Appendix F

Preliminary Geotechnical Report

PRELIMINARY GEOTECHNICAL REPORT

Skyline Quarry Development
Susanville, Lassen County, California

Submitted To:

Ms. Wendy Johnston
VESTRA RESOURCES, INC.
5300 Aviation Drive
City of Redding, CA 96002

Prepared by:
Bajada Geosciences, Inc.

May1, 2023
Project No. 2001.0114

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May 1, 2023
2001.0114

Ms. Wendy Johnston
VESTRA RESOURCES, INC.
5300 Aviation Drive
Redding, California 96002

Subject: **Geotechnical Report**
Skyline Quarry Development Project
Lassen County, California

Dear Ms. Johnston:

Bajada Geosciences, Inc., is pleased to submit this geotechnical report to VESTRA Resources, Inc., for the Skyline Quarry Development project located in Lassen County, California. This report is being submitted in accordance with our proposal dated May 5, 2020. This geotechnical report discusses field mapping and explorations performed, laboratory testing results, and geotechnical analyses associated with the study.

We appreciate the opportunity to perform this study. If you have any questions pertaining to this report, or if we may be of further service, please contact us at (530) 638-5263 at your earliest convenience.

Sincerely,

BAJADA GEOSCIENCES, INC.

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1 INTRODUCTION

BAJADA Geosciences, Inc. (BAJADA), is pleased to submit this preliminary geotechnical study to VESTRA Resources, Inc. (VESTRA), for the proposed development of Hat Creek Construction's (HCC) Skyline Quarry located near Susanville in Lassen County, California. The project includes the following parcels: APN 101-110-24-11 and 101-270-44-11 the locations of which are shown on Plate 1 – Site Location Map. The following preliminary report discusses our understanding of the project, observations and measurements made within the proposed mine area, our analyses, and presents our preliminary opinions regarding slope stability at the proposed quarry location.

1.1 PROJECT DESCRIPTION

We understand that HCC is proposing to develop an aggregate quarry on two parcels of land that encompass approximately 835 acres. We understand that the majority of the quarry will initially be developed on APN 101-110-24-11, with later development to take place on the second parcel sometime thereafter. Plate 2 – Proposed Quarry Area, shows the approximate location of both parcels and where proposed mining will take place. We understand that VESTRA is preparing a mine reclamation plan for the project and that estimated maximum highwall bench heights and widths, and overall highwall inclination, are needed for development of the proposed reclamation plan.

We understand that the quarried materials will be used as aggregate for construction and sand materials for various applications. We understand that future uses could expand into batching of asphaltic concrete, Portland cement concrete, or other materials. It is anticipated that the materials within the quarry will be excavated using a combination of conventional ripping and hauling methods and through blasting and hauling. It is anticipated that overburden and highly weathered rock will be rippable using single- or double-shank rippers attached to bulldozers. With depth, as materials become harder and less weathered, it is anticipated that controlled blasting will be needed to excavate rock materials. Once ripped or blasted, it is anticipated that excavators will load haul trucks with excavated materials. We understand that overburden and topsoil will be stockpiled within the quarry for later use during reclamation. It is anticipated that these soils could be placed on excavated benches to help facilitate revegetation.

The approximate center of the quarry has the following latitude and longitude:

- Latitude: 40° 25' 27.17" (40.424213°)
- Longitude: -120° 37' 19.82" (-120.622222°)

It should be noted that no quarrying has been performed at the project site; hence, there are no large expanses of exposed volcanic rock faces that could be mapped or used to make recommendations

for the site. However, there is an outcrop at the eastern portion of the property that was mapped and used to estimate discontinuity orientations. It should also be noted that drilling and geophysical exploration were not authorized as part of our scope of services for this study. As such, this study should be considered preliminary in nature and should be supplemented with future studies to refine recommendations made, herein.

1.2 PREVIOUS WORK PERFORMED

We know of no site specific geologic or geotechnical studies that have been performed at the site. We understand that an Air Track (a track-mounted air-percussion drill) has drilled a number of exploratory holes on site to estimate material types and locations. Areas of the volcanic rock materials that were drilled were sampled to provide HCC confirmation laboratory testing for aggregate quality. We observed multiple exploratory pits on the property but we are unaware of when those test pits were excavated or by whom.

Geological information has been previously published for the project region and is periodically referred to within this report. References for data used are presented in the References section (Section 12.0) of this report.

1.3 SCOPE OF SERVICES

Services performed for this study included:

- Reconnaissance of the site surface conditions;
- Review of pertinent, selected regional geological data;
- Observation of exposed geological conditions at the project site. Plate 3 – Geologic Map, presents the preliminary geological conditions mapped at the site;
- Collection of six samples of surficially available on-site rock materials suitable for laboratory testing;
- Estimation of rock unconfined compressive strength using Schmidt hammer readings of rock materials encountered in the field;
- Measurement of discontinuity orientations at selected rock outcrops exposed on site. The discontinuity orientations obtained during this study are presented in Appendix A – Discontinuity Data, and the locations of those measurements are noted on Plate 3;
- Performance of laboratory testing on samples obtained from the site to estimate rock strength characteristics for use in stability analyses. Results of the laboratory testing are presented in Appendix B – Laboratory Testing;
- Performance of kinematic rock slope stability evaluations for the proposed quarry slope configurations;
- Performance of limit-equilibrium evaluations of potential wedge, and toppling failures identified within the kinematic analyses. Results of the limit-equilibrium analyses are presented in Appendix C – Slope Stability Analyses;
- Performance of limit-equilibrium evaluations of the gross stability for the proposed

highwall. Results of those evaluations are presented in Appendix C;

- Preparation of this report, which includes:
  - A description of the proposed project;
  - A summary of our field observation and laboratory testing programs;
  - A description of site surface conditions encountered during our field investigation; and
  - Our preliminary opinion regarding slope stability.

1.4 FIELD EXPLORATION

Field exploration performed by BAJADA for this study consisted of reconnaissance-level geologic mapping of the study area, field measurement of discontinuity data (fractures, joints, flow bands, bedding planes, etc.), and estimation of rock mass characteristics at selected locations within the proposed quarry. Field exploration occurred on May 21 and July 29, 2020. Subsurface exploration was not authorized as part of our services.

2 QUARRY SLOPE DESIGN CONCEPTS

2.1 GENERAL

The design of quarry highwalls and quarry slopes is the balance of economic factors with safety/social factors (Read & Stacey, 2009). Mine operators want to maximize the resource extracted from the mine and, hence, would prefer steep overall slope angles within a quarry. Balanced against this is the increased likelihood that steep slopes will lead to the development of slope stability issues that could ultimately impact worker safety, productivity, and, therefore, mine profitability. The approach is to base the quarry design on achieving an acceptable level of risk and incorporating this into the stability analyses as a factor of safety (FOS). Quarry slopes are considered to have been constructed overly conservative if no instability occurs during operations. Hence, some instability should be anticipated, accommodated for, and monitored during quarry development.

Imprinted on quarry slope design due to economic safety/social factors are environmental and/or regulatory factors. While technical evaluations may indicate that a slope is acceptable due to the aforementioned factors, it is not unusual for regulatory and permitting processes to dictate that flatter slopes be utilized in design. Those factors are often out of the control of the geotechnical consultant and mine operator.

This section briefly introduces quarry slope terminology that is used throughout this report and some of the key geotechnical and mining factors that can impact slope design. In addition, a summary of the analysis techniques utilized in this study and the adopted risk management approach are discussed.

2.2 QUARRY SLOPE GEOMETRIES

There are three predominant quarry slope geometries that need to be recognized and addressed for any quarry slope stability evaluation (Read & Stacey, 2009; Wyllie & Mah, 2010):

- Bench Geometry.
- Inter-ramp Slope; and
- Overall Slope.

Those geometries are illustrated on Plate 4 – Common Quarry Geometries and discussed below.

2.2.1 Bench Geometry

The height of benches is typically determined by operational efficiencies chosen for the mining operation or the preferred blasting and extraction methodologies of the mine operator. The bench face angle is usually selected in such a way as to reduce, to an acceptable level, the amount of material that will likely fall from the face or crest (back break). The bench width is sized to prevent small wedges and blocks from the bench faces from falling down the slope and potentially impacting men and equipment. The bench geometry that results from the bench face angle and bench width will ultimately dictate the inter-ramp slope angle. Stacked benches can be used in certain circumstances to steepen inter-ramp slopes.

2.2.2 Inter-Ramp Slope

We anticipate that inter-bench ramps will not be constructed for the quarry. Therefore, this slope definition does not apply to the proposed Skyline quarry.

2.2.3 Overall Slope

Overall slope inclination for the proposed quarry expansion is governed by bench geometry since inter-bench ramps will not be constructed.

2.3 KEY FACTORS FOR QUARRY SLOPE DESIGN

As noted by Wyllie & Mah (2010), stability of quarry slopes in rock is typically controlled by the following key geotechnical and mining factors:

- **Lithology and Alteration** – The rock types intersected by the final quarry walls and level of alteration are key factors that impact eventual stability of the quarry. Geological domains are created by grouping rock masses with similar geomechanical characteristics.
- **Large-Scale Structural Features –** The orientation and strength of major, continuous geological features such as faults, shear planes, weak bedding planes, structural fabric, and/or persistent planar joints will strongly influence the overall stability of the quarry walls.
- **Small-Scale Structural Features –** The orientation, strength, and persistence of smaller scale structural features such as joints will control the stability of individual benches and may ultimately restrict the inter-ramp slope angles.
- **Rock Mass Quality –** Rock mass strengths are typically estimated via intact rock strength and rock mass classification schemes such as the rock mass rating (RMR) system (Hoek, 1995). Lower rock mass quality typically results in flatter overall slope angles.
- **Blasting Practice** – Production blasting can cause considerable damage to interim and final quarry walls. This increased disturbance is typically accounted for with a reduction in the effective strength of the rock mass. Controlled blasting programs near the final wall can be implemented to reduce blasting induced disturbances and allow steeper slopes. Scaling of blast induced fracturing is essential.
- **Groundwater Conditions –** High groundwater pressures and water pressure in tension cracks will reduce rock mass shear strength and may adversely impact slope stability. If needed, depressurization programs can reduce water pressure behind the quarry walls and allow steeper quarry slopes to be developed.

  Stress Conditions – Mining induces stress changes due to lateral unloading within the vicinity of the quarry. Stress release can lead to effective reductions in the quality of the rock mass and increases in slope displacements. Localized stress decrease can reduce confinement and result in an increased incidence of raveling type failures in the walls. Modifying the mining arrangement and sequence can sometimes manage these stress changes to enhance the integrity of the final quarry walls.

2.4 METHODOLOGY FOR QUARRY SLOPE STABILITY ASSESSMENT

Assessment of quarry slope stability is based on the development of a geotechnical model for varying domains encountered within the projected mine area. Those domains are based upon geological, structural (geomechanical), rock mass, and hydrogeological models (Read & Stacey, 2009). Once the domains have been delineated, a number of different types of stability analyses can be undertaken to estimate appropriate slope angles for a given open quarry slope. Slope stability analyses undertaken for this study included the following types:

- **Kinematic Stability Analyses** – Stereographic analyses were conducted on the discontinuity orientation data and the DIPS program (Rocscience, 2020) was utilized to identify the kinematically possible failure modes. Appropriate bench face angles and/or inter-ramp slope angles are assigned in such a way as to reduce the potential for discontinuities to form unstable wedges or planes. Typically, it is not cost effective to eliminate all potentially unstable blocks and a certain percentage of bench face failures and/or multiple bench instabilities are acceptable. Most of the smaller unstable features will be removed during mining by scaling the bench faces and during periodic maintenance activities.
- **Planar and Wedge Stability Analyses** – Limit-equilibrium analyses of potential wedge failures were performed with SLIDE 2018 program (Rocscience, 2020) and GEO5 (Fine Civil Engineering Software, 2020), respectively. These programs provide an estimate for the factor of safety against large-scale, multiple-bench failures through the rock mass. In these particular analyses, as with many quarry designs, minimum static and pseudostatic (pseudo-earthquake forces) factors of safety of at least 1.3 and 1.01, respectively, were specified for these types of failure (Wyllie and Mah, 2004). Lower static factors of safety (e.g. 1.2) may sometimes be utilized for shorter periods of time, such as near the end of mine life, and where good monitoring is implemented.
- **Rock Mass Stability Analyses** – Limit-equilibrium analyses of the rock slopes were performed with SLIDE 2018 program (Rocscience, 2020). This program provides an estimate for the factor of safety against large-scale, multiple-bench failures through the rock mass. In this particular analysis, as with many quarry designs, minimum static and pseudostatic factors of safety of at least 1.3 and 1.01, respectively, were specified for this type of failure (Wyllie and Mah, 2004). Lower static factors of safety (e.g. 1.2) may sometimes be utilized for shorter periods of time, such as near the end of mine life, and where good monitoring is implemented.

3 GEOLOGICAL CONDITIONS

3.1 GENERAL

The project site is located within the Basin and Range geomorphic/geologic province of California. This area is characterized by steeply inclined ridgelines with moderately to steeply incised interior drainages with lakes and playas, and the typical horst and graben fault structure (subparallel, fault-bounded ranges separated by down dropped basins).

3.2 REGIONAL GEOLOGY

The project site is located within the Basin and Range geologic/geomorphic province. However, the project site is also near the Modoc Plateau geologic/geomorphic provinces of California. The Basin and Range province is characterized by interior drainage with lakes and playas, and the typical horst and graben structure (subparallel, fault-bounded ranges separated by down dropped basins). In these basins, moderate to extensive thicknesses of lacustrine (lake) and alluvial deposits are present. Death Valley, the lowest area in the United States (280 feet below sea level at Badwater), is one of these grabens. The province is bounded to the west by the Modoc and Cascade provinces, to the south by the Sierra Nevada province, and to the east by the Basin and Range province of Nevada.

The Modoc Plateau geologic/geomorphic province is a volcanic peneplane (elevation 4,000 to 6,000 feet above sea level) consisting of a thick accumulation of lava beds along with many small volcanic cones. It is the southernmost extent of the Colombian Plateau Flood Basalts and is the youngest geologic/geomorphic province of California (Jenkins, 1938). The plateau is bounded to the east by the Basin and Range province, to its west it is bounded by the Cascade province, to the south by the Sierra Nevada province, and to the north the Columbian Basin province of Oregon. The Modoc Plateau itself is cut by many north-south striking faults and is underlain by much thicker crust than is found in the Klamath Mountains and Cascade Range to the west.

3.3 QUARRY GEOLOGY

The proposed quarry area is underlain by Pliocene to Pleistocene-age volcanic rocks mapped as the Basalt of Susanville (Grose et at., 2014). Plate 3 shows the geologic conditions mapped during this study at the quarry site. Overlaying the Susanville Basalt are colluvium, alluvium, paleo-lake shore deposits, and artificial fill material. These materials are shown as Plates 5.1 thru 5.3 – Geotechnical Sections, and on Plate 6 – Fence Diagram respectively. These materials consist of fine silty sands, sandy silts, and fine-grained soils containing few to abundant gravels, cobbles, and boulders. A regional geologic map depicting these conditions is shown on Plate 7 - Regional Geologic Map.

Mapping at the site observed predominantly basaltic rock materials of the Susanville Basalt. In outcrop, those materials were moderately weathered (International Society of Rock Mechanics

[ISRM] Grade II to III), and medium strong to strong (ISRM Grade R3 to R4). Overall exposures were observed to be well indurated, and where selected testing was performed, approximate compressive strengths of medium weak to strong rock (ISMR Grade R3 to R4 measured in MPa). The exposed volcanic rocks were highly to moderately fractured with closed to wide apertures, slightly rough to rough fracture faces, and a typical joint roughness coefficient ranging from approximately four to eight (ISMR 1981a). Exposed faces were observed having little to moderate infilling and localized surficial iron oxide coatings, large to medium-sized block dimensions, tabular but slightly irregular block shape, and showed little to moderate signs of discontinuity fill (ISMR Grade I-III). Fractures and discontinuities were generally observed to be nonpersistent; however, some predominant discontinuity sets appeared to persist for more than 10 feet.

It should be noted that it a common characteristic of exposed volcanic rock structures/flow deposits observed in exposures above the ground surface to exhibit more exacerbated discontinuities and fractures with relatively wider and smoother apertures than those of volcanic discontinuities found below the surface. This difference in characteristics is commonly caused by the unloading of surface material and the release of pressure thereof, as well as exposure to water and differences in temperature over time (frost wedging, expansion, contraction and exfoliation). These differences are also a function of many physical and chemical contributing factors with the aforementioned being the most common. Structures found below the surface are expected to exhibit slightly weathered to fresh material, with partly open to very tight (0.5 - <0.1mm) aperture dimensions, and with little to no infill.

It should also be noted that Plate 3 is a general depiction of geologic conditions within this area based on limited exposures of rock materials and should be used with an understanding of those limitations. The map should be updated as portions of the quarry are exposed during development.

3.4 FAULT CONSIDERATIONS

The State of California designates faults as Holocene-age or Pre-Holocene-age depending on the recency of movement that can be substantiated for a fault. Fault activity is rated as follows:

FAULT ACTIVITY RATINGS		
Fault Activity Rating	**Geologic Period of Last Rupture**	**Time Interval (Years)**
Holocene-Active	Holocene	Within last 11,000 Years[1]
Pre-Holocene	Quaternary & Older	>11,000 Years[1]
Age Undetermined	Unknown	Unknown

[1] – Holocene is defined as 11,700 years before present by the International Commission on Stratigraphy. The California State Mining and Geology Board, which administers the review and application of the Alquist-Priolo Earthquake Fault Zoning Act, currently recognizes the Holocene as 11,000 years before present.

The California Geologic Survey (CGS) evaluates the activity rating of a fault in fault evaluation reports (FERs). FERs compile available geologic and seismologic data and evaluate if a fault should be zoned as Holocene-active, pre-Holocene, or age undetermined. If an FER evaluates a fault as Holocene-active, then it is typically incorporated into a Special Studies Zone in accordance with the

Alquist-Priolo Earthquake Fault Zoning Act (AP). AP Special Studies Zones require site-specific evaluation of fault location for structures for human occupancy and require a habitable structure setback if the fault is found traversing a project site. The quarry is not located within an Alquist-Priolo Earthquake Fault Zone established by the State. Because of this, the likelihood of faulting occurring across the quarry site is low.

A number of regional faults are present in the project area, as shown on Plate 8 – Fault Location Map. The closest mapped fault to the site is the Holocene-Active and State-zoned Honey Lake Fault Zone located approximately 8 miles southwest of the proposed quarry site.

3.5 PROBABILISTIC ESTIMATES OF STRONG GROUND MOTION

Probabilistic evaluations of horizontal strong ground motion that could affect the site were performed using attenuation evaluation methods provided by the U.S. Geological Survey (USGS, 2019). The evaluations were performed using an estimated shear wave velocity of 1150 meters per second in the upper 100 feet of the profile. Evaluations were performed for upper-bound (UBE) and design-basis (DBE) probabilistic exposures. The UBE corresponds to horizontal ground accelerations having a 10 percent probability of exceedance in a 100-year exposure period, with a statistical return period of 949 years. The DBE corresponds to horizontal ground accelerations having a 10 percent probability of exceedance in a 50-year, exposure period, with a statistical return period of 475 years. The results of these evaluations are presented in the following table:

PROBABILISTIC GROUND MOTION DATA				
Earthquake Level	Probabilistic Estimate Exposure Period (years)	Probability of Exceedance (%)	Return Period (years)	Estimated Peak Horizontal Ground Acceleration (g)
Upper-Bound Ground-Motion	100	10	949	0.25
Design-Basis Ground-Motion	50	10	475	0.18

It should be noted that although the seismic hazard models used for this study predict the probability of exceedance for various levels of acceleration in a given exposure period, the models are not able to account for the effect that the passage of time since past earthquakes has on future earthquake probability. Thus, while time may affect the incipient risk of earthquakes occurring, the

UBE and DBE values are based on any 100-year and 50-year exposure period, respectively, regardless of how recently earthquakes have occurred.

3.6 GROUNDWATER CONDITIONS

Groundwater data for the project region was collected from the California Department of Water Resources (DWR) Water Library (DWR, 2020a), through water well completion reports, and regional water basin boundaries (DWR, 2020b) available online. Well logs from the Public Land Survey Systems (PLSS) at the location designated Township 30N, Range 12E, Section 36, roughly 2.5 miles from the center point of the proposed quarry site, show the depth of the first water encounter at 80 feet below the surface. In addition, well completion reports (DWR, 2020b) for wells within about 1,500 feet of the site recorded static water levels at depths of roughly 100 to 137 feet below the surface. It is unlikely that static water tables will be encountered during mining of the quarry provided deepened pits are not created. However, seasonal and/or perennial water seepage could occur from perched water at the overburden/rock contact, and from discontinuities exposed within the quarry highwall.

4 STRUCTURAL GEOLOGY & GEOTECHNICAL CONDITIONS

4.1 GENERAL

The following section discusses large- and small-scale structural geological features at the site and characterizes rock mass properties and strength used during analyses.

4.2 LARGE-SCALE STRUCTURAL FEATURES

Large-scale structural features consist of faults, folds, bedding, or linear intrusive bodies, such as dikes or sills. Large-scale structural features were identified projecting into or through the site during this preliminary study. Within the parcel boundary of the proposed quarry site are four to five mapped Pre-Holocene faults strands (Grose et al., 2014).

4.3 SMALL-SCALE STRUCTURAL FEATURES

Measurements of discontinuity orientations were performed using two methods:

1. Manual measurement of planes at selected locations across the site; and
2. Use of software to estimate discontinuity orientations from photogrammetry.

Manual measurements were taken with a Brunton compass and the orientations measured during this study are presented in Appendix A. Along with the discontinuity measurements, additional information was collected on selected discontinuity planes that would be applied to rating the overall quality of the rock mass exposed within the highwalls.

Discontinuity data estimates using software were performed by first obtaining overlapping, stereo-imagery of rock exposures at Outcrop location 1 (see Plate 3) using a GPS-enabled camera (via unmanned aerial systems). Those imagery were processed using photogrammetric software to develop a dense point cloud of the highwalls. The point cloud was then imported into software that computes planar features from the data based on user-defined input criteria.

The software evaluation produced millions of estimated discontinuity plane orientations. Discontinuity orientations were then plotted on an equal angle stereonet and populations were contoured to identify predominant discontinuity planes exposed within the highwall slope. Plate 9 – Photogrammetrically Measured Discontinuity Planes shows the results of the dense point cloud analyses of discontinuity planes at Outcrop location 1 (see Plate 3). Those projections are presented as Plate 10 - Predominant Discontinuities. The primary discontinuity planes identified from this analysis have the following orientations:

PREDOMINANT DISCONTINUITY ORIENTATIONS			
Plane No.	**Strike**	**Dip Direction**	**Dip**
1	N42°E	72°	9°
2	N30°E	79°	84°
3	N01°W	269°	89°
4	N24°W	66°	66°

Data were collected on the roughness, aperture and infilling of discontinuities of outcrop exposures encountered in the field. These data indicated that most discontinuity surfaces did not have significant infill and were of moderate roughness. Persistence was estimated to be relatively medium to moderately long (greater than or equal to about ten feet). The characteristics of the encountered discontinuities are utilized in combination with the intact properties of the rock to classify the rock mass as presented in Section 4.5.

4.4 GEOTECHNICAL DOMAINS

Based on the limited exposures of basaltic rock outcrops at the site, we had a limited dataset of discontinuity orientations from which to gauge whether a single or multiple structural domain(s) is present within the proposed quarry area. Based on those datasets, it is our preliminary opinion that a single geotechnical and structural domain is present within the basaltic rock materials. As such, kinematic evaluations for highwall stability have been performed on the global set of discontinuity orientations obtained from this study.

4.5 ROCK MASS QUALITY

The Rock Mass Rating (RMR) classification system (Bieniawski, 1989) was used to summarize the geomechanical characteristics of the rock masses encountered at the Skyline Quarry Site. It is based on five parameters describing the key rock mass characteristics, including: Unconfined Compressive Strength (UCS), Rock Quality Designation (RQD), joint spacing, joint conditions, and groundwater conditions. Ratings are assigned to each of the five parameters and the sum of these ratings defines the rock mass quality as the RMR value. RMR values range from near zero, equating to very poor rock, to 100, equating to very good rock. RMR is used widely on geomechanical projects as is the Geological Strength Index (GSI; Marinos et al., 2005; Marinos et al., 2000). The GSI was developed as a tool for relating failure criteria to geological observations in the field (Wyllie & Mah, 2010). It provides a method for estimating the reduction in rock mass strength for different geological conditions. For this project, we set the GSI at 55 to be conservative. RMR was estimated to be about 60.

Shear strength of the rock was estimated from laboratory unconfined compression tests, and from Schmidt hammer measurements made in field. Results of the unconfined compression tests are presented in Appendix B, and are as follows:

UNCONFINED COMPRESSIVE TEST RESULTS			
Sample	Basalt Characteristics	Compressive Strength	
		psi	psf
1	Massive	10,030	1,444,320
2	Massive	10,210	1,470,240
3	Massive	10,540	1,517,760
Average for Massive:		10,351	1,477,440
4	Vesicular	2,600	374,400
5	Vesicular	9,220	1,327,680
6	Vesicular	5,660	815,040
Average for Vesicular:		5,826	839,040
Overall Average:		8,043	1,158,192

As noted above, the average UCS value for the rock tested from the quarry is 8,043 pounds per square inch (psi). Those intact rock strengths are medium strong to strong with an average strength of medium strong (ISRM Grade R3). It indicates that the rock mass qualities in the Skyline quarry area are generally considered FAIR.

