GEOTECHNICAL INVESTIGATION REPORT

PROPOSED TELECOMMUNICATIONS FACILITY

SOUTH PLACERVILLE, SITE NUMBER: CVL00786
500 JIM HILL ROAD
EL DORADO COUNTY, CALIFORNIA
MPE NO. 04537-01

July 17, 2019
MPE No. 04537-01

Mr. Andrew Medina
Epic Wireless Group LLC
605 Coolidge Drive, Suite 100
Folsom, California 95630

Subject: Geotechnical Investigation
Proposed Telecommunications Facility
South Placerville, Site Number: CVL00786
500 Jim Hill Road
El Dorado County, California

Dear Mr. Medina:

Mid Pacific Engineering is pleased to present the attached geotechnical investigation report for a proposed telecommunications facility to be located at 500 Jim Hill Road in the Placerville area of El Dorado County, California. Results of our study indicate the site is not within a current Earthquake Fault Zone or other area known to possess a significant geologic risk to site development. Further, we anticipate conventional grading practices may be used for most site earthwork activities (if any) and that a mat foundation may be used for support of the proposed steel monopole tower; foundation support for the planned prefabricated equipment shelter may be provided using shallow spread footings and/or a mat foundation.

Though we anticipate the site may be developed generally using conventional grading and foundation construction techniques, it should be noted conditions were identified by our field exploration program that may require special design and/or construction provisions for some project components. A brief summary of these conditions, as well as possible design and/or construction provisions to address these potential concerns, are outlined below.

- Potentially expansive, near-surface clay soils were encountered during our field exploration program. The presence of potentially expansive clay soils may require special design and construction provisions for planned shelter foundations and slabs. Such provisions could include deepening some foundations and reinforcing or otherwise strengthening foundations and slabs to resist earth pressures associated with expansive clay soils.

- Soils containing cobble-to-boulder size rock fragments were encountered during our field investigation at depths in excess of approximately two feet below existing site grade. In addition, weathered sedimentary rock was initially encountered at an approximate depth of three feet below existing grade. In our opinion, the presence of cobble-to-boulder size rock fragments within on-site soils and sedimentary rock will hinder most (if not all) site excavations, necessitating the use of a mat foundation to support the planned tower (i.e., a drilled pier foundation system would not be applicable for this site).

- The presence of shallow rock may also impact trench (and other shallow) excavations into these materials. In our opinion a large, track-mounted excavator, possibly equipped with a single ripper tooth, hydraulic percussion hammer, rock wheel, or other similar equipment specifically intended for rock removal may be required to advance some (if not most) site excavations.

- In addition to excavation difficulties, perched water may develop above on-site rock subsequent to wet weather. The presence of perched groundwater could hinder trenching operations and may necessitate the use of a sump or other type of dewatering system for some trench and/or other earthwork excavations.

Specific comments regarding the conditions outlined above, as well as recommendations regarding the geotechnical aspects of project design and construction, are presented in the following report.

We appreciate the opportunity of providing our services for this project. If you have questions regarding this report or if we may be of further assistance, please contact the undersigned.

Sincerely,

Mid Pacific Engineering, Inc.

Woody Joe Pollard, C.E.G. *07/17/2019*
Project Geologist

Todd Kamisky, P.E. *07/17/2019*
Principal Engineer

cc: Client (One copy sent via email)

TABLE OF CONTENTS

INTRODUCTION **1**
GENERAL 1
PROPOSED CONSTRUCTION 2
SCOPE OF SERVICES 2
FIELD INVESTIGATION **3**
SITE CONDITIONS **3**
GEOLOGY AND SEISMICITY 3
SURFACE 4
SUBSURFACE 4
CONCLUSIONS AND RECOMMENDATIONS **5**
GENERAL 5
GEOLOGIC HAZARDS 6
EXPANSIVE SOIL 8
SURFACE DRAINAGE 8
SHALLOW ROCK 8
EARTHEN SLOPES 9
TOWER FOUNDATION - MAT 10
EQUIPMENT SHELTER FOUNDATIONS 11
CONCRETE SLABS SUPPORTED-ON-GRADE 13
SITE ACCESS ROADWAY 16
ADDITIONAL SERVICES **17**
LIMITATIONS **17**

FIGURES 1 THROUGH 5

REDDING
530-246-9499 p
530-246-9527 f

WEST SACRAMENTO
916-927-7000 p
916-372-9900 f

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED TELECOMMUNICATIONS FACILITY
SOUTH PLACERVILLE, SITE NUMBER: CVL00786
500 JIM HILL ROAD
EL DORADO COUNTY, CALIFORNIA
MPE NO. 04537-01

INTRODUCTION

GENERAL

This report presents the results of our geotechnical investigation for a proposed telecommunications facility to be located at 500 Jim Hill Road in the Placerville area of El Dorado County, California. The purpose of our investigation was to explore and evaluate the subsurface conditions at the site in order to develop recommendations related to the geotechnical aspects of project design and construction.

The project site is located within the northwest portion of the U.S. Geological Survey (USGS) 7.5 minute *Camino quadrangle* at coordinates[1] N 38° 42' 42" (38.7117), W 120° 43' 15" (120.7208). The approximate site location relative to existing topographic features and roads is shown on Figure 1.

PROPOSED CONSTRUCTION

We understand the proposed project will involve construction of a telecommunications facility which will include the installation of a 160-foot-high, steel monopole tower (configured to resemble a pine tree) as well as a prefabricated equipment shelter supported-on-grade. Appurtenant construction may include underground utilities and possibly a partially improved site access roadway.

Based on our review of available grading plans prepared Adaptive Re-Use Engineering (dated March 18, 2019), it appears earthwork cuts and fills required to achieve a level

[1] Datum reference: North American Datum of 1983.

building pad (or pads), provide for site access and drainage, or other similar purpose will generally be less than approximately two feet in vertical extent. Excavations for below-grade utilities are not anticipated to exceed approximately five feet below final site grades.

A Test Pit Location Map indicating the proposed project area is presented on Figure 2.

