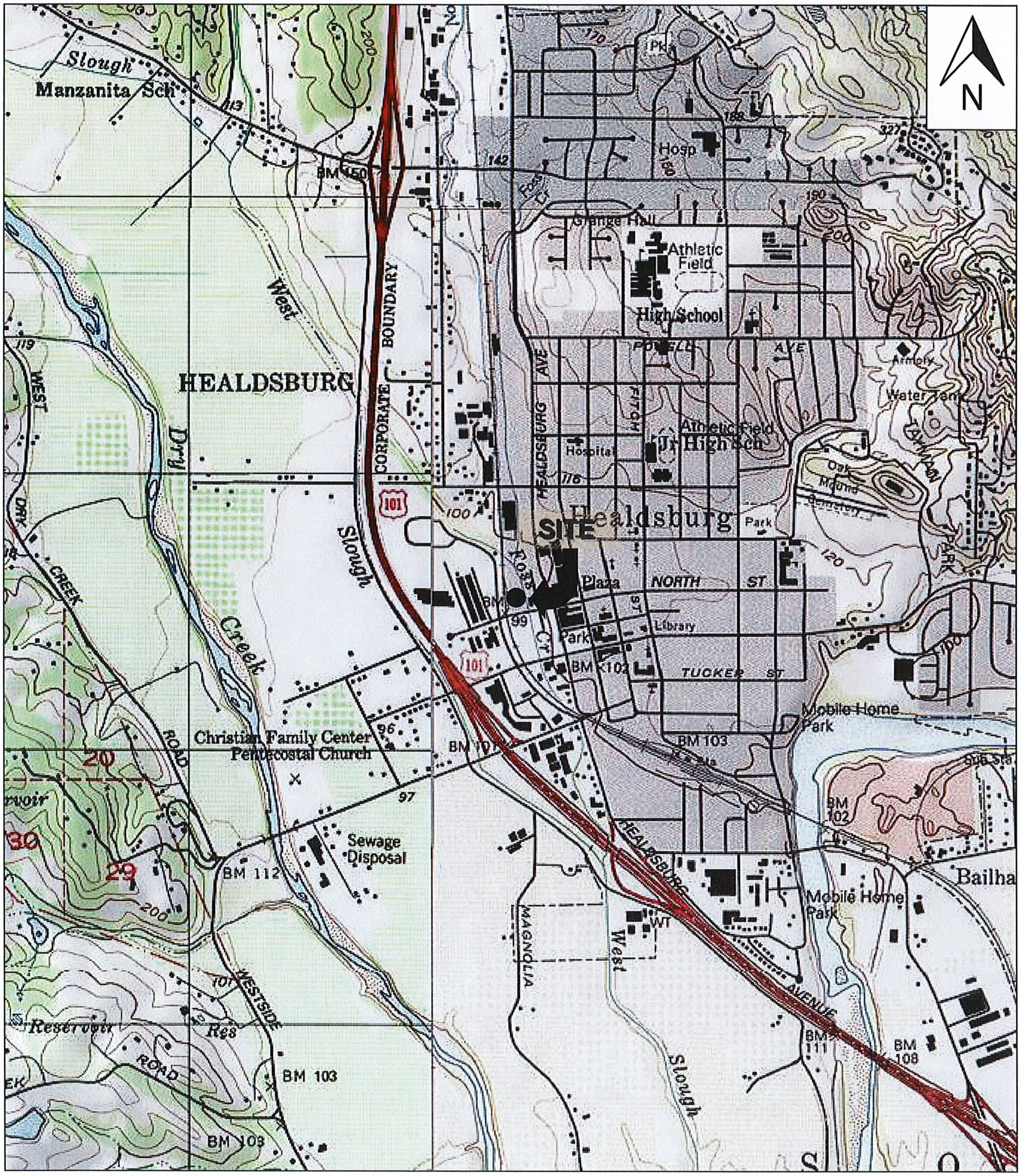
Subject: Geotechnical Investigation
Proposed Structural Upgrades for the Foley Family Pavilion
Healdsburg Farmer's Market
3 North Street
Healdsburg, California

Dear Mark:

PJC and Associates, Inc. (PJC) is pleased to submit this report which presents the results of our geotechnical investigation for the proposed structural upgrades to the Foley Family Pavilion located at 3 North Street in Healdsburg, California. The approximate location of the site is shown on the Site Location Map, Plate 1. The site corresponds to latitudinal and longitudinal coordinates of 38.6119° north and 122.8727° west, according to field GPS measurements. Our services were completed in accordance with our agreement for geotechnical engineering services dated August 12, 2022 and your authorization to proceed with the work. This report presents our opinions and recommendations regarding the geotechnical engineering aspects of the design and construction of the proposed project. Based on the results of this study, it is our opinion that the project site can be developed from a geotechnical engineering standpoint provided the recommendations presented herein are incorporated in the design and carried out through construction.

1. PROJECT DESCRIPTION

Based on preliminary project plans prepared by TLCD Architecture, Alan B. Cohen and MKM & Associates, with dates that vary from April 5, 2017 to August 8, 2022, it is our understanding that the project will consist of upgrading the existing structure at the property for inclusion to the Healdsburg Farmer's Market. The existing building consists of a single-story, metal and wood frame structure with an elevated concrete slab-on-grade floor supported on a concrete stem wall and spread footing foundation. It is planned to convert the enclosed building into an open-walled pavilion type structure. The retrofit will consist of constructing new foundations, improving the framing of the structure and adding new structural components. We anticipate the construction of new exterior flatwork, walkways and an ADA ramp as part of the project. We expect that the project



SCALE: 1:24,000

REFERENCE: USGS HEALDSBURG, CALIFORNIA 7.5 MINUTE QUADRANGLE, DATED 1993.

PJC & Associates, Inc. Consulting Engineers & Geologists	SITE LOCATION MAP PROPOSED FOLEY BUILDING STRUCTURAL UPGRADES HEALDSBURG FARMER'S MARKET 3 NORTH STREET HEALDSBURG, CALIFORNIA	PLATE 1
	Proj. No: 11045.01 Date: 12/2022 App'd by: PJC	

will be serviced by the existing site utilities. It is our understanding that permeable pavers will be used in exterior parking and driveway areas.

Structural loading information was not available at the time of this report. For our analysis, we anticipate that structural foundation loads will be light with dead plus live continuous wall loads less than two kips per lineal foot (plf) and dead plus live isolated column loads less than 50 kips. If these assumed loads vary significantly from the actual loads, we should be consulted to review the actual loading conditions and, if necessary, revise the recommendations of this report.

Grading plans and finish floor elevations were not available at the time of this report. We anticipate that construction will mainly be confined to the existing building envelope and site grading, if any, will be minimal. However, as previously noted, some exterior flatwork permeable pavers will be constructed. Based on the site topography and planned construction, we anticipate that grading will consist of cuts and fills of two feet or less in order to achieve interior and exterior finish grade elevations, upgrade existing soil conditions and provide adequate gradients for site drainage. It is our understanding that some retaining walls maybe be required for the project.

2. SCOPE OF SERVICES

The purpose of this study is to provide geotechnical criteria for the design and construction of the proposed project as described above. Specifically, the scope of our services included the following:

a. Observing the drilling of two exploratory boreholes to depths of 50 and 50.5 feet below the existing ground surface to observe the soil and groundwater conditions underlying the site. The site is located within a high liquefaction zone and the deep boreholes were performed to evaluate the liquefaction potential at the site. Our project geologist was on site to log the materials encountered in the boreholes and to obtain representative samples for visual classification and laboratory testing.

b. Observing the saw cutting, at three locations, of the existing slab-on-grade floor of the building. The saw cutting operation was performed at the direction of the project structural engineer to observe the existing perimeter foundations. Hand dug excavations were performed within the saw cuts to observe the approximate dimensions and depths of the existing perimeter foundations of the building. One hand dug pit was observed at the exterior perimeter of the structure.

c. Laboratory observation and testing of representative samples obtained during the course of our field investigation to evaluate the index and engineering properties of the subsurface soils at the site.

d. Review seismological and geologic literature on the site area, discuss site geology and seismicity, and evaluate potential geologic hazards and earthquake effects (i.e., liquefaction, ground rupture, settlement, lurching and lateral spreading, expansive soils, etc.). A liquefaction evaluation was performed for the project.

e. Perform engineering analyses to develop geotechnical recommendations for site preparation and earthwork, foundation type(s) and design criteria, lateral earth pressures, settlement, concrete slab-on-grade recommendations, surface and subsurface drainage control and construction considerations.

f. Preparation of this report summarizing our work on this project

3. SITE CONDITIONS

a. General. The project site is located in downtown Healdsburg in a fully developed commercial area. At the time of our field investigation, the western margin of the property was occupied by the existing 12,000 square-foot building to be retrofitted. The remaining portions of the property were occupied by a concrete ramp, gravel and asphalt parking areas, weeds and minor landscaping. The site is bounded by North Street to the south, a hotel to the north, Foss Creek to the east and Grove Street to the west.

b. Topography. The site is situated on nearly level terrain at the northern margin of the Santa Rosa Plain. According to the USGS Healdsburg, California 7.5 minute Quadrangle, the site lies at an approximate elevation ranging from 105 feet above mean sea level. The site generally has a gentle southwest gradient. Although the natural topography is relatively level, shallow hummocky features from past structures and artificial fills blanket the site.

c. Drainage. Site drainage consists of sheet flow and surface infiltration that migrates towards either Foss Creek or city maintained storm water control systems located on Grove and North Streets. No active springs or seeps were observed at or near the site. As previously noted, Foss Creek borders the eastern margin of the property.

