Geotechnical Exploration Report

GARNET HILL RECREATION AREA – VARIOUS IMPROVEMENTS
U.S. Highway 50
Near Ely, Nevada

Prepared for:
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October 18, 2024
Project No. 4030.2400162

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Reference: Geotechnical Engineering Report
Garnet Hill Recreation Area – Various Improvements
U.S. Highway 50
Near Ely, Nevada
Project No: 4030.2400162

UES is pleased to submit this Geotechnical Engineering Report for the referenced project. This report includes the results from the field exploration, geological reconnaissance and laboratory testing program, along with recommendations for use in the preparation of the appropriate design and construction documents for this project.

UES appreciates the opportunity to provide this Geotechnical Engineering Report and looks forward to continuing participation during the design and construction phases of this project. UES also has great interest in providing construction services, including materials testing and inspection services during the construction of this project, and will be glad to meet with you to further discuss how we can be of assistance as the project advances.

If there are questions pertaining to this report, or if UES may be of further service, please contact us at your convenience.

Respectfully,
UES

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1.0 INTRODUCTION

Nova Geotechnical and Inspection Services dba UES, Consultant, has completed a field exploration and geotechnical evaluation for the Garnet Hill Recreation Area project. Sharon Christ, representing S&B Christ Consulting, LLC, authorized UES services on August 14, 2024, by signing UES Proposal No. 4030.0524.00031 and the 'Request for Change Order' document dated August 29, 2024.

The site is located along U.S. Highway 50 near Ely, Nevada. The general location of the site is shown in Figure No. 1, Vicinity Map.

The purpose of our services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- General geology of the area
- Foundation design and construction
- Lateral earth pressure and retaining wall design parameters
- Slab-on-grade design and construction
- Pavement design and construction
- Slope Stability Analysis
- Earthwork

This report is for the purpose of providing geotechnical engineering requirements. The scope of our services for this project did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic material in structures, soil, surface water, groundwater, or air, below or around this site.

1.1 PROPOSED DEVELOPMENT

The project site consists of recreational BLM land partially developed with day-use facilities. The planned construction sites include Egan Crest Trailhead, Garnet Hill Lower Campground, Garnet Hill Upper Campground, and Garnet Hill Trailhead. The site constructions/improvements include the following:

- Egan Crest Trailhead
    - Parking area enlargement
    - ADA accessible vault toilet
    - Concrete dumpster pad
    - ADA accessible day-use sites with steel shade structure
    - Earthen berm (max 600-feet)
- Garnet Hill Campground (Upper and Lower)
    - ADA accessible group and individual camp sites with steel shade structure
    - ADA accessible vault toilet
    - Concrete dumpster pad
- Garnet Hill Trailhead

  - Trailhead enlargement
  - Retaining wall construction
  - ADA accessible day-use sites with steel shade structure
  - Break up rock at existing rockhounding areas
  - Concrete or pavement trails to rockhounding areas and day-use sites
  - ADA accessible vault toilet (may be preserving existing toilet)
- Improved dirt access roads with drainage ditches
- New signage at all sites
- Gravel parking area and large sign at Garnet Hill/U.S. 50 intersection
- Demolition of existing vegetation or structures at the proposed sites

Structural loads for the proposed buildings were not provided. We anticipate maximum dead- plus live-loads for columns and wall loading at approximately 60 kips and 2.0 kips per lineal foot, respectively. There will be on-site paved areas. Based on the topography of the area, it is further anticipated that significant cut and fill will be required, particularly at Garnet Hill Campgrounds and Trailhead.

1.2 Scope of Work

Our scope of work included the following:

- Site reconnaissance
- Review of United States Geological Survey (USGS) topographic maps, aerial photographs and available groundwater data
- Review of geologic maps and fault maps
- Review of seismic activity within 100 kilometers (62 miles) of the site
- Subsurface exploration, including the drilling and sampling of nine borings to target depths ranging from approximately 15 to 16½ feet below the ground surface (bgs).
- Bulk sampling of near-surface soils
- Laboratory testing of selected soil samples
- Slope stability analysis of narrow sections on Pole Line Road
- Engineering analyses
- Preparation of this report

1.3 Figures and Attachments

The following figures are included with this report:

1. Vicinity Map
2. Site Plan

Appended to this report are:

- Appendix A

- Logs of Soil Borings
- United Soil Classification System
- General information regarding project concepts, exploratory methods used during our field investigation and laboratory test results not included on the Logs of Soil Borings
- Laboratory Test Results

2.0 SITE INFORMATION

2.1 SITE DESCRIPTION

The project site is recreational land located approximately 8 miles Northwest of Ely, Nevada along Highway 50. The Robinson Copper Mine is to the northwest and downhill of the project site with the Egan Mountain range running from the NW-SE north of the site. Site conditions for each area were recorded during site reconnaissance visit on August 19, 2024 and drilling on September 17-18, 2024.

2.1.1 Egan Crest Trailhead

The Egan Crest project location is a total of approximately four acres, with a 1/3-acre gravel parking area that includes two shade structures with slab on grade concrete pads, and trail sign. The remainder of the site consists of historically graded native material with sparce vegetation.

2.1.2 Garnet Hill Sign – US-50 and Pole Line Road

This location is south of Pole Line Road at the intersection of Hwy-50. The area consists of undisturbed, native vegetation with utility infrastructure on the north side of Pole Line Road.

2.1.3 Narrow Road

Several areas along Pole Line Road (access road to Garnet Hill) will require road-widening, which will likely include excavation techniques (including rock excavation) at the toe of the slopes to the north. The slope North of Pole Line Road are approximately 10-12 degrees, with undisturbed vegetation, surficial soils and gravels, and bedrock outcrops.