SCOPE OF SERVICES

The scope of our services was outlined in our proposal dated June 11, 2019, and included the following:

- ► Review readily available (and relevant) literature pertaining to site geology, faulting, and seismicity.

- ► Exploration of the subsurface conditions at the site by excavating, logging, and sampling three exploratory test pits.

- ► Preparation of this report which includes:

  - A description of the proposed project;

  - A summary of our field exploration program;

  - A description of site surface and subsurface conditions encountered during our field investigation;

  - Our comments regarding potential geologic hazards which could affect the site or proposed project;

  - California Building Code (CBC, 2016 edition) seismic parameters; and

  - Recommendations related to the geotechnical aspects of site preparation and engineered fill, temporary excavations and trench backfill, earthen slopes, foundation design and construction, concrete slabs supported-on-grade, and a partially improved site access roadway.

FIELD INVESTIGATION

Subsurface conditions at the site were explored on July 1, 2019, by excavating three test pits (designated TP-1 through TP-3) to approximate depths of four to 7½ feet below existing site grade. The test pits were excavated using a Kubota U27-4, track-mounted excavator equipped with a 12-inch-wide bucket. The approximate locations of the test pits excavated for this investigation are shown on Figure 2.

Note: All of the test pits excavated for this investigation were prematurely terminated (i.e., reached depths less than initially planned) due to essential bucket refusal on rock.

Our engineer maintained a log of the test pits, visually classified the soils and rock encountered according to the Unified Soil Classification System (see Figure 3) or Rock Classification Legend (see Figure 4), respectively, and obtained representative samples of the subsurface materials. After the test pits were completed, they were loosely backfilled with the excavated material. Logs of the exploratory test pits excavated for this investigation are presented on Figures 5 and 6.

SITE CONDITIONS

GEOLOGY AND SEISMICITY

Geologic Setting

The project site is located within the western portion of the Sierra Nevada geomorphic province of California, a strongly asymmetric mountain range with a long gentle western slope and a high and steep eastern escarpment. The Sierra Nevada is 50 to 80 miles wide, and runs through eastern California for more than 400 miles (from the Mojave Desert on the south to the Cascade Range and the Modoc Plateau on the north).

In the north half of the range the batholith is flanked on the west by the western metamorphic belt, a terrane of strongly deformed, but weakly metamorphosed sedimentary and volcanic rocks of Paleozoic and Mesozoic age. Farther south, scattered remnants of metamorphic rock are found within the batholith, especially in the western foothills and along the crest in the east-central Sierra Nevada.

Geologic mapping of the Placerville area compiled by D.L. Wagner, E.J. Bortugno and R.D. McJunkin [2] indicates the site lies within an area of Tertiary-age sedimentary rock. Results of our subsurface investigation generally confirmed the presence of sedimentary rock at the site overlain by a thin veneer of soil.

Faulting and Seismicity

The project site is located within an area of California generally not characterized by an abundance of active faulting. No active faults (or fault zones) are located within the site vicinity, nor is the site within a current Earthquake Fault Zone. In general, seismic ground shaking at the site would be due to movement on more distant faults.

SURFACE

The project site consists of a rectangular shaped area located at 500 Jim Hill Road in the Placerville area of El Dorado County, California. The site is bounded to all sides by undeveloped, semi-rural residential property. At the time of our field investigation, the site area was covered with low weeds, brush, and grasses. Existing topography within the immediate site area sloped gently down towards the south.

SUBSURFACE

Near-surface earth materials encountered in the test pit excavated for this investigation consisted predominantly of sandy silt to an approximate depth of two feet below existing site grade. Below these near-surface soils, sandy clay underlain by weathered sedimentary rock was encountered to the maximum depth explored (approximately 7½ feet below existing site grade).

No free groundwater was encountered during our field investigation. However, it should be recognized groundwater conditions can vary depending on location, time of the year, duration and amount of recent (and past) precipitation, runoff conditions (both on- and off-site), and possibly other factors either not present or readily apparent at the time of our field investigation. Therefore, groundwater conditions presented in this report may not be representative of those which may be encountered during or subsequent to construction.

A more detailed description of the subsurface conditions encountered during our field investigation is provided on the attached log.

---

[2] Reference: "Geologic Map of the Sacramento Quadrangle," California, California Division of Mines and Geology, compiled by D.L. Wagner, E.J. Bortugno and R.D. McJunkin, 1981.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Results of our study indicate the site is not within a current Earthquake Fault Zone or other area known to possess a significant geologic risk to site development. Further, we anticipate conventional grading practices may be used for most site earthwork activities (if any) and that a mat foundation may be used for support of the proposed steel monopole tower; foundation support for the planned prefabricated equipment shelter may be provided using shallow spread footings and/or a mat foundation.

Though we anticipate the site may be developed generally using conventional grading and foundation construction techniques, it should be noted conditions were identified by our field exploration program that may require special design and/or construction provisions for some project components. A brief summary of these conditions, as well as possible design and/or construction provisions to address these potential concerns, are outlined below.

- Potentially expansive, near-surface clay soils were encountered during our field exploration program. The presence of potentially expansive clay soils may require special design and construction provisions for planned shelter foundations and slabs. Such provisions could include deepening some foundations and reinforcing or otherwise strengthening foundations and slabs to resist earth pressures associated with expansive clay soils.

- Soils containing cobble-to-boulder size rock fragments were encountered during our field investigation at depths in excess of approximately two feet below existing site grade. In addition, weathered sedimentary rock was initially encountered at an approximate depth of three feet below existing grade. In our opinion, the presence of cobble-to-boulder size rock fragments within on-site soils and sedimentary rock will hinder most (if not all) site excavations, necessitating the use of a mat foundation to support the planned tower (i.e., a drilled pier foundation system would not be applicable for this site).

- The presence of shallow rock may also impact trench (and other shallow) excavations into these materials. In our opinion a large, track-mounted excavator, possibly equipped with a single ripper tooth, hydraulic percussion hammer, rock wheel, or other similar equipment specifically intended for rock removal may be required to advance some (if not most) site excavations.