4. GEOLOGIC SETTING

a. General. The site is located in the Coast Ranges Geomorphic Province of California. This province is characterized by northwest trending topographic and geologic features, and includes many separate ranges, coalescing mountain masses and several major structural valleys. The province is bounded on the east by the Great Valley and on the west by the Pacific Ocean. It extends north into Oregon and south to the Transverse Ranges in Ventura County.

The structure of the northern Coast Ranges region is extremely complex due to continuous tectonic deformation imposed over a long period of time. The initial tectonic episode in the northern Coast Ranges was a result of plate convergence, which is believed to have begun during the late Jurassic period. This process involved eastward thrusting of oceanic crust beneath the continental crust (Klamath Mountains and Sierra Nevada) and the scraping off of materials that are now accreted to the continent (northern Coast Ranges). East-dipping thrust and reverse faults were believed to be the dominant structures formed.

Right lateral, strike slip deformation was superimposed on the earlier structures beginning mid-Cenozoic time, and has progressed northward to the vicinity of Cape Mendocino in Southern Humboldt County. Thus, the principal structures south of Cape Mendocino are northwest trending, nearly vertical faults of the San Andreas system.

b. Local Geology. According to the Geologic Map of the Healdsburg 7.5 Minute Quadrangle prepared by the California Geological Survey (CGS), the site is underlain by early to late Pleistocene Age, older and undivided alluvial deposits (Qoa). These units are described to consist of uplifted, or deeply dissected older alluvium, alluvial fan, and terrace deposits. Our subsurface exploration confirmed that the project site is underlain by alluvial deposits. These deposits likely extend to great depths below the project site.

5. FAULTING

Geologic structures in the region are primarily controlled by northwest trending faults. The site is not located in a State of California Alquist-Priolo Earthquake Fault Zone. According to the USGS, National Seismic Hazard maps (2008), the three closest known active faults to the site are the Rogers Creek, Maacama and Collayomi faults. Table 1 outlines the nearest known active faults, their distance and direction from the project site, and their associated maximum moment magnitudes.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	Direction	Distance (Miles)	Maximum Earthquake (Moment Magnitude)
Rogers Creek	Southeast	5.17	7.33
Maacama	East	5.81	7.40
Collayomi	Northeast	15.43	6.70

Reference – USGS 2008 National Seismic Hazard Maps.

6. SEISMICITY

The site is located within a zone of high seismic activity related to the active faults that traverse through the surrounding region. Future damaging earthquakes could occur on any of these fault systems during the lifetime of the proposed project. In general, the intensity of ground shaking at the site will depend upon the distance to the causative earthquake epicenter, the magnitude of the shock, the response characteristics of the underlying earth materials and the quality of construction. Seismic considerations and hazards are discussed in Section 8 of this report.

7. SUBSURFACE CONDITIONS

a. Exploration and Soils. The subsurface conditions were explored by drilling two exploratory boreholes (BH-1 and BH-2) at the subject property. The boreholes were drilled to depths of 50 and 50.5 feet below the existing ground surface, respectively. The approximate borehole locations are shown on the Borehole Location Plan, Plate 2. The boreholes were drilled to collect soil samples of the underlying strata for visual examination and laboratory testing and to evaluate liquefaction potential at the site. We also observed the shallow subsurface conditions by excavating four exploratory test pits adjacent to the existing foundations to observe the bearing conditions of the foundation soils. The approximate locations of the test pits are also shown on Plate 2. The excavation and drilling, and sampling procedures and descriptive test pit and borehole logs are presented in Appendix A. The laboratory procedures are described in Appendix B.

Our boreholes generally encountered a thin layer of artificial fill underlain by native alluvial soil deposits that extended to the maximum depths explored. The fill consisted of asphalt and aggregate base rock material for the parking area and extended up to nine inches below existing grade. Underlying the fill layer, native alluvial soils generally consisting of sandy clays, clayey sands and clayey gravels that extended to the maximum depths explored were encountered. The fine grained soils varied from moist to saturated, medium stiff to very stiff, and medium to highly plastic. The granular deposits varied appeared saturated, medium dense to dense and fine to coarse grained. A detailed description of subsurface conditions encountered in our boreholes are presented on the Borehole Logs, Plates 3 and 4.

b. Groundwater. The phreatic groundwater table was observed at 13 feet below grade in BH-1 and 22 feet below grade in BH-2. Groundwater levels typically rise and fall by several feet due to variations in seasonal rainfall intensity, duration and other factors. The groundwater may rise and fall by several feet throughout the year. Provided the project does not include significantly deep excavations, we do not anticipate the presence of groundwater will significantly impact the project.

8. EXISTING BUILDING FOUNDATIONS

To observe the existing foundations of the building, two locations along the mid-eastern wall and two locations at the northeastern wall were chosen to cut sections into the existing concrete slab-on-grade floor. One pit was excavated adjacent to the exterior foundation. These cut-out sections were then hand dug adjacent to the foundations to observe and document approximate dimensions, footing depths and general conditions of the foundations. The excavations were dug up to six feet below the top of interior slab elevation.

The soils beneath the slab consisted of artificial fill underlain by native alluvial soils. The fill extended up to two and one-half feet below the top of the interior slab floor. Native alluvial soils were encountered below the fill soils. Foundation depths ranged from 18 to 26 inches deep and included stem walls that measured 53 to 60 inches tall. No excessive distress or signs of visual deterioration was observed on the exposed foundations. However, these observations were limited to four isolated locations. No groundwater or seepage was observed in the test pits.

9. GEOLOGIC HAZARDS AND SEISMIC CONSIDERATIONS

The site is located within a region subject to a high level of seismic activity. Therefore, the site could experience strong seismic ground shaking during the lifetime of the project. The following discussion reflects the possible earthquake effects which could result in damage to the proposed project.

a. Fault Rupture. Rupture of the ground surface is expected to occur along known active fault traces. According to the State of California, no known active faults exist near the project site. Therefore, the likelihood of ground rupture at the site due to faulting is considered to be low. However, it cannot be entirely dismissed because the site is located in an active tectonic area.

b. Ground Shaking. The site has been subjected in the past to ground shaking by earthquakes on the active fault systems that traverse the region. It is believed that earthquakes with significant ground shaking will occur in the region within the next several decades. Therefore, the risk that the site will be subjected to strong ground shaking during the design life of the project is high.

c. Liquefaction. Based on our review of the Association of Bay Area Governments (ABAG) liquefaction susceptibility map, the site is underlain by soils which are considered to have high liquefaction potential. Liquefaction is a seismic hazard that occurs in saturated, low density, predominantly granular soils encountered below the phreatic groundwater table. In general, these loose materials experience a rapid, temporary loss in shear strength due to an increase in pore water pressure in response to strong earthquake ground shaking. Upon dissipation of pore water pressures following shaking, there is reduction in the void ratio of the impacted soil particles that can cause differential and erratic ground settlement. Low density, fine-grained sandy soils below the phreatic groundwater elevation are most susceptible to liquefaction. However, case studies have shown that soft silts, low plasticity clays and loose gravels with limited drainage paths are also susceptible to liquefaction. Bedrock materials and plastic clayey soils with a liquid limit (LL) greater than 32 are generally not known to be prone to liquefaction.

The occurrence of this phenomenon is dependent on many complex factors including the intensity and duration of ground shaking, groundwater elevation at time of shaking, particle size distribution, consistency/relative density of the soil, overburden stress, age of deposit, and many other factors.

In order to evaluate liquefaction potential at the site, our boreholes were drilled to depths of 50 and 50.5 feet below the existing ground surface. The boreholes generally encountered interbedded low to high plasticity clays and dense clayey sands and gravels that extended to the maximum depths explored. Some of these stratums were saturated. However, they exhibited high relative densities and high fines clay content. These soils are not considered prone to liquefaction. Therefore, we judge the overall risk of liquefaction at the site to be low.

d. Lateral Spreading and Lurching. Lateral spreading is normally induced by vibration of near-horizontal alluvial soil layers adjacent to an exposed face. Lurching is an action, which produces cracks or fissures parallel to streams or banks when the earthquake motion is at right angles to them. Foss Creek runs along the eastern perimeter of the property. Foss Creek has steep banks that could be prone to lurching. However, we judge that the project is set back a safe distance from the bank to protect the improvements from lateral spreading and lurching if they were to occur.

e. Expansive Soils. Based on our field observations and laboratory testing (PI = 16 & 18, the site surface soils have medium plasticity characteristics and are judged to have a moderate expansion potential. However, based on our experience and observations of the site conditions, expansive soils are not a concern for the project.

f. Slope Stability. Based on our review of the California Division of Mines and Geology, Geology for Planning in Sonoma County, Special Report 120 the site is mapped in an area of greatest relative stability due to slope inclinations dominantly less than 15% (Category A). No landslides are mapped on or adjacent to the site and we did not observe any indication of landslides on or adjacent to the site. We judge that slope instability does not pose a hazard for the proposed project due to low slope inclinations.

10. CONCLUSIONS

Based on the results of our investigation, it is our professional opinion that the project is feasible from a geotechnical engineering standpoint provided the recommendations contained in this report are incorporated into the design and carried out through construction of the project. The primary geotechnical concerns in design and construction of the project are as follows:

1. The presence of artificial fill of unknown source and variable density, and weak and compressible surface and near surface natural soils at the site.