2.1.4 Garnet Hill Upper and Lower Campground

The upper and lower campground sites are located approximately 2.8 and 2.2 miles from Hwy-50 along Pole Line Road. The sites appear to have been used for primitive recreation sites as evidenced by the fire rings and trash. There are several small two-track roads throughout these areas; however, the area is primarily undeveloped, with undisturbed surface vegetation, surficial soils and gravels, and some bedrock outcrops. The upper campground has significant slopes in all directions, likely requiring significant cut and fill, depending on final design.

2.1.5 Garnet Hill Recreation Area

The Garnet Hill Recreation Area is currently developed as a rockhounding trailhead including a vault toilet, railroad-tie retaining wall, gravel parking area, and several small picnic areas and walking trails. Native vegetation with surficial soils and gravels exists at the site between the developed areas. Previous grading at the site has been done at the site Northwest of the vault toilet.

Figure 2-1: Top Left: View looking North at the Egan Crest Trailhead showing existing shade structures and gravel parking area. Top Right: View looking east at undeveloped Lower Garnet Hill Campground Site (approximate B-3 location). Bottom Left: View looking North at Garnet Hill Trailhead showing existing gravel parking area and existing retaining wall structure (approximate B-1 location). Bottom Right: View looking southwest at slope stability analysis area where road is to be widened.

2.2 Site History

Review of the aerial photographs from Google Earth and historicaerials.com reveal that the project site has been relatively undeveloped other than the dirt roads and trail head parking lots on the sites. Egan Crest Trailhead appears to have been mass graded; however, the grading conditions have not changed since the earliest imagery in 1979. The current gravel area and shade structures at Egan Crest Trailhead appears to have been constructed between 1985 and 1999. The Garnet Hill access road (Pole Line Road) appears to have been partially developed before 1979, with the final section of road up to Garnet Hill Trailhead being constructed between 1982 and 1999. Based on historical imagery, it is unknown when the picnic areas and vault toilet were constructed.

2.3 Geologic History

The project site is located within the eastern area of the Great Basin geomorphic province of Nevada. The Great Basin covers a rough area of 190,000 square miles across Utah, Nevada, Idaho, and Oregon with

small portions of California[1]. The area of interest has been heavily impacted by tectonics, volcanics, and weathering from wind and water; this has caused chemical and physical changes throughout the site which can be seen in geologic analysis.

The Great Basin is associated with basin-and- range normal faulting which creates the distinctive north-south running mountain ranges with valleys between which surrounds the project area. The basin-and -range allows for surficial expression near the Eagan Crest Trailhead of Permian interbedded Siltstone and Sandstone (Pau). The fine-grained sandstone and sandstone ranges in color from tan to orange/red with a thickness of 1400-1500 feet. In some areas there is quaternary Alluvium which consists of silt, sand, and gravel (Qal) which has deposited from higher in the Eagan Range to near highway 50. The Garnet Hill area experiences the relatively recent volcanism of the area in Tertiary aged Rhyolitic rock ranging in color from light to dark gray with thin layers of pink. The rhyolite contains smokey quartz, potassium feldspar, plagioclase, biotite, and garnet crystals[2]. Near the Garnet Hill area is exposed upper Mississippian limestone thickly bedded with interbedded chert, this limestone ranges from light olive to brown-gray with a bedding thickness between 2,500-2,700 feet.

2.4 Seismic Site Class

The 2018 International Building Code (IBC) also requires that a default Site Class D be assumed for seismic design when soil conditions for the top 100 feet are not known in sufficient detail for determination in accordance with Table 20.3-1 of ASCE Standard 7.

The site is located at approximately the following latitude and longitude:

Location	Latitude	Longitude
Egan Crest	39.31095°	-114.99006°
Garnet Hill	39.282942°	-114.949621°
Hwy50/Pole Line Rd	39.286628°	-114.964112°

A search of the USGS Earthquake Hazards Program's ASCE 7-16 data, as published by the ASCE 7 Hazard Tool (https://asce7hazardtool.online/), indicated the following spectral acceleration parameters for the locations indicated above and a Site Class D:

Table 2-1: Seismic Design Parameters

Period (s)	MCE_R ground motion (g)		Site-modified spectral acceleration value (g)		Numeric seismic design value (g)		Site amplification factor (g)	
0.2	S_S	0.371	S_{MS}	0.558	S_{DS}	0.372	F_a	1.503
1.0	S_1	0.125	S_{M1}	0.293	S_{D1}	0.195	F_v	2.351

[1] Spencer, A.C,. 1917. The Geology and Ore Deposits of Ely, Nevada. United States Geologic Survey. //efaidnbmnnnibpcajpcglclefindmkaj/https://pubs.usgs.gov/pp/0096/report.pdf

[2] Brokaw, A.L., Bauer, H.L., Breitrick, R.A. 1973. Geologic Map of the Rush quadrangle, White Pine County, Nevada. U.S. Geologic Survey. Map Scale 1:24,000. https://ngmdb.usgs.gov/Prodesc/proddesc_10629.htm.

2.5 GeoHazards Assessments

2.5.1 Historic Seismicity

Seismological data regarding significant historical earthquakes affecting the site was obtained using the USGS Earthquake Catalog (USGS, https://earthquake.usgs.gov/earthquakes/search/). A search radius of 100 kilometers (62 miles) was specified for this analysis.

According to the tabulated data, the most intense earthquake ground shaking within 100 kilometers of the site resulted from a MR (Richter Scale Magnitude) 3.2 earthquake on May 17, 1991, with an epicenter located approximately 49.83 kilometers (31 miles) East of the Garnet Hill site and 57.94 kilometers (36 miles) Southeast of the Eagen Crest site.

The closest earthquake to the site is indicated to be an MR 2.5 earthquake that occurred on February 16, 2013, with an epicenter located approximately 4.83 kilometers (3 miles) East of the Garnet Hill site and 12.87 kilometers (8 miles) Southeast of the Eagen Crest site.