- In addition to excavation difficulties, perched water may develop above on-site rock subsequent to wet weather. The presence of perched groundwater could hinder trenching operations and may necessitate the use of a sump or other type of dewatering system for some trench and/or other earthwork excavations.

Specific comments regarding the conditions outlined above, as well as recommendations regarding the geotechnical aspects of project design and construction, are presented in the following sections of this report.

GEOLOGIC HAZARDS

Ground Rupture

No active faults are known to cross the site area, nor is the site within a current Earthquake Fault Zone. Therefore, it is our professional opinion that the potential for ground rupture (or other similar effect) at the site in the event of a seismic event is unlikely.

CBC Seismic Design Parameters

In the event the California Building Code (CBC, 2016 edition) is used for seismic design, it is our opinion encountered subsurface conditions (and those suspected below the maximum depth explored) would warrant a type C (i.e., very dense soil and soft rock) Site Classification. Further, using software provided by the Structural Engineers Association of California in association with the California Office of Statewide Health Planning and Development (SEAOC/OSHPD), site-specific spectral response acceleration parameters were obtained for the maximum considered earthquake and are summarized in the table on the following page.

Spectral Response Acceleration Parameters		Value
Mapped spectral acceleration for short periods	S_S	0.490g
Mapped spectral acceleration at 1-second period	S_1	0.228g
Site coefficient for short periods	F_a	1.200
Site coefficient at 1-second period	F_v	1.572
Adjusted earthquake spectral response acceleration for short periods	S_{MS}	0.588g
Adjusted earthquake spectral response acceleration at 1-second period	S_{M1}	0.358g
Design earthquake spectral response acceleration for short periods	S_{DS}	0.392g
Design earthquake spectral response acceleration at 1-second period	S_{D1}	0.239g

Liquefaction

Liquefaction is a phenomenon whereby loose, saturated, granular soil deposits lose a significant portion of their shear strength due to excess pore water pressure buildup resulting from cyclic loading, such as that caused by an earthquake. Among other effects, liquefaction can result in densification of such deposits after an earthquake as excess pore pressures are dissipated (and hence settlements of overlying deposits). The primary factors deciding liquefaction potential of a soil deposit are: (1) the level and duration of seismic ground motions; (2) the type and consistency of the soils; and (3) the depth to groundwater.

Subsurface earth materials encountered during our field investigation generally consisted of sandy silt and sandy clay underlain (at a relatively shallow depth) by weathered sedimentary rock. No free groundwater was encountered during our field investigation.

Given the presence of shallow rock encountered during our field investigation, it is our professional opinion that the potential for liquefaction at the site during or subsequent to a seismic event is unlikely.

Ground Subsidence

Ground subsidence within the site area would typically be due to densification of subsurface soils during or subsequent to a seismic event. Generally, loose, granular soils would be most susceptible to densification, resulting in ground subsidence.

Given the presence of shallow rock encountered during our field investigation, it is our professional opinion that the potential for significant ground subsidence at the site during or subsequent to a seismic event is unlikely.

Landslides

No landslides or indications of slope instability were visually identified during our field investigation nor is the site within an area of mapped landslide activity. Since earthwork grading for the project will likely only result in shallow, sloped (or braced) excavations, it is our professional opinion that landsliding is unlikely at the site and that earthwork grading (if implemented using accepted construction practices) should not result in a potential for slope instability within or in the immediate vicinity of the site.

EXPANSIVE SOIL

Based on the results of our field exploration program, near-surface clay soils located at the site may be expansive. Expansive soils are characterized by their ability to undergo significant volume change (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from rainfall, landscape irrigation, utility leakage, roof drainage, drought, or other factors, and may cause unacceptable settlement or heave of structures, concrete slabs supported-on-grade, or pavements supported over these materials.

Though several options are available to reduce potential adverse effects of expansive soils on planned project improvements, we anticipate the most applicable method for this project would involve moisture conditioning slab subgrade soils and strengthening equipment shelter foundations and slabs. Recommendations addressing expansive soils with respect to equipment shelter foundations and slabs are provided below (see sections titled "SURFACE DRAINAGE", "EQUIPMENT SHELTER FOUNDATIONS", and "CONCRETE SLABS SUPPORTED-ON-GRADE").

SURFACE DRAINAGE

The ground surface surrounding the proposed equipment shelter should be sloped to facilitate surface drainage away from the planned structure and to eliminate the possibility of water accumulation in or around foundation areas.

SHALLOW ROCK

Weathered sedimentary rock was encountered in the test pit excavated for this investigation at an approximate depth of three feet below existing site grade. Based on this experience, as well as our general knowledge of the site area, we anticipate trench (and other shallow) excavations into these materials may be difficult with a conventional backhoe. Therefore, a large, track-mounted excavator, possibly equipped with a single ripper tooth, hydraulic percussion hammer, rock wheel, or other similar equipment specifically intended for rock removal may be required to advance some (if not most) on-site excavations.

In addition to excavation difficulties, perched water may develop above on-site rock subsequent to wet weather. The presence of perched groundwater could hinder trenching operations and may necessitate the use of a sump or other type of dewatering system for some trench and/or other earthwork excavations (see section below titled: "TEMPORARY DEWATERING").

EARTHEN SLOPES

General

Earthen cut and fill slopes less than five feet in height may be constructed at a gradient of 2(h):1(v) or flatter; slopes in excess of five feet should be constructed at a gradient of 2½(h):1(v) or flatter. All cut and fill slopes should be revegetated with deep rooted, perennial grasses or other suitable method soon after construction. To further reduce the potential for erosion, surface runoff should not be allowed to flow onto, over, or across any on-site slope(s) more than a few feet in height. Typically, surface runoff water may be intercepted and redirected using a small berm or shallow gutter (placed at the top of the slope), or by grading adjacent areas to drain away from the top of all downward trending slopes.