2. Control of surface and subsurface drainage across the site.

Our field work encountered artificial fill extending up to two and one-half feet below the existing concrete slab at the interior of the building and 12 inches below exterior grade. This fill was placed in an unknown manner and is of variable density. Although the fill has been present for some time, when exposed to loads from new foundations, slabs or new fills, this material could be prone to intolerable differential settlement. This can cause damage and cracking to structural and concrete elements if constructed on these materials in their existing state. Additionally, the project site is blanketed by approximately one and one-half feet of weak and compressible surface natural soils. Weak and compressible soils may appear hard and strong when dry. However, they could potentially collapse under the load of foundations, engineered fill or concrete slabs when their moisture content increases and approaches saturation. The moisture content of these soils can increase as the result of rainfall or when the natural upward migration of water vapor through the soils is impeded by fills, slabs and foundations. These soils can undergo considerable strength loss and increased compressibility, thus causing irregular and erratic ground settlement under loads. This ground movement manifests in the form of cracked foundations and slabs-on-grades and distress to architectural features of structures.

It is crucial that all final grades be provided with positive gradients away from all foundations to provide rapid removal of surface water runoff to an adequate discharge point. No ponding of water should be allowed adjacent to building foundations or slabs. Care must be taken so that discharges from the roof gutter and downspout systems are not allowed to infiltrate the subsurface near structures.

11. RECOMMENDATIONS

Based on the results of the test pits, it appears that the existing footings are embedded in firm bearing soil with adequate bearing capacity. Therefore, upgrading of the existing foundations is not needed unless required by the project structural engineer. If new foundations are required, we recommend the new foundations bear on firm native soils. Due to the varying depths of firm native soils across the site, footing depths of 24 to 36 inches should be anticipated.

It is our understanding that the existing interior concrete slab-on-grade floor of the building will be demolish and removed of the site. It is proposed to construct a new interior slab-on-grade for the proposed project. For new slabs-on-grade, they should be supported on a uniform layer of compacted engineered fill that is at least 18 inches thick. Exterior flatwork should be supported on at least 18 inches of compacted engineered fill. The engineered fill should be placed in accordance with the recommendations of this report. The engineered fill should extend laterally five feet beyond the edges of foundations, if possible, and three feet beyond the edges of exterior flatwork.

It is our understating that permeable pavements will be used for the project. The top 12 inches of the pervious pavements should be scarified and recompacted according to the recommendations of this report. Due to the clayey composition of the on-site natural surface soils, subdrains should be provided beneath the pavers.

The following sections present geotechnical recommendations and criteria for design and construction of the project.

12. EARTHWORK AND GRADING

a. Stripping. The existing interior slab should be completely demolished and removed off site. For areas to be graded, we recommend that structural areas be stripped of surface vegetation, asphalt, old fill/debris, roots and the upper few inches of soil containing organic matter. These materials should be moved off site. Some of them, if suitable, could be stockpiled for later use in landscape areas. Where underground utilities pass through the site, we recommend that these utilities be removed in their entirety or rerouted where they exist outside an imaginary plane sloped two horizontal to one vertical (2H:1V) from the outside bottom edge of the nearest foundation element. Any existing wells, septic systems and leach fields should be abandoned and plugged according to regulations set forth by the Sonoma County Health Department. Voids left from the removal of utilities or other obstructions should be replaced with compacted engineered fill placed in conformance with the earthwork section of this report and should be observed by the geotechnical engineer in the field during grading. Loosely backfilled voids generated from demolition will settle excessively over time and potentially cause damage to structures constructed above them.

   The hand dug excavations performed during our field exploration were loosely backfilled upon completion and not compacted to engineered fill standards. The loosely backfill materials should be removed from the excavations and properly backfilled with engineered fill in conformance with the recommendations of the following subsection.

b. Excavation and Compaction. Following site stripping, excavation should be performed to achieve finished grade or prepare areas to receive fill. Newly constructed interior slabs should be underlain by at least 18 inches of low to non-expansive compacted engineered fill. Exterior flatwork should be underlain by at least 18 inches of low to non-expansive compacted engineered fill. Final subexcavation depths should be evaluated and approved by the Geotechnical Engineer in the field during grading. Subexcavations should extend at least five feet beyond the limits of structural areas, where possible, and at least three feet beyond exterior flatwork edges. If obstructions are encountered within subexcavation areas, the geotechnical engineer should be consulted.

The exposed surface should be scarified to a depth of eight inches, moisture conditioned to within two percent of optimum moisture content and compacted to a minimum of 90 percent of the material's maximum dry density, as determined by the ASTM D 1557-12 laboratory compaction test procedures. The site soils are considered acceptable for use as engineered fill, if approved by the geotechnical engineer in the field during grading. Additional testing may be required during grading to further evaluate the suitability of the existing soil for use as engineered fill. The fill material should be spread in eight-inch-thick loose lifts, moisture conditioned to within two percent of optimum and compacted to at least 90 percent of the material's maximum dry density. The thickness of the fill should not vary by more than two feet across non-structural slabs-on-grade. Care in equipment selection must be implemented when compacting soil against existing walls. We recommend the hand held jumping jacks be utilized to compact fill within five feet of existing retaining walls.

Any imported fill should be evaluated and approved by the geotechnical engineer before importation. It is recommended that any import fill to be used on site should be of a low to non-expansive nature and should meet the following criteria:

Plasticity Index	less than 12
Liquid Limit	less than 38
Percent Soil Passing #200 Sieve	between 15% and 40%
Maximum Aggregate Size	4 inches

c. Temporary Cut Slopes. Although not anticipated, we recommend that temporary cut slopes should not exceed 1/2H:1V. The geotechnical engineer should observe the excavation to determine if 1/2H:1V cut slopes are acceptable during grading. Depending on conditions encountered during grading, shoring may still be required even with 1/2H:1V cut slopes. Temporary cut slopes should not be left exposed longer than absolutely necessary. If the slopes are allowed to dry out, they will likely lose strength and be prone to failures. If sloping excavation side walls are not feasible, shoring or other methods of stabilization may be required.

d. Cut and Fill Slopes. Cut and unreinforced fill slopes should be graded to an inclination no steeper than 2H:1V. If potentially unstable subsurface conditions such as adverse bedding, joint planes, zones of weakness, weak clay zones, or exposed seepage are encountered, it may be necessary to flatten slopes or provide other treatment. It is recommended that the geotechnical engineer observe the cut slopes and provide final recommendations for the control of adverse conditions during grading operations, if encountered. During the rainy season, the cut slopes should be checked for springs or seepage areas. The surfaces of the cut slopes should be treated as needed in order to minimize the possibility of slumping and erosion.

Disturbed slopes should be planted or seeded with deep-rooted ground cover and covered with straw matting to prevent erosion. Surface drainage should be directed away from cut and fill slopes. The exterior slopes should be protected from erosion as determined by the project Civil Engineer.

A representative of PJC should observe all site preparation and fill placement. It is important that during the stripping, excavation, grading, and scarification processes, a representative of our firm is present to observe whether any undesirable material is encountered in the construction area. If unforeseen soil conditions are encountered, deeper subexcavation depths may be necessary.

Generally, grading is most economically performed during the summer months when the onsite soils are usually dry of their optimum moisture content. Delays should be anticipated in site grading performed during the rainy season or early spring due to excessive moisture in onsite soils. Special and relatively expensive construction procedures should be anticipated if grading must be completed during the winter and early spring.

13. FOUNDATIONS: SPREAD FOOTINGS

To mitigate the effects of artificial fill and weak surface and near surface soils, we recommend the new foundations consist of spread footings that extend into compacted engineered fill or firm native soils.

a. Vertical Loads. The anticipated structural loads may be adequately supported by spread footings extending a minimum of 18 inches into firm native soils or compacted engineered fill. Footings should be approved by the geotechnical engineer before reinforcing steel is placed. All footings should be reinforced as determined by the project structural engineer. The recommended soil bearing pressures, depth of embedment and minimum widths of spread footings are presented in Table 2. The bearing values provided have been calculated assuming that all footings uniformly bear on firm native soils or compacted engineered fill, as determined by the geotechnical engineer on site during construction.

TABLE 2
FOUNDATION DESIGN CRITERIA

Footing Type	Bearing Pressure (psf)*	Minimum Depth (in)**	Minimum Width (in)
Continuous wall	2,000	18	12
Isolated Column	2,000	18	18

* Dead plus live load.
** Below existing into firm native soils.

The allowable bearing pressures are net values. The weight of the foundation and backfill over the foundation may be neglected when computing dead loads. Allowable bearing pressures may be increased by one-third for transient applications such as wind and seismic loads.

b. Lateral Loads. Resistance to lateral forces may be computed by using friction and passive pressure. A friction factor of 0.30 is considered appropriate between the bottom of the concrete structures and the bearing soils. A passive pressure of 300 pounds per square foot per foot of depth (psf/ft) is recommended. Unless restrained at the surface, the upper six inches should be neglected for passive resistance due to soil disturbance and desiccation. Footing concrete should be placed neat against undisturbed native soils. Footing excavations should not be allowed to dry before placing concrete. If shrinkage cracks appear in the footing excavations, the soil should be thoroughly moistened prior to concrete placement.

c. Settlement. Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Foundation settlements have been estimated based on the foundation loads and bearing values provided. Maximum settlements of shallow foundations designed and constructed in accordance with the preceding recommendations are estimated to be one inch or less. Differential settlement between similarly loaded, adjacent footings is expected to be one-half inch or less. The majority of the settlement is expected to occur during construction and placement of dead loads, and occur within a few weeks upon application of the loads.