2.5.2 Seismic Hazards

No active or potentially active faults are known to underlie the site based on the published geologic maps or aerial photographs that we reviewed. The site is not located within an Alquist-Priolo Earthquake Fault Rupture Hazard Zone, and we observed no surface evidence of faulting during our site reconnaissance. Therefore, it is our opinion that ground rupture at the site resulting from seismic activity is unlikely. The site is not located within a seismic hazard zone pursuant to the Seismic Hazard Zone Mapping Act.

2.5.3 Landslides

The topography across the project area varies depending on site. Egan Crest Trailhead and Garnet Hill Sign (Hwy 50) development appears to be on relatively level ground, posing no landslide risk. The Lower Campground slopes very gently to the northeast, with very low landslide potential. Upper Campground has considerable slopes given the area has considerable elevation gain Garnet Hill Trailhead is only 100-feet shy of the nearest peak, therefore development in this area has considerable potential for high amounts of cut and fill. Additionally, the parking area has an approximately 15% slope toward the northeast, where the current retaining wall sits. Stability of this slope should be considered in retaining wall design. Landslide potential at the Upper Campground and Garnet Hill Trailhead should be further considered if the final design is such that significant cut and fill is required as that may affect the current stability of the area. UES is available to perform global stability analyses in these areas upon request. A specific scope of work and cost proposal will be prepared prior to engaging in these services.

The access road leading to the Garnet Hill Campgrounds and Trailhead is currently too narrow for large recreational vehicles to access the proposed development; therefore, it is necessary to widen several areas of the existing road. Field explorations and stability analysis of this area was completed as the bedrock and soil slope toes will be removed to accommodate the road widening..

2.5.4 Soil Expansion Potential

Based on the Atterberg Limits test results, the native clayey sand soils are not capable of exerting significant expansion pressures on building foundations, or exterior flatwork.

3.0 FIELD EXPLORATION & LABORATORY PROGRAM

3.1 FIELD ACTIVITIES

The scope of our services for this project included a subsurface exploration program at Egan Crest Trailhead, Garnet Hill Sign location, narrow road modification area, and Garnet Hill Campgrounds. The subsurface exploration program consisted of drilling nine (9) borings to target depths of approximately 15 to 16 1/2 feet below existing site grades. Early auger refusal was encountered on bedrock at the following borings and depths.

Boring No.	Depth to Bedrock (ft)
B-1	13
B-6	14 ½
Slope-1	3.5
Slope-3	13 ½

The borings were logged during drilling by a geotechnical staff professional. SPT and bulk samples were obtained to aid in material classification and for laboratory testing. The approximate locations of the borings are shown in Figure 2, Project Site Plan. The locations of the borings were determined in the field by using a tablet GPS. The locations of the borings should be considered accurate only to the degree implied by the method used. Results of the boring are presented in the Appendix.

During drilling, two of the borings, B-05 and B-06, at Egan Crest Trailhead had a yellow sulfide mineral as well as petroleum smell between 7-13 feet. Three borings (B-1, Slope-1, and Slope-3) did not reach the targeted 15 feet depth due to early termination on bedrock.

3.2 LAB PROGRAM

The soil samples collected in the field as part of our field exploration were transported to our lab. Laboratory testing was conducted to determine certain physical and chemical properties of the soils. Further discussion of the laboratory testing and the laboratory testing result will be discussed later in this report. The laboratory testing data is also included in the Appendix.

3.3 SUBSURFACE CONDITIONS

Fill was encountered in the upper 2-feet of all explorations. The fill generally consisted of native, compacted rhyolitic sand, silt and gravels and very stiff sandy silt. However, due to previous site development/grading there could be deeper and/or poorer quality fill in other areas of the site beyond our explorations.

The Garnet Hill Trailhead as well as Upper and Lower Campground consist of approximately 2-feet of compacted natural fill material underlain by medium to very dense silty sands and gravel. Bedrock was encountered at 13-feet at the Garnet Hill Trailhead site.

The slope borings along the narrow section of Pole Line Road as well as the Garnet Hill Sign boring (B-04) revealed 2-feet of compacted native fill material underlain by loose to very dense silty sand to varying

depths. Refusal was encountered on very dense, cemented gravel at a depth of 3.5-feet at the southwestern most slope boring (Slope-1) and on bedrock at 13.5-feet at the middle slope boring (Slope-3).

Egan Crest Trailhead consists of 2 to 3-feet of fill underlain by firm to very stiff silt with gravel and medium dense sand with gravel. As stated previously, this site has yellow mineral inclusions that contain elevated arsenic concentrations. There was an apparent petroleum smell between 7-13-feet below ground surface.

Laboratory test results indicate that the on-site clay soils have a low expansion potential. Groundwater was not encountered within the depths explored. The boring logs and laboratory test results presented in the Appendix should be referred to for more detailed information.

3.4 GROUNDWATER

To supplement the groundwater data, we reviewed available groundwater data published by the Nevada Department of Water Resources (DWR) from a monitoring well (385521114503601) located about 30 miles south of the site. DWR has monitored water levels in the well since May 2020. Ground surface elevation at the well is indicated to be about 7,328 feet which is close to the subject property's elevation. The monitoring well data shows static water level of 428 feet below ground surface (bgs) on 09/24/2024.

3.4.1 Groundwater Effect on Development and Seasonal Water

Review of available groundwater data revealed the groundwater elevation at nearby monitoring wells has ranged from 100-430 feet below the existing well ground surface. Groundwater levels at the site should be expected to fluctuate throughout the year based on variations in seasonal precipitation, local pumping, and other factors. Locally perched shallower groundwater may be encountered.

Based on our subsurface exploration, experience at the site, and review of groundwater information near the site, the permanent groundwater table will not likely be a significant factor in construction for excavations extending less than 50 feet below the ground surface. However, it is possible that perched groundwater may be encountered in excavations if construction begins in the winter and early spring months. If groundwater is encountered, the use of sumps, submersible pumps, deep wells or a well point system could be used as methods to lower the groundwater level. The dewatering method used will depend on the soil conditions, depth of the excavation and amount of groundwater present within the excavation. Dewatering, if required, should be the contractor's responsibility. The dewatering system should be designed and constructed by a dewatering contractor with local experience. We recommend the selected dewatering system lower the groundwater level to at least two feet below the bottom of the proposed excavations.