Setbacks

Structures located near the top (or bottom) of a slope steeper than 3(h):1(v) should maintain a minimum set-back in accordance with requirements outlined in Section 1808.7 of the California Building Code (CBC, 2016 edition), or three feet (measured horizontally from the top or bottom of slope to the closest point of approach of the structure), whichever is greater. All other planned surface improvements (including pavements, sidewalks, etc.) should not be placed any closer than three feet (measured horizontally) from the top of any slope steeper than 3(h):1(v). In the event below-grade improvements (such as underground utilities) are to be located within the vicinity (and parallel) to any slope faces steeper than 3(h):1(v), these features should not be placed any closer than five feet (measured horizontally) from the nearby slope face.

TOWER FOUNDATION - MAT

General

Due to the presence of on-site rock, we anticipate it would be difficult to construct a conventional drilled, cast-in-place concrete pier foundation to support the planned tower. Hence, provided below are geotechnical parameters for the design and construction of a mat foundation. In general, we recommend this proposed mat be constructed of reinforced concrete, a minimum of five feet wide, embedded a minimum of six feet below the lowest adjacent final subgrade[3] or two feet into competent rock, whichever is deeper, and founded on undisturbed and/or rock.

Allowable Bearing Pressure

An allowable bearing pressure of 2,500 pounds per square foot (psf) may be used for the design of a mat foundation with the above minimum dimensions. The allowable bearing pressure provided is a net value; therefore, the weight of the foundation (which extends below finished subgrade) may be neglected when computing dead loads. The allowable bearing pressure provided herein applies to dead plus live loads, includes a calculated minimum factor of safety of three, and may be increased by 1/3 for short-term loading due to wind or seismic forces. For a mat foundation subject to overturning, the maximum edge pressure should not exceed the allowable bearing pressure.

Estimated Settlement

Based on anticipated foundation dimensions and loads, we estimate maximum settlement of the proposed mat foundation to be on the order of 1/2-inch. Settlement of this foundation is expected to occur rapidly, and should be essentially complete shortly after initial application of the loads.

Overturning Resistance

Overturning tower forces may be resisted by the weight of the proposed concrete mat foundation (and any soil and/or processed on-site rock placed over this foundation) and edge bearing of the foundation on undisturbed on-site soil and/or rock. If soil (and/or processed on-site rock) is to be placed over the proposed mat, the unit weight of this material may be taken as 100 pounds per cubic foot.

[3] Within this report, final subgrade refers to the top surface of undisturbed on-site soil or rock, on-site soil compacted during site preparation, and/or engineered fill.

Lateral Resistance

Resistance to lateral loads (including those due to wind or seismic forces) may be provided by frictional resistance between the bottom of the proposed concrete mat foundation and the underlying soil and/or rock, and by passive earth pressure against the sides of the foundation. A coefficient of friction of 0.35 may be used between cast-in-place concrete foundations and the underlying soil and/or rock; passive pressure available in undisturbed on-site soil, rock, and/or engineered fill may be taken as equivalent to the pressure exerted by a fluid weighing 350 pounds per cubic foot (pcf). To account for the possible future loss of subgrade support due to surface disturbance, we recommend earth materials located within the uppermost one foot of the embedded portion of the proposed tower mat foundation be neglected when evaluating passive resistance.

Friction and passive pressure parameters provided above are ultimate values. Therefore, a suitable factor of safety should be applied to these values for design purposes. The appropriate factor of safety will depend on the design condition and should be determined by the project Structural Engineer. Depending on the application, typical factors of safety could range from 1.0 to 1.5. Frictional and passive resistance may be used in combination, provided a suitable factor of safety is applied to these values during design.

Construction Considerations

Prior to placing steel or concrete, the excavation for the proposed tower mat foundation should be cleaned of all debris, loose or disturbed soil and/or rock, and any water.

EQUIPMENT SHELTER FOUNDATIONS

General

Foundation support for the planned equipment shelter may be provided using either spread footings or a mat foundation (mat foundations should typically consist of a slab with thickened edges). In general, these proposed foundations should be constructed of reinforced concrete and founded on undisturbed native soil, on-site rock, and/or engineered fill. In addition, we recommend all spread footings be a minimum of 12 inches wide and embedded a minimum of 18 inches below the lowest adjacent final subgrade; the thickened edge of all mat slab foundations should also be embedded a minimum of 18 inches below the lowest adjacent final subgrade. Further, spread footings (if used) should be continuous around the entire perimeter of the planned structure to limit surface water infiltration into subgrade soils supporting interior concrete slabs.

Allowable Bearing Pressure

An allowable bearing pressure of 1,500 pounds per square foot (psf) may be used for the design of proposed spread and/or mat foundations which possess the above minimum dimensions. The allowable bearing pressure provided is a net value; therefore, the weight of the foundation (which extends below finished subgrade) may be neglected when computing dead loads. The allowable bearing pressure provided herein applies to dead plus live loads, includes a calculated minimum factor of safety of three, and may be increased by 1/3 for short-term loading due to wind or seismic forces. For mat foundations subject to overturning forces, the maximum edge pressure should not exceed the allowable bearing pressure.

Lateral Resistance

Resistance to lateral loads (including those due to wind or seismic forces) may be provided by frictional resistance between the bottom of proposed concrete foundations and the underlying soil or rock, and by passive earth pressure against the sides of the foundations. A coefficient of friction of 0.25 may be used between cast-in-place concrete foundations and the underlying soil or rock; passive pressure available in undisturbed native soil, on-site rock, and/or engineered fill may be taken as equivalent to the pressure exerted by a fluid weighing 250 pounds per cubic foot (pcf). To account for possible future loss of subgrade support due to surface disturbance, we recommend earth materials located within the uppermost six inches of the embedded portion of all shallow foundations be neglected when evaluating passive pressures.

Lateral resistance parameters provided above are ultimate values. Therefore, a suitable factor of safety should be applied to these values for design purposes. The appropriate factor of safety will depend on the design condition and should be determined by the project Structural Engineer. Depending on the application, typical factors of safety could range from 1.0 to 1.5.

Foundation Reinforcement

We recommend exterior perimeter footings (if used) be reinforced with steel to reduce distress due to pressures associated with possible swelling or shrinking of potentially expansive subgrade soils. Based on our experience with similar projects, reinforcement to distribute pressures associated with expansive subgrade soils would typically involve a minimum of two No. 4 bars, top and bottom (i.e., a total of four bars). If a mat foundation is used to support the planned equipment shelter (or shelters), reinforcement would typically involve a minimum of No. 4 bars, a minimum of 24 inches on-center, each way, and centered within the slab. Concrete used for shelter foundations should have a minimum 28-day compressive strength of 2,500 pounds per square inch (psi).