14. NON-STRUCTURAL CONCRETE SLABS-ON-GRADE

The new non-structural interior slabs-on-grade may be used provided they are underlain by at least 18 inches of low to non-expansive compacted engineered fill. Exterior flatwork should be supported by at least 18 inches of low to non-expansive, engineered fill. The engineered fill should extend at least five feet beyond foundations, where possible, and three feet beyond exterior flatwork edges.

All slab subgrades should be moisture conditioned and compacted to produce a firm and unyielding subgrade. The slab subgrade should not be allowed to dry. Non-structural slabs should be at least five inches thick and underlain with a capillary moisture break consisting of at least four inches of clean, free-draining crushed rock or gravel. The rock should be graded so that 100 percent passes the one-inch sieve and no more than five percent passes the No. 4 sieve.

For slabs-on-grade with moisture sensitive surfacing, we recommend that a vapor barrier at least 15 mils in thickness be placed over the rock to prevent migration of moisture vapor through the concrete slabs.

We recommend that slabs be designed and reinforced as determined by the project structural engineer. Special care should be taken to insure that reinforcement is placed at the slab mid-height. The gravel should be moistened prior to placing concrete. Exterior slabs should not be attached to foundations. Control joints should be provided to induce and control cracking.

Special precautions must be taken during the placement and curing of concrete slabs-on-grade. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures and ad mixtures used during either hot or cold weather conditions will lead to excessive shrinkage, cracking or curling of the slabs. High water-cement ratios and/or improper curing also greatly increases water vapor transmission through the concrete. Concrete placement and curing operations should be performed in accordance with the American Concrete Institute (ACI) manual.

15. DRAINAGE

a. Surface Drainage. Drainage control design should include provisions for positive surface gradients so that surface runoff is not permitted to pond, particularly adjacent to slabs and foundations. Surface runoff should be directed away from foundations. If drainage facilities discharge onto the natural ground, adequate means should be provided to control erosion and to create sheet flow. The structure should be provided with gutters and downspouts. The downspouts should be connected to closed conduits and discharged away from the structure.

16. UTILITY TRENCHES

Shallow excavations for utility trenches can be readily made with either a backhoe or trencher. Larger earth moving equipment should be used for deeper excavations. We expect the walls of trenches less than five feet deep, excavated into engineered fill or native soils, to remain in a near-vertical configuration during construction provided no equipment or excavated spoil surcharges are located near the top of the excavation. Where trenches extend deeper than five feet, the excavation may become unstable. All trenches, regardless of depth, should be evaluated to monitor stability prior to personnel entering the trenches. Shoring or sloping of any deep trench wall may be necessary to protect personnel and to provide stability. All trenches should conform to the current CAL-OSHA requirements for worker safety.

Utility trenches may be backfilled with native or imported soils placed, moisture conditioned, and compacted in conformance with Table 3. Jetting of soils should not be allowed.

TABLE 3
SUMMARY OF TRENCH BACKFILL RECOMMENDATIONS

Area	Compaction Recommendations*
Trench Backfill** (Onsite Native Material)	Placed in loose lifts, moisture conditioned to within two percent of the optimum moisture content, and compacted to a minimum of 90 percent relative compaction.
Trench Backfill** (Low to Non-Expansive Import)	Placed in loose lifts, moisture conditioned to within two percent of the optimum moisture content, and compacted to a minimum of 90 percent relative compaction.
Loose Lift Thickness	Jumping Jack – six to eight inches Excavator with Wheel – eight to ten inches

* All compaction requirements stated in this report refer to dry density and moisture content relationships obtained through the laboratory standard described by ASTM D 1557-12.
** Depths below finished subgrade elevations

17. SEISMIC DESIGN

Based on criteria presented in the 2019 edition of the California Building Code (CBC) and ASCE (American Society of Civil Engineers) STANDARD ASCE/SEI 7-16, the following minimum criteria should be used in seismic design:

a. Site Class: D

b. Mapped Acceleration Parameters: $S_S = 2.089g$; $S_1 = 0.812g$

c. Spectral Response Acceleration Parameters: $S_{MS} = 2.089g$; S_{M1} = null

d. Design Spectral Acceleration Parameters: $S_{DS} = 1.393g$; S_{D1} = null

18. RETAINING WALLS

Retaining walls may be supported on spread footings, per the recommendations presented in Section 13 of this report.

a. Static Lateral Earth Pressures. Retaining walls free to rotate on the top should be designed to resist active lateral earth pressures. If walls are restrained by rigid elements to prevent rotation or supporting compacted engineered fill, they should be designed for "at rest" lateral earth pressures.

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

Active Pressure (level backfill) (15% or less)	40 psf/ft
At Rest Pressure (level backfill) (15% or less)	55 psf/ft
Active Pressure (sloping backfill)	55 psf/ft
At Rest Pressure (sloping backfill)	70 psf/ft

These pressures to not include external surcharge loads. If surcharge loads are anticipated, we should be consulted to provide recommendations for design.

b. Pseudostatic Force. For retaining walls taller than six feet, the horizontal pseudostatic force acting upon the retaining wall during a seismic event should be calculated from the following equation:

$$P_E = 10.5\ H^2$$

P_E = Pseudostatic Force (lbs)
H = retained height (ft)

The location of the pseudostatic force is assumed to act at a distance of 0.33H above the base of the wall.

c. Drainage. We recommend that a back drain be provided behind all retaining walls or that the walls be designed for full hydrostatic pressures. The back drains should consist of four-inch diameter SDR 35 perforated pipe sloped to drain to outlets by gravity, and of clean, free-draining Class II permeable drain rock. The Class II permeable drain rock should extend 12 inches horizontally from the back face of the wall and extend from the bottom of the wall to one foot below the finished ground surface. The upper 12 inches should be backfilled with compacted fine-grained soil to exclude surface water. We recommend that the ground surface behind retaining walls be sloped to drain. Under no circumstances should surface water be diverted into retaining wall back drains. Where migration of moisture through walls would be detrimental, the walls should be waterproofed.

19. PERMEABLE PAVEMENT SURFACES

It is our understanding that permeable concrete pavers will be used in parking and driveway areas. The natural surface soils consist of medium plastic clay soils. These soils will exhibit poor infiltration rates, especially when compacted and saturated. Permeable concrete pavers should be at least three and one eighth inches thick or a thickness based on the anticipated traffic frequency and loading. At a minimum, we recommend that the permeable pavers be underlain by two inches of number 8 aggregate base bedding course, underlain by a four inch layer of open graded gravel three-eighths of an inch to threequarters inch in size. Beneath the open graded layer, we recommend a minimum six inch thick layer of Class 2 base rock compacted to at least 90 percent relative compaction. The Class 2 base rock should be placed over a permeable geotextile fabric. As mentioned, the subgrade soils will have low infiltration rates. The system should be provided with subdrains consisting of perforated pipes encapsulated with Class 2 permeable drainage material. The subgrade should be sloped to drain to the perforated pipes which are spaced and sloped to drain all stored water eventually to the project storm sewer drainage system. The top 12 inches of the subgrade soils should be scarified and compacted to 90 percent relative compaction.

Furthermore, highly expansive soils are prone to differential ground movement due to wetting and drying cycles. The differential movement could potentially cause displacement and cracking of pavements and Class 2 base rock, especially along the perimeter edges where moisture variation is the greatest. There are several engineering techniques that could be performed to mitigate the movement to within tolerable limits. However, the cost to perform these techniques should be balanced with the cost of repairing the damaged surface. If a permeable surface is constructed on the clay soils, the permeable surface will be prone to differential movement and damage. Annual maintenance and repair costs will be incurred.

20. LIMITATIONS

The data, information, interpretations and recommendations contained in this report are presented solely as bases and guides to the geotechnical design of the proposed structural upgrades for the Foley Family Pavilion located at 3 North Street in Healdsburg, California. The conclusions and professional opinions presented herein were developed by PJC in accordance with generally accepted geotechnical engineering principles and practices. No warranty, either expressed or implied, is intended.

This report has not been prepared for use by parties other than the designers of the project. It may not contain sufficient information for the purposes of other parties or other uses. If any changes are made in the project as described in this report, the conclusions and recommendations contained herein should not be considered valid, unless the changes are reviewed by PJC and the conclusions and recommendations are modified or approved in writing. This report and the figures contained herein are intended for design purposes only. They are not intended to act by themselves as construction drawings or specifications.

Soil deposits may vary in type, strength, and many other important properties between points of observation and exploration. Additionally, changes can occur in groundwater and soil moisture conditions due to seasonal variations or for other reasons. Therefore, it must be recognized that we do not and cannot have complete knowledge of the subsurface conditions underlying the subject site. The criteria presented herein are based on the findings at the points of exploration and on interpretative data, including interpolation and extrapolation of information obtained at points of observation.

21. ADDITIONAL SERVICES

Upon completion of the project plans, they should be reviewed by our firm to determine that the design is consistent with the recommendations of this report. During the course of this investigation, several assumptions were made regarding development concepts. Should our assumptions differ significantly from the final intent of the project designers, our office should be notified of the changes to assess any potential need for revised recommendations. Observation and testing services should also be provided by PJC to verify that the intent of the plans and specifications are carried out during construction; these services should include observing and testing during grading and earthwork, observing the foundation excavations and observing the installation of drainage facilities. These services will be performed only if PJC is provided with sufficient notice to perform the work. PJC does not accept responsibility for items we are not notified to observe.