Schmidt hammer tests were performed in the field on in-place rocks and on rock samples obtained during this study. Results of those tests are presented in Appendix A. For non-vesiculated or slightly vesiculated basalt, the Schmidt hammer tests correlated to unconfined compressive strengths ranging from about 3,700 psi to over 13,000 psi. For moderately to highly vesiculated basalt, the results ranged from about 2,600 to 7,900 psi.

Compared to the laboratory unconfined compressive strength tests, the Schmidt hammer results underestimated unconfined compressive strengths by about 19 to 26 percent, except for highly vesiculated rock, where the Schmidt hammer overestimated the rock compressive strength by about 40 percent.

4.6 ESTIMATE OF ROCK MASS STRENGTH

The rock mass strength parameters were derived using the Hoek-Brown failure criterion (Marinos et al., 2005; Marinos et al., 2000). The overall strength of a rock mass is difficult to estimate because of scale issues. Methods of estimating rock mass strength based on the strength of intact rock materials and the lithology, rock mass quality and other factors are used to downgrade the measured intact rock strength to rock mass scale values. Once these strength properties have been estimated, they can be adjusted to account for the expected level of disturbance. Rock mass disturbance is typically caused by blast damage and vertical unloading, as well as strains resulting from stress changes in the quarry walls.

Following Hoek, et. al. (1995), the petrographic constant for intact rock (m_i) has been set for basalt encountered within the proposed quarry area using a value of 25. Intact rock strength and rock mass quality at the site have been discussed in Section 4.5.

The Geological Strength Index (GSI) is based on the RMR rating system and was introduced by Hoek et al. (1995) to overcome issues with the RMR values for very poor-quality rock masses. For better quality rock masses (GSI>25), the value of GSI can be estimated from Bieniawski's RMR (1989) as GSI=RMR-5. This assumes a groundwater rating set to 15 (dry) and the adjustment for joint orientation set to 0 (very favorable). For this study, the GSI was conservatively established to be 55, which is more conservative than the typical estimation using RMR values.

Hoek et al, (2002) recommends that the utilized rock mass strengths be downgraded to disturbed values to account for rock mass disturbance associated with heavy production blasting and vertical stress relief. He indicates that a disturbance factor of 0.7 would be appropriate for a mechanical excavation where no blasting damage is expected. A value of 1.0 is assumed for conventional production blasting. A well-controlled production blasting strategy is expected to be between these extremes and consistent with a disturbance factor of 0.85. For this study a disturbance factor of 1.0 was used.

The following table presents a summary of the rock mass strength parameters for the anticipated rock that will be encountered within the quarry walls.

SUMMARY OF ROCK MASS STRENGTH PARAMETERS			
Basic Parameter	**Symbol**	**Unit**	**Values**
Unit Weight	Γ	pcf	160
Intact Unconfined Compressive Strength (UCS)	σ_{ci}	psi	6922
Basic Rock Mass Rating (1989)	RMR	-	60
Geologic Strength Index	GSI	-	55
Petrographic Constant for Intact Rock	m_i	-	25
Disturbed Rock Factor (Disturbance Factor D=1.0)			
Hoek-Brown Constant for Rock Mass	m_b	-	1.005
Hoek-Brown Constant	S	-	0.0006
Friction angle of Rock Mass	Ø'	degrees	26
Cohesion of Rock Mass	C'	psf	40,000
Compressive Strength of Rock Mass	S_{cm}	ksf	22.72
Deformation Modulus	E_m	ksf	96,165.97

The intact unconfined compressive strength used in the noted parameters was obtained by averaging the results of the Schmidt hammer tests presented in Appendix A. Based on these values, an angle of internal friction (Ø) of 26 degrees and a cohesion of 40,000 psf were obtained using the methods of Hoek et al. (2002).

5 KINEMATIC STABILITY ANALYSES

5.1 GENERAL

Kinematic analyses were undertaken on the discontinuity orientation data within the geotechnical database. The purpose of this analysis was to identify the kinematically possible failure modes using the stereographic technique. This section introduces kinematically possible failure modes and the results of the stereographic analyses.

5.2 PROPOSED QUARRY DESIGN

The proposed pit slopes and benches have yet to be designed. As such, we have assumed that the quarry would utilize 40-foot tall benches and we then estimated the bench widths and bench face inclinations during our kinematic evaluations.

5.3 MODES OF FAILURE

Kinematically possible failure modes in rock slopes typically include planar, wedge, and toppling failures. These failure modes can be identified by using stereographic analysis of peak pole/dip vector concentrations of the discontinuity data. These failure modes will occur if the discontinuities are continuous over the bench scale or more, if weak infilling is present along the measured discontinuities, or the geometry of the discontinuities is conducive to failure. A brief introduction on each mode of failure is provided below:

5.3.1 Planar Failure

This failure mode is kinematically possible when a discontinuity plane is inclined flatter than the slope face (it daylights) and at an angle steeper than the friction angle.

5.3.2 Wedge Failure

Wedge failures are kinematically possible when the plunge of the intersection of two planes (sliding vector) is inclined flatter than the slope face (it daylights) and at an angle greater than the combined friction angle, which is estimated from the characteristics of each plane that forms the wedge. Where kinematics are the controlling factor, the recommended quarry slope angles have been adjusted to reduce the potential for large-scale, multiple bench wedge failures.

5.3.3 Toppling Failure

This failure mode is kinematically possible due to interlayer slip along discontinuity surfaces where sub-vertical jointing dips into the slope at a steep angle β. The condition for toppling to occur is when $\beta > (\varphi_j + (90-\Psi))$, where Ψ is the slope face angle and φ_j is the friction angle of the joint (Goodman, 1989).

5.4 STEREOGRAPHIC ANALYSES

We performed a stereographic analysis of potential planar, wedge, and toppling failures for proposed quarry wall face orientations of 0°, 90°, 180°, & 270°. The analyses were carried out for each failure mode using the DIPS program (Rocscience, 2020a). We evaluated all possible slope angles relative to the four main discontinuity groupings to estimate the possibility of planar, wedge, and toppling failures occurring. An angle of internal friction (Ø) of 26 degrees was used in the kinematic evaluations.

5.4.1 Potential Planar Failures

Highwall orientations in respect to planar failures are shown on Plate 11.1, 11.2, 11.3, & 11.4 – Kinematic Evaluations. These potential planes correspond to the overall slope along with bench-scale failures. Based on data collected in the field and analyzed in our office, we estimated that potential planar failures pose a low risk to the project regardless of highwall face orientations. Isolated and individual planar discontinuities may be expected to locally fail, although isolated planes like these would likely not increase the possibility of overall planar failures on a bench-scale. At worse these small isolated failures may result in a small maintenance issue. Thus, potential planar failures at the proposed quarry site appear to have a relatively low potential for failures to occur.

5.4.2 Potential Wedge Failures

Potential wedge failures are estimated to be possible for slopes with a dip direction of 0° and 180° degrees, as shown on Plate 11.1 thru 11.4. Slopes with the following discontinuity orientations and with slope inclinations steeper than 65 degrees have the potential for wedge failures:

POTENTIAL WEDGE FAILURES				
Wedge No.	Slope Dip Direction (degrees)	Discontinuity	Orientation (degrees)	
			Dip Direction	Dip
1	0°	Plane 2	79°	84°
		Plane 3	269°	89°
2	180°	Plane 2	80°	84°
		Plane 4	66°	66°
3	180°	Plane 3	269°	89°
		Plane 4	66°	66°

5.4.3 Potential Toppling Failures

Flexural toppling occurs when the length to width ratio of adjacent blocks causes the center of gravity to fall beyond the lower block hinge point or the corner of the block. Direct toppling can occur whenever the resultant weight of a block projects beyond the downslope outside corner of a rectangular shaped block. Potential direct toppling is possible for the proposed highwall, but it was estimated that there is little flexural toppling as possible with proposed highwall orientations.

Direct toppling is kinematically possible for highwalls with dip directions orientations of 0° & 180°, as shown on Plate 11.1 thru 11.4.

5.4.4 Summary of Kinematically Possible Failures

As previously noted, wedge and toppling failures are kinematically possible for varying slope orientations along the proposed quarry highwall. Plates 11.1 thru 11.2 graphically presents the possible failures and their influenced slope orientations. The following table presents the estimated slope dip ranges for each failure type:

RESULTS OF KINEMATIC ANALYSES		
POTENTIAL FAILURE TYPE	NUMBER OF POTENTIAL FAILURES	PRIMARY DISCONTINUITY PLANES INVOLVED[1]
SLOPE DIP DIRECTION = 0 DEGREES		
Planar	0	
Wedge	1	2 & 3
Direct Topple	0	
Flexural Topple	1	3 & 4
SLOPE DIP DIRECTION = 90 DEGREES		
Planar	0	
Wedge	0	
Direct Topple	1	1
Flexural Topple	0	
SLOPE DIP DIRECTION = 180 DEGREES		
Planar	0	
Wedge	2	2 & 4, 3 & 4
Direct Topple	0	
Flexural Topple	1	2 & 3
SLOPE DIP DIRECTION = 270 DEGREES		
Planar	0	
Wedge	0	
Direct Topple	1	2
Flexural Topple	0	
[1] – See Plates 11.1, 11.2, 11.3, & 11.4 for plane orientations		

Whether these potential failures pose an issue for the proposed quarry development is evaluated further in Section 6.

6 ROCK MASS STABILITY ANALYSES

6.1 GENERAL

Conventional limit-equilibrium analyses were conducted to evaluate the stability of planar and wedge failures and the gross stability of the rock that the proposed highwalls will consist of. Limit-equilibrium stability analyses were performed using GEO5 – Rock Stability (Fine Civil Engineering Software, 2019), SLIDE 2018 (Rocscience, 2020b), and RocTopple (Rocscience, 2020c) computer programs for the quarry design. GEO5 was used to evaluate limit-equilibrium conditions for potential wedge failures identified during kinematic evaluations. SLIDE 2018 was used to estimate the gross stability of the overall quarry slope. RocTopple was used to perform limit-equilibrium evaluations of potential toppling failures.

Results of the limit-equilibrium analyses are presented in Appendix C. The limit-equilibrium analyses were completed to evaluate the overall stability of the jointed rock mass and to demonstrate the sensitivity of the calculated Factors of Safety (FOS) to different overall slope angles, blasting disturbance, and groundwater levels.

The evaluation of stability of rock slopes generally takes into consideration a number of rock strength parameters, geologic conditions within the slope, orientations of discontinuities (fractures, joints, flow bands, faults, etc.), hydrogeologic conditions, and surcharge and seismic loads that could affect the slope. Those parameters are typically modeled using limit-equilibrium methods (and less commonly using finite element or finite difference modeling) to estimate if the modeled scenario meets or exceeds a target minimum FOS against failure. The FOS is estimated by calculating the forces resisting slope failure divided by the forces causing slope failure. Thus, a FOS of greater than 1 implies a stable slope, a FOS of less than 1 implies a slope that is failing, and a FOS of 1 implies a slope that is on the verge of failure.

Slopes having a minimum FOS of 1.5 for static evaluations are typically considered stable for permanent engineered conditions. For open quarry slopes, the FOS for static conditions is often reduced to 1.3 because the risk to structures, people, and improvements is relatively low. Pseudostatic (pseudo-earthquake forces) FOS values above 1.01 are considered stable for most engineered projects (Blake et al., 2002; CGS, 2008).

To estimate the appropriate horizontal ground acceleration to use within our model, we used methods of Blake et al (2002) and CGS (2008). Using a probabilistic horizontal ground acceleration of 0.26g, which corresponds to a 475-year return period (10% chance of exceedance in 50 years; see Section 3.5), we reduced that value by 42 percent to obtain a pseudostatic acceleration of 0.12g.

6.2 ENGINEERING CRITERIA USED IN LIMIT-EQUILIBRIUM EVALUATIONS

Limit-equilibrium analyses for potential failures and for gross quarry highwall stability were performed using rock mass strength criteria described in Section 4.6. Those criteria estimated a minimum angle of internal friction (Ø) of 26° and a cohesion value of 40,861 psf. Because cohesion along discontinuity plane sets is difficult to estimate, we reduced the cohesion value to 3,500 psf for these studies. In addition, a unit weight of 160 pounds per cubic foot was utilized for the basalt.

6.3 LIMIT-EQUILIBRIUM ANALYSES

The following sections discuss the results of limit-equilibrium evaluations for various conditions.

6.3.1 General

As noted in Section 5.4.1 - Potential Planar Failures, there were no potential planar failures identified for the proposed highwalls for this study.

6.3.2 Evaluation of Potential Wedge Failures

As noted in Section 5.4.2, kinematic evaluations identified three primary potential wedge failures that were evaluated to estimate the FOS against slope failure. For the analyses, we assumed that discontinuities were 50 percent filled with water and that no tension crack was present, as shown on Plates 12.1 and 12.2 – Potential Wedge Failures. Results of the analyses are presented in Appendix C and are tabulated as follows:

RESULTS OF STABILITY EVALUATIONS WEDGE FAILURES

Dip Direction of Slope Face	Wedge No.	Factor of Safety	
		Static	Pseudostatic
0°	1	15.05	12.84
180°	2	9.24	8.13
180°	3[A]	-	-

[A] – Wedge 3 only had one plane in contact and thus did not form a true wedge.

Based on our evaluations, the FOS values for the wedges analyzed exceed the minimum thresholds typically required for quarry projects.

6.3.3 Evaluation of Potential Toppling Failures

Two potential toppling failures were identified as a part of this study. Potential slope failures were identified at 0° and 180° slope dip directions. Plate 13 – Potential Topple Analysis, shows that the static and pseudostatic FOS for potential toppling failures exceed 1.5 and 1.01, respectively.

7 QUARRY WATER MANAGEMENT

7.1 GENERAL

Groundwater data for the project region was collected from the California Department of Water Resources (DWR) Water Library (DWR, 2020a), through water well completion reports, and regional water basin boundaries (DWR, 2020b) available online. Well logs from the Public Land Survey Systems (PLSS) at the location designated Township 30N, Range 12E, Section 36, roughly 2.5 miles from the center point of the proposed quarry site, show the depth of the first water encounter at 80 feet below the surface. In addition, well completion reports (DWR, 2020b) for wells within about 1,500 feet of the site recorded static water levels at depths of roughly 100 to 137 feet below the surface.

It is unlikely that static water tables will be encountered during mining of the quarry, provided deepened pits are not created. However, seasonal and/or perennial water seepage could occur from perched water at the overburden/rock contact, and from discontinuities exposed within the quarry highwall. Because of these conditions, groundwater depressurization measures are not likely to be needed; however, as the quarry floor is lowered and additional geotechnical conditions are exposed, depressurization may need to be implemented to enhance quarry slope stability. Surface water should be diverted to prevent overland flow into the open pit. A general concept of water management for the HCC quarry is briefly discussed below.

7.2 SURFACE DIVERSION DITCH AND/OR BERM

A diversion ditch and/or berm along the quarry crest are recommended to divert surface runoff and snowmelt away from the quarry during operations. Shotcrete or a low permeability lining is often recommended for diversion ditches in order to minimize seepage losses and groundwater recharge to underlying quarry slopes.

7.3 SLOPE DEPRESSURIZATION SYSTEM

As discussed above, slope depressurization systems are likely not to be needed. If they are, then depressurization systems could include a combination of techniques such as diversion ditches, vertical pumping wells, and horizontal drains. These measures should be implemented based on regular site reconnaissance, a staged approach during quarry development, and could involve the installation of depressurization systems and associated monitoring of groundwater pressures. This will enable an assessment of the quarry slope drainage capability and the requirements for additional installations.

7.4 IN-QUARRY DEWATERING SYSTEM

Quarry inflows will likely occur along discontinuities extending through the basalt and volcanic rocks. The quarry dewatering system should be designed to meet the combined requirements of the anticipated groundwater quarry inflow rates and runoff from precipitation. The peak operational design capacity of the system is controlled by the peak storm inflow assumptions.

8 QUARRY SLOPE DESIGN

8.1 GENERAL

This preliminary study for proposed quarry slope design has considered relevant geotechnical data, limited hydrogeological information, and the results of various stability analyses. Maximum recommended quarry slope geometries are summarized in this section, and some operational considerations related to the recommended slopes are considered. Our recommended design can be seen on Plate 14 – Recommended Slope Design.

8.2 RECOMMENDED QUARRY SLOPE ANGLES

Based on results from our kinematic evaluations and limit-equilibrium analyses, we recommend the following bench geometries for the quarry:

- Maximum vertical bench height: 40 feet
- Minimum bench width: 23 feet
- Maximum design bench face angle: 80 degrees
- Maximum overall slope angle: 53 degrees

Variations on bench width and height can be made as long as the proportion of maximum height to minimum width is maintained (i.e., a 40-foot-tall and 23-foot-wide bench geometry would be equivalent to the recommendations made above) or flatter.

HCC should implement a number of operational and maintenance procedures that can reduce the potential of backbreak and safety issues associated with local bench-level slope failures. Those procedures include:

- Presplitting all final rock faces.
- Scaling of blasted rock faces to remove loose rocks;
- Maintenance of a 25-foot wide offset barrier from all inactive rock faces; and
- Complete daily inspections of rock faces.

We recommend that these procedures be implemented and maintained by HCC and future mine owners, should the mine change ownership. Furthermore, when bench-level wedge or planar failures occur, we recommend that debris from those failures be removed from the bench. By implementing those procedures, impacts from backbreak should be reduced to an acceptable level.

Finally, the upper quarry slope face should be inclined no steeper than 1.5:1 (horizontal:vertical) when exposing soil and 1:1 when exposing intensely to moderately weathered rock materials.

8.3 OPERATIONAL CONSIDERATIONS

8.3.1 Controlled Blasting

Blasting disturbance is one of the controlling factors for rock mass strength and overall slope stability. Slope instabilities are often triggered by the progressive deterioration (raveling) of the wall face and this process is often initiated with the detachment of small rock blocks (key blocks) bounded by the rock mass discontinuities, The preservation of rock mass integrity during mining is critical to reduce the potential of these progressive failures and is required to achieve the steepest bench face angles possible.

Controlled blasting methods will facilitate steeper final quarry slopes by reducing face damage from blasting. Typical controlled blasting strategies utilize small diameter blast holes detonated as a pre-shear line in harder, massive rock (pre-splitting) or as a post-shear (cushion) line in weak or heavily fractured rock. In all cases, it is important that blasthole lengths be staggered so the bottom of the hole does not intercept the crest on the bench below. Otherwise, highly fragmented bench crests will develop, leading to increased and possibly unacceptable backbreak.

Interim quarry slopes should incorporate some "controlled blasting" to maintain safety, but the requirements in this situation are less rigorous due to shorter operating life of these walls. The initial quarry can be developed with variable slopes and blast patterns to develop optimal blasting design for final quarry walls. Trial blasts are also recommended wherever there is a substantial change in rock mass characteristics, in order to evaluate and optimize blast performance.

8.3.2 Geotechnical Monitoring

Proactive geotechnical monitoring is recommended for all stages of quarry development. The monitoring program should be implemented as a staged approach and include geotechnical and tension crack observation and monitoring, as well as implementation of a surface displacement monitoring program.

Detailed geological mapping should be performed following creation of new benches but at a frequency no longer than quarterly to annually, depending on the rate of resource extraction and bench formation. Detailed information to be noted should include orientations, types, persistence, frequency, infilling, and condition of discontinuities exposed during mining operations. In addition, seepage volumes and relative changes in seepage volumes should be noted as those changes might indicate dilation of discontinuities and a change in the hydrogeologic environment.

Observations of tension cracks should be carried out along all newly formed benches. Detailed information to be noted should include the surveyed location, orientation, aperture, and both vertical and lateral extents of all tension cracks. The development of tension cracks should be very carefully observed. The frequency of observations should be commensurate with the rate of development of individual cracks. A map and database of tension crack information should be compiled and updated as new information becomes available. Areas of slope movement that are associated with development of tension cracks should also be monitored with survey and/or instrumentation, that can consist of time domain reflectometry (TDR), inclinometers, borehole and/or surface extensometers, tiltmeters, and piezometers.

8.3.3 **Bench Scaling**

It is important that benches be kept clear and that the bench faces be maintained regularly so that they remain functional during mining operations. Scaling will be an important part of the bench maintenance program and may be conducted after blasting in areas where access is still available. Routine scaling may allow the bench widths to be minimized, due to a reduction in the volume of material to be controlled.

9 NATURALLY OCCURRING ASBESTOS (NOA)

9.1 INFORMATION REGARDING NATURALLY OCCURRING ASBESTOS

Ultramafic rock, such as serpentinite, amphibolite, peridotite, dunite, pyroxenite, hornblendite, etc., can contain asbestiform minerals, which are fibrous, silica-rich crystals that can cause lung cancer, mesothelioma, asbestosis, and other health-related issues, if present. Typically, six minerals within ultramafic rocks are responsible for the primary, naturally occurring asbestiform concerns for health-related issues: chrysotile, tremolite, actinolite, anthophyllite, crocidolite, and amosite. These minerals may or may not be present in ultramafic rocks; thus, the presence of ultramafic rock does not automatically indicate that there is a health hazard. The presence of asbestiform minerals can sometimes be discerned in the field based on visual examination of rock exposures but, most often, must be confirmed using laboratory testing.

Naturally occurring asbestos can be hazardous to human health if it is disturbed, becomes airborne and is inhaled. If NOA is not disturbed and fibers are not released into the air, then it is typically not considered a health hazard. Inhalation is the primary exposure route of concern, because breathing asbestos fibers may cause them to become trapped in the lungs. Ingestion is another, albeit less common, pathway of concern, because swallowing asbestos fibers may also cause the fibers to be trapped in body tissues. Asbestos is not absorbed through the skin, so merely touching it does not pose a significant risk to human health. Asbestos fibers are not water soluble and do not move through groundwater to any appreciable extent. Based on studies of other insoluble particles of similar size, the expected migration rate of an asbestos fiber through soils by the forces of groundwater is approximately 1 to 10 centimeters (0.4 to 4 inches) per 3,000 to 40,000 years (New Hampshire DES, 2010). Thus, asbestos is not considered a groundwater contaminant.

As discussed in Section 3.0, the highwall should expose basalt and volcanic rocks, which are not rock types that typically are considered as generators of NOA. If fibrous rock, or differing rock materials, such as those mentioned above, are encountered during quarrying, we recommend that an assessment of the potential presence of NOA and its associated concentrations be performed.

9.2 SITE CONDITIONS

Basaltic rocks at the site are typically not considered asbestos bearing, since they do not meet the criteria noted above. Thus, testing was not performed to assess the potential presence of NOA. If such testing is desired, we would be pleased to assist in those services.

10 FUTURE GEOTECHNICAL ASSESSMENTS

This preliminary report was prepared using limited data available from surficial rock exposures at the site. Thus, it is preliminary in nature. Findings, conclusions, and recommendations made within this report should all be considered preliminary. Because of this, we recommend that future geotechnical assessment of the quarry be performed once rock exposures are made within the quarry highwall and/or once subsurface geotechnical exploration is authorized. Those future geotechnical assessments should collect additional discontinuity orientations, rock quality data, rock strength data, groundwater information, and evaluate whether recommendations made within this preliminary geotechnical report are valid or require amendment.

In addition, periodic on-going geotechnical assessment of the quarry geologic and geotechnical conditions should be performed, as discussed in Section 8.3.2 of this report.

11 CLOSURE

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

Preliminary conclusions contained in this report are based on the conditions encountered during our field observations and mapping, and are applicable only to those project features described herein (see Section 1.1). Subsurface exploration was not performed for completion of this study. Soil and rock deposits can vary in type, strength, and other geotechnical properties between points of observation and exploration. Additionally, groundwater and soil moisture conditions can also vary seasonally and for other reasons. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the project site. The preliminary conclusions and recommendations presented in this report are based upon the findings at the points of observation, and interpolation and extrapolation of information between and beyond the points of observation, and are preliminary in nature and subject to confirmation based on the conditions revealed by construction. If conditions encountered during construction differ from those described in this report, or if the scope or nature of the proposed construction changes, we should be notified immediately to review and, if deemed necessary, conduct additional studies.

The scope of services provided by BAJADA 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 BAJADA for this project did not include the evaluation of the presence of critical environmental habitats or culturally sensitive areas.

This report may be used only by our client and their agents 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 that may require additional studies. In the event significant time elapses between the issuance date of this report and full construction of the quarry, BAJADA shall be notified of such occurrence to review current conditions. Depending on that review, BAJADA may require that additional studies be conducted and that an updated or revised report is issued.

Any party other than our client who wishes to use all or any portion of this report shall notify BAJADA of such intended use. Based on the intended use as well as other site-related factors, BAJADA 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 BAJADA from any liability arising from the unauthorized use of this report.

We appreciate the opportunity to assist with this project. If you have any questions, please do not hesitate to contact our office.