During the wet season, infiltrating surface runoff water can create saturated surface conditions. Earthwork operations attempted following the onset of winter rains and prior to prolonged drying periods will be hampered by high soil moisture contents.

Soils beneath existing pavements will likely be at an elevated moisture content regardless of the time of year and will require drying before compaction or use as fill. Such soils, intended for use as engineered fill, will require considerable aeration and/or drying to reach a moisture content that will permit the soils to be properly compacted.

3.5 CORROSION

3.5.1 Soil Corrosion Potential

Three soil samples were tested to determine minimum resistivity, pH, chloride, and sulfate concentrations to help evaluate the potential for corrosive attack upon reinforced concrete and buried metal. The results of the corrosivity tests are summarized in the below table. Copies of the corrosion potential test results performed by ChemTech Ford are included in the Appendix.

Table 3-1: Soil Corrosivity Testing Results

Analyte	Test Method	Sample Identification			
		B-06@7.5'	B-05 @5'	B-02 @2.5'	Slope-3 @2.5'
pH	EPA 9045D	NA	9.0	8.8	8.5
Minimum Resistivity	SSSA 10-3.3	NA	22.3 ohm-m	22.1 ohm-m	21.6 ohm-m
Chloride	EPA 300.0	NA	18.3 mg/kg	35 mg/kg	32 mg/kg
Sulfate	EPA 300.0	NA	Not Detectable	26 mg/kg	16 mg/kg
Total Solids	CTF8000	NA	92.3%	87.0%	96.3%
Arsenic	EPA 6010D/3050B	4.58 mg/kg	3.95 mg/kg	Not tested	Not tested

Based on test results and *Table 19.3.1.1* of *ACI 318-14 Section 19.3*, the on-site soils classify as having an "**S0**" (Negligible) sulfate exposure. Please refer to *Table 19.3.2.1* of *ACI 318-14* for the requirements for concrete by exposure class. Consideration should be given to providing protection to buried metal pipes or the use of nonmetallic pipes where permitted by local building codes. Non-corrosive backfill, protective coatings and wrappings, sacrificial anodes, or a combination of these methods could be considered. UES personnel are not experts regarding corrosion and/or corrosion protection, and we recommend that a "Corrosion Engineer" be consulted for actual recommendations regarding the necessity and/or method of cathodic protection.

The soil at Egan Crest Trailhead have elevated arsenic concentrations which adds to human health hazards, and in addition is also a corrosive mineral which could pose higher risk of corrosion.

4.0 ENGINEERING ANALYSIS

4.1 ENVIRONMENTAL AND HUMAN HEALTH HAZARDS

The Egan Crest Trailhead Site has several factors that could pose an environmental or human health hazard.

The arsenic concentration sampled in the soils at Egan Crest is above the 'Minimal Risk Level (MRL)' of 0.005 mg As/kg/day as defined by the U.S. Department of Health & Human Services.

There was an apparent petroleum smell from boring B-6 at a depth of 7.5 feet at Egan Crest Trailhead, which may pose an environmental concern. UES is available to investigate this further upon request. A separate cost proposal can be prepared to define the scope of work.

UES recommends that an environmental assessment be completed for the Egan Crest Site if the client assesses that construction or recreational use could cause elevated arsenic exposure to human occupants.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GEOTECHNICAL DISCUSSION

Our recommendations are based on the assumption that the soil conditions are similar to those disclosed by the explorations. If variations are noted during construction or if changes are made in the site plan, structural loading, foundation type or floor level, we should be notified so we can supplement our recommendations, as applicable.

Based on our field and laboratory test results, it is our opinion that firm, undisturbed native soils will be capable of supporting the proposed improvements provided the further recommendations regarding site preparation and soils compaction are followed. Our work also indicates that native soils and/or engineered fill, properly placed and compacted in accordance with the recommendations of this report, will be capable of supporting the proposed structures and pavements, if applicable.

An important aspect of site development will be the adequate clearing of existing surface and subsurface features associated with the existing structures, the proper backfilling of depressions created by structure removal, and uniform compaction of all disturbed soils. During demolition we anticipate that the upper one to two feet of near-surface soils will become disturbed. Thorough compaction of the upper soils will be crucial to providing uniform support of the planned structures and pavements, if applicable.

5.2 SITE PREPARATION

5.2.1 Site Clearing

- Strip and remove existing vegetation, debris, uncontrolled fill, disturbed natural soils, and other deleterious materials from proposed building areas, adjacent walks and slabs, and in areas to be paved. Excavations should extend at least 5 feet beyond the areas to be improved in plan view. Uncontrolled fill is defined as any existing fill that was not properly placed, observed and tested.
- Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.
- If unexpected fills or abandoned structures/improvements are encountered during site clearing, such features should be removed and the excavation thoroughly cleaned and backfilled. Excavations should be observed by the geotechnical engineer prior to backfill placement.
- Demolition of existing structures/improvements should include removal of any foundation system and utilities. Any excavations as a result of demolition and removal should be properly filled.
- Materials derived from the demolition of existing structures/improvements should be removed from the site, and not be allowed for use in any fills. In some cases, existing pavements, if properly broken up, can be used in required fills. The geotechnical engineer should determine the suitability for use based on conditions in the field.

5.2.2 Excavation

- It is anticipated that excavation of the on-site natural deposits for the proposed project can be accomplished with conventional earthmoving equipment.
- Excavations penetrating bedrock will require special consideration where they are to be performed.