It has been a pleasure working with you on this project. Please call if you have any questions regarding this report or if we can be of further assistance.

Sincerely,

PJC & ASSOCIATES, INC.

Patrick J. Conway
Geotechnical Engineer
GE 2303, California

REGISTERED PROFESSIONAL ENGINEER
PATRICK J. CONWAY
No. 2303
Exp. 3-31-24
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PJC/bc

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APPENDIX A
FIELD INVESTIGATION

1. INTRODUCTION

The field program performed for this study consisted of drilling two exploratory boreholes and hand excavating four exploratory test pits at the subject site. The approximate borehole and test pit locations are shown on the Borehole/Test Pit Location Plan, Plate 2. Descriptive logs of the boreholes are presented in this appendix as Plates 3 and 4 and the test pits are presented on Plates 5 through 8.

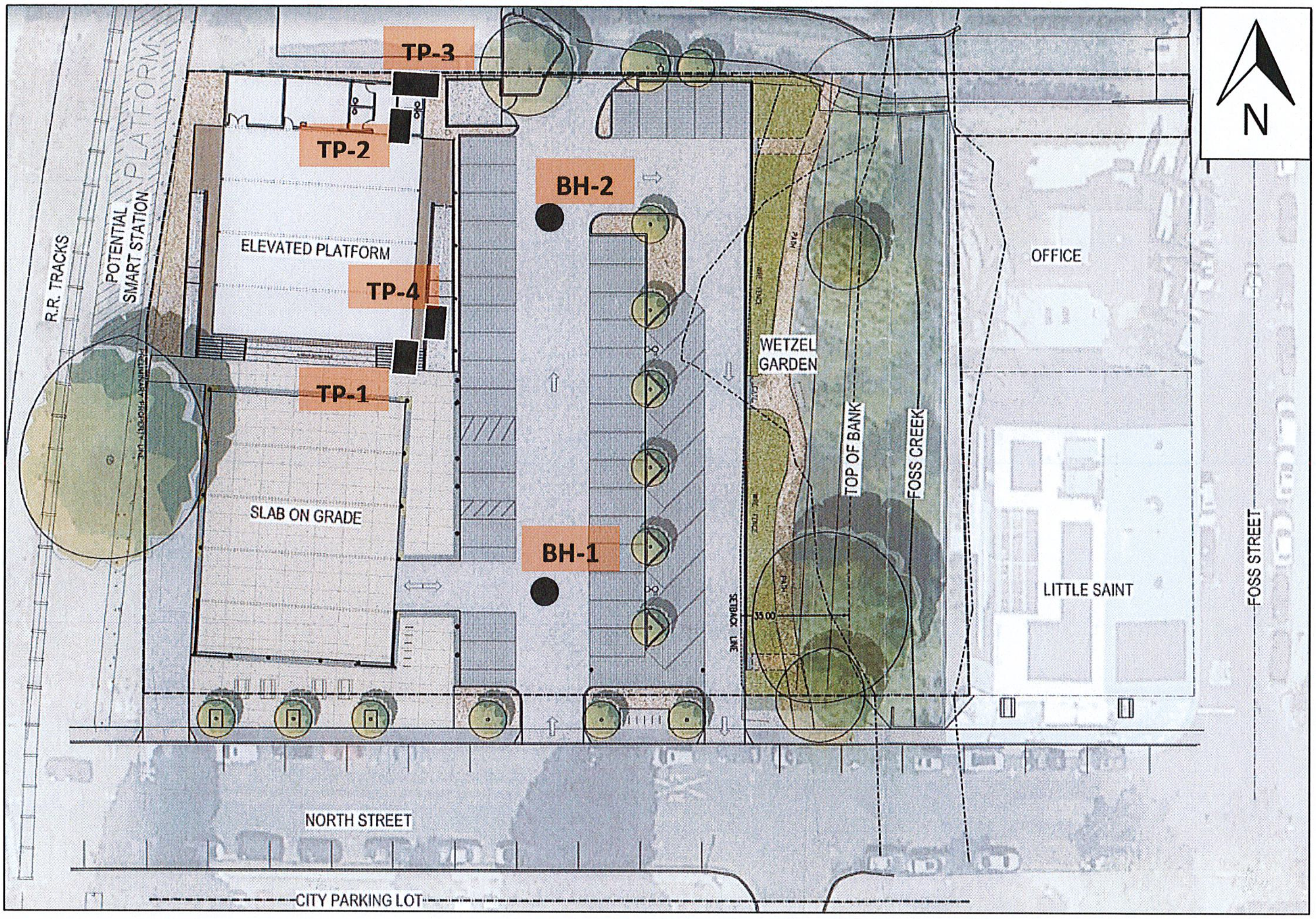
2. TEST PITS

The test pits were hand excavated within the saw cut sections of the concrete slab-on-grade floor. Disturbed samples for logging and laboratory testing were collected. The excavation was performed under the observation of our principal geotechnical engineer, who maintained a continuous log of soil conditions and obtained samples suitable for laboratory testing. The soils were classified according to Unified Soil Classification System as presented on Plate 9.

3. BOREHOLES

The boreholes were advanced using a truck-mounted B-53 drill rig equipped with 8-inch diameter hollow stem flight augers. The drilling was performed under the observation of our project geologist who maintained a continuous log of the soil conditions and obtained samples suitable for laboratory testing.

Relatively undisturbed and disturbed samples were obtained from the exploratory boreholes. A 2.43 in I.D. California Modified Sampler containing liners was driven into the underlying soil using a 140 pound hammer falling 30 inches. A 1.375-inch inside diameter Standard Penetration Test (SPT), without liners, was also driven into the soils. The samplers were driven to obtain an indication of the consistency and relative density of the soil and to allow visual examination of at least a portion of the soil column. Soil samples obtained with the split-spoon samplers were retained for further observation and testing. The number of blows required to drive the samplers at 6-inch increments was recorded on each borehole log, and converted to equivalent SPT blow counts for correlation with empirical data. All samples collected were labeled and transported to PJC's office for laboratory examination and testing.



APPROXIMATE SCALE: 1" = 30'

EXPLANATION

TEST PIT LOCATION AND DESIGNATION

BOREHOLE LOCATION AND DESIGNATION

REFERENCE: CONTEXT PLAN TITLED "FOLEY FAMILY COMMUNITY PAVILION" PREPARED BY ALAN B. COHEN ARCHITECT DATED AUGUST 8,

PJC & Associates, Inc. Consulting Engineers & Geologists	BOREHOLE AND TEST PIT LOCATION MAP PROPOSED FOLEY BUILDING STRUCTURAL UPGRADES HEALDSBURG FARMER'S MARKET 3 NORTH STREET HEALDSBURG, CALIFORNIA	PLATE 2
	Proj. No: 11045.01 Date: 12/2022 App'd by: PJC	

PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-1

CLIENT City of Healdsburg- Community Services Department
PROJECT NAME Proposed Structural Upgrades
JOB NUMBER 11045.01
LOCATION 3 North Street, Healdsburg, California
DATE STARTED 11/15/22
COMPLETED 11/15/22
GROUND ELEVATION
HOLE SIZE 8"
DRILLING CONTRACTOR Pearson Exploration
GROUND WATER LEVELS:
DRILLING METHOD 8" Hollow Stem Auger & 140lb Hammer
AT TIME OF DRILLING 18.50 ft Groundwater encountered at 18.5 feet.
LOGGED BY AB
CHECKED BY PJC
AT END OF DRILLING 13.00 ft Groundwater at 13.0 feet at end of drilling.
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		0.5" ASPHALTIC CONCRETE (AC) / 8.0" AGGREGATE BASE (AB).										
		0.7' - 9.5'; SANDY CLAY (CL); medium brown, moist, stiff to very stiff, medium plasticity (ALLUVIUM).										
			MC		11	3	86	25	36	20	16	
5			MC		6	1.25	79	14				
10		9.5' - 19.0'; SANDY CLAY (CL); mottled moderate brown and orange, moist to saturated, stiff, medium to high plasticity (ALLUVIUM).	MC		15	2.5	82	22	45	19	26	
15			MC		11	1.0(U)	95	29				
20		19.0' - 24.5'; SANDY CLAY (CL); mottled blue-green and gray, saturated, stiff, high plasticity, with subrounded gravels (ALLUVIUM)										

(Continued Next Page)

PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-1

CLIENT City of Healdsburg- Community Services Department **PROJECT NAME** Proposed Structural Upgrades

JOB NUMBER 11045.01 **LOCATION** 3 North Street, Healdsburg, California

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
20		19.0' - 24.5'; SANDY CLAY (CL); mottled blue-green and gray, saturated, stiff, high plasticity, with subrounded gravels (ALLUVIUM). *(continued)*	SPT		8				43	17	26	
25		24.5' - 34.0'; SANDY CLAY (CL); mottled blue-gray, saturated, medium stiff, medium plasticity, with sands & few gravels (ALLUVIUM).	MC		13	0.9(U)	104	22	35	15	20	
30			MC		21							
		34.0' - 44.0'; CLAYEY SAND WITH GRAVEL (SC); brown with orange, saturated, dense, fine to coarse-grained, medium plasticity fines (ALLUVIUM).										
35			SPT		39			12				
40			SPT		38			14				38

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PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-1

CLIENT City of Healdsburg- Community Services Department **PROJECT NAME** Proposed Structural Upgrades

JOB NUMBER 11045.01 **LOCATION** 3 North Street, Healdsburg, California

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
		34.0' - 44.0'; CLAYEY SAND WITH GRAVEL (SC); brown with orange, saturated, dense, fine to coarse-grained, medium plasticity fines (ALLUVIUM). *(continued)*										
45		44.0' - 50.0'; CLAYEY SAND (SC); orange & light brown, saturated, dense, fine to coarse-grained, with low & medium plasticity fines, with gravels at 49.0' (ALLUVIUM).	SPT		39			32				
50			SPT		46			14				

Bottom of borehole at 50.5 feet.