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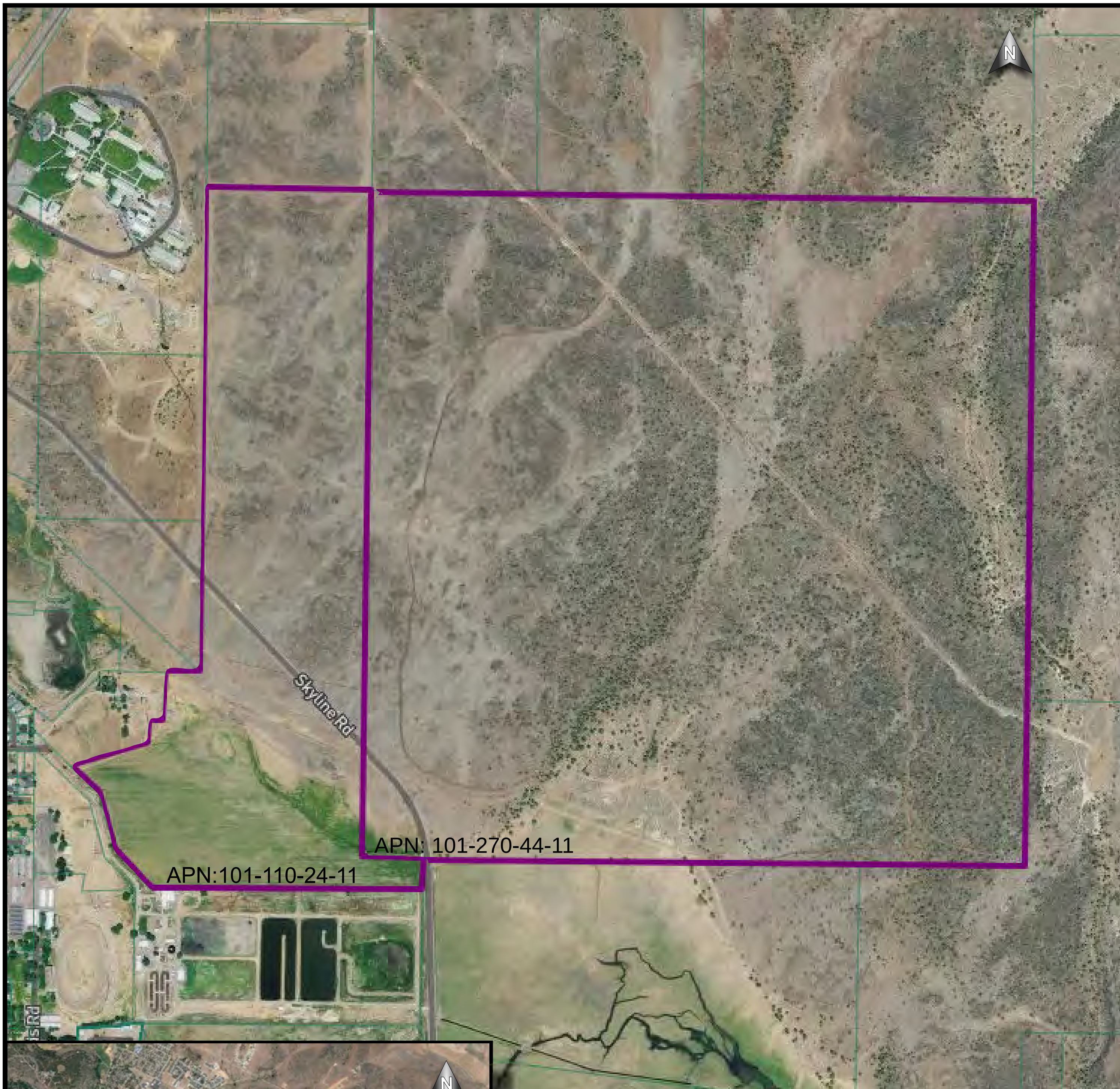
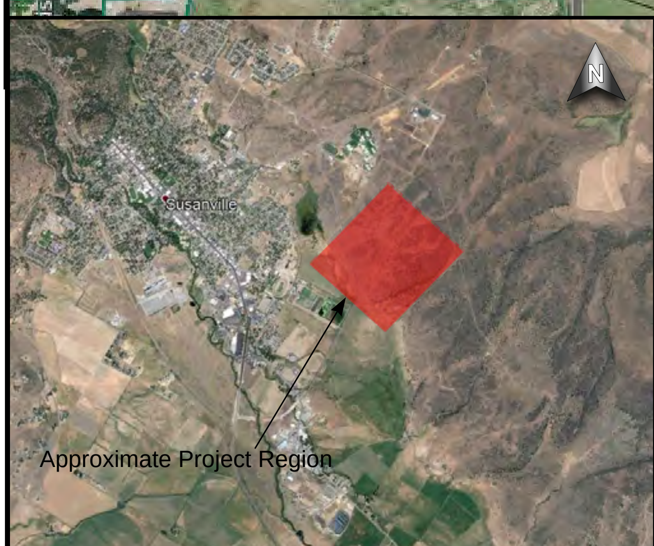
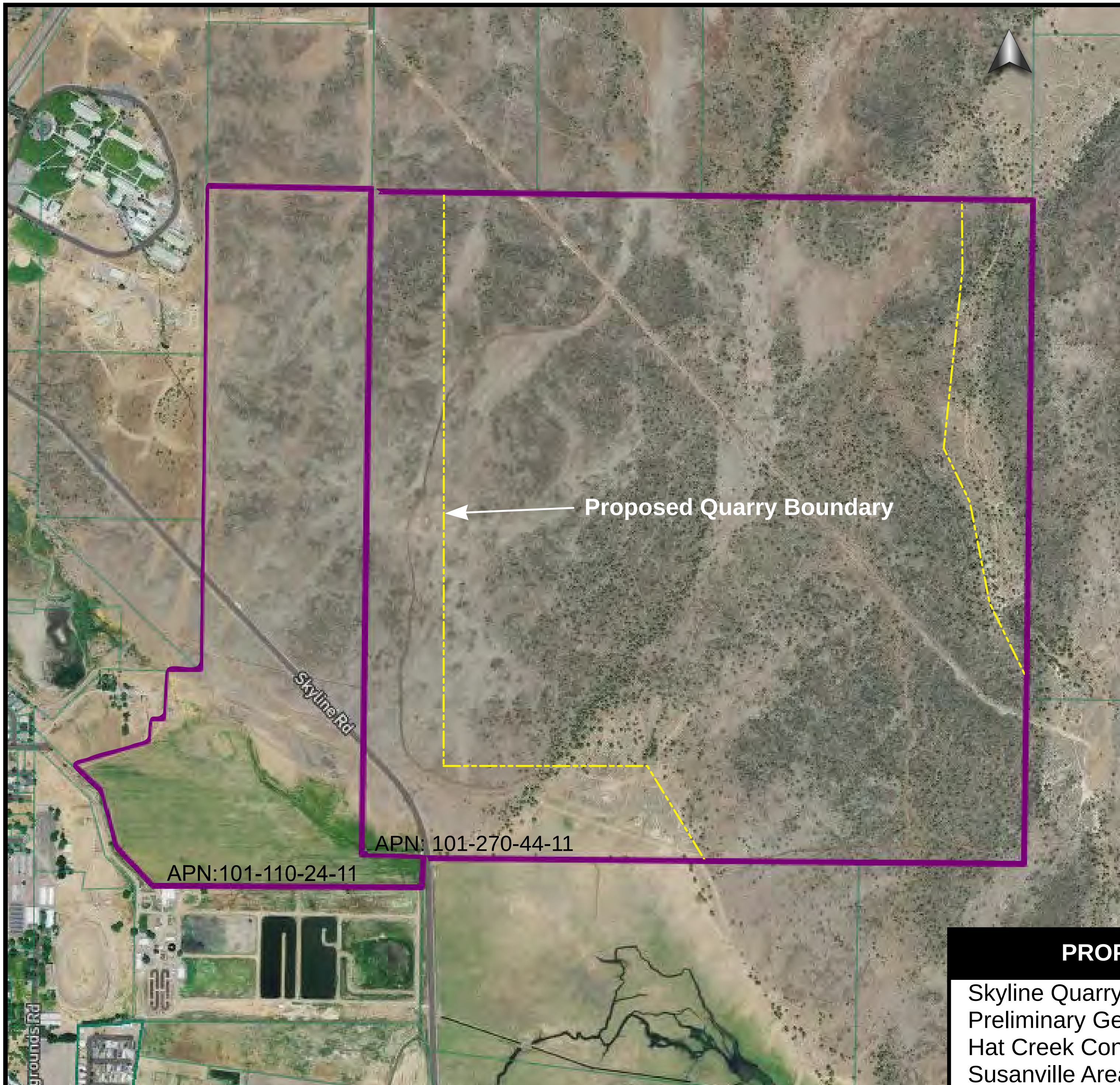




SITE LOCATION MAP

Skyline Quarry Preliminary Geotechnical Study Hat Creek Construction Susanville Area, Lassen Co., CA	Plate No. 1
BAJADA Geosciences, Inc.	Project no. 2001.0114

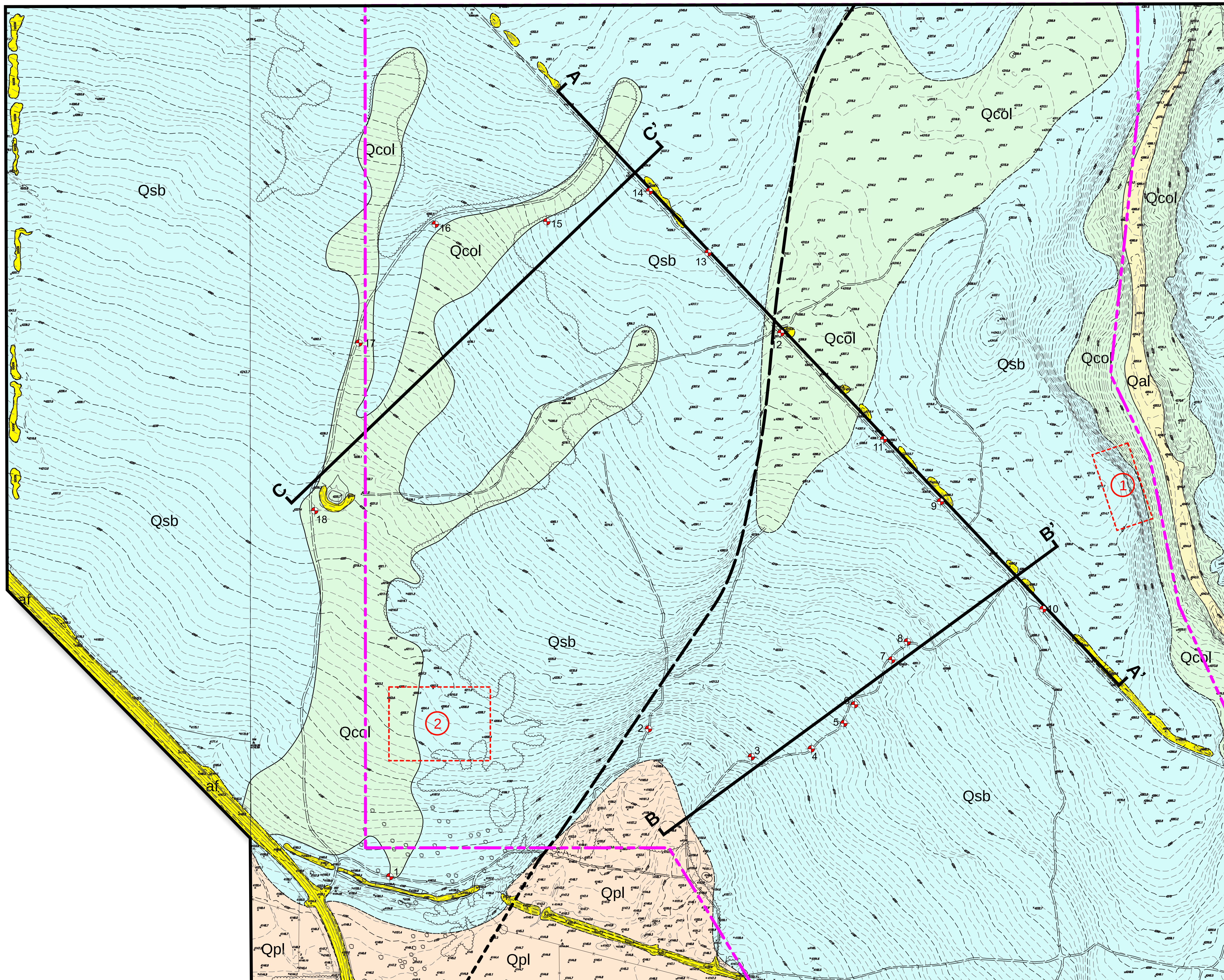
Base maps from Google Maps & MapQuest. Scale Undetermined.



PROPOSED QUARRY AREA

Skyline Quarry Preliminary Geotechnical Study Hat Creek Construction Susanville Area, Lassen Co., CA	Plate No. 2
BAJADA Geosciences, Inc.	Project no. 2001.0114

Base maps from Google Maps. Scale Undetermined.



N

af	Artificial Fill/Stockpile
Qal	Alluvium
Qcol	Colluvium
Qpl	Lacustrine Deposits
Qsb	Susanville Basalt

Geologic Contact, Dashed where approximate

Fault, dashed where approximate (per Grose et al., 2014)

Proposed limits of quarry

1 Outcrop areas where measurement of discontinuities was performed

A A' Cross Sections see Plate 4

18 Air-percussion drill hole location

0 300 600

Scale: 1"=600'
1:7,200

Contour Intervals: 2'

Topography from VESTRA (2020)

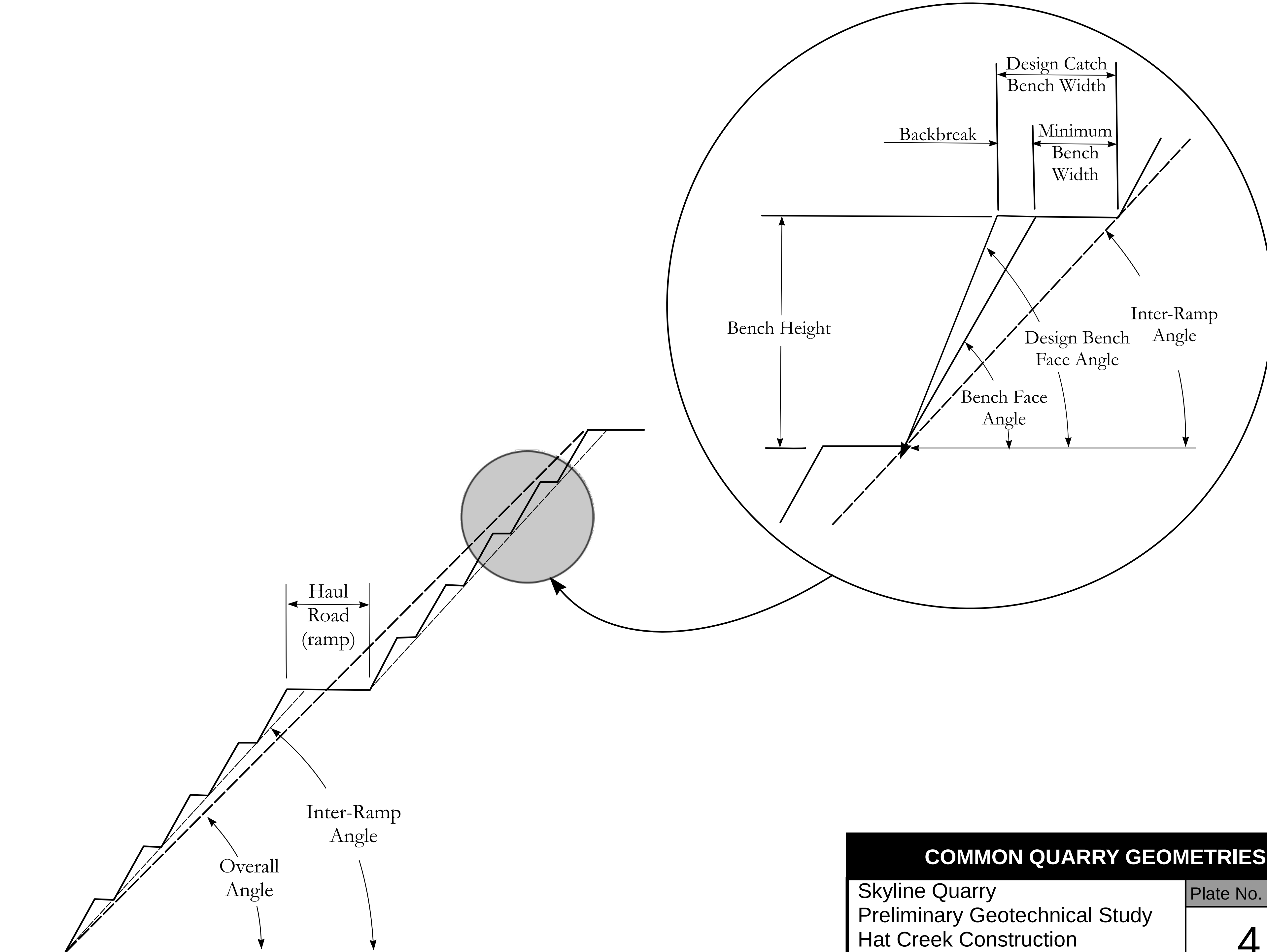
GEOLOGIC MAP

Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 3

BAJADA Geosciences, Inc.

Project no. 2001.0114



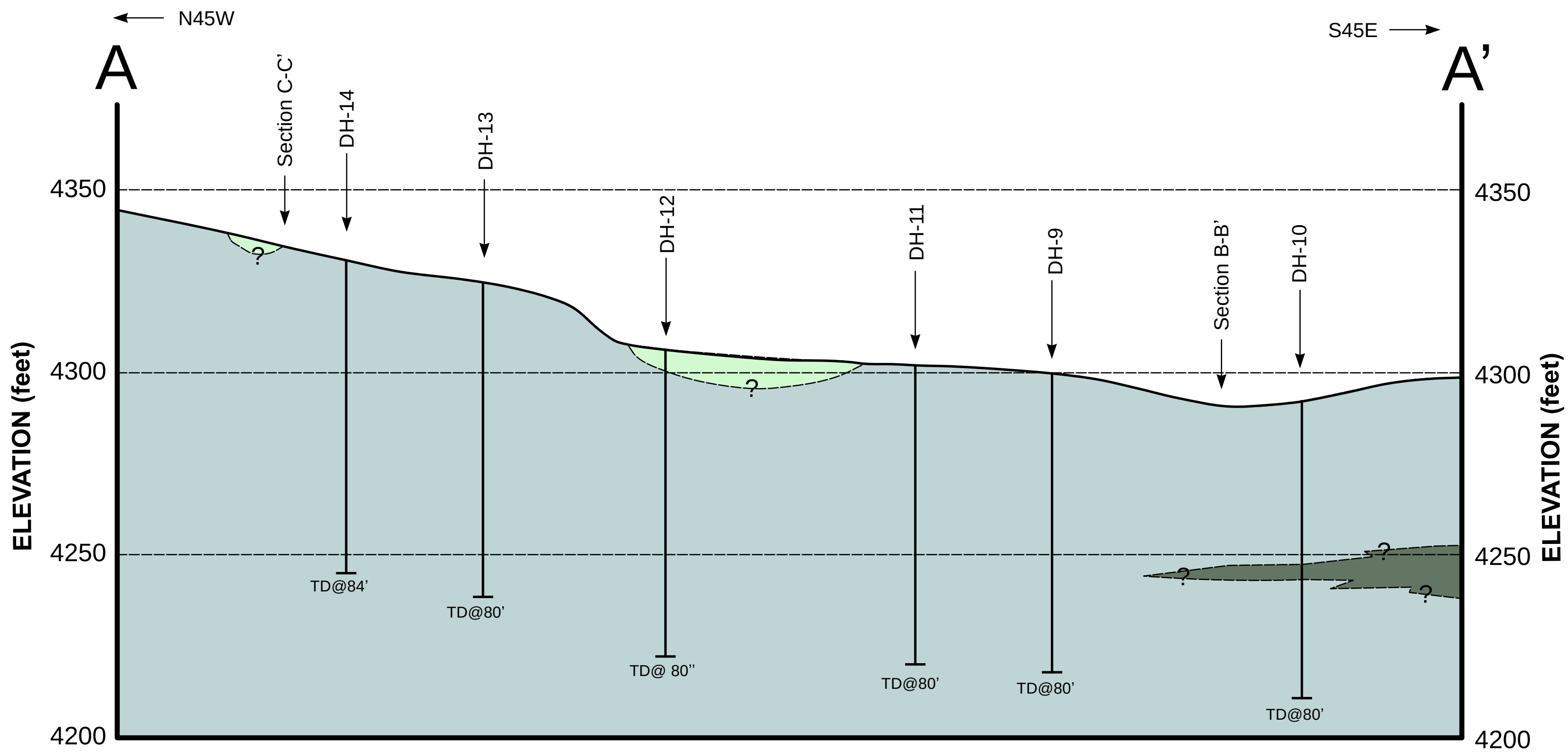
COMMON QUARRY GEOMETRIES

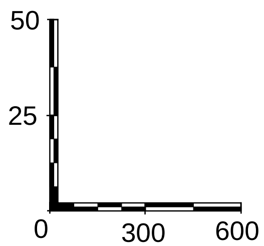
Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 4

BAJADA Geosciences, Inc.

Project no. 2001.0114





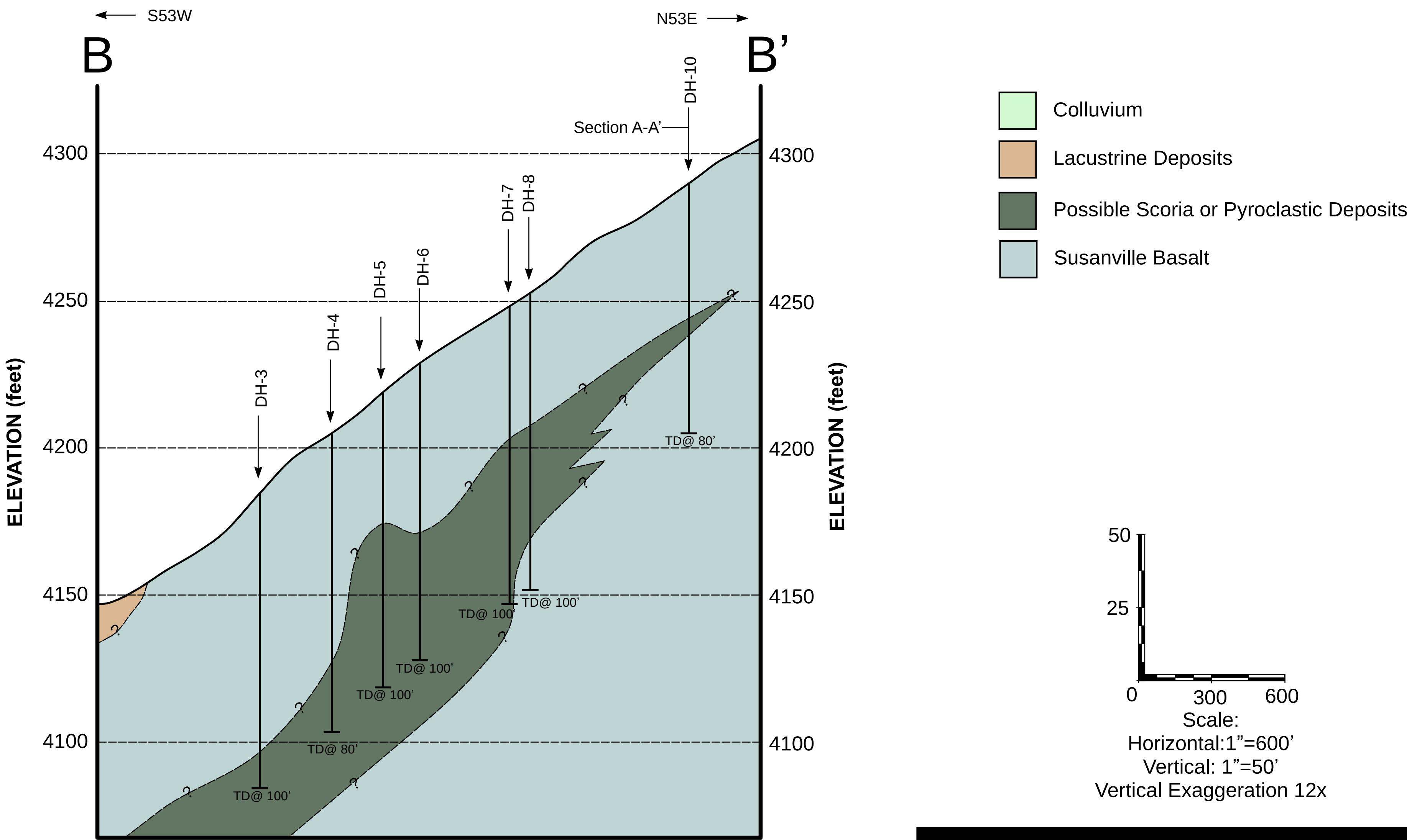
Scale:
Horizontal:1”=600’
Vertical: 1”=50’
Vertical Exaggeration 12x

- Colluvium
- Lacustrine Deposits
- Possible Scoria or Pyroclastic Deposits
- Susanville Basalt

Interpretation of subsurface conditions based upon air-percussion drill hole logs provided by HCC and logged by Cal-Nevada Precision Blasting (2020)

GEOTECHNICAL SECTION A-A’

Skyline Quarry Preliminary Geotechnical Study Hat Creek Construction Susanville Area, Lassen Co., CA	Plate No. 5.1
BAJADA Geosciences, Inc.	Project no. 2001.0114



GEOTECHNICAL SECTION B-B'