- Contractors, especially those excavating for utilities, should satisfy themselves as to the hardness of materials and equipment required.
- Temporary unsurcharged construction excavations should be sloped or shored. Slopes should not be steeper than 2 horizontal to 1 vertical. Slopes may need to be flattened depending on conditions exposed during construction. Exposed slopes should be kept moist (but not saturated) during construction. If there is not enough space for sloped excavations, shoring should be used. Traffic and surcharge loads should be kept back at least 10 feet from the top of the excavation.
- If excavations, including utility trenches, are extended to a depth of more than 20 feet, OSHA requires that the protective system of such excavations be designed by a professional engineer. Excavation, trenching and shoring should be conducted in accordance with the *U.S. Department of Labor Occupational Safety and Health Administration's (OSHA) Excavation and Trenching Standard, Title 29 of the Code of Federal Regulation (CFR), Part 1926.650*. The safety of construction personnel is the responsibility of the contractor.

5.3 EARTHWORK

All earthwork should be performed in accordance with the guidelines presented in *Chapter 18 of the 2018 IBC*, except where specific recommendations are presented in this report. It is recommended that contractors perform their own reconnaissance of the site. If the contractors have any questions regarding site conditions, site preparation, or recommendations in this report, they should contact a representative of Universal Engineering Sciences.

5.3.1 Subgrade Preparation

Following site clearing activities, areas designated to receive fill, at-grade areas, or those achieved by excavation should be scarified to a depth of at least 12 inches, moisture conditioned to at least the optimum moisture content and compacted to not less than 90 percent of the maximum dry density as determined by ASTM D1557.

The upper 12 inches of final subgrade for the concrete slabs and exterior flatwork should consist of imported compactable, low-expansive soils. All soils supporting interior and exterior slab-on-grade concrete should be uniformly compacted to 90 percent of the ASTM D1557 maximum dry density.

Difficulty in achieving the recommended compaction may require drying the near-surface subgrade to a compactable moisture content, removal and replacement, and/or the use of a layer of geogrid reinforcement (Tensar BX1100, Tensar TX140, Mirafi 5XT, or equivalent). Recommendations to achieve the recommended compaction can be made during construction and will depend on the conditions encountered in the field and other factors, such as project schedule and prevailing weather conditions.

Compaction of all subgrade soils should be performed using a heavy, self-propelled, compactor capable of achieving the required compaction and must be performed in the presence of the Geotechnical Engineer's representative who will evaluate the performance of subgrade under compactive load. Difficulty in achieving subgrade compaction may be an indication of loose, soft or unstable soil conditions that could require additional excavation. If these conditions exist, additional subgrade stabilization recommendations may be required at the time of construction.

5.3.2 Fill Materials

- On-site soils meeting the following criteria, as determined by visual observation by the 3rd party inspector, may be used in required fills:

Table 5-3.2: Fill Materials

Sieve Size	Percent Passing
12-inch	100
6-inch	85-100
¾-inch	40-100

Notes: Material should be free of all debris and organic matter.
Material has an expansion potential less than 4.0 percent.

- In general, material greater than 12 inches in diameter should not be used in fills within 5 feet below the bottom of the footing within building pad areas.
- Fill containing material greater than 6 inches in diameter should not be used in any utility trenches, behind retaining walls or against foundations or grade beams.
- Imported material should be compatible with on-site soils in addition to being suitable for its intended use. All imported materials should be approved by the geotechnical firm providing testing during construction prior to importing. In general, imported soils should be granular and non-expansive or have a maximum expansion index of 20, a maximum solubility of 0.5%, a maximum sulfate content of 0.1% and a maximum sodium sulfate content of 0.2%.
- Select free draining granular materials should be used as backfill immediately behind retaining walls (6 to 12 inches). As an option, a prefabricated drain may be used and should be installed in accordance with the manufacturer's recommendations.
- Based on chemical test results, some on-site native soils contain sufficient concentrations of sodium sulfate to be susceptible to chemical expansion. The upper 12 inches of material beneath concrete floor slabs should consist of Type II.

5.3.3 Fill Placement and Compaction

- After performing required excavations, the exposed soils should be carefully observed to verify removal of all unsuitable deposits. Exposed soils should then be scarified to a depth of 6 inches, watered as necessary, and compacted as recommended.
- Fill materials should be placed on a horizontal plane unless otherwise accepted by the geotechnical engineer.
- Where the slope ratio of the original ground is steeper than 5 horizontal to 1 vertical, the slope should be benched to create near-level areas for the placement of fill. The maximum allowable height of the bench is 3 feet. Bench excavation should be continued to the top of the existing slope in structural fill areas or the daylight (cut/fill) contact.
- All required fill should be placed in loose lifts. The lift thickness will depend on the size of the material present. Based on the size of the material encountered, lifts will range from 8 to 18 inches in thickness.
- Materials should be compacted to the following:

Table 5-1: Compaction Criteria and Testing Frequency

Material Type (location)	Per Modified Proctor Test (ASTM D1557)			
	Compaction (%)	Moisture Content Range of OMC		Testing Frequency (min. 3 per lift)
		Minimum	Maximum	
Fine–grained/lean clays	90 (minimum) 92 (preferred)	0%	+2%	1 per 2,500 sf
Granular (including aggregate base)	90 (minimum) 95 (preferred)	-2%	+2%	1 per 5,000 sf

Notes: OMC = Optimum Moisture Content

1. For compaction, fine-grained soils are soils with at least 30 percent passing the No. 200 sieve and/or soils having an expansion index of less than 20.
2. All fill placed deeper than 5 feet below the final grade should be compacted to a minimum of 95 percent at a moisture content of optimum or greater.
3. Street/pavement subgrade and retaining wall backfill only need to be compacted to a minimum of 90 percent.
4. Moderately to highly expansive clays (expansion index more than 50), if encountered, should not be used as structural fill.