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PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-2

CLIENT City of Healdsburg- Community Services Department **PROJECT NAME** Proposed Structural Upgrades

JOB NUMBER 11045.01 **LOCATION** 3 North Street, Healdsburg, California

DATE STARTED 11/16/22 **COMPLETED** 11/16/22 **GROUND ELEVATION** **HOLE SIZE** 8"

DRILLING CONTRACTOR Pearson Exploration **GROUND WATER LEVELS:**

DRILLING METHOD 8" Hollow Stem Auger & 140lb Hammer ∇ **AT TIME OF DRILLING** 21.00 ft Groundwater encountered at 21.0 feet.

LOGGED BY AB **CHECKED BY** PJC **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		1.4" ASPHALTIC CONCRETE (AC) / 8.5" AGGREGATE BASE (AB).										
		0.8' - 9.5'; SANDY CLAY (CL); mottled dark brown, moist, very stiff, medium plasticity, with fine subrounded gravels (ALLUVIUM).										
			MC		12	3.5	92	24	40	22	18	
5			MC		11	3.5	93	22				
10		9.5' - 19.0'; SANDY CLAY (CL); mottled dark brown, moist, medium stiff to very stiff, high plasticity, moisture & plasticity increases at approx. 12.0 feet (ALLUVIUM).	MC		12	2.5	90	26				
15			MC		8	0.8(U)	97	27				
20		19.0' - 24.0'; SANDY CLAY (CL); mottled dark blue-gray, moist to saturated, medium plasticity, very stiff (ALLUVIUM).										

(Continued Next Page)

PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-2

CLIENT City of Healdsburg- Community Services Department **PROJECT NAME** Proposed Structural Upgrades

JOB NUMBER 11045.01 **LOCATION** 3 North Street, Healdsburg, California

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
20		19.0' - 24.0'; SANDY CLAY (CL); mottled dark blue-gray, moist to saturated, medium plasticity, very stiff (ALLUVIUM). *(continued)* ∇	MC		11			30				
		24.0' - 32.0'; SANDY CLAY (CL); blue-gray, saturated, stiff, medium plasticity, with fine to medium-grained sand seams (ALLUVIUM).										
25			SPT		5			25	36	15	21	
30			SPT		8			25				
		32.0' - 39.0'; CLAYEY GRAVEL (GC); brown-olive, saturated, dense, fine to coarse-grained, low plasticity fines (ALLUVIUM).										
35			SPT		49			10				
		39.0' - 50.5'; CLAYEY GRAVEL (GC); mottled brown and orange, saturated, fine to coarse-grained, dense, low to medium plasticity fines (ALLUVIUM).										
40			SPT		46			12				

(Continued Next Page)

PJC & Associates, Inc.

Consulting Engineers & Geologists

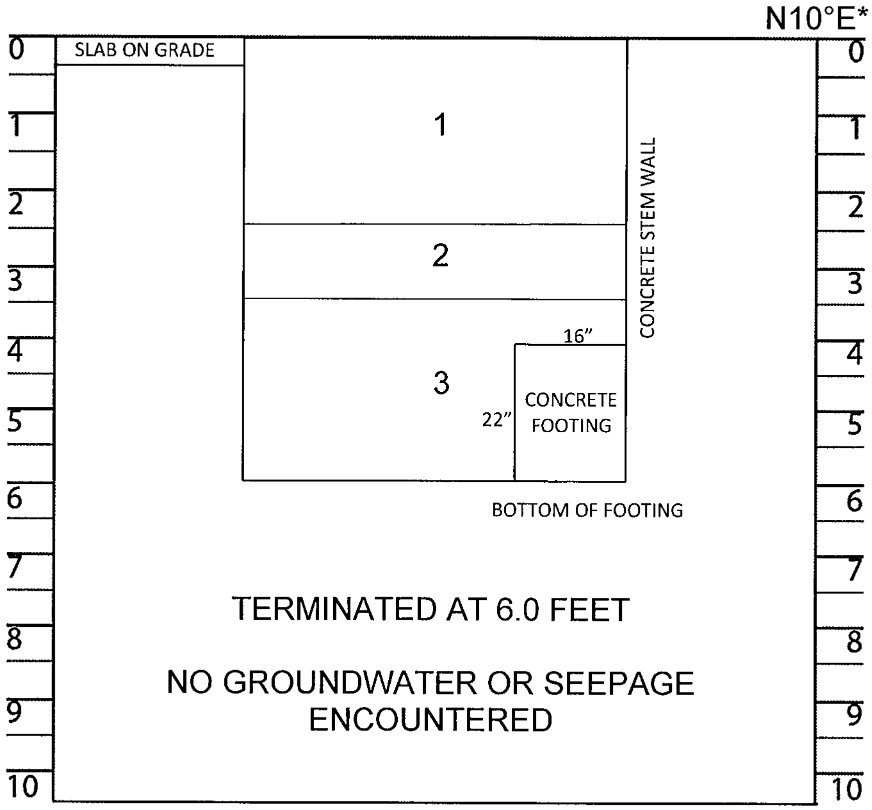
BORING NUMBER BH-2

CLIENT City of Healdsburg- Community Services Department **PROJECT NAME** Proposed Structural Upgrades

JOB NUMBER 11045.01 **LOCATION** 3 North Street, Healdsburg, California

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
		39.0' - 50.5'; CLAYEY GRAVEL (GC); mottled brown and orange, saturated, fine to coarse-grained, dense, low to medium plasticity fines (ALLUVIUM). *(continued)*										
45			SPT		44			11				13
50			SPT		42			13				

Bottom of borehole at 50.5 feet.



* ORIENTATION OF TEST PIT

LITHOLOGY

1) 0.0 – 2.5'; GRAVELLY SAND (SP); olive brown, slightly moist, loosely compacted, fine to coarse grained (FILL).

2) 2.5' – 3.5; SANDY SILT (ML); dark brown, slightly moist, stiff, low plasticity (ALLUVIUM).

3) 3.5' – 6.0'; GRAVELLY SAND (SP); olive brown, slightly moist, medium dense, fine to coarse grained (ALLUVIUM).

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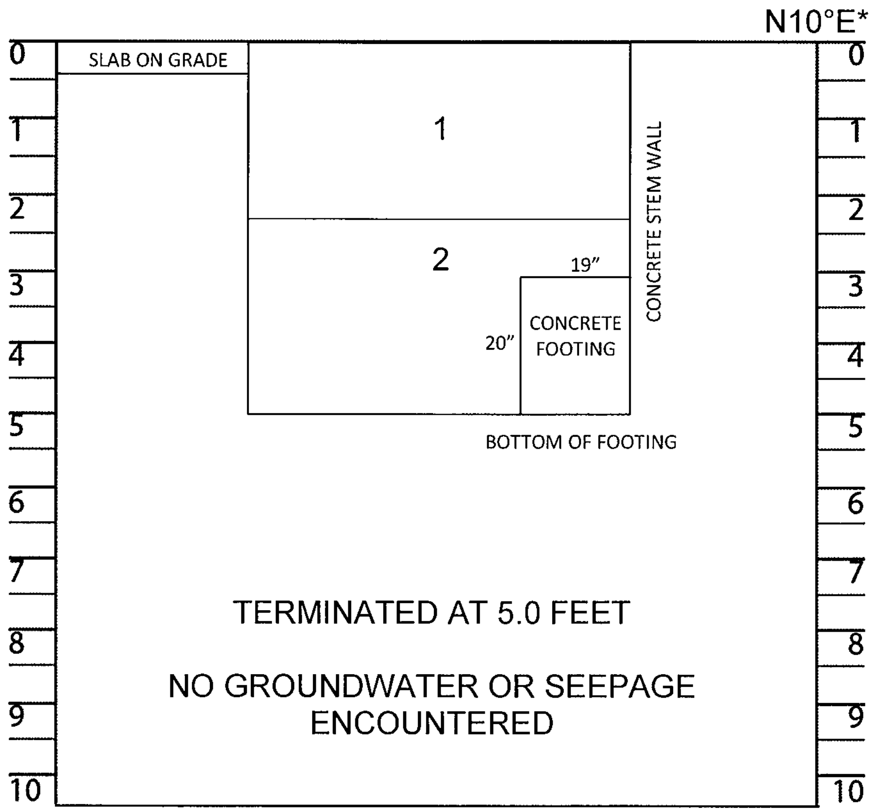
LOG OF TEST PIT 1
FOLEY FAMILY COMMUNITY PAVILLION
3 NORTH STREET
HEALDSBURG, CALIFORNIA

PLATE
5

Proj. No: 11045.01 Date: 12/2022 App'd by: PJC



* ORIENTATION OF TEST PIT

LITHOLOGY

1) 0.0 – 28"; SILTY SAND (SM); olive brown, slightly moist, well compacted, fine to coarse grained, with fine gravel (FILL).

2) 28" – 60"; SILTY SAND (SM); brown, slightly moist, medium dense, fine to medium grained (ALLUVIUM).