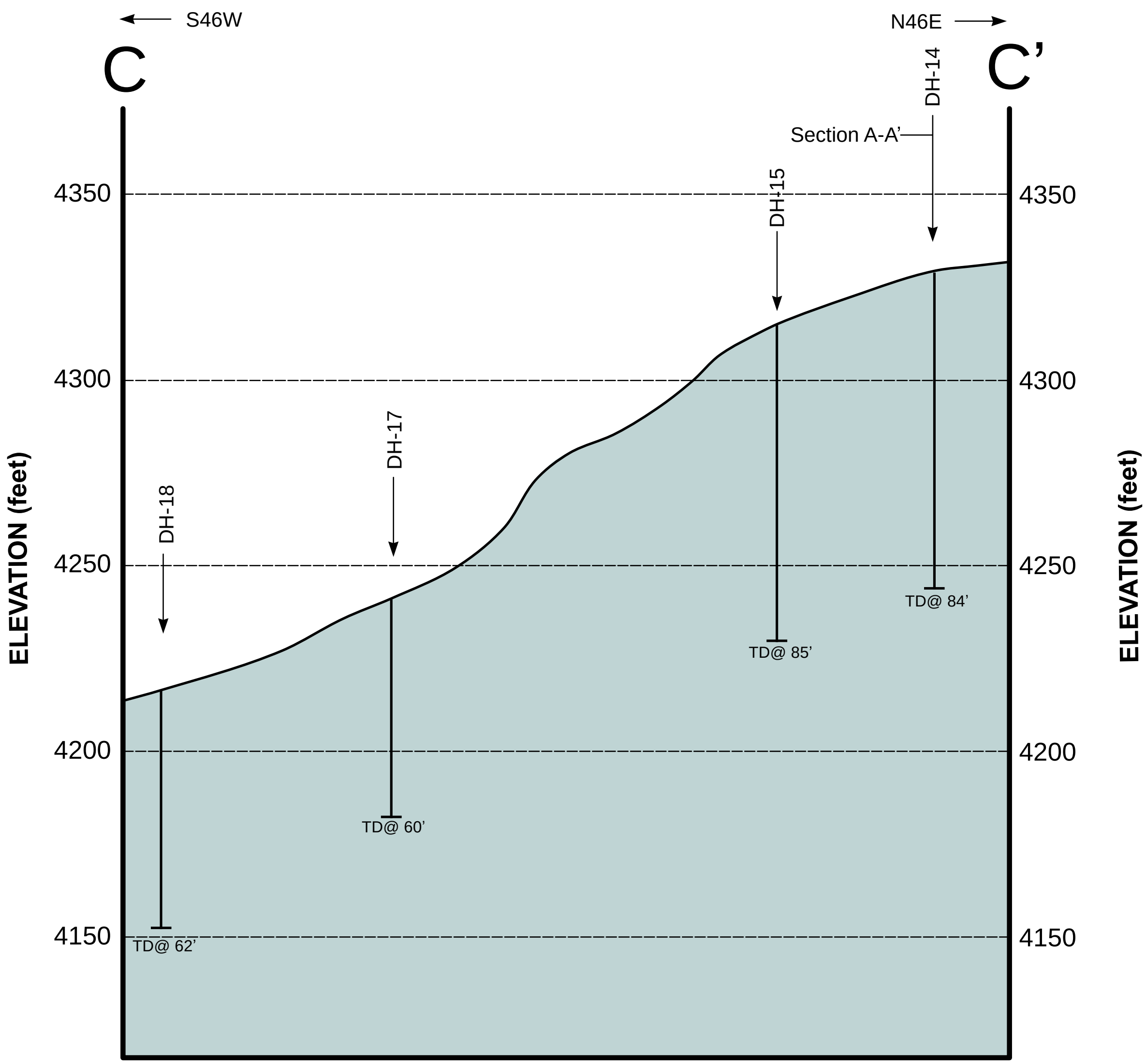
Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 5.2

BAJADA Geosciences, Inc.

Project no. 2001.0114

Interpretation of subsurface conditions based upon air-percussion drill hole logs provided by HCC and logged by Cal-Nevada Precision Blasting (2020)



Interpretation of subsurface conditions based upon air-percussion drill hole logs provided by HCC and logged by Cal-Nevada Precision Blasting (2020)

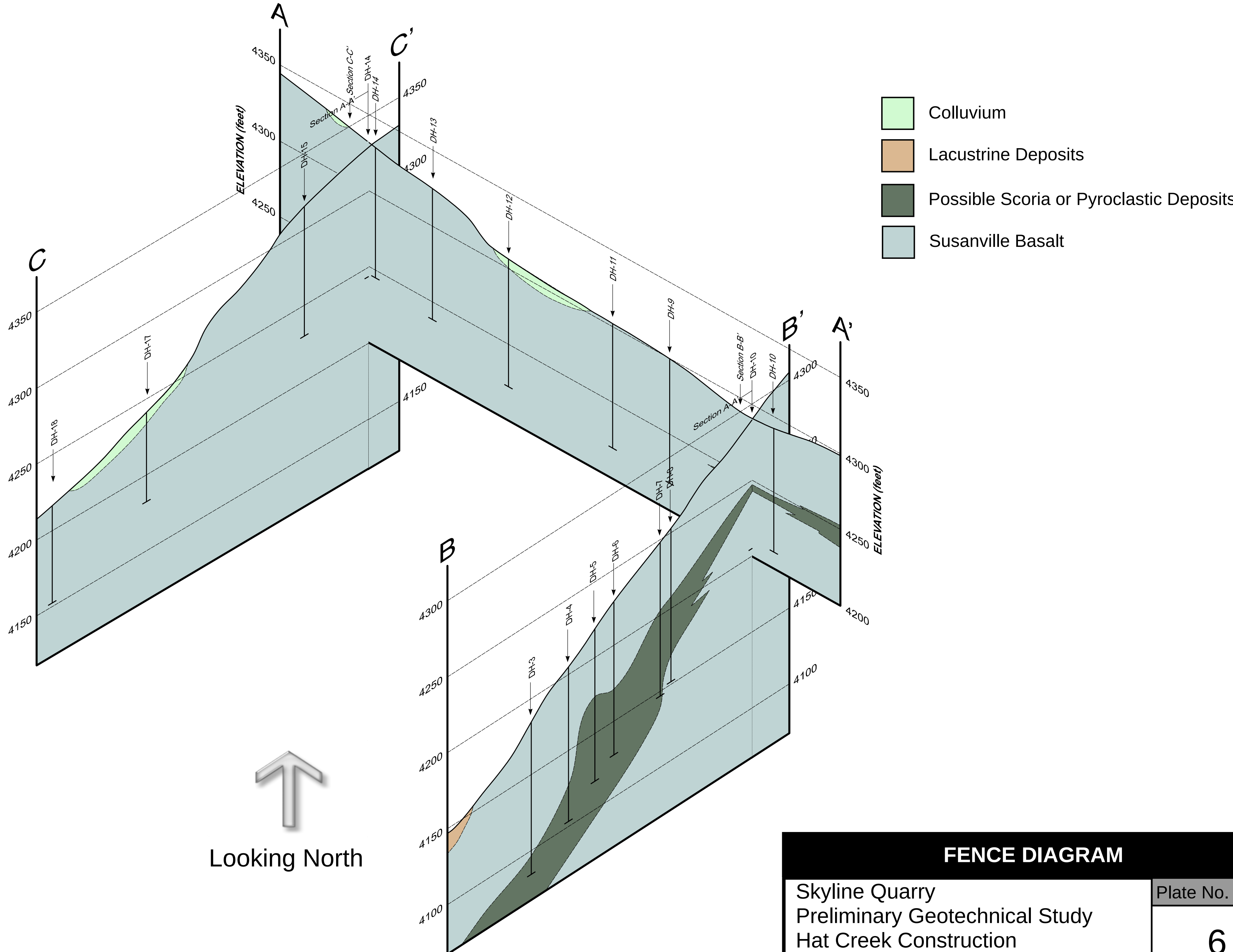
GEOTECHNICAL SECTION B-B’

Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 5.3

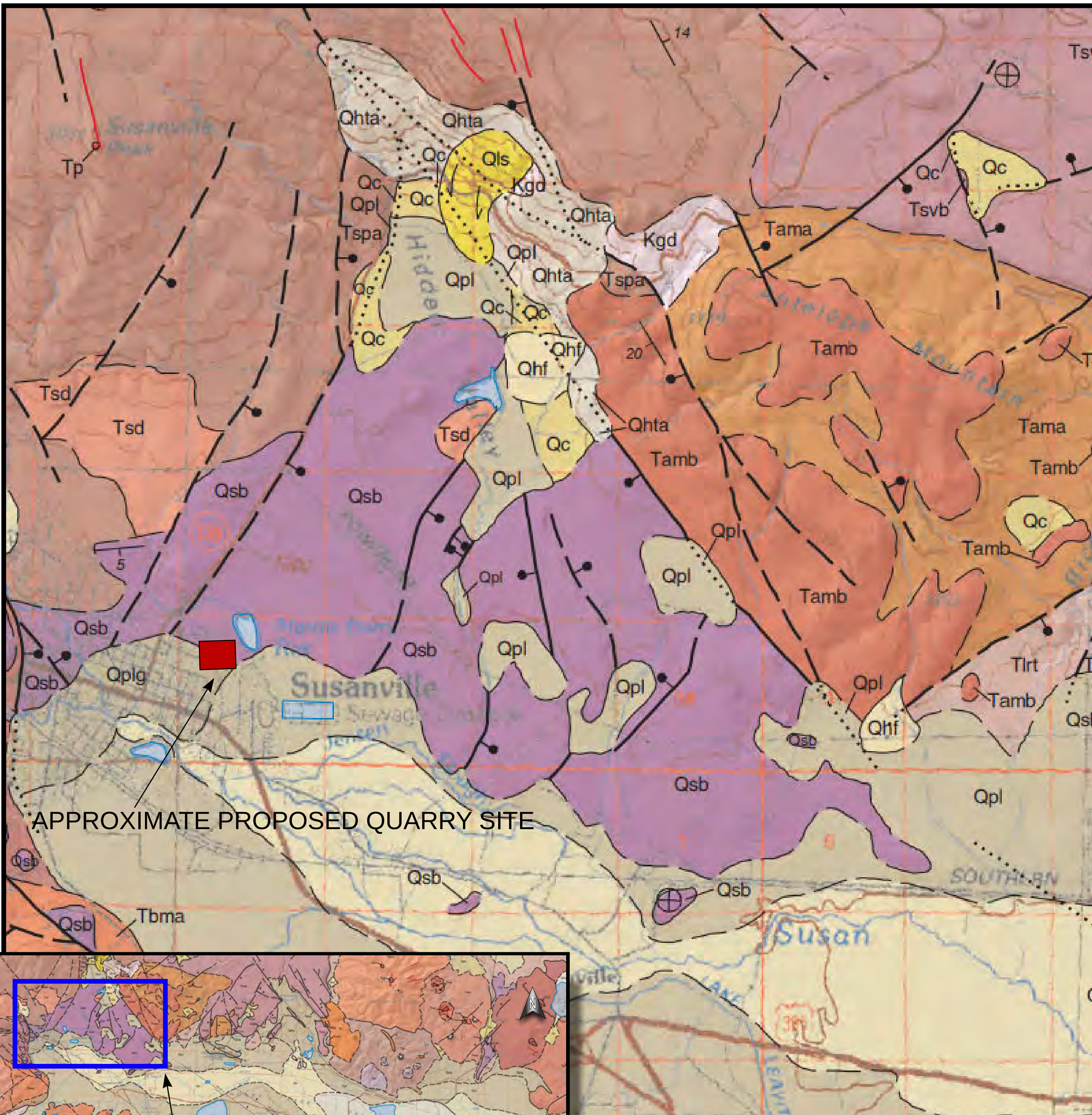
BAJADA Geosciences, Inc.

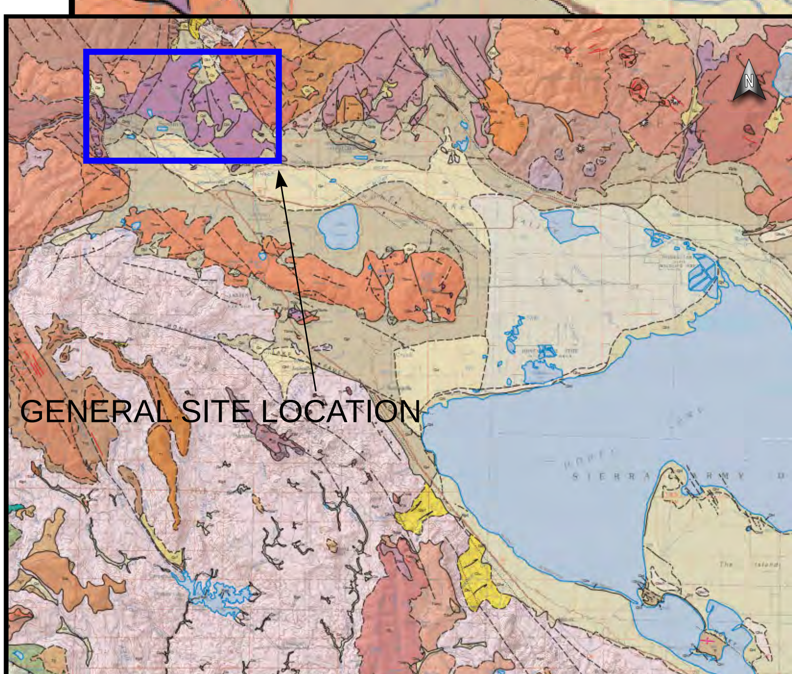
Project no. 2001.0114



Interpretation of subsurface conditions based upon air-percussion drill hole logs provided by HCC and logged by Cal-Nevada Precision Blasting (2020)

FENCE DIAGRAM	
Skyline Quarry Preliminary Geotechnical Study Hat Creek Construction Susanville Area, Lassen Co., CA	Plate No. 6
BAJADA Geosciences, Inc.	Project no. 2001.0114





Qc	Colluvium	Qa	Alluvium
Qpl	Near-shore deposits of Lake Lahontan	Qhf	Alluvial fan deposits
Qsb	Basalt of Susanville	Qls	Landslide deposits
Tspa	Mafic andesite of Susanville Peak	Tsd	Rhyolite to dacite

REGIONAL GEOLOGIC MAP

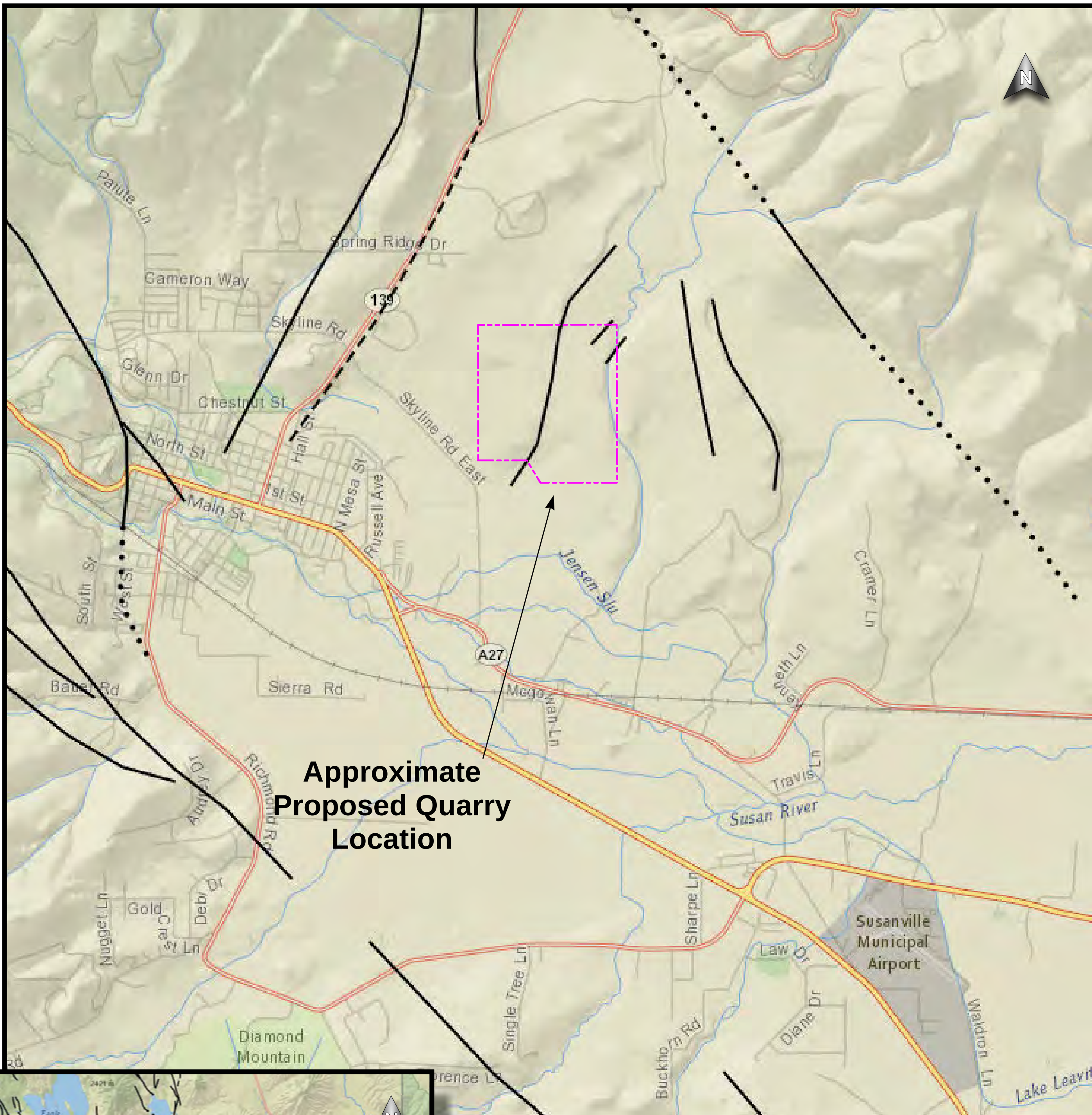
Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

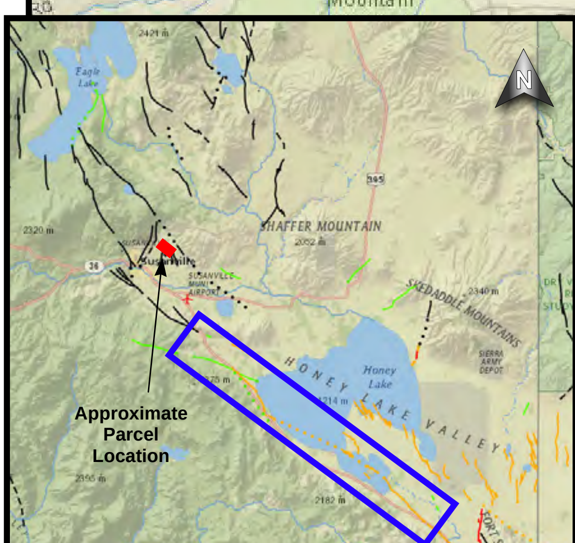
Plate No. 7

BAJADA Geosciences, Inc.

Project no. 2001.0114

Base map from Grose (2013). Scale Undetermined.





- Marks the general location of the Honey Lake Fault Strand

- Marks the genreal location of the study site and parcel location

- Pre-Holocene (Late Quaternary)

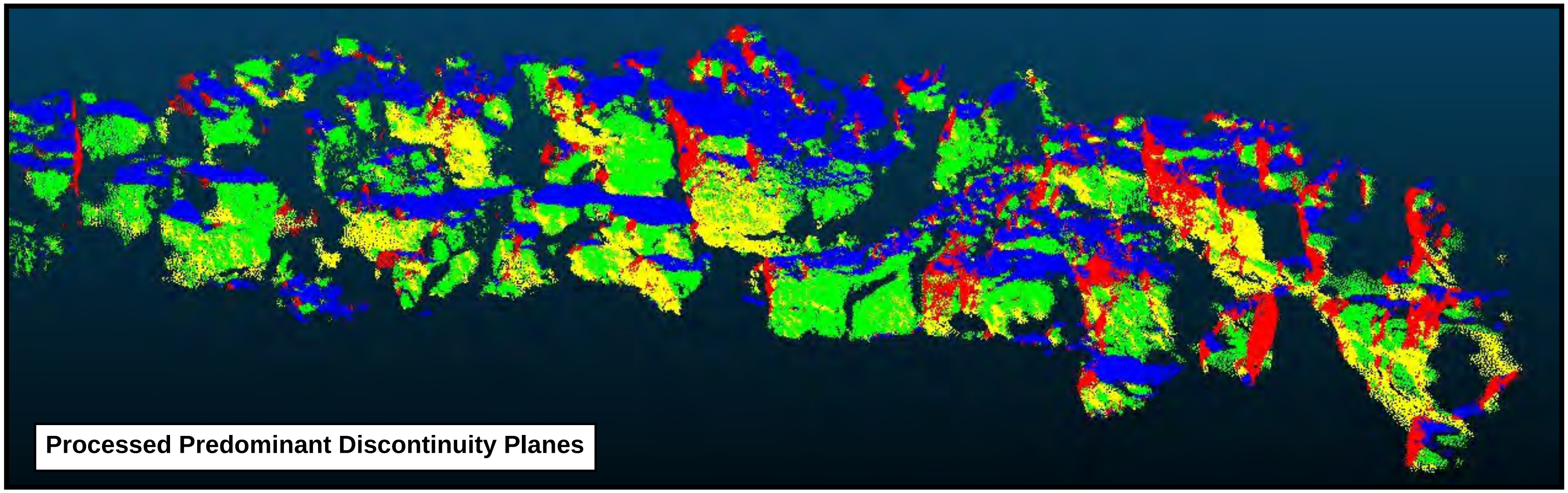
-Pre-Holocene (Undifferentiated Quaternary)

FAULT LOCATION MAP

Skyline Quarry Preliminary Geotechnical Study Hat Creek Construction Susanville Area, Lassen Co., CA	Plate No. 8
BAJADA Geosciences, Inc.	Project no. 2001.0114

Base map from The USGS Geologic Hazard Center . Scale Undetermined.

Panorama of Outcrop 1



Processed Predominant Discontinuity Planes

PREDOMINANT DISCONTINUITY ORIENTATIONS

Plane No.	Strike	Dip Direction	Dip
1	N42°E	72°	9°
2	N30°E	79°	84°
3	N01°W	269°	89°
4	N24°W	66°	66°

See Plate 3 for location of Outcrop 1

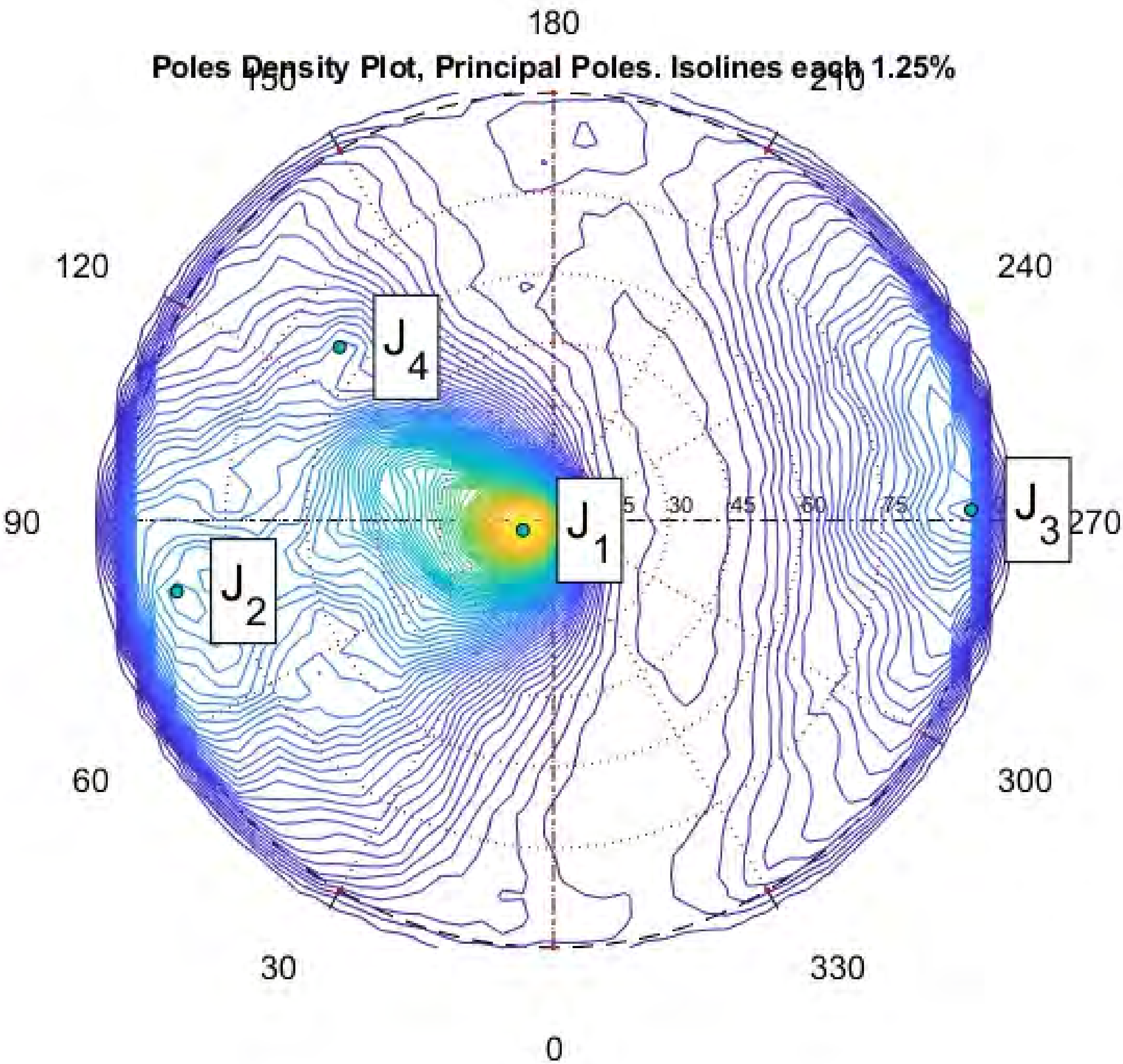
PHOTOGRAMMETRICALLY MEASURED DISCONTINUITY PLANES

Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 9

BAJADA Geosciences, Inc.