- Soils should not be allowed to dry out such that cracking occurs during or after grading. Sufficient moisture contents should be maintained, to prevent cracking, at least until foundations, floor slabs, flatwork, and pavements are constructed. Any significantly dried or cracked soils could be wetted until they reach acceptable moisture contents or they could be excavated and replaced with acceptable properly compacted fill.
- Structural fill should be observed and tested as necessary to determine compliance with the compaction requirements presented in this report. In general, one compaction test should be performed for approximately every 500 cubic yards of fill, one for one foot of fill placed, or change in material.

5.3.4 On-site Soil Suitability for Use in Fill Construction

- The on-site soils encountered in our borings are considered suitable for use in engineered fill construction, provided these materials do not contain rubble, rubbish, significant organic concentrations, and are at a workable moisture content appropriate for compaction. However, near-surface clays (if encountered) should not be used within the upper 12 inches of the final subgrade within interior and exterior slab-on-grade improvements.
- Existing pavements and flatwork (asphalt concrete and/or concrete), if any, within areas to be demolished may be broken up and pulverized for use as fill. Asphalt and Portland cement concrete rubble may be used as fill provided it is processed into fragments less than three inches in largest dimension, is mixed with soil to form a compactable mixture, and is approved by the District.
- Clean aggregate base materials recovered during site clearing also may be used in engineered fill construction.

5.3.5 Permanent Slopes

Earthwork activities to construct slopes at the site should be done in accordance with the following:

- Cut and/or fill slopes should be constructed no steeper than 2 horizontal to 1 vertical.

- If any slope exceeds 30 feet in height, the slope design should include mid-height benches to intercept surface drainage and divert flow from the slope face.
- The surfaces of slopes should be compacted (not necessary where caliche/rock is exposed) to the minimum specifications recommended in the Earthwork section of this report until the slopes are stable and there are no loose soils on the slopes. Alternately, fill slopes could be constructed by over-filling and cutting back to expose fully compacted soil.
- The ground surface adjacent to the top of the slopes should be graded to drain away from the slopes. Any required erosion control measures should be provided for all slopes as soon as possible after grading.

5.4 FOUNDATIONS

If the grading recommendations presented in the Earthwork section of this report are complied with, the proposed structures and any block walls or retaining walls may be supported by conventional type foundations. Any proposed retaining walls or block walls may be established on conventional footings. Foundations should be established on undisturbed natural soils having a consistency of at least medium dense (granular) or very stiff (fine-grained soils) and/or properly compacted fill or bedrock. If bedrock deposits are encountered at foundation elevations, foundations for the structure should be supported entirely on bedrock deposits. Foundations for a portion of a structure should not be established partly on bedrock deposits and partly on natural soils and/or properly compacted fill. Foundation design parameters are summarized below.

Soil-moisture changes below foundations and floor slabs is the major factor in damages relating to soils. Settlement of the proposed structures, supported as recommended, should be within acceptable limits as provided above. However, if the soils beneath foundations experience an increase in moisture, settlement could occur and cause additional movement of a structure. Therefore, it is important that the recommendations presented in the Drainage and Moisture Protection section of this report be adhered to.

Individual foundations should not be established partly on bedrock and partly on natural soils and/or properly compacted fill. In some instances, bedrock will be deeper than the design elevation of the bottom of the foundations. In such cases, the following three alternatives can be considered:

1. The column foundation should be extended to bedrock so that all foundations are supported on bedrock.
2. Rather than extending the column foundation to bedrock, lean concrete or controlled low-strength material (CLSM) may be used between the planned design bottom of the foundation and the top of the caliche. Lean concrete shall have a minimum design strength of 1,000 psi. CLSM shall have a minimum design strength of 100 to 300 psi. One test should be performed for every 50 cubic yards of CLSM or one test per placement day, whichever is more frequent. The sampling and testing of CLSM should be performed in accordance with ASTM D5971 and ASTM D4832, respectively.

5.4.1 Outdoor Amphitheater and Roadway Signs

The outdoor amphitheater may be supported using conventional type foundations. Parameters for foundations are shown in the table below. These parameters should be used for design of all grade beams bearing on undisturbed soil or placed and compacted as recommended in Section 5.3.3 of this report.

Table 5-5.1: Foundation Design Parameters

Description	Parameter
Allowable bearing pressure [1,2]	2,000 psf (soil), 4,000 psf (bedrock)
Minimum width [3]	12 inches
Minimum embedment depth [3, 4]	36 inches
Anticipated total settlement	Less than 1 inch
Anticipated differential settlement	Less than ½ inch

Notes:
1. The bearing value may be increased by 500 psf for each additional 12 inches of embedment up to a maximum of 4,000 psf.
2. A one-third increase may be used for wind or seismic loads.
3. Minimum width and embedment depth are for conventional spread footings or the thickened edge of post-tension slab foundations.
4. Below the lowest adjacent final compacted subgrade (generally pad grade before landscaping; exterior footings) or the top of the finished floor slab (interior footings).

5.4.2 Shade Structures and Concrete Dumpster Pads

The shade structures and concrete dumpster pads at the site may be supported using a monolithic slab-on-grade foundation system. Foundation design parameters for slab-on-grade foundations or the thickened edge of the slabs are shown in the table below. These parameters should be used for design of all grade beams bearing on undisturbed soil or placed and compacted as recommended in Section 5.3.3 of this report.

For foundations constructed on slopes, a minimum horizontal distance of 4 feet, measured from the top of the footing, should be provided between the near face of the footing and the face of the finished slope.

Table 5-5.2: Foundation Design Parameters Shade Structures and Dumpster Pads

Description	Parameter
Allowable bearing pressure [1,2]	2,000 psf (soil), 4,000 psf (bedrock)
Minimum width [3]	12 inches
Minimum embedment depth [3, 4]	36 inches
Anticipated total settlement	Less than 1 inch
Anticipated differential settlement	Less than ½ inch

Notes:
1. The bearing value may be increased by 500 psf for each additional 12 inches of embedment up to a maximum of 4,000 psf.
2. A one-third increase may be used for wind or seismic loads.
3. Minimum width and embedment depth are for conventional spread footings or the thickened edge of post-tension slab foundations.