It should be noted reinforcing and concrete guidelines provided above address only expansive soils. Reinforcing and/or concrete parameters beyond those indicate above may be necessary to accommodate structural requirements of the project.

Setbacks

Structures located near the top (or bottom) of a slope steeper than 3(h):1(v) should maintain a minimum set-back in accordance with requirements indicate in Section 1808.7 of the California Building Code (CBC, 2016 edition), or three feet (measured horizontally from the top or bottom of slope to the closest point of approach of the structure), whichever is greater.

Construction Considerations

Prior to placing steel or concrete, foundation excavations should be cleaned of all debris, loose or disturbed soil or rock, and any water.

CONCRETE SLABS SUPPORTED-ON-GRADE

Subgrade Preparation

Subgrade soils supporting concrete floor slabs should be scarified to a depth of eight inches, uniformly moisture conditioned to a minimum of three (but generally no more than approximately five) percent above the optimum moisture content, and compacted to a minimum of 88 (but generally no more than approximately 92) percent relative compaction. Scarification and compaction may be omitted if slabs are to be placed directly on undisturbed on-site rock and/or engineered fill and if approved by the project Geotechnical Engineer.

Subgrade Moisture

We recommend the moisture content of subgrade soils supporting concrete floor slabs be a minimum of three percent above optimum moisture content at the time of concrete placement. Recommended soil moisture contents may be established either during site grading (and maintained up to the time of concrete placement) or by ponding or sprinkling with water. Over optimum moisture conditions (of the subgrade soils) should extend a minimum of 12 inches below finished subgrade and should be verified by Mid Pacific Engineering just prior to placement of slab concrete.

Steel Reinforcement

We recommend interior concrete floor slabs supported on expansive subgrade soils be reinforced with steel to reduce distress due to pressures associated with swelling or shrinking of the subgrade soils. Based on our experience with similar projects, slab reinforcement to distribute pressures associated with moderately expansive subgrade soils (that have been properly moisture conditioned) would typically involve a minimum of No. 4 bars, 24 inches on-center, each way, and centered within the slab.

In addition, we recommend interior floor slabs be structurally integrated into the continuous perimeter footing with dowels consisting of a minimum of No. 4 reinforcing bars, spaced 24 inches on-center along the perimeter of the slab. All dowels should extend a minimum of 40 bar diameters into the slab and adjacent foundation.

Slab Thicknesses and Strengths

All concrete floor slabs supported-on-grade should be a minimum of four inches thick and have a minimum 28-day compressive strength of 2,500 pounds per square inch (psi). It should be noted reinforcing and concrete guidelines provided herein address only expansive soils. Reinforcing and/or concrete parameters beyond those indicate above may be necessary to accommodate structural requirements of the project.

Surrounding Grades

It has been our experience that ground surface grades surrounding structures can affect the post-construction presence and quantity of water beneath such structures, as well as vapor emissions from interior concrete floor slabs. In order to reduce the possibility for these potentially adverse conditions, we recommend areas adjacent to all structures be graded, or floor slabs raised, so that the bottoms of all interior concrete floor slabs are elevated a minimum of four inches above adjacent, finished pad grades.

Rock Capillary Break

Interior concrete floor slabs supported-on-grade should be underlain by a capillary break consisting of free draining durable rock a minimum of four inches thick, graded such that 100 percent passes the one-inch sieve and less than five percent passes the No. 4 sieve[4]. This rock should be compacted to the extent possible using light vibratory equipment prior to

[4] In general, Caltrans Class 2 aggregate base (or other similar material) will not meet the gradation requirements provided above for a capillary break. Therefore, we recommend this material not be used for a capillary break beneath interior concrete slabs supported-on-grade.

placing any vapor membranes or slab concrete. Further, precautions should be taken during construction to reduce contamination of the rock with soil or other materials. Contamination of the rock with soil or other materials may significantly reduce the effectiveness of the capillary break, possibly resulting in excessive (and adverse) free water transmission to the bottom of the overlying slab.

Vapor Emission Considerations

Though generally not a geotechnical consideration, it has been our experience that a plastic or vinyl membrane is often placed directly over the rock capillary break to reduce water migration from the subgrade soils up to the overlying concrete floor slab. If used, we suggest this membrane be installed in a manner to reduce punctures and penetrations. Where penetrations are unavoidable, or adjacent to footings or other similar obstructions, the vapor membrane should be placed tightly against these features. Further, it has been our experience that sand, one to two inches thick, is often placed on top of the membrane prior to placing slab concrete to promote more uniform curing of the slab. If used, we strongly suggest that concrete not be placed if sand overlying the vapor membrane has become wet (due to precipitation or excessive moistening), or if standing water is present above the membrane. It has been our experience that excessive water beneath interior floor slabs can result in significant, post-construction vapor transmission through the slab, adversely affecting floor coverings, and possibly resulting in potentially hazardous molds.

In addition to a capillary break and vapor membrane, it has also been our experience that concrete quality is critical to the ability of concrete floor slabs to resist vapor transmission. As a minimum, we suggest that concrete used for floor slab construction possess a maximum water/cement ratio of 0.5. Since water is often added to uncured concrete to increase workability, it is important that strict quality control be exercised during the installation of all slab concrete to insure water/cement ratios are not altered prior or during placement.

It must be recognized comments provided above are suggestions only. These comments are intended to assist the project Architect, Structural Engineer, or other design professional, and should not be inferred to mean that Mid Pacific Engineering is assuming the design responsibility for interior concrete floor slabs or appurtenant vapor reduction provisions. In all cases, it is solely the responsibility of the project Architect, Structural Engineer, or other design professional to determine the design based on project specific requirements (which were beyond our knowledge or involvement with the project). In the event the project Architect, Structural Engineer, or other design professional is unfamiliar with concrete slab-on-grade issues, or if the project will include floor coverings sensitive to slab vapor emissions, a professional specializing in vapor transmission should be consulted to provide project specific recommendations and design provisions.