Project no. 2001.0114



	Dip dir (º)	Dip (º)	Density	%
1	71.7075	8.6046	2.2658	19.72
2	79.3010	83.7549	0.8019	21.29
3	268.5918	88.6367	0.6865	14.76
4	128.9989	65.5120	0.4874	15.24

PREDOMINANT DISCONTINUITIES

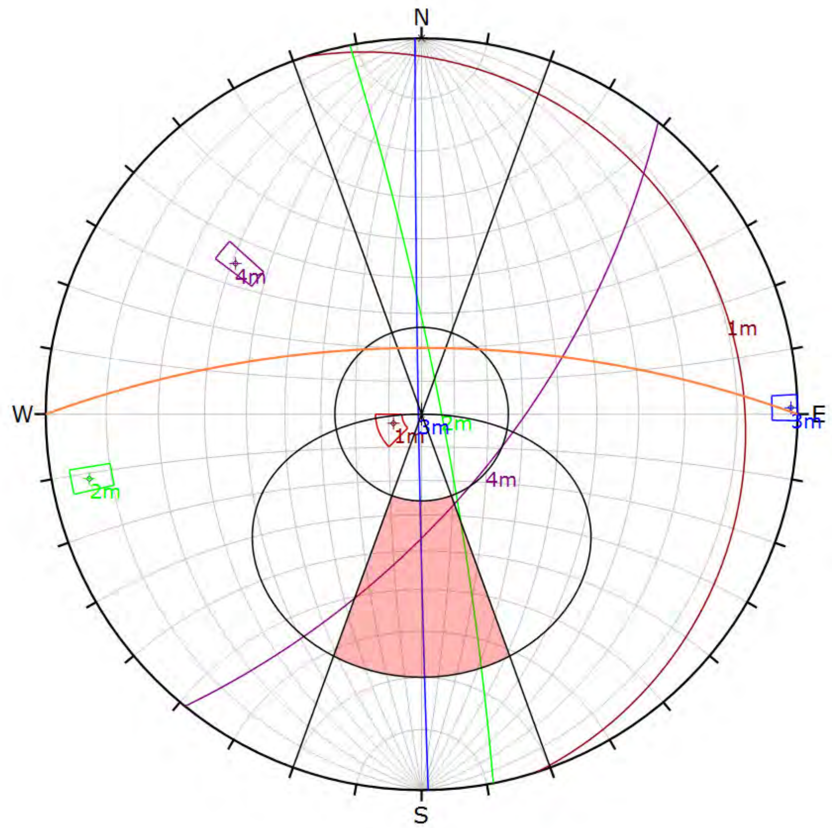
Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 10

BAJADA Geosciences, Inc.

Project no. 2001.0114

MARKLAND'S TEST OF KINEMATICALLY POSSIBLE FAILURES

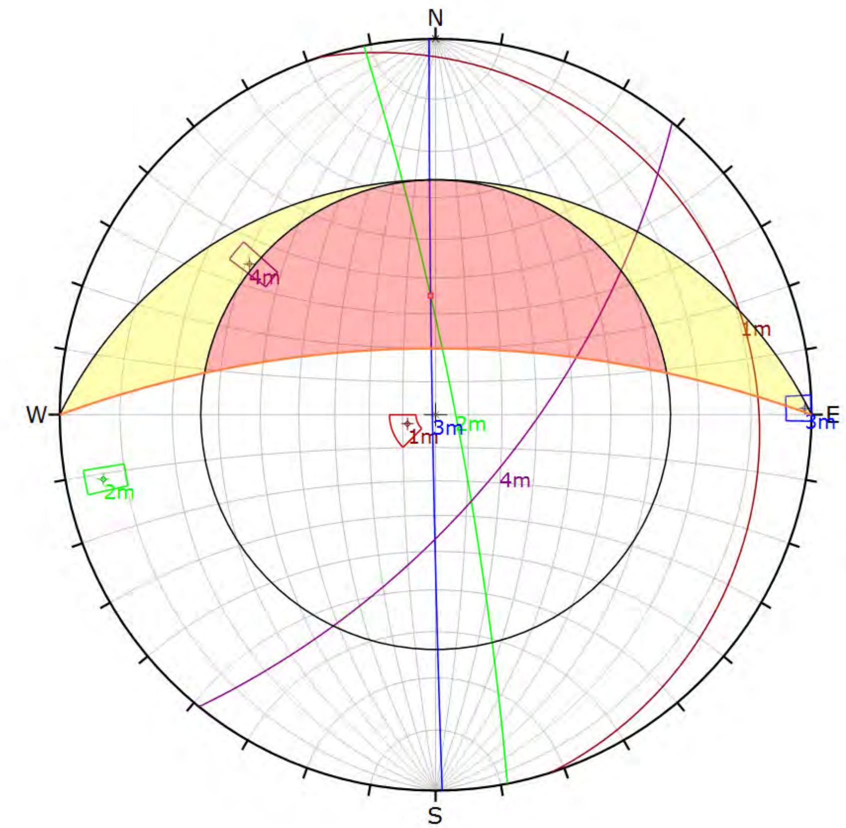


Symbol	Feature
◇	Pole Vectors

Kinematic Analysis	Planar Sliding
Slope Dip	70
Slope Dip Direction	0
Friction Angle	26°
Lateral Limits	20°

	Critical	Total	%
Planar Sliding (All)	0	4	0.00%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

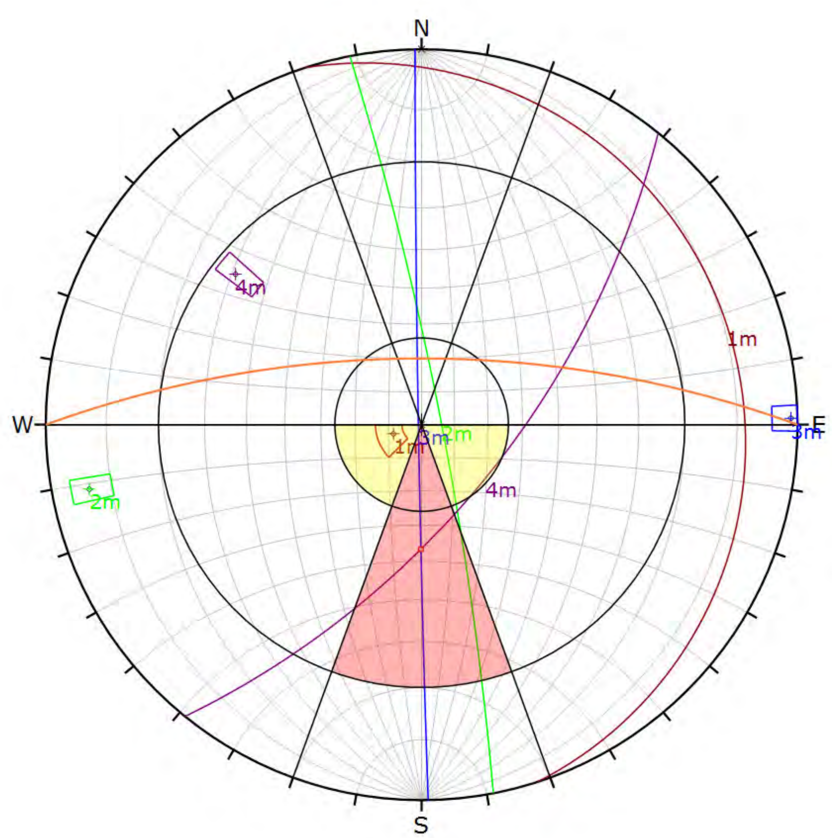


Symbol	Feature
◇	Pole Vectors
◘	Critical Intersection

Kinematic Analysis	Wedge Sliding
Slope Dip	70
Slope Dip Direction	0
Friction Angle	26°

	Critical	Total	%
Wedge Sliding	1	6	16.67%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

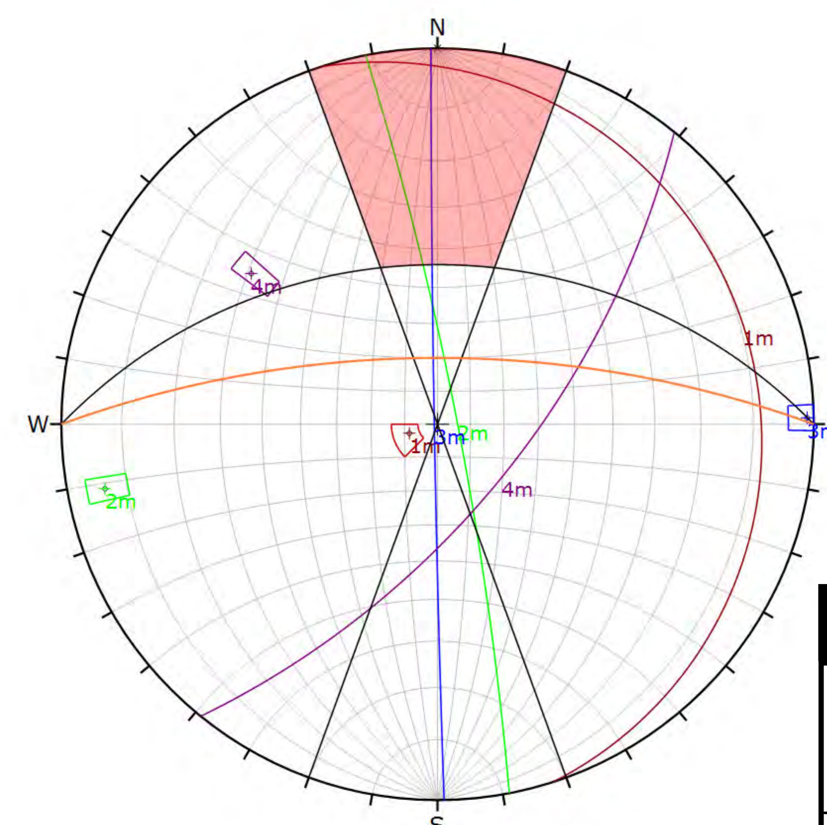


Symbol	Feature
◇	Pole Vectors
◘	Critical Intersection

Kinematic Analysis	Direct Toppling
Slope Dip	70
Slope Dip Direction	0
Friction Angle	26°
Lateral Limits	20°

	Critical	Total	%
Direct Toppling (Intersection)	1	6	16.67%
Oblique Toppling (Intersection)	0	6	0.00%
Base Plane (All)	1	4	25.00%
Base Plane (Set 1)	1	1	100.00%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle



Symbol	Feature
◇	Pole Vectors

Kinematic Analysis	Flexural Toppling
Slope Dip	70
Slope Dip Direction	0
Friction Angle	26°
Lateral Limits	20°

	Critical	Total	%
Flexural Toppling (All)	0	4	0.00%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

KINEMATIC EVALUATIONS
SLOPE DIP DIRECTION = 0 DEGREES

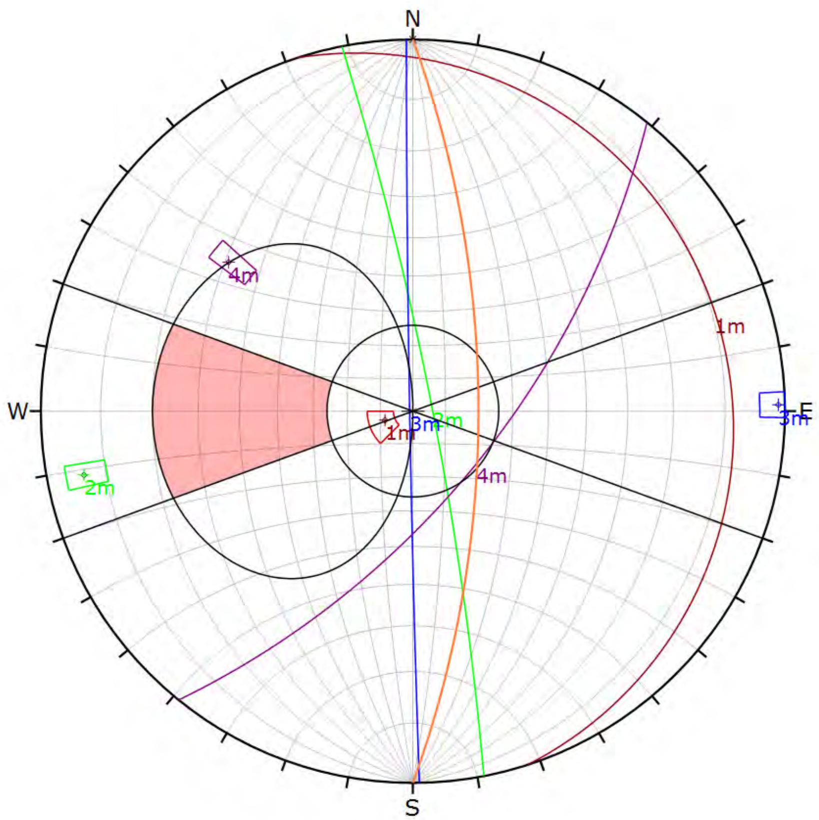
Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No.
11.1

BAJADA Geosciences, Inc.

Project no.
2001.0114

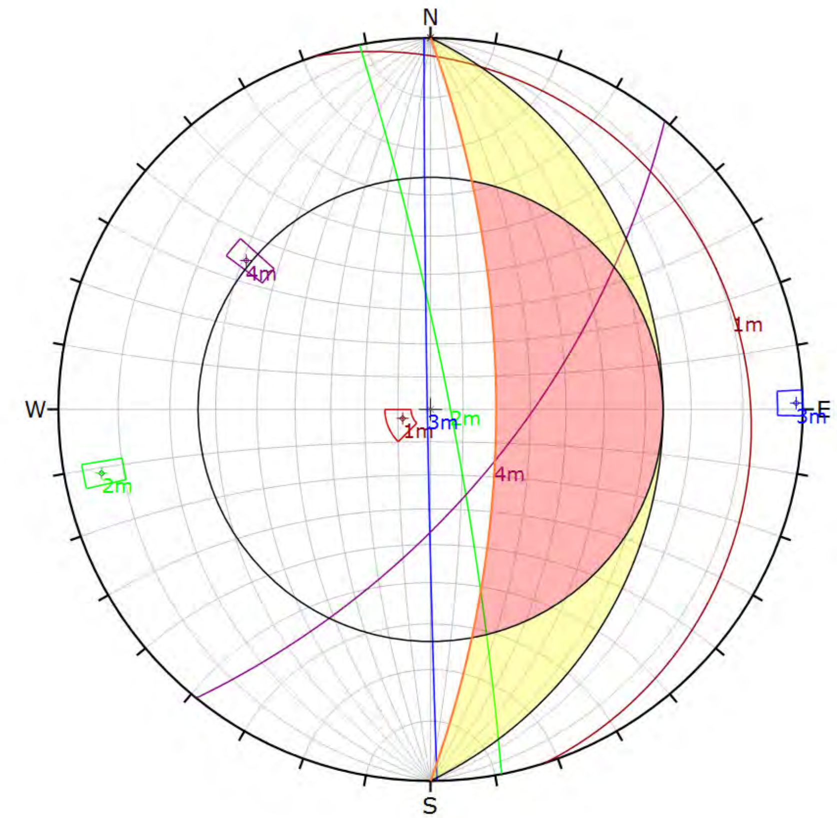
MARKLAND'S TEST OF KINEMATICALLY POSSIBLE FAILURES



Symbol	Feature
◇	Pole Vectors

Kinematic Analysis	Planar Sliding		
Slope Dip	70		
Slope Dip Direction	90		
Friction Angle	26°		
Lateral Limits	20°		
	Critical	Total	%
Planar Sliding (All)	0	4	0.00%

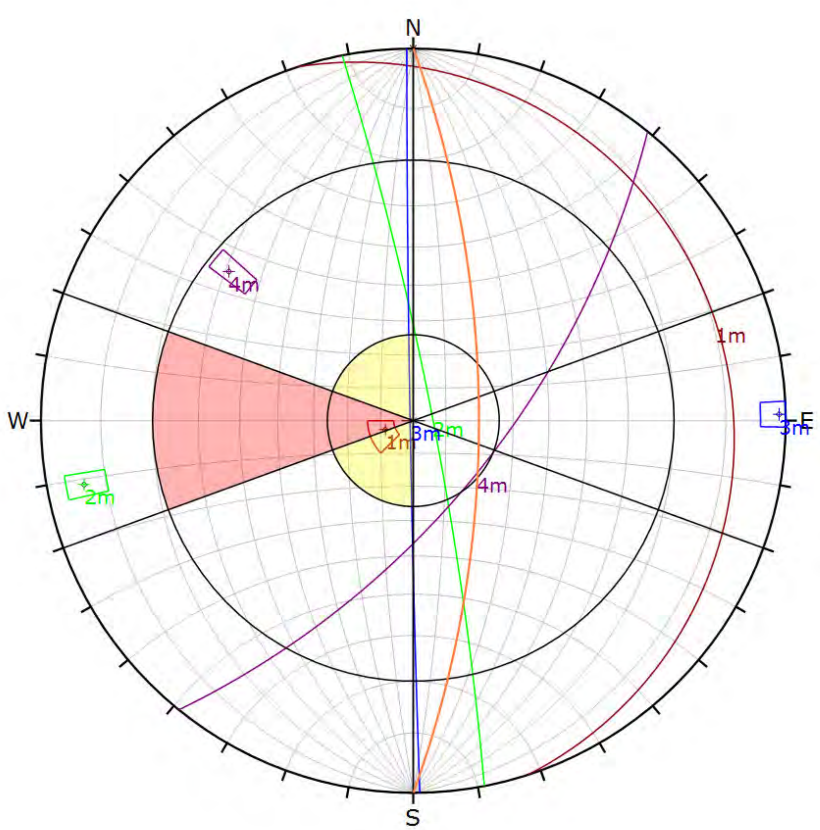
Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Kinematic Analysis	Wedge Sliding		
Slope Dip	70		
Slope Dip Direction	90		
Friction Angle	26°		
	Critical	Total	%
Wedge Sliding	0	6	0.00%

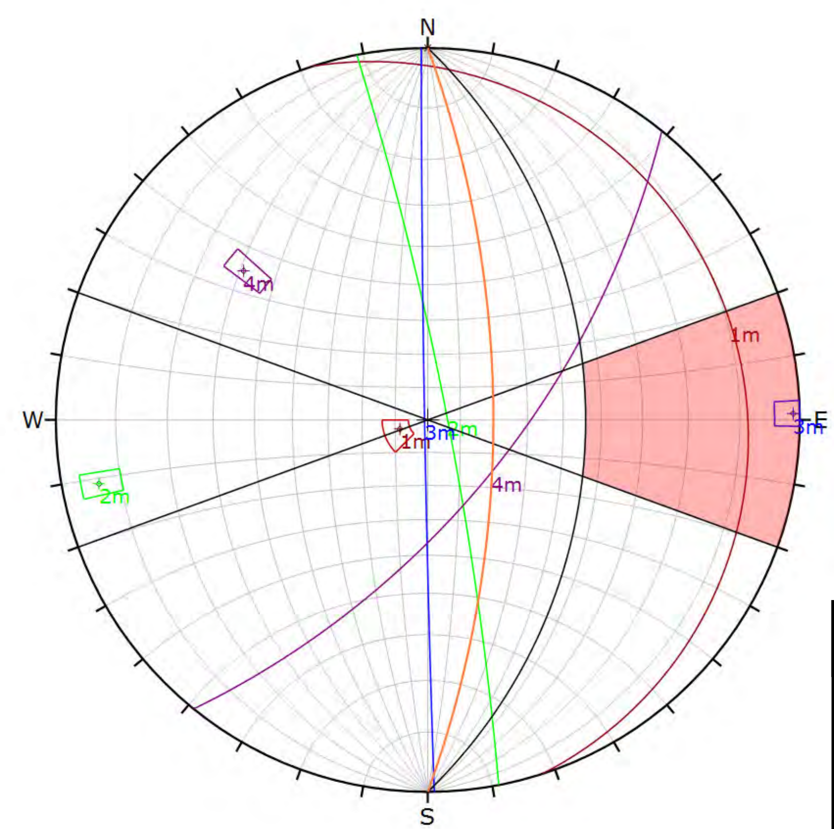
Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle



Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Kinematic Analysis	Direct Toppling		
Slope Dip	70		
Slope Dip Direction	90		
Friction Angle	26°		
Lateral Limits	20°		
	Critical	Total	%
Direct Toppling (Intersection)	0	6	0.00%
Oblique Toppling (Intersection)	0	6	0.00%
Base Plane (All)	1	4	25.00%
Base Plane (Set 1)	1	1	100.00%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle



Symbol	Feature
◇	Pole Vectors

Kinematic Analysis	Flexural Toppling		
Slope Dip	70		
Slope Dip Direction	90		
Friction Angle	26°		
Lateral Limits	20°		
	Critical	Total	%
Flexural Toppling (All)	1	4	25.00%
Flexural Toppling (Set 3)	1	1	100.00%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

KINEMATIC EVALUATIONS
SLOPE DIP DIRECTION = 90 DEGREES

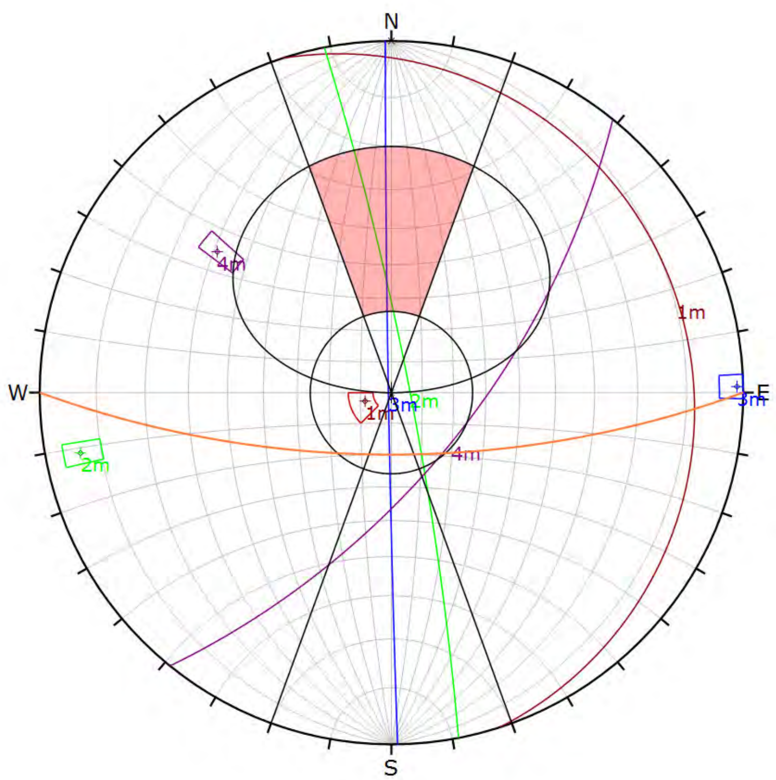
Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No.
11.2

BAJADA Geosciences, Inc.