Description	Parameter
4. Below the lowest adjacent final compacted subgrade (generally pad grade before landscaping; exterior footings) or the top of the finished floor slab (interior footings).	

5.4.3 ADA Vault Toilets

The bottom of the vault will act as its foundation. We recommend a net allowable bearing pressure of 2,000 pounds per square foot (soil) for the vault bearing on undisturbed native soils, or 4,000 psf (bedrock). We understand the shelter contains a pre-cast concrete floor slab and will be installed over the entire vault.

Open cut methods require a significant amount of space and may require temporary shoring. Regardless of the excavation/retention system utilized, such systems should be designed by a professional engineer registered in the State of Nevada that is experienced in design of these systems.

5.4.4 Earthen Berm (Egan Crest)

The exposed surface should be relatively flat, uniform, and free of materials greater than 12 inches in any direction. The cleared and grubbed area should be proof-rolled to identify weak areas within the subgrade. The primary purpose of proof roll testing is to identify areas where instability may be exhibited under heavy loads, requiring higher compaction effort to ensure the area is stable and meets performance expectations. Proof rolling with a fully loaded 4,000-gallon water truck (or equivalent) is a proven method to identify weak, unstable soil layers. Identifying and mitigating unstable subgrades improves constructability by ensuring a smooth and uniform foundation for construction. Furthermore, the early identification of potentially problematic areas reduces the effort required to mitigate soil-related defects in the final materials and potential future maintenance.

We recommend that the firm conducting quality insurance inspections inspect and document the proof rolling equipment and procedures. Proofing rolling should meet the following criteria:

- The proof rolling equipment shall make at least two overlapping passes at a speed not exceeding five miles per hour (5 mph).
- Proof rolling shall be completed in the longitudinal direction, starting from the outside edge and moving in (approximately the width of the proof rolling equipment's tires) with each subsequent pass.
- The recommended proof rolling vehicle shall have a gross weight between 30 and 50 tons and provide a uniform compaction effort over the entire contact area.
- Failure criteria for proof rolling include:
    - Permanent rutting or pumping exceeding one inch (1").
    - Signs of soil pumping.
- Possible mitigation alternatives for soft or weak areas exposed during proof-rolling include:
    - Removing, replacing, and recompacting the area of concern
    - Add additional soil such that there is a smooth transition (± 1/2 inch) between the improved area and the remaining subgrade after recompacting the area.

- Other approved alternative methods provided by the Earthwork Contractor
- The contractor should provide in writing a description of their ways and means to the design team, UES, and the firm providing quality assurance for acceptance.

Regardless of the mitigation approach selected, all mitigated areas require verification through proof rolling and shall be documented by the firm conducting quality assurance efforts.

5.5 Exterior Flatwork Construction (including paved walking trails)

The upper 12 inches of final soil subgrade for exterior concrete flatwork areas should consist of approved, imported, compactable, low-expansive (less than 4% swell) soils compacted in accordance with the Engineered Fill Construction recommendations included in this report. Exterior flatwork subgrade soils should be maintained in a moist condition and protected from disturbance.

Proper moisture conditioning of the subgrade soils is considered important to the performance of exterior flatwork. Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of the perimeter building foundation and isolated column foundations by the placement of a layer of felt material between the flatwork and the foundation.

Exterior flatwork concrete should be at least four inches thick in pedestrian traffic areas and underlain by at least four inches of aggregate base compacted to at least 95 percent of the ASTM D1557 maximum dry density. The four inches of aggregate base is not required if the low-expansion imported fill below the flatwork consists of aggregate base.

Consideration should be given to thickening the edges of the slabs at least twice the slab thickness where wheel traffic is expected over the slabs. Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of other structural elements by the placement of a layer of felt material between the flatwork and the structural element. The slab designer should determine the final thickness, strength and joint spacing of exterior slab-on-grade concrete. The slab designer should also determine if slab reinforcement for crack control is required and determine final slab reinforcing requirements.

Our recommendations are intended to reduce the effects of variable soil subgrade conditions in exterior concrete flatwork areas. However, some seasonal movement of exterior flatwork should be anticipated where flatwork is adjacent to landscape areas.

Areas adjacent to new exterior flatwork should be landscaped to maintain more uniform soil moisture conditions adjacent to and beneath flatwork. We recommend final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork.

5.6 Drainage and Moisture Protection

Foundation soils should generally not be allowed to become saturated during or after construction, except when necessary to increase moisture contents prior to construction. Infiltration of water into foundation or utility excavations should be prevented during construction. Utility lines should be properly installed and the backfill properly compacted to avoid possible sources for subsurface saturation.

Positive drainage away from the structures should be provided during construction and maintained throughout the life of the structure. Any downspouts, roof drains or scuppers should discharge into splash blocks or extensions and away from the structures. Backfill against footings, exterior walls, and in utility

trenches should be properly compacted and free of all construction debris to reduce the possibility of moisture infiltration.

If the above recommendations are not followed there would be an increased risk/potential for increasing moisture below foundations and slabs, resulting in additional movement and distress to structures and slabs.