SITE ACCESS ROADWAY

General

We anticipate the proposed facility may be accessed using a new, partially improved roadway. Further, we anticipate a conventional surfacing material (such as asphalt concrete) would not be considered applicable due to cost and possibly other considerations beyond the scope of this study. Therefore, provided below are our comments regarding surfacing these areas with gravel.

Note: Comments and recommendations provided below are intended to assist the project Civil Engineer in the design of a partially improved roadway to service the site subsequent to construction. In general, we anticipate such use will involve infrequent automobile traffic. Recommendations provided below are not intended for the design of roadways to be utilized by cranes and other similar equipment during construction. If such use is anticipated, we recommend the project Civil Engineer prepare a design based on anticipated loads and other relevant conditions (which were not available at the time this report was prepared and completely beyond the scope of this study).

Surface Drainage

Areas to be surfaced with gravel, as well as adjoining areas, should be adequately graded to provide positive drainage such that surface water is not allowed to accumulate on or near areas intended to carry vehicular traffic.

Subgrade Preparation

Subgrade areas to be surfaced with gravel should be scarified to a depth of eight inches below finished subgrade, uniformly moisture conditioned to between one and three percent above the optimum moisture content, and compacted to a minimum of 95 percent relative compaction. In the event the exposed subgrade consists of undisturbed on-site rock, scarification and compaction may be omitted if approved by the project Geotechnical Engineer.

Gravel Surfacing - Materials and Placement

To provide increased subgrade support, dust control, and a wearing surface, we anticipate gravel (such as Caltrans Class 2 aggregate baserock or other similar material) may be spread and compacted over the area of the possible (or planned) site access roadway. Should Caltrans Class 2 aggregate baserock (or other similar material) be used, we recommend it be a minimum of six inches thick. Baserock used as surfacing material should be compacted to a minimum of 95 percent relative compaction.

Depending on the frequency of use and vehicle loading, it may be desirable to underlay gravel surfacing material (such as Caltrans Class 2 aggregate baserock) with a geotextile stabilization fabric. The primary purpose of this fabric would be to reduce migration of subgrade soil into the baserock and redistribute concentrated loads, thereby extending the service life of this type of surfacing material. If a geotextile fabric is used, we recommend it consist of Mirafi 500X or other equivalent fabric approved by the project Geotechnical Engineer.

ADDITIONAL SERVICES

We recommend Mid Pacific Engineering review final earthwork grading (if any) and/or foundation plans and specifications to evaluate that recommendations contained herein have been properly interpreted and implemented during design. Further, all site earthwork activities, including site preparation, placement of engineered fill and trench backfill, construction of roadway subgrades, and all foundation excavations should be monitored by a representative from Mid Pacific Engineering.

Monitoring services are an essential component of our design services. Monitoring allows us to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

LIMITATIONS

This report has been prepared in substantial accordance with the generally accepted geotechnical engineering practice as it existed in the site area at the time our services were rendered. No warranty is either expressed or implied.

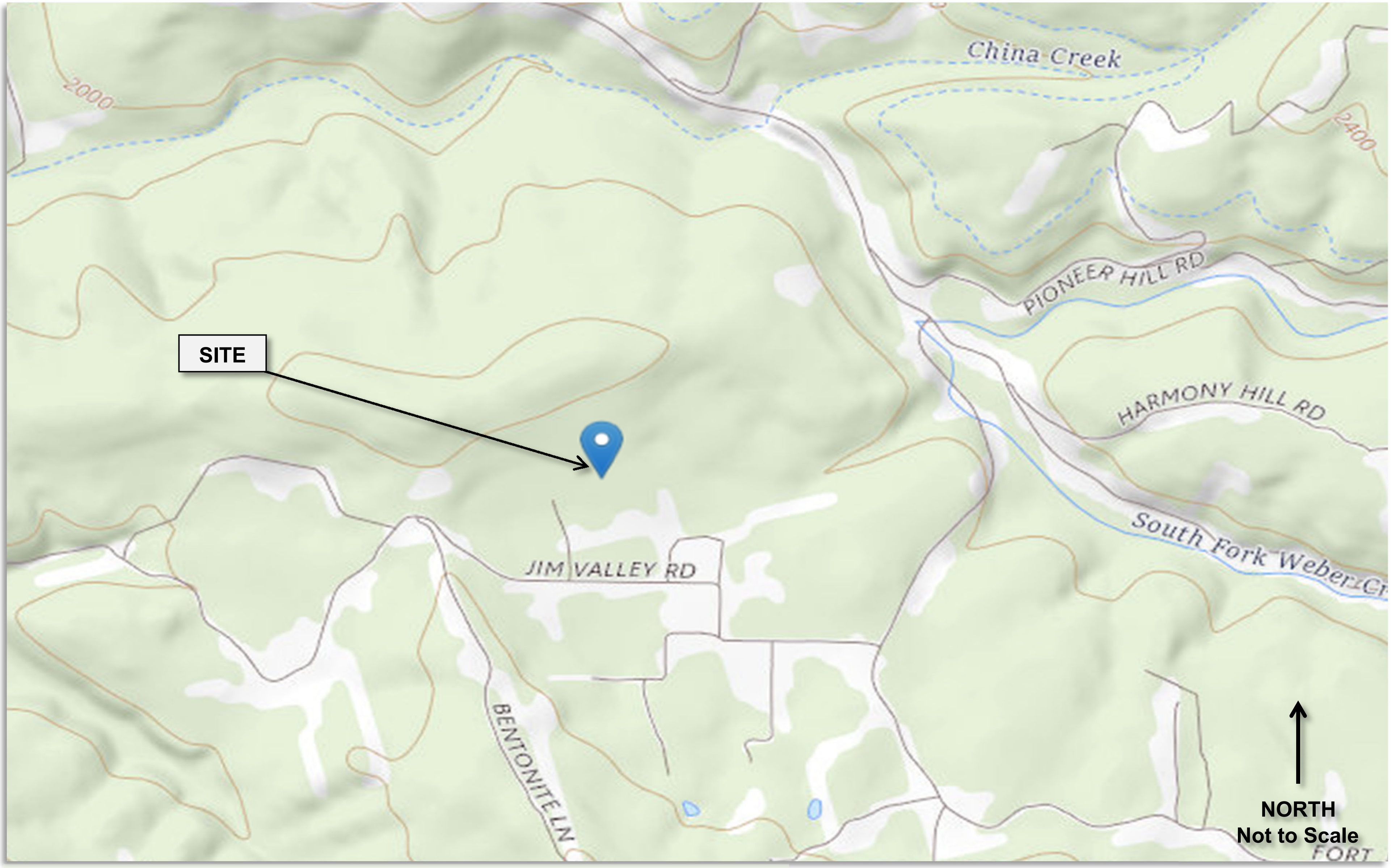
Conclusions and recommendations contained in this report were based on the conditions encountered during our field investigation and are applicable only to those project features described above (see section titled "PROPOSED CONSTRUCTION"). It is possible subsurface conditions could vary beyond the point explored. If conditions are encountered during construction which differ from those described in this report, or if the scope or nature of the proposed construction changes, we should be notified immediately in order to review and, if deemed necessary, conduct additional studies and/or provide supplemental recommendations.

Recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by Mid Pacific Engineering during the construction phase in order to evaluate compliance with our recommendations.

The scope of services provided by Mid Pacific Engineering for this project did not include the investigation and/or evaluation of toxic substances, or soil or groundwater contamination of any type. If such conditions are encountered during site development, additional studies may be required. Further, services provided by Mid Pacific Engineering for this project did not include the investigation and/or evaluation of soil corrosivity. Depending on planned pipe types, bedding conditions, and other factors beyond the scope of this study, it may be appropriate to evaluate soil corrosivity prior to development.

This report may be used only by our client, and only for the purposes stated herein, within a reasonable time from its issuance. Land use, site conditions, and other factors may change over time which may require additional studies. In the event a significant period of time elapses between the date of this report and construction, Mid Pacific Engineering shall be notified of such occurrence in order to review current conditions. Depending on that review, additional studies and/or an updated or revised report may be required prior to completion of final design.

Any party other than our client who wishes to use all or any portion of this report shall notify Mid Pacific Engineering of such intended use. Based on the intended use, as well as other site-related factors, Mid Pacific Engineering may require that additional studies be conducted and that an updated or revised report be issued. Failure to comply with any of the requirements outlined above by the client or any other party shall release Mid Pacific Engineering from any liability arising from the unauthorized use of this report.



NOTES: Adapted from USGS *Topo of Camino, California, 7.5 Minute Series, 2018*

MPE
MID PACIFIC ENGINEERING, INC.