Project no.
2001.0114

MARKLAND'S TEST OF KINEMATICALLY POSSIBLE FAILURES

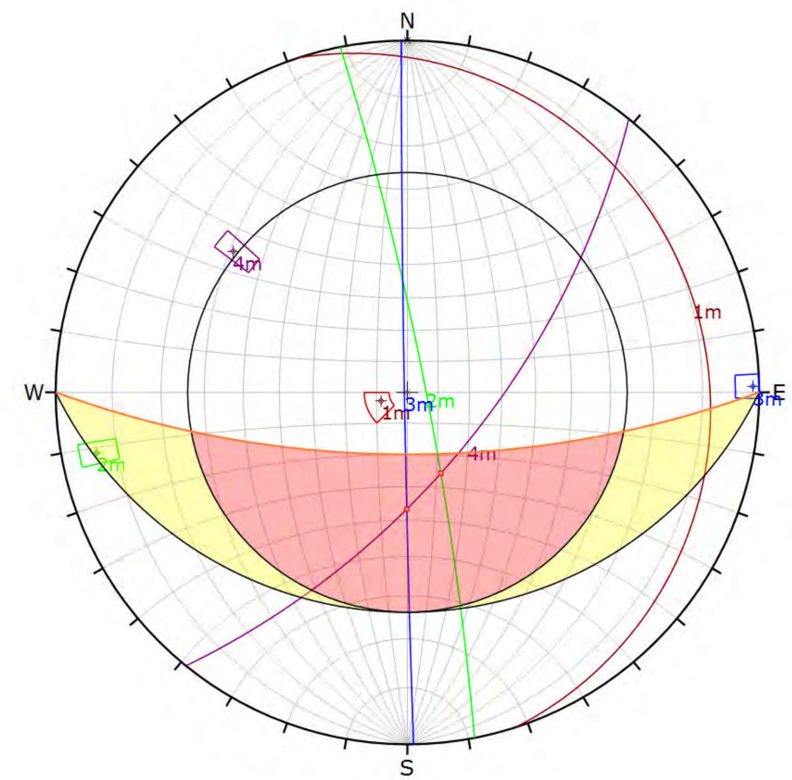


Symbol	Feature
◇	Pole Vectors

Kinematic Analysis	Planar Sliding
Slope Dip	70
Slope Dip Direction	180
Friction Angle	26°
Lateral Limits	20°

	Critical	Total	%
Planar Sliding (All)	0	4	0.00%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

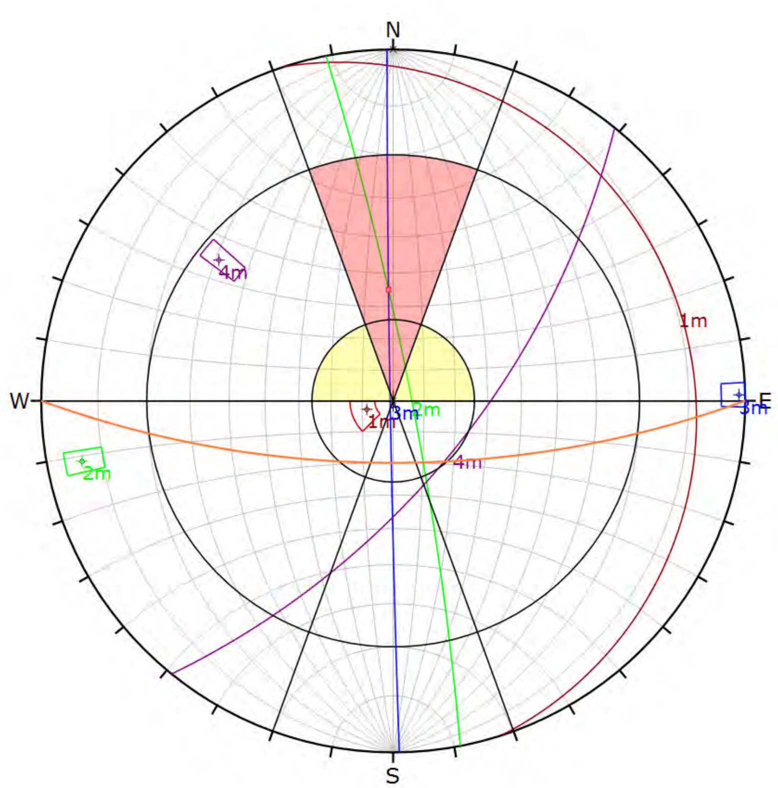


Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Kinematic Analysis	Wedge Sliding
Slope Dip	70
Slope Dip Direction	180
Friction Angle	26°

	Critical	Total	%
Wedge Sliding	2	6	33.33%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle

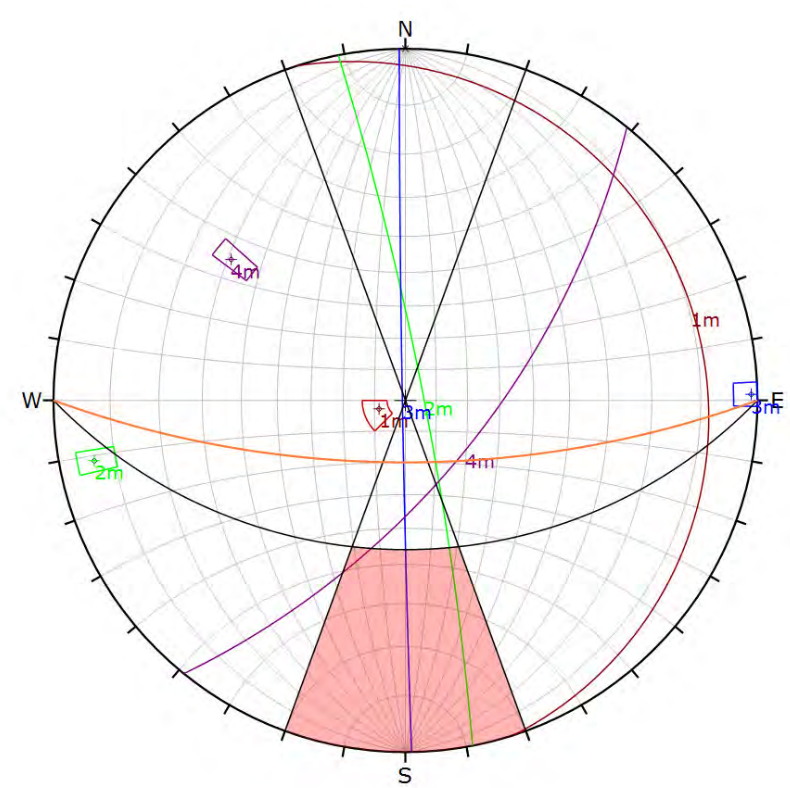


Symbol	Feature
◇	Pole Vectors
▫	Critical Intersection

Kinematic Analysis	Direct Toppling
Slope Dip	70
Slope Dip Direction	180
Friction Angle	26°
Lateral Limits	20°

	Critical	Total	%
Direct Toppling (Intersection)	1	6	16.67%
Oblique Toppling (Intersection)	0	6	0.00%
Base Plane (All)	0	4	0.00%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	6
Hemisphere	Lower
Projection	Equal Angle



Symbol	Feature
◇	Pole Vectors

Kinematic Analysis	Flexural Toppling
Slope Dip	70
Slope Dip Direction	180
Friction Angle	26°
Lateral Limits	20°

	Critical	Total	%
Flexural Toppling (All)	0	4	0.00%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

KINEMATIC EVALUATIONS
SLOPE DIP DIRECTION = 180 DEGREES

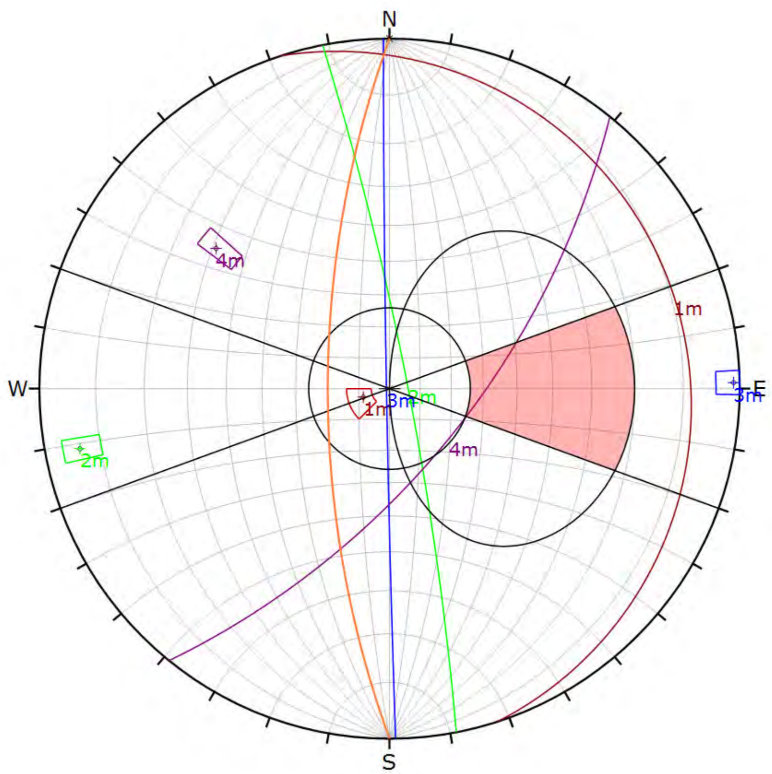
Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 11.3

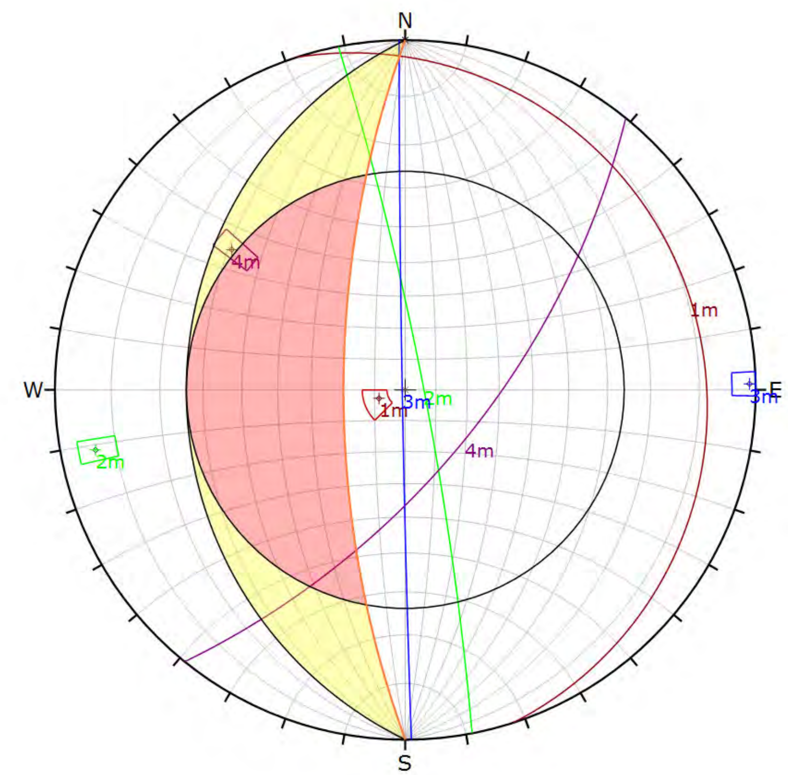
BAJADA Geosciences, Inc.

Project no. 2001.0114

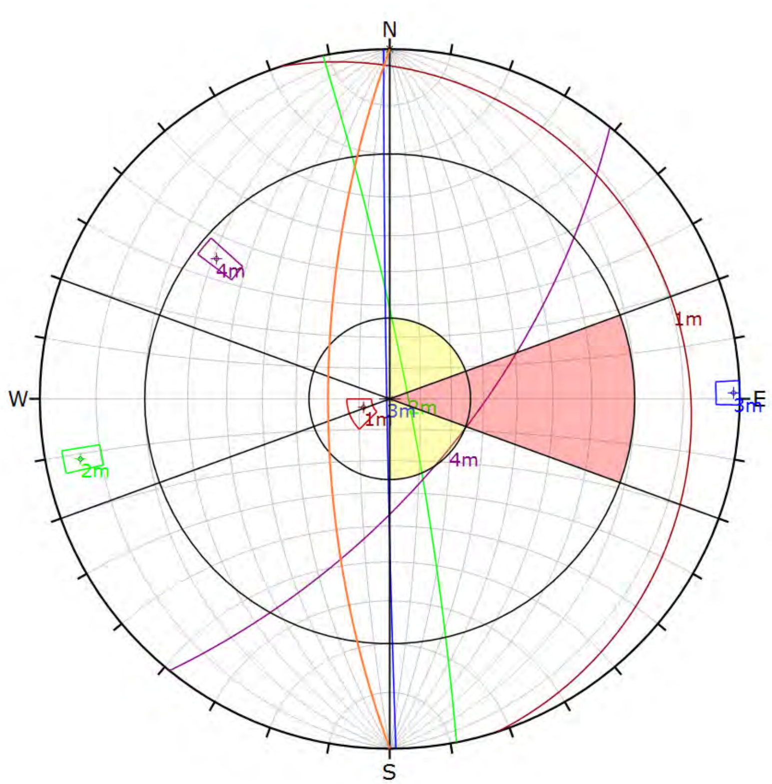
MARKLAND'S TEST OF KINEMATICALLY POSSIBLE FAILURES



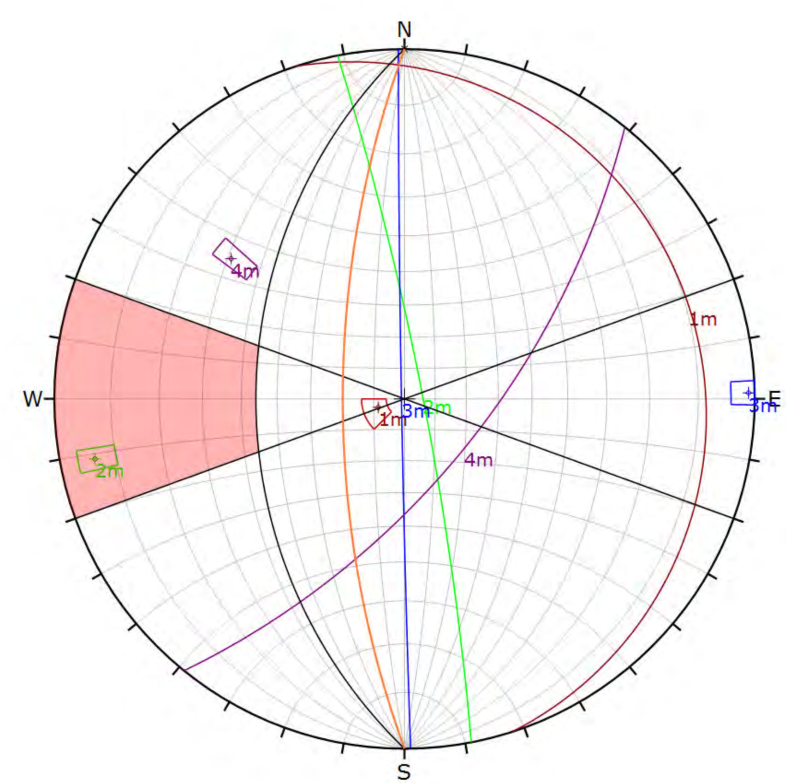
Symbol	Feature		
◇	Pole Vectors		
Kinematic Analysis	Planar Sliding		
Slope Dip	70		
Slope Dip Direction	270		
Friction Angle	26°		
Lateral Limits	20°		
	Critical	**Total**	**%**
Planar Sliding (All)	0	4	0.00%
Plot Mode	Pole Vectors		
Vector Count	4 (4 Entries)		
Hemisphere	Lower		
Projection	Equal Angle		



Symbol	Feature		
◇	Pole Vectors		
▫	Critical Intersection		
Kinematic Analysis	Wedge Sliding		
Slope Dip	70		
Slope Dip Direction	270		
Friction Angle	26°		
	Critical	**Total**	**%**
Wedge Sliding	0	6	0.00%
Plot Mode	Pole Vectors		
Vector Count	4 (4 Entries)		
Intersection Mode	Grid Data Planes		
Intersections Count	6		
Hemisphere	Lower		
Projection	Equal Angle		



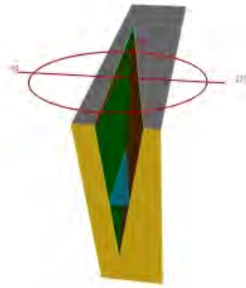
Symbol	Feature		
◇	Pole Vectors		
▫	Critical Intersection		
Kinematic Analysis	Direct Toppling		
Slope Dip	70		
Slope Dip Direction	270		
Friction Angle	26°		
Lateral Limits	20°		
	Critical	**Total**	**%**
Direct Toppling (Intersection)	0	6	0.00%
Oblique Toppling (Intersection)	0	6	0.00%
Base Plane (All)	0	4	0.00%
Plot Mode	Pole Vectors		
Vector Count	4 (4 Entries)		
Intersection Mode	Grid Data Planes		
Intersections Count	6		
Hemisphere	Lower		
Projection	Equal Angle		

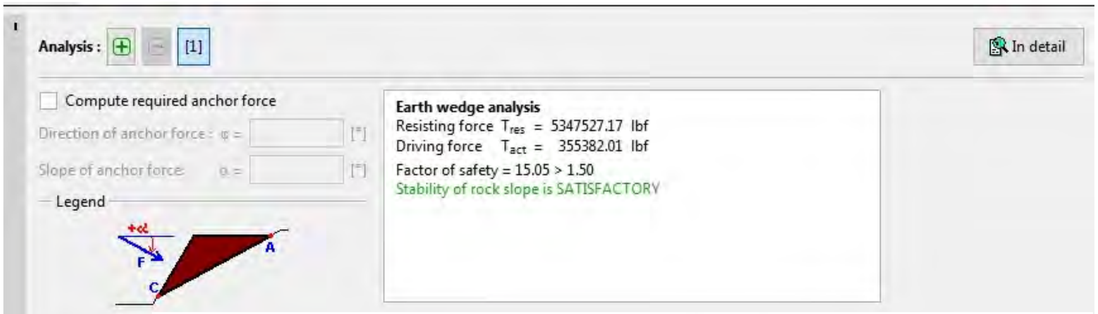


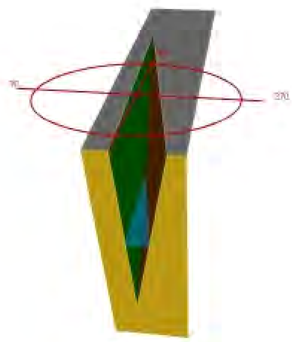
Symbol	Feature		
◇	Pole Vectors		
Kinematic Analysis	Flexural Toppling		
Slope Dip	70		
Slope Dip Direction	270		
Friction Angle	26°		
Lateral Limits	20°		
	Critical	**Total**	**%**
Flexural Toppling (All)	1	4	25.00%
Flexural Toppling (Set 2)	1	1	100.00%
Plot Mode	Pole Vectors		
Vector Count	4 (4 Entries)		
Hemisphere	Lower		
Projection	Equal Angle		

KINEMATIC EVALUATIONS
SLOPE DIP DIRECTION = 270 DEGREES

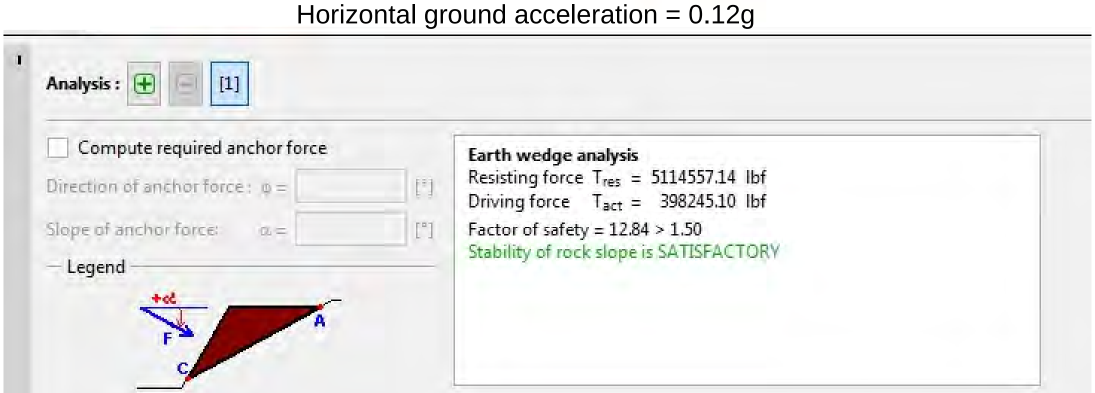
Skyline Quarry Preliminary Geotechnical Study Hat Creek Construction Susanville Area, Lassen Co., CA	Plate No. 11.4
BAJADA Geosciences, Inc.	Project no. 2001.0114







Horizontal ground acceleration = 0.12g



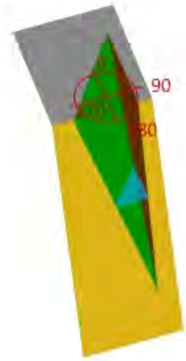
POTENTIAL WEDGE FAILURE
SLOPE DIP DIRECTION = 0 DEGREES

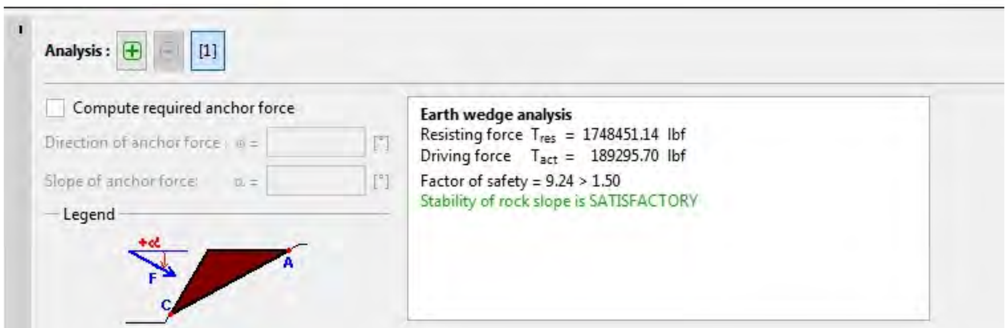
Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

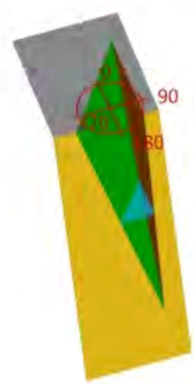
Plate No. 12.1

BAJADA Geosciences, Inc.