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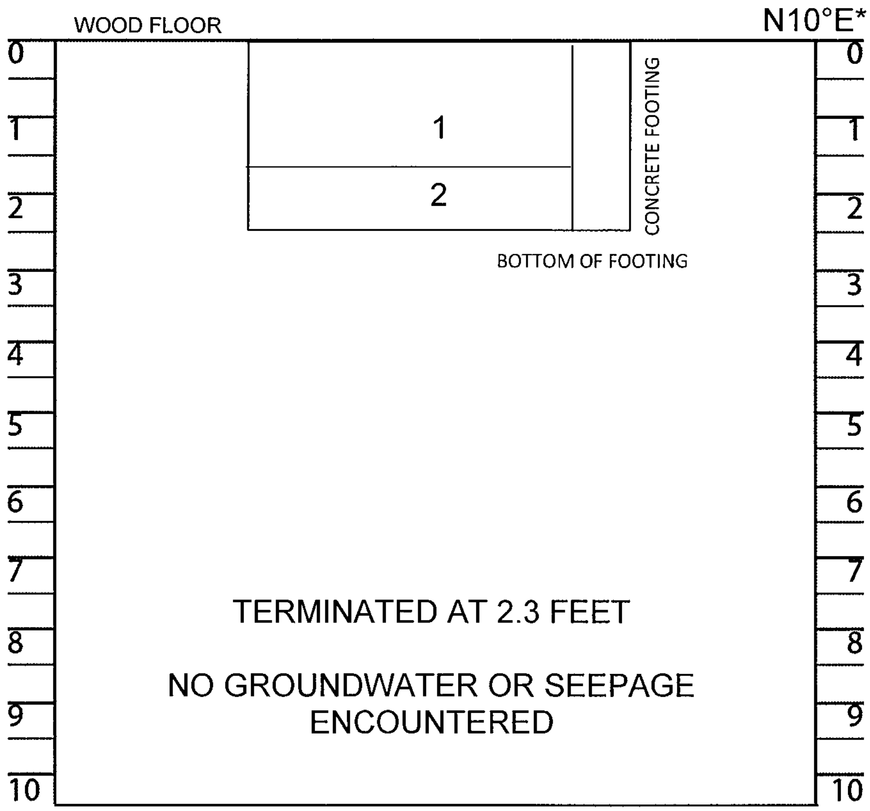
LOG OF TEST PIT 2
FOLEY FAMILY COMMUNITY PAVILLION
3 NORTH STREET
HEALDSBURG, CALIFORNIA

PLATE **6**

Proj. No: 11045.01 Date: 12/2022 App'd by: PJC

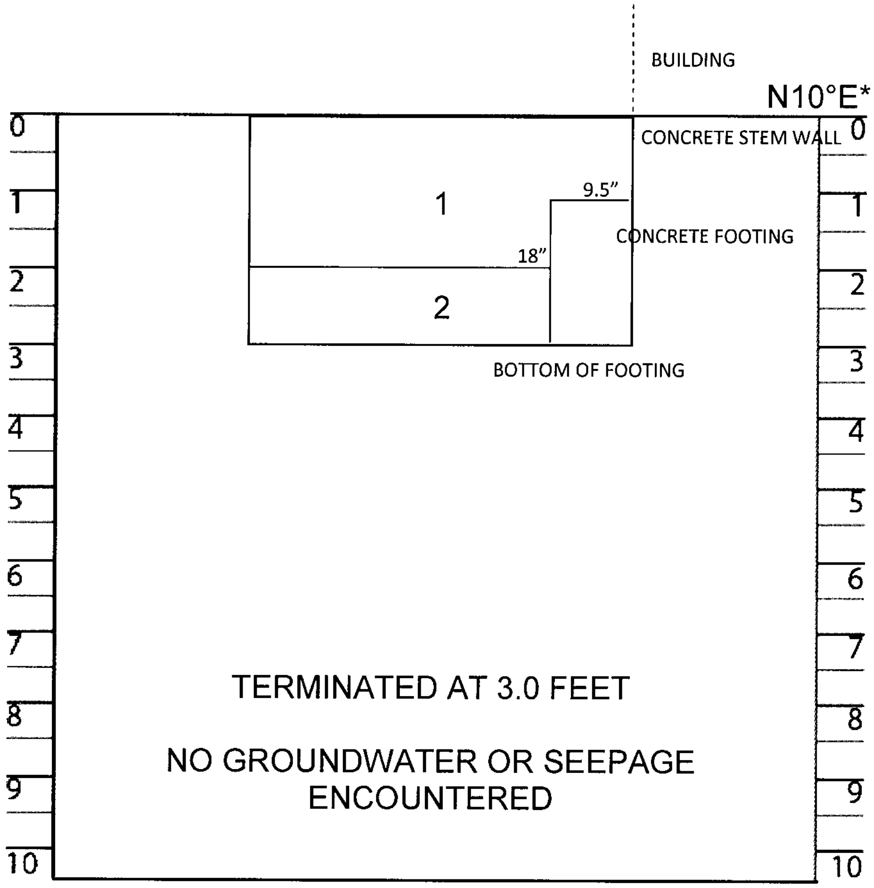


* ORIENTATION OF TEST PIT

LITHOLOGY

1) 0.0 – 20"; CONCRETE FOOTING

2) 20" –28"; SANDY CLAY (CL); brown, dry, hard, low plasticity (TOPSOIL).



* ORIENTATION OF TEST PIT

LITHOLOGY

1) 0.0 – 2.0'; SILTY SAND (SP); brown, slightly moist, dense, with gravel (FILL).

2) 2.0' – 3.0'; SANDY SILT (ML); grayish brown, slightly moist, hard, low plasticity (ALLUVIUM).

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than half is larger than #200 sieve	GRAVELS more than half coarse fraction is larger than no. 4 sieve size	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND MIXTURES
	SANDS more than half coarse fraction is smaller than no. 4 sieve size	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVEL-SAND MIXTURES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than half is smaller than #200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, VERY FINE SANDS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS OR LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 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 SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

KEY TO TEST DATA

LL — Liquid Limit (in %)
PL — Plastic Limit (in %)
G — Specific Gravity
SA — Sieve Analysis
Consol — Consolidation
"Undisturbed" Sample
Bulk or Disturbed Sample
No Sample Recovery

	Shear Strength, psf	Confining Pressure, psf	
*Tx	320	(2600)	Unconsolidated Undrained Triaxial
Tx CU	320	(2600)	Consolidated Undrained Triaxial
DS	2750	(2000)	Consolidated Drained Direct Shear
FVS	470		Field Vane Shear
*UC	2000		Unconfined Compression
LVS	700		Laboratory Vane Shear

Notes: (1) All strength tests on 2.8" or 2.4" diameter sample unless otherwise indicated
(2) * Indicates 1.4" diameter sample

APPENDIX B
LABORATORY INVESTIGATION

1. INTRODUCTION

This appendix includes a discussion of the test procedures of the laboratory tests performed by PJC for use in the geotechnical study. The testing was carried out employing, whenever practical, currently accepted test procedures of the American Society for Testing and Materials (ASTM).

Disturbed samples used in the laboratory investigation were obtained from various locations during the course of the field investigation, as discussed in Appendix A of this report. Identification of each sample is by test pit number and depth. All of the various laboratory tests performed during the course of the investigation are described below.

2. INDEX PROPERTY TESTING

In the field of soil mechanics and geotechnical engineering design, it is advantageous to have a standard method of identifying soils and classifying them into categories or groups that have similar distinct engineering properties. The most commonly used method of identifying and classifying soils according to their engineering properties is the Unified Soil Classification System as described by ASTM D-2487. The USCS is based on a recognition of the various types and significant distribution of soil characteristics and plasticity of materials. The index properties tests discussed in this report include the determination of natural water content and dry density, gradation analysis and Atterberg Limits.

a. Dry Density and Natural Water Content. Dry Density and natural water content was determined on selected undisturbed and disturbed samples. The samples were visually classified and accurately measured to obtain volume and weighed to obtain wet weight. The samples were then dried, in accordance with ASTM D-2216-80, for a period of 24 hours in an oven maintained at a temperature of 100 degrees C. After drying, the weight of each sample was determined and the moisture content calculated. Dry density and natural water content of the soils is presented on the borehole logs.