VICINITY MAP

PROPOSED TELECOMMUNICATIONS FACILITY

South Placerville, Site Number: CVL00786

Placerville, California

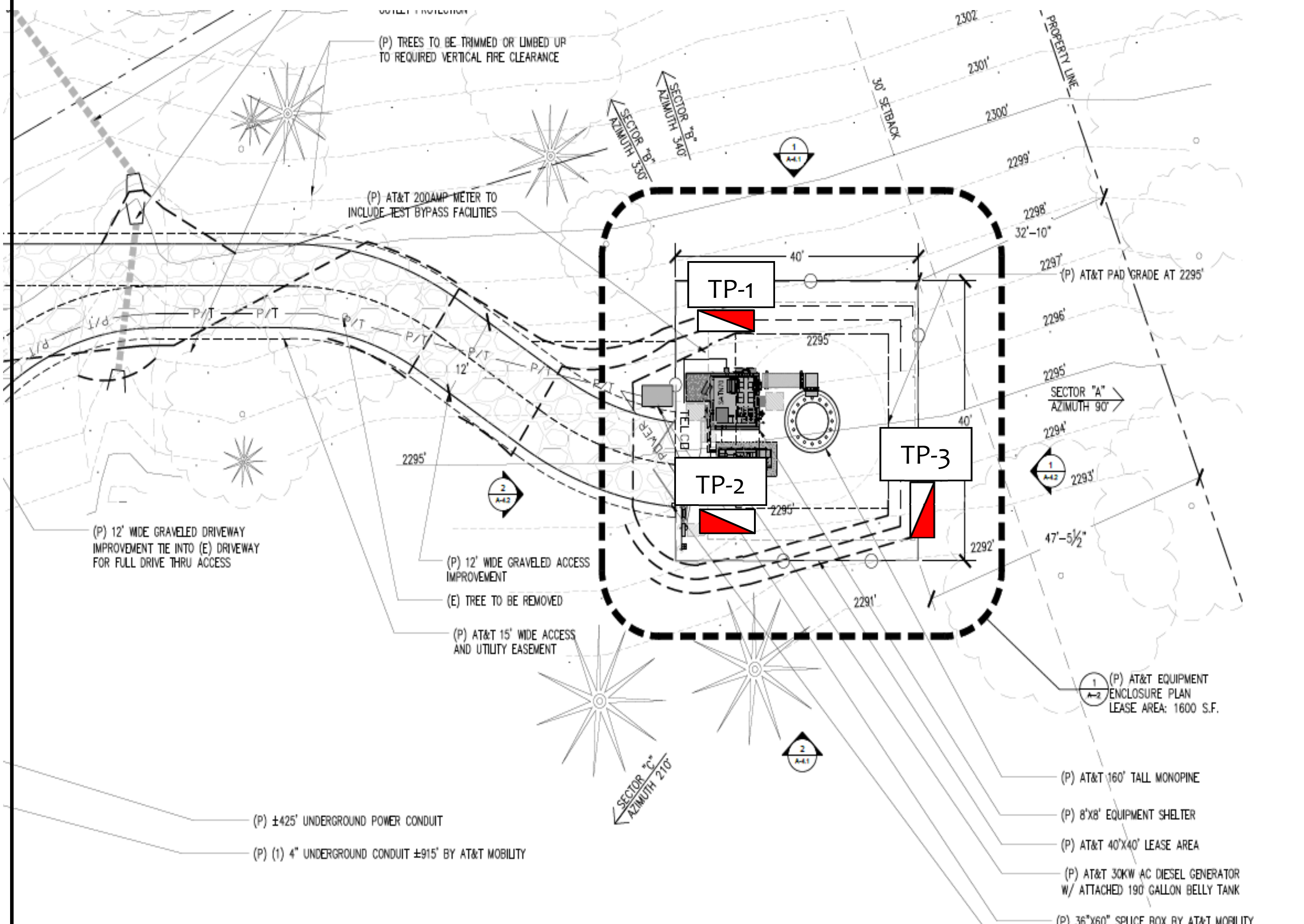
FIGURE 1

Date: 07/19

MPE No. 04537-01

EXPLANATION

TP-2 Approximate Test Pit Location



NOTES: Adapted from *South Placerville, Site Plan,* Sheet A-1.1, prepared by Adaptive Re-Use Engineering, dated 03/18/2019.

NORTH
Not to Scale

MPE
MID PACIFIC ENGINEERING, INC.

TEST PIT LOCATION MAP

PROPOSED TELECOMMUNICATIONS FACILITY
South Placerville, Site Number: CVL00786
Placerville, California

FIGURE 2

Date: 07/19

MPE No. 04537-01

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 coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) Medium (m) fine (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 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

MPE
Mid Pacific Engineering, Inc.

UNIFIED SOIL CLASSIFICATION SYSTEM
PROPOSED TELECOMMUNICATIONS FACILITY
South Placerville, Site Number: CVL02184
Placerville, California

FIGURE 3
Date: 07/19
MPE No. 04537-01

FRACTURING	
LOG TERM	DEFINITION
Very Wide	> 6 feet
Wide	2 to 6 feet
Moderately	8 to 24 inches
Closely	2 1/2 to 8 inches
Very Closely	3/4 to 2 1/2 inches

ROCK QUALITY DESIGNATION (ROD)	
ROD (%)	ROCK QUALITY
90 to 100	Excellent
75 to 90	Good
50 to 75	Fair
25 to 50	Poor
0 to 25	Very Poor

WEATHERING	
LOG TERM	DESCRIPTION/DEFINITION
Fresh	No visible sign of decomposition or discoloration. Rings under hammer impact
Slightly Weathered	Slight discoloration inwards from open fractures; otherwise similar to fresh
Moderately Weathered	Discoloration throughout. Strength less than fresh rock, specimens cannot be broken by hand or scraped with knife
Highly Weathered	Specimens can be broken by hand with effort and shaved with knife. Textures becoming indistinct but fabric preserved
Completely Weathered	Mineral decomposed to soil but fabric and structure preserved. Specimens easily crumbled or penetrated.

COMPETENCY			
CLASS	LOG TERM	DESCRIPTION/DEFINITION	APPROXIMATE RANGE OF UNCONFINED COMPRESSIVE STRENGTHS (tsf)
I	Extremely Strong	Many blows with geologic hammer required to break intact specimens	>2000
II	Very Strong	Hand held specimens break with pick end of hammer under more than one blow	1000 to 2000
III	Strong	Hand held specimens can be broken with singer, moderate blow with pick end of hammer	500 to 1000
IV	Moderately Strong	Specimens can be scraped with knife; light blow with pick end of hammer causes indentations	250 to 500
V	Weak	Specimens crumble under moderate blow with pick end of hammer	10 to 250
VI	Friable	Specimens crumble in hand	N/A

MPE
MID PACIFIC ENGINEERING, INC.

ROCK LEGEND

PROPOSED TELECOMMUNICATIONS FACILITY
South Placerville, Site Number: CVL00786
Placerville, California

FIGURE 4
Date: 07/19
MPE No. 04537-01

LOGS OF TEST PITS 1 and 2

Kubota U27-4 Mini-Excavator with a 12-inch Bucket

July 1, 2019

Test Pit 1

	Surficial Soils
0 – 2"	Brown, slightly moist, fine sandy silt with organics (ML).
2" – 2'	Brown, slightly moist, fine sandy silt (ML) with rock fragments up to 12 inches.
2' – 3'	Reddish brown, moist, fine to medium sandy clay (CL) with fragments of weathered rock up to 8 inches.
	Sedimentary Rock
3' –7½'	Light brown, moist, completely weathered, weathers into fine sandy clay (CL) with gray, chalky rock fragments up to 8 inches. Bucket refusal at 7½ feet on yellow, slightly weathered rock (RX).

Total depth = 7½ feet.
No groundwater encountered.
Backfilled with excavated soil.

Test Pit 2

	Surficial Soils
0 – 1'	Light/Reddish brown, slightly moist, fine sandy silt (ML).
1' – 3'	Brown/Reddish brown, slightly moist, clayey silt (ML) with fragments of slightly weathered rock up to 4 inches.
	Sedimentary Rock
3' – 4'	Light brown/tan, slightly moist, highly weathered, weathers into sandy clay with cobbles up to 3 inches. Bucket refusal at 4 feet on slightly weathered rock (RX).

Total depth = 4 feet.
No groundwater encountered.
Backfilled with excavated soil.

MPE Mid Pacific Engineering, Inc.	**LOGS OF TEST PITS TP-1 & TP-2** **PROPOSED TELECOMMUNICATIONS FACILITY** South Placerville, Site Number: CVL00786 Placerville, California	**FIGURE 5** Date: 07/19 MPE No. 04537-01

LOG OF TEST PIT 3

Kubota U27-4 Mini-Excavator with a 12-inch Bucket

July 1, 2019

Test Pit 3

	Surficial Soils
0 – 1’	Light brown, slightly moist, fine sandy silt (ML).
	Sedimentary Rock
1’ – 5’	Yellow, slightly moist, moderately weathered, weathers into clayey silt (ML) and sandy clay (CL) with rock fragments up to 12 inches. Bucket refusal at 5 feet on slightly weathered rock (RX).

Total depth = 5 feet.
No groundwater encountered.
Backfilled with excavated soil.