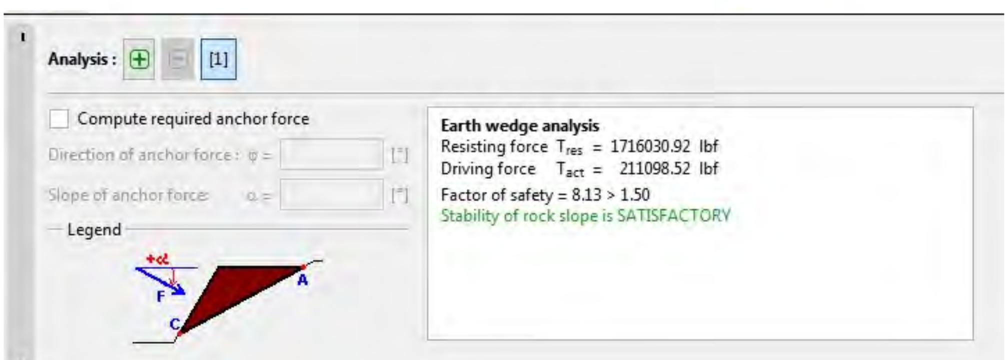
Project no. 2001.0114





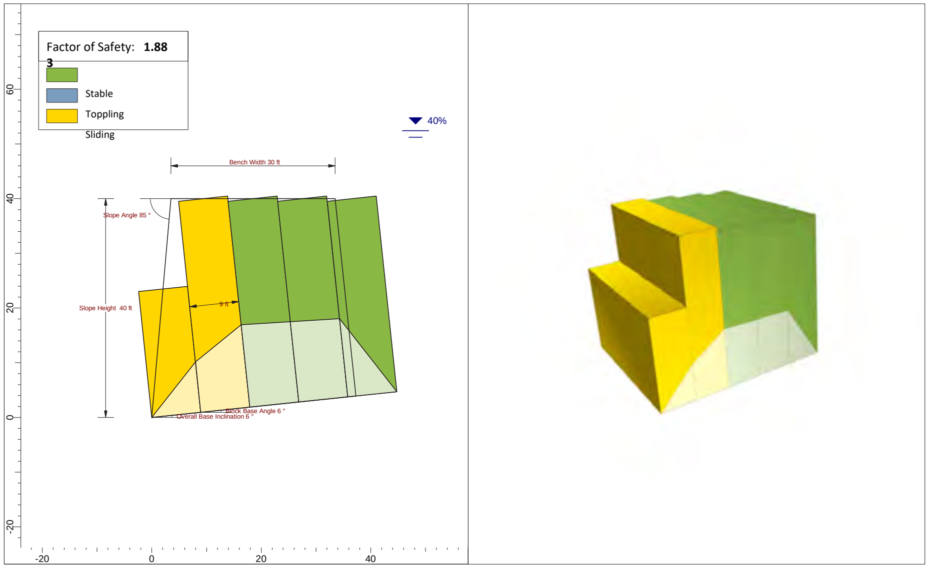


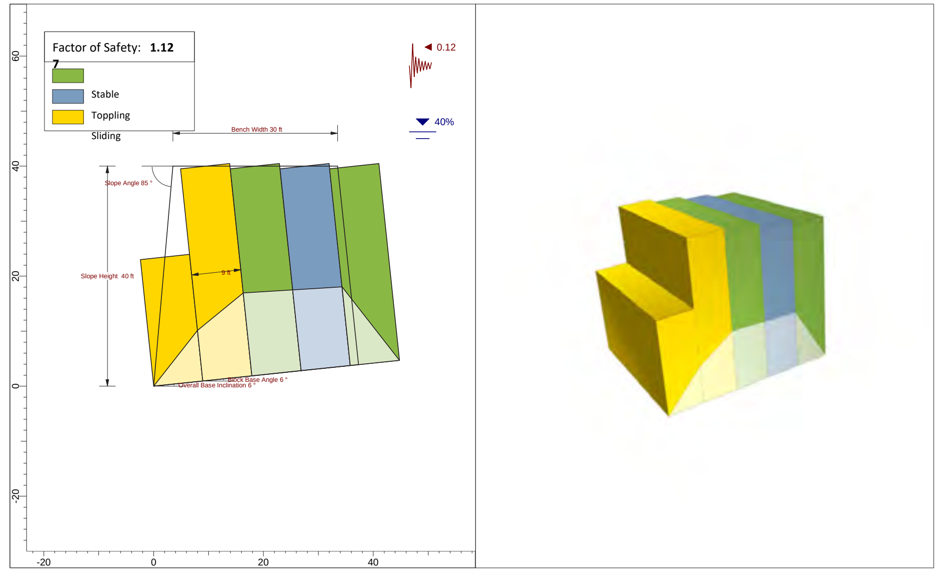
Horizontal ground acceleration = 0.12g

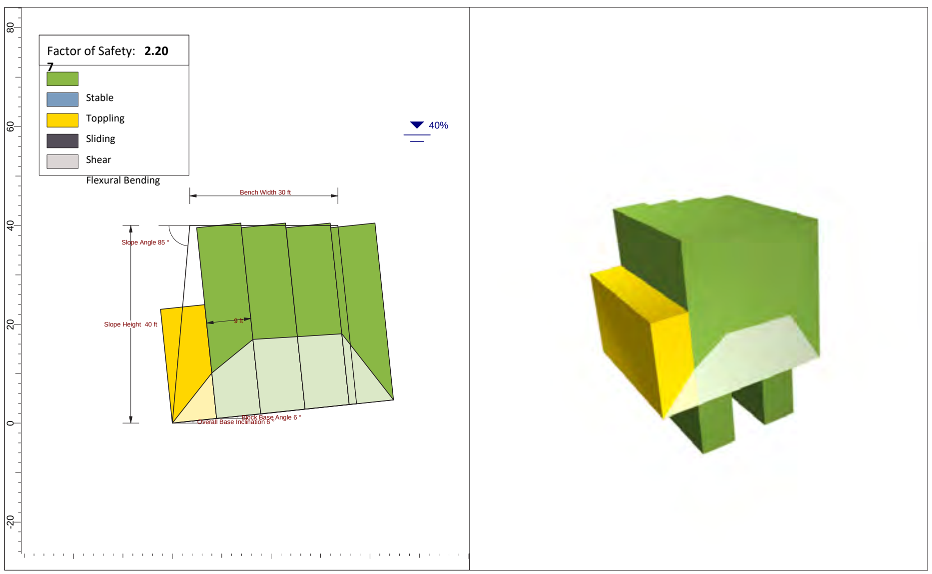


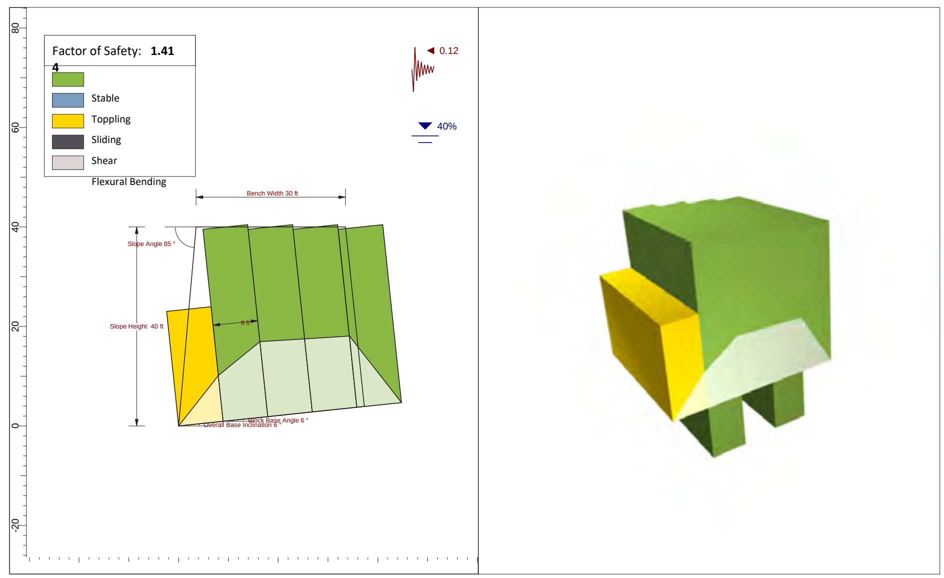
POTENTIAL WEDGE FAILURE
SLOPE DIP DIRECTION = 0 DEGREES

Skyline Quarry Preliminary Geotechnical Study Hat Creek Construction Susanville Area, Lassen Co., CA	Plate No. 12.2
BAJADA Geosciences, Inc.	Project no. 2001.0114









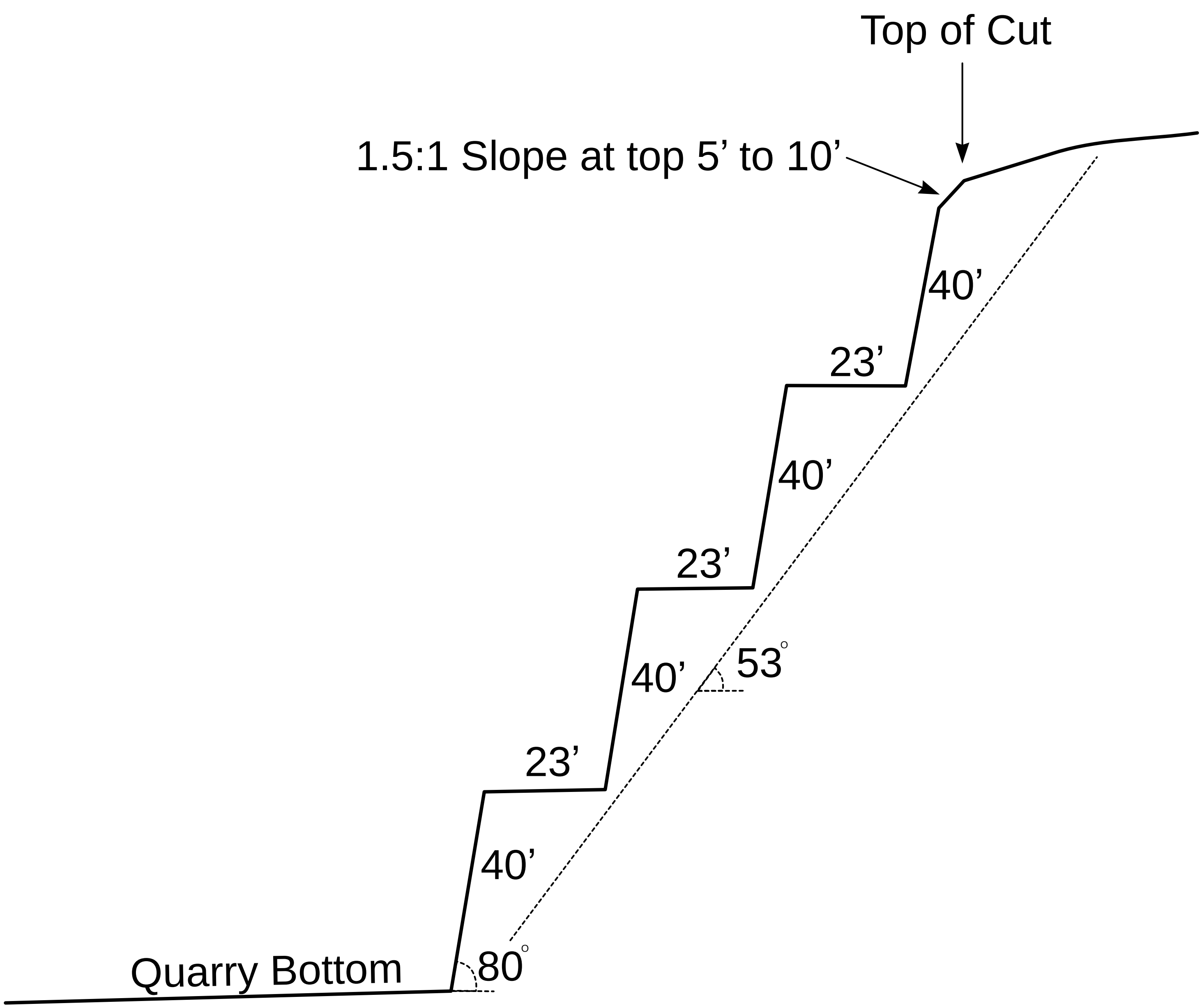
RESULTS OF TOPPLE ANALYSES

Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 13

BAJADA Geosciences, Inc.

Project no. 2001.0114



RECOMMENDED SLOPE DESIGN

Skyline Quarry
Preliminary Geotechnical Study
Hat Creek Construction
Susanville Area, Lassen Co., CA

Plate No. 14

BAJADA Geosciences, Inc.

Project no. 2001.0114

APPENDIX A

Discontinuity Data

DISCONTINUITY & ROCK QUALITY DATA - Skyline Quarry

Location	Disc No.	Strike			Dip		Dip Direction	Type	Strength	RQD	Joint			RMR		
											Spacing	Condition	Groundwater	Rating	Class	Description
1	1	N	28	E	4	S	118	Fracture	6	17	15	22	0	60	III	Fair Rock
1	2	N	17	E	87	S	107	Fracture	6	17	15	22	0	60	III	Fair Rock
1	3	N	75	E	42	N	345	Fracture	6	17	15	22	0	60	III	Fair Rock
1	4	N	49	W	77	S	221	Fracture	6	17	15	22	0	60	III	Fair Rock
1	5	N	82	E	0	N	352	Fracture	6	17	15	22	0	60	III	Fair Rock
1	6	N	77	W	88	S	193	Fracture	6	17	15	22	0	60	III	Fair Rock
1	7	N	34	E	88	S	124	Fracture	6	17	15	22	0	60	III	Fair Rock
1	8	N	71	W	88	S	199	Fracture	6	17	15	22	0	60	III	Fair Rock
1	9	N	17	W	4	N	73	Fracture	6	17	15	22	0	60	III	Fair Rock
1	10	N	26	E	85	S	116	Fracture	6	17	15	22	0	60	III	Fair Rock
1	11	N	15	W	9	N	75	Fracture	6	17	15	22	0	60	III	Fair Rock
1	12	N	45	E	89	S	135	Fracture	6	17	15	22	0	60	III	Fair Rock
1	13	N	15	W	4	N	75	Fracture	6	17	15	22	0	60	III	Fair Rock
1	14	N	47	W	38	N	43	Fracture	6	17	15	22	0	60	III	Fair Rock
1	15	N	82	E	87	S	172	Fracture	6	17	15	22	0	60	III	Fair Rock
1	16	N	74	W	70	N	16	Fracture	6	17	15	22	0	60	III	Fair Rock
1	17	N	25	E	85	S	115	Fracture	6	17	15	22	0	60	III	Fair Rock
1	18	N	20	W	2	S	250	Fracture	6	17	15	22	0	60	III	Fair Rock
1	19	N	52	W	89	S	218	Fracture	6	17	15	22	0	60	III	Fair Rock
1	20	N	20	W	82	N	70	Fracture	6	17	15	22	0	60	III	Fair Rock
1	21	N	69	W	90	S	201	Fracture	6	17	15	22	0	60	III	Fair Rock
1	22	N	52	W	1	N	38	Fracture	6	17	15	22	0	60	III	Fair Rock
1	23	N	90	E	1	N	360	Fracture	6	17	15	22	0	60	III	Fair Rock
2	1	N	0	E	0	S	95	Fracture	6	17	15	22	0	60	III	Fair Rock
2	2	N	0	W	0	N	50	Fracture	6	17	15	22	0	60	III	Fair Rock
2	3	N	58	E	90	S	148	Fracture	6	17	15	22	0	60	III	Fair Rock
2	4	N	15	W	75	N	75	Fracture	6	17	15	22	0	60	III	Fair Rock
2	7	N	15	E	78	N	285	Fracture	6	17	15	22	0	60	III	Fair Rock
2	8	N	28	E	90	S	118	Fracture	6	17	15	22	0	60	III	Fair Rock
2	9	N	5	E	90	N	275	Fracture	6	17	15	22	0	60	III	Fair Rock
2	10	N	50	E	90	S	140	Fracture	6	17	15	22	0	60	III	Fair Rock
2	11	N	53	E	80	S	143	Fracture	6	17	15	22	0	60	III	Fair Rock
2	12	N	30	E	78	S	120	Fracture	6	17	15	22	0	60	III	Fair Rock

SCHMIDT HAMMER RESULTS

Skyline Quarry

	Hammer Value	Mpa	psi	
Location #1	42	45.4	6581	Relatively Massive
	48	59.6	8651	
	32	26.0	3778	
Location #2	44	49.9	7239	Relatively Massive
	44	49.9	7239	
	38	37.0	5363	
Location #3	47	57.1	8286	Relatively Massive
	56	81.8	11865	
	34	29.5	4274	
Location #4	42	45.4	6581	Relatively Massive
	56	81.8	11865	
	50	64.9	9406	
Location #5	46	54.7	7929	Relatively Massive
	46	54.7	7929	
	54	75.9	11013	
Location #6	32	26.0	3778	Relatively Massive
	43	47.6	6906	
	42	45.4	6581	
Location #7	37	35.0	5078	Vesiculated
	28	19.9	2883	
	52	70.3	10193	
Location #8	48	59.6	8651	Relatively Massive
	54	75.9	11013	
	42	45.4	6581	
Location #9	28	19.9	2883	Vesiculated
	24	14.6	2118	
	20	10.2	1482	
Location #10	54	75.9	11013	Relatively Massive
	42	45.4	6581	
	44	49.9	7239	
Location #11	28	19.9	2883	Platty
	36	33.1	4802	
	48	59.6	8651	
Location #12	36	33.1	4802	Vesiculated
	32	26.0	3778	
	40	41.1	5956	
Location #13	42	45.4	6581	Relatively Massive
	56	81.8	11865	
	48	59.6	8651	
Location #14	56	81.8	11865	Relatively Massive
	59	91.0	13204	
	44	49.9	7239	
Location #15	34	29.5	4274	Relatively Massive
	44	49.9	7239	
	40	41.1	5956	
Location #16	40	41.1	5956	Relatively Massive
	34	29.5	4274	
	30	22.9	3314	
Rock Sample #1	32	26.0	3778	Relatively Massive
	50	64.9	9406	
	50	64.9	9406	
	46	54.7	7929	
Rock Sample #2	56	81.8	11865	Relatively Massive
	46	54.7	7929	
	38	37.0	5363	
	51	67.5	9796	
Rock Sample #3	40	41.1	5956	Vesiculated
	32	26.0	3778	
	32	26.0	3778	
	32	26.0	3778	
Rock Sample #4	30	22.9	3314	Vesiculated
	28	19.9	2883	
	42	45.4	6581	
	42	45.4	6581	
	46	54.7	7929	

Averages	Mpa	psi
Location #1	43.7	6337
Location #2	45.6	6613
Location #3	56.1	8142
Location #4	125.8	9284
Location #5	61.8	8957
Location #6	39.7	5755
Location #7	41.7	6052
Location #8	60.3	8748
Location #9	14.9	2161
Location #10	57.1	8278
Location #11	37.5	5445
Location #12	33.4	4845
Location #13	62.3	9032.4
Location #14	74.3	10769.1
Location #15	40.1	5822.6
Location #16	31.1	4514.5
Bulk Sample #1	52.6	7629.7
Bulk Sample #2	60.2	8738.0
Bulk Sample #3	29.8	4322.2
Bulk Sample #4	37.6	5457.6

Overall Average Rock Strength

	Mpa	PSI	PSF
OutCrop	51.6	6922	996797
Bulk Samples	45.1	6537	941314

APPENDIX B

Laboratory Testing

Materials Testing, Inc.

8798 Airport Road
Redding, California 96002
(530) 222-1116, fax 222-1611

865 Cotting Lane, Suite A
Vacaville, California 95688
(707) 447-4025, fax 447-4143

Client: BAJADA Geosciences, Inc.
28301 Inwood Road
Shingletown, CA 96088
Project: Skyline Quarry
Location: Lassen County, #2001.0114

Revised: 08/17/2020
Client No: 3237-048
Report No: 0100-001

ROCK CORE COMPRESSIVE STRENGTH DATA
(ASTM D7012 Method C)

Identification	Rock 1-A	Rock 2-C	Rock 2 -D
Material	Basalt – Massive	Basalt – Massive	Basalt – Massive
Date Cored	08/12/20	08/12/20	08/12/20
Date Trimmed	08/13/20	08/13/20	08/13/20
Date Tested	08/14/20	08/14/20	08/14/20
Average Diameter, in^2	2.00	2.00	2.00
Average X-Sect. Area, in^2	3.14	3.14	3.14
Average Length, in	5.5	5.8	6.0
L/D Factor (2.0 – 2.5)	2.0	1.9	2.0
Maximum Load, lbs.	31,490	32,069	33,100
Time to Failure, min (2 - 15)	2:49	2:31	2:34
Compressive Strength, psi	**10,030**	**10,210**	**10,540**
Fracture Pattern, Type	3	3	3

Notes: Specimens prepared in accordance with ASTM D4543.

Tested by Allante Blocker.

Materials Testing, Inc.

8798 Airport Road
Redding, California 96002
(530) 222-1116, fax 222-1611

865 Cotting Lane, Suite A
Vacaville, California 95688
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Client: BAJADA Geosciences, Inc.
28301 Inwood Road
Shingletown, CA 96088
Project: Skyline Quarry
Location: Lassen County, #2001.0114

Revised: 08/17/2020
Client No: 3237-048
Report No: 0100-001

ROCK CORE COMPRESSIVE STRENGTH DATA
(ASTM D7012 Method C)

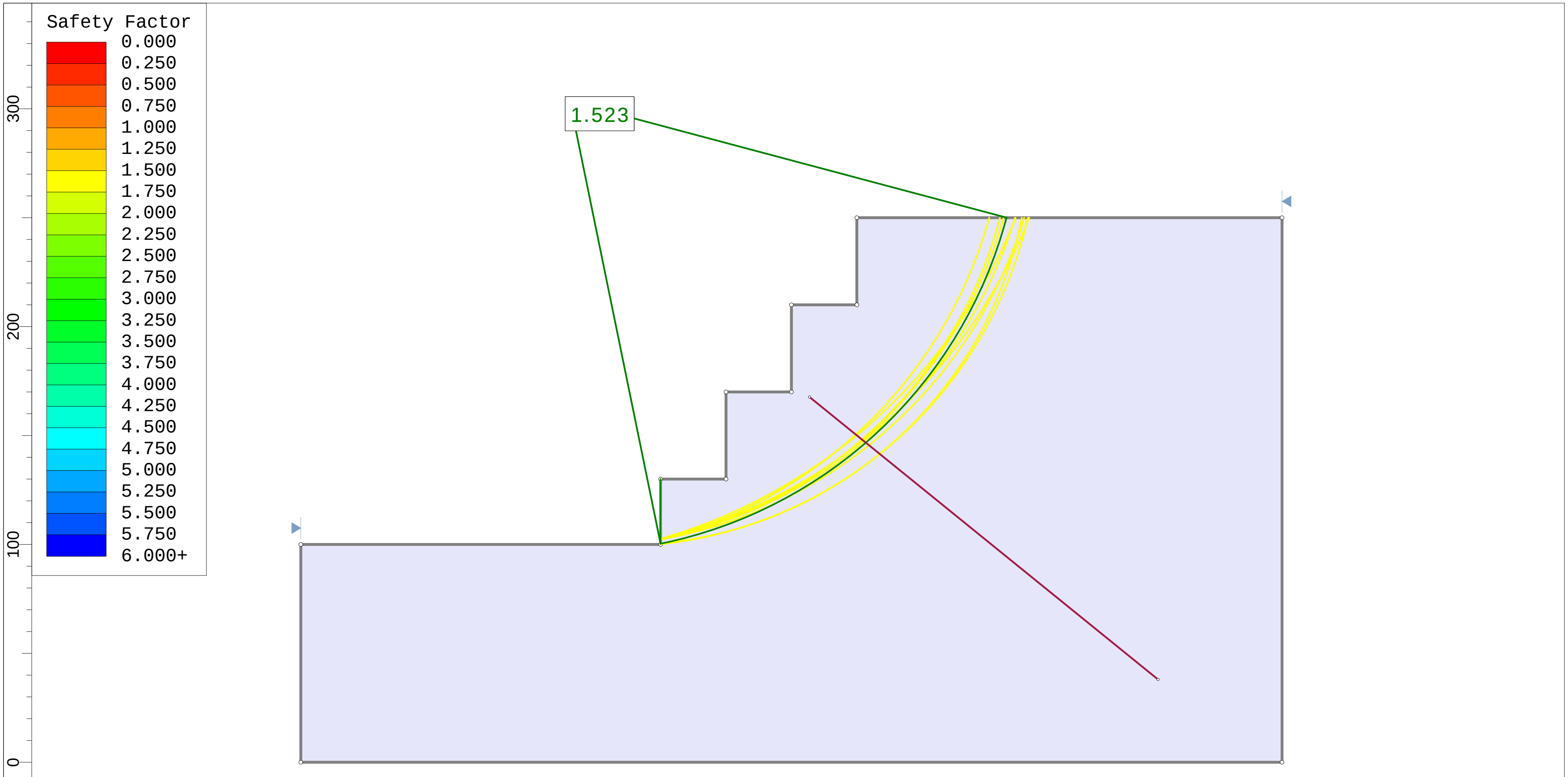
Identification	Rock 3-E	Rock 4-F	Rock 4-G
Material	Basalt – Vesicular	Basalt – Vesicular	Basalt - Vesicular
Date Cored	08/12/20	08/12/20	08/12/20
Date Trimmed	08/13/20	08/13/20	08/13/20
Date Tested	08/14/20	08/14/20	08/14/20
Average Diameter, in^2	2.0	2.0	2.0
Average X-Section Area, in^2	3.14	3.14	3.14
Average Length, in	5.60	6.00	8.50
L/D Factor (2.0 – 2.5)	1.6	2.0	2.0
Maximum Load, lbs.	8,170	28,940	17,760
Time to Failure, min (2 – 15)	1:26	3:12	2:04
Compressive Strength, psi	**2,600**	**9,220**	**5,660**
Fracture Pattern, Type	3	3	3

Notes: Specimens prepared in accordance with ASTM D4543.

Tested by Allante Blocker.
The samples were tested according to the referenced standard test procedures and relate only to the items inspected or tested. Results are not transferable and shall not be reproduced, except in full, without written permission from MTI.

APPENDIX C

Slope Stability Analyses



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Susanville Basalt		160	Mohr-Coulomb	3500	26	None	0

Bajada Geosciences, Inc.