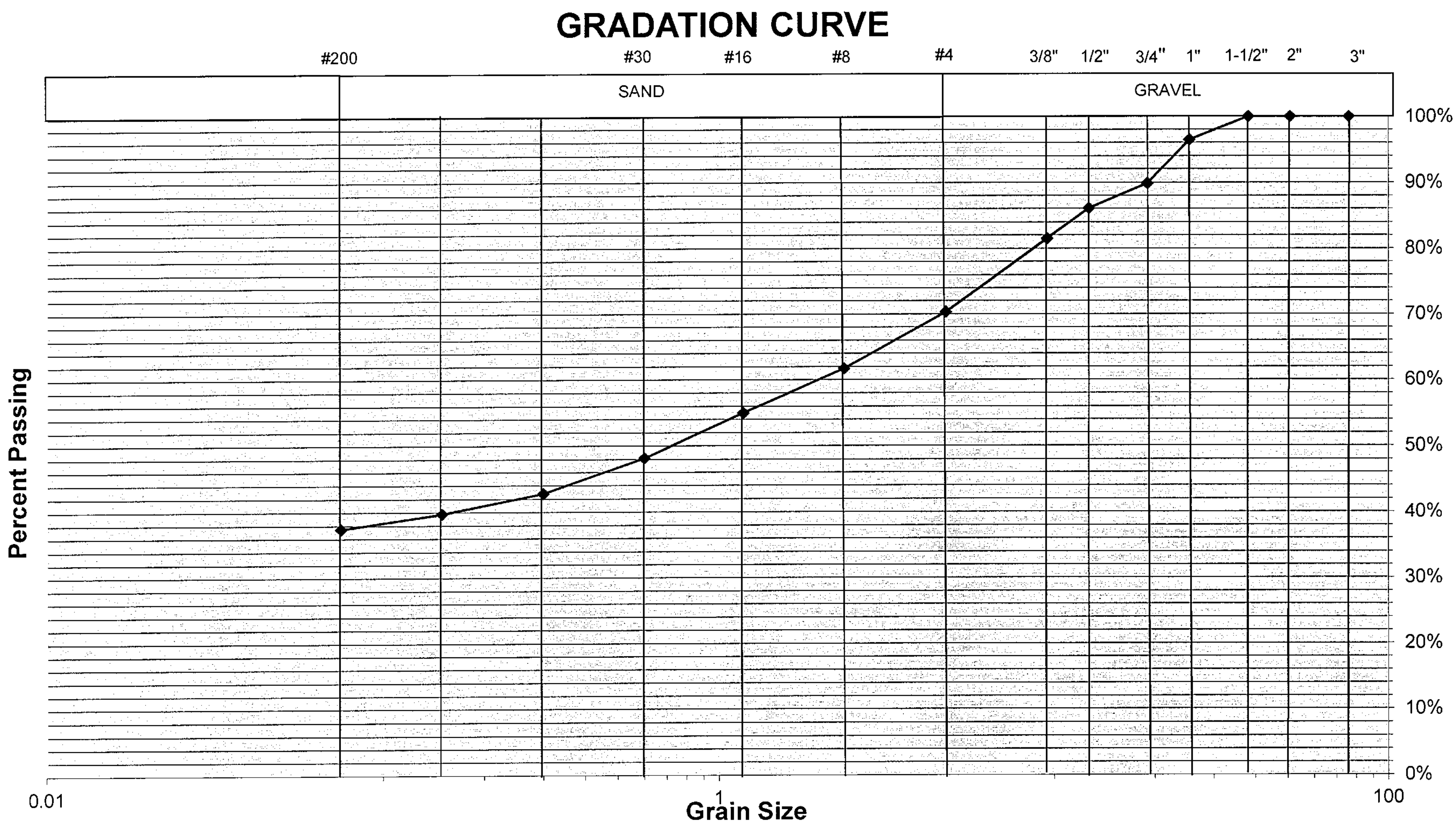
b. Sieve Analysis. The gradation characteristics of selected samples were determined in accordance with ASTM D422-63. The sample was soaked in water until individual soil particles were separated and then washed on the No. 200 mesh sieve. That portion of the material retained on the No. 200 mesh sieve was oven-dried and then mechanically sieved. The grain-size distribution tests are presented on Plates 10 and 11.

c. Atterberg Limits. Liquid and plastic limits were determined on a selected sample in accordance with ASTM D4318. The test results are presented on the borehole logs.

3. ENGINEERING PROPERTIES TESTING

The engineering properties testing consisted of unconfined compression.

a. Unconfined Compression Test. Unconfined compression tests were performed on intact samples obtained from the boreholes. In the unconfined compression test, the shear strength is determined by axial loading the sample under a slow constant strain rate until failure is obtained. Failure stress is defined as the maximum stress at ten percent strain. The results of these tests are presented on the borehole logs.



Sample: BH-1 at 39.0 to 40.0 feet; Brown with Orange Clayey Sand with Gravel (SC).

SIEVE ANALYSIS
PROPOSED STRUCTURAL UPGRADES
3 NORTH STREET
HEALDSBURG, CALIFORNIA

PLATE 10

Proj. No: 11045.01

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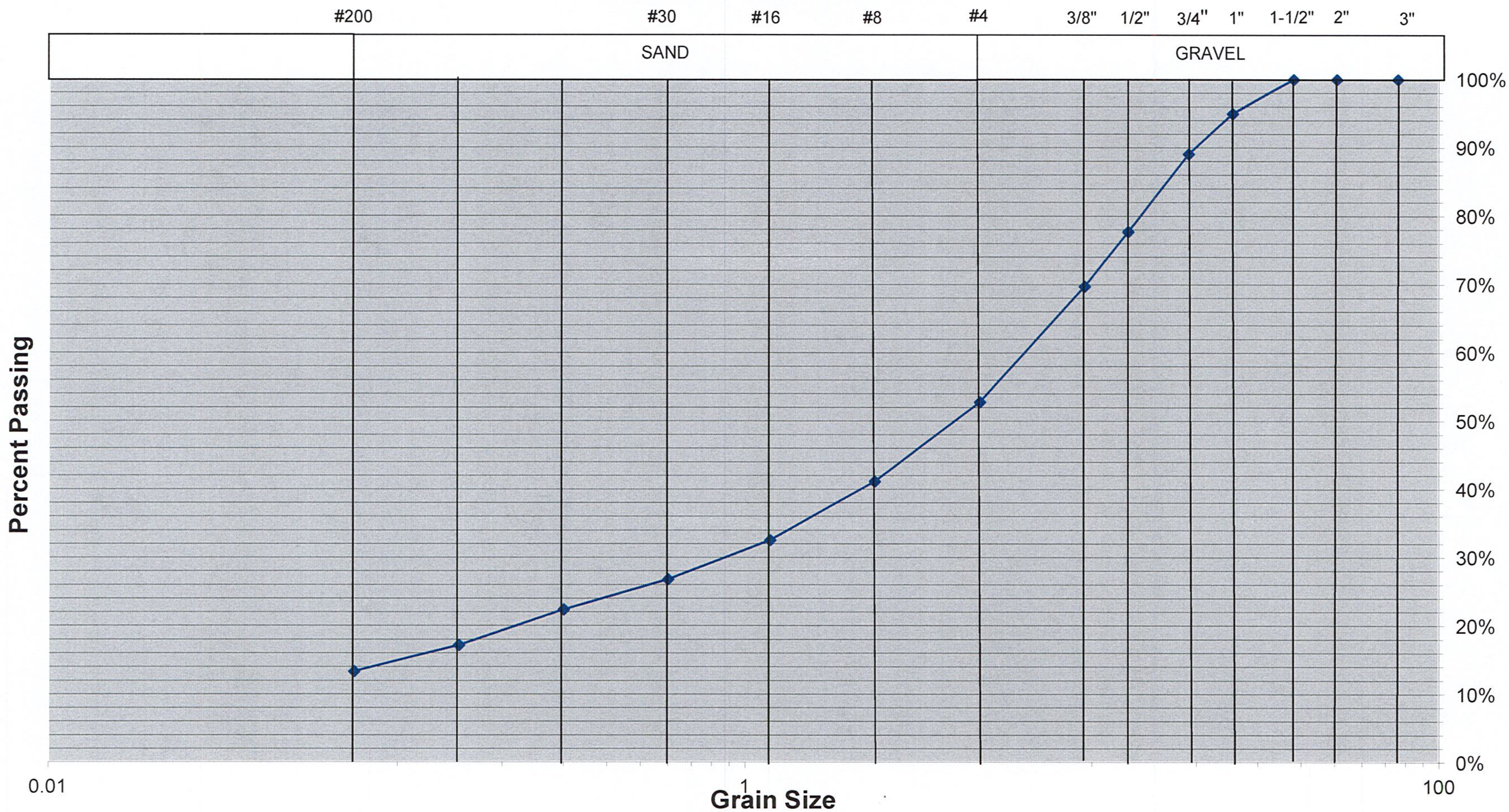
Date: 12/2022

GRADATION CURVE



Sample: BH-2 at 44.0 to 45.0 feet; Mottled Brown and Orange Clayey Gravel (GC).

SIEVE ANALYSIS
PROPOSED STRUCTURAL UPGRADES
3 NORTH STREET
HEALDSBURG, CALIFORNIA

PLATE 11

Proj. No: 11045.01

App'd by: PJC

Date: 12/2022

APPENDIX C
REFERENCES

1. "Foundations and Earth Structures" Department of the Navy Design Manual 7.2 (NAVFAC DM-7.2), dated May 1982.

2. "Soil Dynamics, Deep Stabilization, and Special Geotechnical Construction" Department of the Navy Design Manual 7.3 (NAVFAC DM-7.3), dated April 1983.

3. Preliminary Geologic Map of the Healdsburg 7.5 Minute, prepared by the California Geological Survey, dated 2011.

4. Geology for Planning in Sonoma County, Special Report 120, California Division of Mines and Geology, 1980.

5. "Soil Mechanics" Department of the Navy Design Manual 7.1 (NAVFAC DM-7.1), dated May 1982.

6. USGS Healdsburg, California Quadrangle 7.5-Minute Topographic Map, photo-revised 1980.

7. Association of Bay Area Governments (ABAG), Interactive Hazard Maps, dated June 2009.

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10. Bowels, Joseph, Engineering Properties of Soils and Their Measurement. 4th Edition, 1992.

11. California Building Code (CBC), 2019 edition.

12. ASCE STANDARD ASCE/SEI 7-16, prepared by the American Society of Civil Engineers.

13. Preliminary Project Plans prepared by TLCD Architecture, Alan B. Cohen and MKM & Associates, dated August 8, 2022.