Project	Skyline Quarry Preliminary Evaluation
Analysis Description	Static, Dry
Drawn By	J.Bianchin
Scale	1:818
Company	Bajada Geosciences, Inc.
Date	8/5/2020, 12:41:44 PM
File Name	GrossStab_Static_Dry.slim

SLIDEINTERPRET 8.032

Slide Analysis Information

Skyline Quarry Preliminary Evaluation

Project Summary

Slide Modeler Version:	8.032
Compute Time:	00h:00m:01.399s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical

Analysis Methods Used
Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000

Upper Angle [°]:	Not Defined
Lower Angle [°]:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Property	Susanville Basalt
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	160
Cohesion [psf]	3500
Friction Angle [°]	26
Water Surface	None
Ru Value	0

Global Minimums

Method: spencer

FS	1.523300
Center:	123.419, 303.442
Radius:	207.334
Left Slip Surface Endpoint:	165.000, 100.320
Right Slip Surface Endpoint:	323.747, 250.000
Left Slope Intercept:	165.000 130.000
Right Slope Intercept:	323.747 250.000
Resisting Moment:	2.83848e+08 lb-ft
Driving Moment:	1.86338e+08 lb-ft
Resisting Horizontal Force:	1.00729e+06 lb
Driving Horizontal Force:	661255 lb
Total Slice Area:	9262.11 ft2
Surface Horizontal Width:	158.747 ft
Surface Average Height:	58.3449 ft

Valid/Invalid Surfaces

Method: spencer

Number of Valid Surfaces:	1392
Number of Invalid Surfaces:	3608

Error Codes:

Error Code -103 reported for 436 surfaces
Error Code -108 reported for 3 surfaces
Error Code -111 reported for 132 surfaces
Error Code -112 reported for 2 surfaces

Error Code -114 reported for 3033 surfaces
Error Code -118 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.
-118 = Surface does not pass through the search focus

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.5233

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.17495	14905.6	12.0177	Susanville Basalt	3500	26	3558.19	5420.19	3936.98	0	3936.98	4694.44	4694.44
2	3.17495	14549	12.9163	Susanville Basalt	3500	26	3507.22	5342.55	3777.77	0	3777.77	4582.08	4582.08
3	3.17495	14165.7	13.8181	Susanville Basalt	3500	26	3454.07	5261.59	3611.79	0	3611.79	4461.35	4461.35
4	3.17495	13755.4	14.7235	Susanville Basalt	3500	26	3398.75	5177.31	3438.98	0	3438.98	4332.12	4332.12
5	3.17495	13317.9	15.6326	Susanville Basalt	3500	26	3341.23	5089.69	3259.36	0	3259.36	4194.3	4194.3
6	3.17495	12852.6	16.5458	Susanville Basalt	3500	26	3281.51	4998.73	3072.86	0	3072.86	4047.74	4047.74
7	3.17495	12359.4	17.4634	Susanville Basalt	3500	26	3219.6	4904.42	2879.48	0	2879.48	3892.36	3892.36
8	3.17495	11837.6	18.3855	Susanville Basalt	3500	26	3155.48	4806.74	2679.21	0	2679.21	3728.02	3728.02
9	3.17495	11287	19.3127	Susanville Basalt	3500	26	3089.14	4705.68	2472	0	2472	3554.57	3554.57
10	3.17495	21903.7	20.2451	Susanville Basalt	3500	26	4030.39	6139.5	5411.77	0	5411.77	6898.28	6898.28
11	3.17495	30416.7	21.1832	Susanville Basalt	3500	26	4772.61	7270.12	7729.89	0	7729.89	9579.46	9579.46
12	3.17495	29776.3	22.1273	Susanville Basalt	3500	26	4689.67	7143.77	7470.85	0	7470.85	9377.72	9377.72
13	3.17495	29104.8	23.0777	Susanville Basalt	3500	26	4604.35	7013.81	7204.37	0	7204.37	9166.17	9166.17
14	3.17495	28401.5	24.0349	Susanville Basalt	3500	26	4516.64	6880.2	6930.44	0	6930.44	8944.68	8944.68
15	3.17495	27665.9	24.9993	Susanville Basalt	3500	26	4426.5	6742.89	6648.91	0	6648.91	8712.95	8712.95
16	3.17495	26897	25.9713	Susanville Basalt	3500	26	4333.89	6601.82	6359.68	0	6359.68	8470.78	8470.78
17	3.17495	26094.2	26.9514	Susanville Basalt	3500	26	4238.78	6456.94	6062.62	0	6062.62	8217.87	8217.87
18	3.17495	25256.4	27.9401	Susanville Basalt	3500	26	4141.14	6308.2	5757.66	0	5757.66	7953.99	7953.99
19	3.17495	26456.6	28.938	Susanville Basalt	3500	26	4218.58	6426.16	5999.53	0	5999.53	8331.96	8331.96
20	3.17495	43792.1	29.9456	Susanville Basalt	3500	26	5668	8634.07	10526.4	0	10526.4	13791.7	13791.7

21	3.17495	42843.7	30.9635	Susanville Basalt	3500	26	5551.37	8456.4	10162.1	0	10162.1	13492.9	13492.9
22	3.17495	41856.1	31.9923	Susanville Basalt	3500	26	5431.79	8274.25	9788.68	0	9788.68	13181.8	13181.8
23	3.17495	40828	33.0329	Susanville Basalt	3500	26	5309.21	8087.52	9405.79	0	9405.79	12858	12858
24	3.17495	39757.9	34.0858	Susanville Basalt	3500	26	5183.53	7896.07	9013.27	0	9013.27	12520.9	12520.9
25	3.17495	38644.4	35.1521	Susanville Basalt	3500	26	5054.67	7699.78	8610.82	0	8610.82	12170.2	12170.2
26	3.17495	37485.6	36.2325	Susanville Basalt	3500	26	4922.54	7498.5	8198.14	0	8198.14	11805.2	11805.2
27	3.17495	36279.7	37.3281	Susanville Basalt	3500	26	4787.02	7292.07	7774.9	0	7774.9	11425.3	11425.3
28	3.17495	35024.7	38.4399	Susanville Basalt	3500	26	4648.03	7080.34	7340.79	0	7340.79	11030	11030
29	3.17495	46988.7	39.5691	Susanville Basalt	3500	26	5563.61	8475.04	10200.3	0	10200.3	14797.9	14797.9
30	3.17495	52677.4	40.717	Susanville Basalt	3500	26	5965.42	9087.12	11455.3	0	11455.3	16589.4	16589.4
31	3.17495	51260.2	41.885	Susanville Basalt	3500	26	5800.76	8836.3	10941.1	0	10941.1	16143	16143
32	3.17495	49783	43.0749	Susanville Basalt	3500	26	5631.53	8578.51	10412.5	0	10412.5	15677.7	15677.7
33	3.17495	48242.4	44.2883	Susanville Basalt	3500	26	5457.49	8313.4	9868.93	0	9868.93	15192.5	15192.5
34	3.17495	46634.4	45.5273	Susanville Basalt	3500	26	5278.39	8040.57	9309.53	0	9309.53	14686	14686
35	3.17495	44954.4	46.7943	Susanville Basalt	3500	26	5093.93	7759.58	8733.42	0	8733.42	14156.8	14156.8
36	3.17495	43197.3	48.0919	Susanville Basalt	3500	26	4903.79	7469.94	8139.58	0	8139.58	13603.4	13603.4
37	3.17495	41357.1	49.4232	Susanville Basalt	3500	26	4707.6	7171.09	7526.84	0	7526.84	13023.8	13023.8
38	3.17495	39427	50.7916	Susanville Basalt	3500	26	4504.94	6862.38	6893.89	0	6893.89	12415.8	12415.8
39	3.17495	37398.8	52.2014	Susanville Basalt	3500	26	4295.34	6543.09	6239.26	0	6239.26	11777.1	11777.1
40	3.17495	35263	53.6575	Susanville Basalt	3500	26	4078.22	6212.35	5561.15	0	5561.15	11104.3	11104.3
41	3.17495	33008.1	55.1658	Susanville Basalt	3500	26	3852.94	5869.18	4857.52	0	4857.52	10394.1	10394.1
42	3.17495	30620.1	56.7336	Susanville Basalt	3500	26	3618.7	5512.37	4125.98	0	4125.98	9641.98	9641.98
43	3.17495	28081.6	58.3699	Susanville Basalt	3500	26	3374.59	5140.52	3363.56	0	3363.56	8842.44	8842.44
44	3.17495	25370.6	60.0862	Susanville Basalt	3500	26	3119.46	4751.88	2566.74	0	2566.74	7988.62	7988.62
45	3.17495	22458.9	61.8972	Susanville Basalt	3500	26	2851.9	4344.29	1731.06	0	1731.06	7071.56	7071.56
46	3.17495	19308.2	63.823	Susanville Basalt	3500	26	2570.08	3915	850.871	0	850.871	6079.26	6079.26
47	3.17495	15865.6	65.8916	Susanville Basalt	3500	26	2271.63	3460.37	-81.2591	0	-81.2591	4995.02	4995.02
48	3.17495	12053	68.1441	Susanville Basalt	3500	26	1953.28	2975.44	-1075.51	0	-1075.51	3794.27	3794.27
49	3.17495	7746.62	70.6465	Susanville Basalt	3500	26	1610.33	2453.01	-2146.63	0	-2146.63	2438.01	2438.01
50	3.17495	2725.36	73.5167	Susanville Basalt	3500	26	1235.27	1881.69	-3318.02	0	-3318.02	856.653	856.653

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.5233

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	165	100.32	0	0	0
2	168.175	100.996	8640.85	0	0
3	171.35	101.724	17030.1	0	0
4	174.525	102.505	25180.7	0	0
5	177.7	103.339	33106.8	0	0
6	180.875	104.227	40823.8	0	0
7	184.05	105.171	48348.3	0	0
8	187.225	106.17	55698.6	0	0
9	190.4	107.225	62893.9	0	0
10	193.575	108.337	69955.4	0	0
11	196.749	109.508	76419.8	0	0
12	199.924	110.739	82068	0	0
13	203.099	112.03	87319	0	0
14	206.274	113.383	92197.8	0	0
15	209.449	114.798	96731.1	0	0
16	212.624	116.279	100947	0	0
17	215.799	117.826	104877	0	0
18	218.974	119.44	108554	0	0
19	222.149	121.124	112012	0	0
20	225.324	122.879	114880	0	0
21	228.499	124.708	113630	0	0
22	231.674	126.613	111904	0	0
23	234.849	128.596	109743	0	0
24	238.024	130.661	107188	0	0
25	241.199	132.809	104288	0	0
26	244.374	135.045	101092	0	0
27	247.549	137.372	97654.4	0	0
28	250.724	139.793	94035.2	0	0
29	253.899	142.313	90299.6	0	0
30	257.074	144.936	81208.9	0	0
31	260.248	147.669	68854.8	0	0
32	263.423	150.516	56128	0	0
33	266.598	153.485	43106.3	0	0
34	269.773	156.582	29876.3	0	0
35	272.948	159.816	16535.5	0	0
36	276.123	163.196	3193.47	0	0
37	279.298	166.733	-10024.8	0	0
38	282.473	170.441	-22976.6	0	0
39	285.648	174.332	-35496.7	0	0
40	288.823	178.426	-47392.8	0	0
41	291.998	182.741	-58438.2	0	0
42	295.173	187.303	-68361.9	0	0
43	298.348	192.143	-76835.9	0	0
44	301.523	197.298	-83455.6	0	0
45	304.698	202.816	-87711.4	0	0
46	307.873	208.762	-88945	0	0
47	311.048	215.22	-86277.4	0	0
48	314.223	222.315	-78485.6	0	0
49	317.398	230.231	-63768.2	0	0
50	320.572	239.27	-39249.5	0	0
51	323.747	250	0	0	0

Entity Information

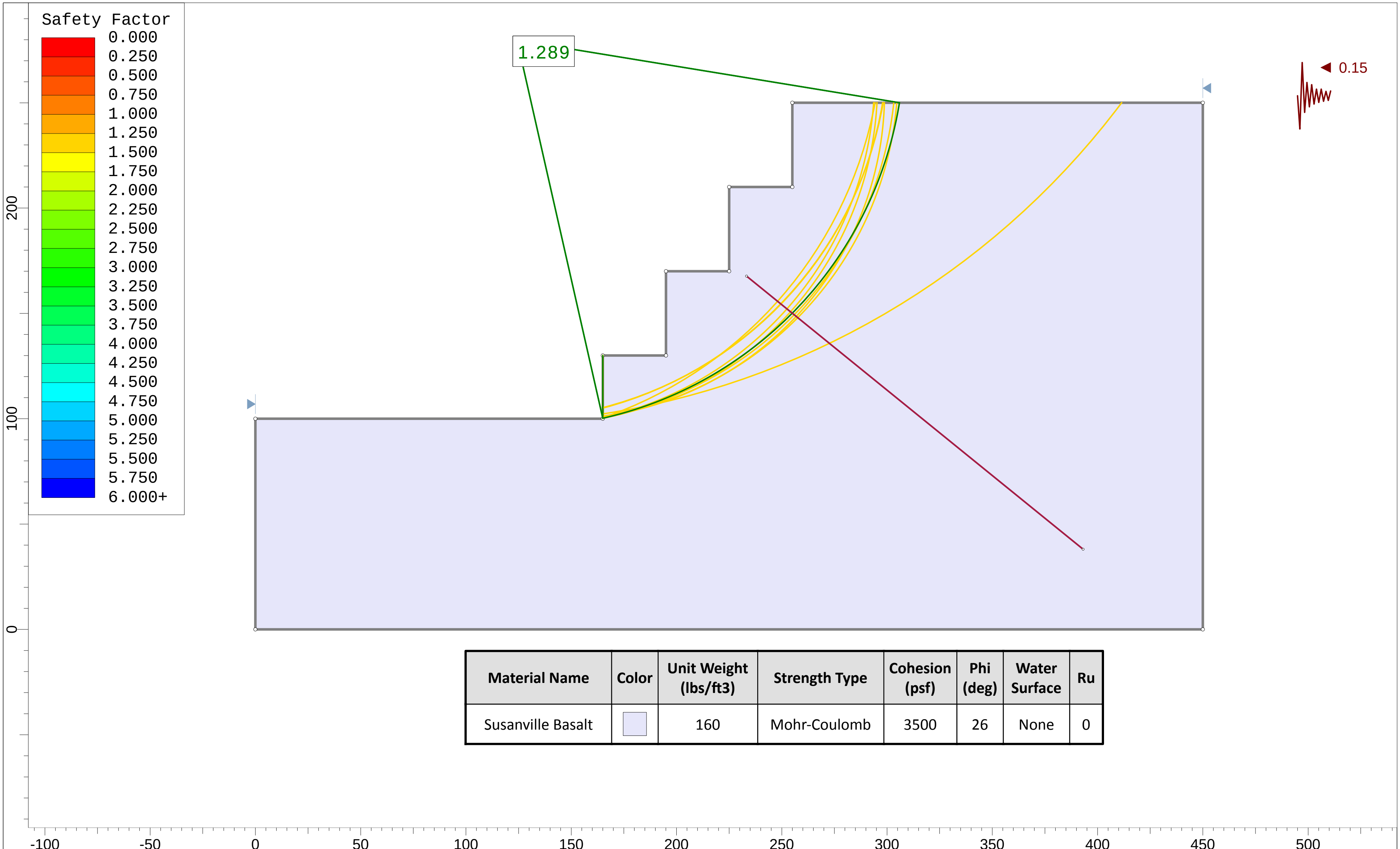
Focus Search Line

X	Y
233.272	167.698

393.112	38.038

External Boundary

X	Y
0	0
450	0
450	250
255	250
255	210
225	210
225	170
195	170
195	130
165	130
165	100
0	100



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Susanville Basalt		160	Mohr-Coulomb	3500	26	None	0

Bajada Geosciences, Inc.

SLIDEINTERPRET 8.032

Project	Skyline Quarry Preliminary Evaluation		
Analysis Description	Pseudostatic, Dry		
Drawn By J.Bianchin	*Scale* 1:757	*Company*	Bajada Geosciences, Inc.
Date	8/5/2020, 12:41:44 PM	*File Name*	GrossStab_Static_Dry_PS.slim

Slide Analysis Information

Skyline Quarry Preliminary Evaluation

Project Summary

Slide Modeler Version:	8.032
Compute Time:	00h:00m:02.852s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical

Analysis Methods Used
Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000

Upper Angle [°]:	Not Defined
Lower Angle [°]:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.15

Materials

Property	Susanville Basalt
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	160
Cohesion [psf]	3500
Friction Angle [°]	26
Water Surface	None
Ru Value	0

Global Minimums

Method: spencer

FS	1.289290
Center:	124.275, 279.702
Radius:	184.080
Left Slip Surface Endpoint:	165.000, 100.183
Right Slip Surface Endpoint:	305.943, 250.000
Left Slope Intercept:	165.000 130.000
Right Slope Intercept:	305.943 250.000
Resisting Moment:	2.11762e+08 lb-ft
Driving Moment:	1.64246e+08 lb-ft
Resisting Horizontal Force:	815939 lb
Driving Horizontal Force:	632857 lb
Total Slice Area:	7740.6 ft2
Surface Horizontal Width:	140.943 ft
Surface Average Height:	54.92 ft

Valid/Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 455
Number of Invalid Surfaces: 4545

Error Codes:

Error Code -103 reported for 436 surfaces
Error Code -111 reported for 1074 surfaces

Error Code -114 reported for 3033 surfaces
Error Code -118 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-111 = safety factor equation did not converge
-114 = Surface with Reverse Curvature.
-118 = Surface does not pass through the search focus

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.28929

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.81887	13298.3	13.2322	Susanville Basalt	3500	26	4053.14	5225.67	3538.15	0	3538.15	4491.21	4491.21
2	2.81887	12988.8	14.1352	Susanville Basalt	3500	26	3993.72	5149.06	3381.07	0	3381.07	4386.83	4386.83
3	2.81887	12657.9	15.0419	Susanville Basalt	3500	26	3931.95	5069.43	3217.8	0	3217.8	4274.45	4274.45
4	2.81887	12305.3	15.9524	Susanville Basalt	3500	26	3867.83	4986.76	3048.31	0	3048.31	4153.92	4153.92
5	2.81887	11930.9	16.8671	Susanville Basalt	3500	26	3801.35	4901.04	2872.55	0	2872.55	4025.11	4025.11
6	2.81887	11534.2	17.7862	Susanville Basalt	3500	26	3732.47	4812.24	2690.48	0	2690.48	3887.86	3887.86
7	2.81887	11115	18.7101	Susanville Basalt	3500	26	3661.19	4720.34	2502.06	0	2502.06	3742.03	3742.03
8	2.81887	10672.9	19.6391	Susanville Basalt	3500	26	3587.49	4625.31	2307.23	0	2307.23	3587.43	3587.43
9	2.81887	10207.4	20.5735	Susanville Basalt	3500	26	3511.34	4527.13	2105.93	0	2105.93	3423.9	3423.9
10	2.81887	9718.24	21.5136	Susanville Basalt	3500	26	3432.71	4425.76	1898.1	0	1898.1	3251.22	3251.22
11	2.81887	15653.1	22.4599	Susanville Basalt	3500	26	4111.73	5301.21	3693.03	0	3693.03	5392.79	5392.79
12	2.81887	26707.6	23.4126	Susanville Basalt	3500	26	5384.21	6941.81	7056.73	0	7056.73	9388.1	9388.1
13	2.81887	26144.4	24.3723	Susanville Basalt	3500	26	5287.46	6817.07	6800.99	0	6800.99	9196.41	9196.41
14	2.81887	25555.4	25.3393	Susanville Basalt	3500	26	5187.98	6688.81	6538.05	0	6538.05	8994.75	8994.75
15	2.81887	24940	26.3141	Susanville Basalt	3500	26	5085.74	6556.99	6267.75	0	6267.75	8782.84	8782.84
16	2.81887	24297.5	27.2972	Susanville Basalt	3500	26	4980.66	6421.52	5990.01	0	5990.01	8560.42	8560.42
17	2.81887	23627.4	28.2891	Susanville Basalt	3500	26	4872.71	6282.34	5704.66	0	5704.66	8327.14	8327.14
18	2.81887	22928.6	29.2903	Susanville Basalt	3500	26	4761.82	6139.37	5411.53	0	5411.53	8082.68	8082.68
19	2.81887	22200.6	30.3014	Susanville Basalt	3500	26	4647.93	5992.53	5110.43	0	5110.43	7826.62	7826.62
20	2.81887	21442.2	31.3231	Susanville Basalt	3500	26	4530.96	5841.72	4801.24	0	4801.24	7558.6	7558.6
21	2.81887	20652.7	32.356	Susanville Basalt	3500	26	4410.85	5686.86	4483.71	0	4483.71	7278.17	7278.17
22	2.81887	32727.2	33.4008	Susanville Basalt	3500	26	5719.19	7373.7	7942.26	0	7942.26	11713.5	11713.5
23	2.81887	37016.1	34.4583	Susanville	3500	26	6150.99	7930.41	9083.69	0	9083.69	13304.6	13304.6

				Basalt									
24	2.81887	36126	35.5294	Susanville Basalt	3500	26	6007.95	7745.99	8705.57	0	8705.57	12995.7	12995.7
25	2.81887	35199.7	36.615	Susanville Basalt	3500	26	5861.04	7556.58	8317.23	0	8317.23	12672.4	12672.4
26	2.81887	34235.8	37.7162	Susanville Basalt	3500	26	5710.12	7362	7918.29	0	7918.29	12334.1	12334.1
27	2.81887	33232.5	38.8339	Susanville Basalt	3500	26	5555.03	7162.05	7508.31	0	7508.31	11980.1	11980.1
28	2.81887	32187.9	39.9695	Susanville Basalt	3500	26	5395.6	6956.49	7086.86	0	7086.86	11609.4	11609.4
29	2.81887	31100.1	41.1244	Susanville Basalt	3500	26	5231.63	6745.09	6653.42	0	6653.42	11221.2	11221.2
30	2.81887	29966.6	42.2999	Susanville Basalt	3500	26	5062.93	6527.58	6207.46	0	6207.46	10814.3	10814.3
31	2.81887	28785	43.4978	Susanville Basalt	3500	26	4889.25	6303.66	5748.36	0	5748.36	10387.7	10387.7
32	2.81887	28856.2	44.7199	Susanville Basalt	3500	26	4844.57	6246.06	5630.26	0	5630.26	10427.7	10427.7
33	2.81887	44306	45.9685	Susanville Basalt	3500	26	6365.26	8206.66	9650.09	0	9650.09	16234.3	16234.3
34	2.81887	42960.9	47.2459	Susanville Basalt	3500	26	6156.26	7937.2	9097.61	0	9097.61	15756.5	15756.5
35	2.81887	41553.4	48.555	Susanville Basalt	3500	26	5940.05	7658.45	8526.08	0	8526.08	15253.1	15253.1
36	2.81887	40078.7	49.8988	Susanville Basalt	3500	26	5716.08	7369.68	7934.03	0	7934.03	14721.8	14721.8
37	2.81887	38530.9	51.2813	Susanville Basalt	3500	26	5483.71	7070.09	7319.78	0	7319.78	14160	14160
38	2.81887	36903.3	52.7067	Susanville Basalt	3500	26	5242.2	6758.71	6681.33	0	6681.33	13564.4	13564.4
39	2.81887	35187.9	54.1804	Susanville Basalt	3500	26	4990.64	6434.38	6016.38	0	6016.38	12931.1	12931.1
40	2.81887	33375	55.7087	Susanville Basalt	3500	26	4728	6095.76	5322.1	0	5322.1	12255.3	12255.3
41	2.81887	31452.6	57.2994	Susanville Basalt	3500	26	4452.98	5741.18	4595.1	0	4595.1	11531.2	11531.2
42	2.81887	29406.1	58.9623	Susanville Basalt	3500	26	4163.99	5368.59	3831.16	0	3831.16	10750.9	10750.9
43	2.81887	27216.5	60.7099	Susanville Basalt	3500	26	3859.02	4975.39	3024.98	0	3024.98	9904.45	9904.45
44	2.81887	24859.1	62.5586	Susanville Basalt	3500	26	3535.44	4558.21	2169.65	0	2169.65	8978.17	8978.17
45	2.81887	22300.3	64.5308	Susanville Basalt	3500	26	3189.79	4112.56	1255.94	0	1255.94	7952.74	7952.74
46	2.81887	19492.7	66.6583	Susanville Basalt	3500	26	2817.16	3632.14	270.93	0	270.93	6799.22	6799.22
47	2.81887	16364.5	68.9892	Susanville Basalt	3500	26	2410.34	3107.63	-804.484	0	-804.484	5471.13	5471.13
48	2.81887	12798.2	71.603	Susanville Basalt	3500	26	1957.68	2524.02	-2001.07	0	-2001.07	3884.96	3884.96
49	2.81887	8571.09	74.6507	Susanville Basalt	3500	26	1437.74	1853.66	-3375.49	0	-3375.49	1862.27	1862.27
50	2.81887	3127.63	78.5113	Susanville Basalt	3500	26	798.556	1029.57	-5065.13	0	-5065.13	-1136.13	-1136.13

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.28929

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	165	100.183	0	0	0
2	167.819	100.846	7108.31	-633.023	-5.08899

3	170.638	101.556	14040.2	-1250.34	-5.08901
4	173.457	102.314	20809.9	-1853.21	-5.08901
5	176.275	103.119	27432.8	-2443	-5.08899
6	179.094	103.974	33925.1	-3021.16	-5.08898
7	181.913	104.878	40304.5	-3589.27	-5.08898
8	184.732	105.833	46589.8	-4149	-5.08898
9	187.551	106.839	52800.9	-4702.13	-5.08899
10	190.37	107.897	58959.6	-5250.58	-5.08899
11	193.189	109.008	65088.6	-5796.39	-5.08898
12	196.008	110.174	70050.9	-6238.3	-5.08898
13	198.826	111.394	72639.4	-6468.82	-5.08899
14	201.645	112.671	74967.2	-6676.12	-5.08899
15	204.464	114.006	77060.3	-6862.52	-5.08899
16	207.283	115.4	78946.7	-7030.51	-5.08899
17	210.102	116.855	80656.2	-7182.75	-5.08899
18	212.921	118.372	82220.7	-7322.07	-5.08899
19	215.74	119.953	83674.4	-7451.53	-5.08899
20	218.558	121.6	85054.2	-7574.4	-5.08898
21	221.377	123.316	86399.4	-7694.2	-5.08899
22	224.196	125.102	87752.8	-7814.73	-5.08899
23	227.015	126.961	84235.1	-7501.46	-5.08899
24	229.834	128.895	78485.5	-6989.44	-5.08899
25	232.653	130.908	72513.2	-6457.58	-5.08899
26	235.472	133.002	66366.5	-5910.19	-5.08898
27	238.291	135.182	60098.2	-5351.98	-5.08899
28	241.109	137.451	53766.1	-4788.08	-5.08899
29	243.928	139.814	47433.5	-4224.14	-5.08899
30	246.747	142.275	41170.3	-3666.37	-5.08898
31	249.566	144.84	35053.8	-3121.68	-5.08899
32	252.385	147.515	29170.3	-2597.73	-5.08899
33	255.204	150.307	22809	-2031.23	-5.08899
34	258.023	153.222	6004.14	-534.692	-5.08899
35	260.841	156.271	-10790	960.891	-5.08898
36	263.66	159.464	-27463	2445.69	-5.08899
37	266.479	162.811	-43887.7	3908.37	-5.08899
38	269.298	166.327	-59915.9	5335.74	-5.08898
39	272.117	170.028	-75373.5	6712.3	-5.08898
40	274.936	173.934	-90053.2	8019.58	-5.08898
41	277.755	178.068	-103705	9235.3	-5.08897
42	280.574	182.458	-116021	10332.1	-5.08898
43	283.392	187.143	-126617	11275.7	-5.08897
44	286.211	192.168	-135001	12022.3	-5.08896
45	289.03	197.597	-140522	12514	-5.08898
46	291.849	203.515	-142290	12671.5	-5.089
47	294.668	210.047	-139026	12380.8	-5.08898
48	297.487	217.386	-128769	11467.3	-5.08895
49	300.306	225.861	-108199	9635.55	-5.08899
50	303.124	236.131	-70759.8	6301.44	-5.08899
51	305.943	250	0	0	0

Entity Information

Focus Search Line

X	Y
233.272	167.698
393.112	38.038

External Boundary

X	Y

0	0
450	0
450	250
255	250
255	210
225	210
225	170
195	170
195	130
165	130
165	100
0	100