5.7 Lateral Earth Pressures and Retaining Walls (including ADA vault toilet)

For soils above any free water surface, with level backfill and no surcharge loads, we recommend the following equivalent fluid pressures and coefficient of friction:

Table 5-2: Earth Pressure Soil Parameters

Soil Parameter	Native Soil
Soil Unit Weight	120 pcf
Internal Angle of Friction	30°
Cohesion	0 psf
Coefficient of Friction	0.35

Table 5-3: Lateral Earth Pressures

Loading Condition	Lateral Earth Coefficient		Equivalent Fluid Pressure (psf/ft)
Horizontal Backfill	K_0	0.50	60
	K_a	0.33	40
	K_p	3.00	365

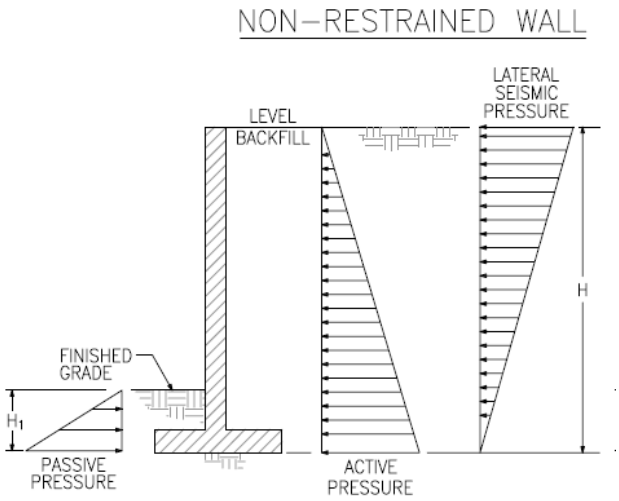
Notes:
1. The above values do not include a factor of safety. The designer should employ an adequate factor of safety
2. The above values assume no hydrostatic pressure.
3. Active pressure assumes unrestrained (cantilever) wall and assumes no loading from heavy compaction equipment.
4. Passive pressure should not exceed a maximum of 2,000 psf. A one-third increase may be used for wind or seismic loads.
5. The passive pressure and the frictional resistance of the soils may be combined without reduction in determining the total lateral resistance.
6. Passive earth pressures should be considered negligible for block or retaining walls within 5-feet of a descending slope.

If required by the 2018 IBC, the lateral seismic pressure acting on an unrestrained wall can be estimated by the method presented below, where the dynamic (seismic) lateral thrust, ΔP_{AE}, per linear foot of wall may be determined as follows:

$$\Delta P_{AE} = {}^{3}/_{8}(k_h)H^2\gamma$$

- k_h is equal to $S_{DS}/2.5$
- H is the height of the wall in feet
- γ is equal to the unit weight of the backfill material, in pcf

The resultant dynamic force acts at 0.6H above the base of the wall. This equation applies to level backfill and walls that retain no more than 15 feet.



Any surcharge from adjacent loadings should be added to the retaining wall pressures using the K_a factor for non-restrained walls. K_a is presented in the table above. As indicated, the pressures assume that there will be no build-up of hydrostatic pressure. Therefore, if walls are subject to saturated conditions, we recommend weep holes (if practical) and a wall drainage system. The wall drainage may consist of a minimum of 2 cubic feet of drain rock per foot of length of retaining wall wrapped in filter fabric, Mirafi 140N or equivalent, placed at the base of the wall and discharged to an appropriate outlet. Drain rock should consist of clean, uniformly sized gravel, ¾-inch in nominal size. Alternatively, a drainage system including a perforated pipe with a filter sock placed within the drain rock is also acceptable. The structural fill immediately behind retaining walls (6 to 12 inches) should be granular and free draining. The upper 2 feet of backfill should consist of compacted native soils. As an option, a prefabricated drain may be used behind walls. The wall drainage system is an integral part of the retaining wall design. The retaining wall designer is ultimately responsible for the retaining wall design and shall ensure that the above recommended drainage system is compatible with the design of the wall or select a different drainage system at their discretion. All walls below grade should be waterproofed or at least dampproofed.

Fill against foundations, grade beams and retaining walls should be properly placed and compacted. Backfill should be mechanically compacted in layers (12 inches maximum thickness); flooding should not be permitted. Backfill within a lateral distance equal to the height of retaining walls should be compacted to at least 90 percent of the maximum dry density obtainable by the ASTM D1557 method. The backfill materials within this zone should consist of none to low expansive soils. If expansive soils are used within this backfill zone, the wall should be designed to resist the additional pressure that the expansive soils may exert. Backfill outside this zone should be compacted as outlined in the Fill Placement and Compaction section of this report. Care should be taken when placing backfill so as not to damage the walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Over-compaction may cause excessive lateral earth pressures which could result in wall movements. Retaining walls should not be backfilled until the concrete or masonry has reached adequate strength as specified by the wall designer.

5.8 PAVEMENT DESIGN

The pavement area subgrade should be properly prepared as outlined in the Earthwork section of this report before placing any asphalt or base materials. Proper drainage of the paved areas should be provided to increase pavement life. In addition, pavements must be maintained for durability and integrity during their life. Therefore, periodic seal coating, crack sealing, and/or patching may be required.

The performance of the pavement sections can be enhanced by minimizing excess moisture which can reach the subgrade soils. The following recommendations should be followed, where possible:

- Site grading at a minimum 2% grade away from the pavements unless otherwise required for ADA compliance.
- Compaction of any utility trenches for landscaped areas to the same criteria as the pavement subgrade.
- Landscaped areas should have cutoff walls/moisture barriers adjacent to pavement areas to minimize or prevent moisture migration to subgrade soils.
- Consideration should be given to using "desert" landscaping and/or minimizing watering to help prevent surface runoff.
- Placing compacted backfill against the exterior side of curb and gutter.

The recommended pavement sections should be adequate for the anticipated traffic volumes. Future performance of pavements constructed on these soils will be dependent upon several factors, including maintaining a stable moisture content of the subgrade soils. If the soils experience an increase in moisture, distress/cracking and pavement failure may occur.

Asphalt and base course materials and compaction should meet the criteria set forth in Section 401 of the latest edition of State of Nevada DOT Standard Specifications for Road and Bridge Construction. Subgrade should be compacted to a minimum of 90 percent (ASTM D1557).

5.8.1 Asphalt Pavement (Pole Line Road)

Based on our experience and test results, the on-site soils should have an R-value on the order of 40. Therefore, based on the assumed R-value and default traffic values, the following minimum pavement sections will be applicable:

Roadway Type	Pavement Section (inches)	
	Asphalt Concrete	Type II Base Course
Low Volume Access Road	3.5	6.0

As indicated, the pavement sections presented are preliminary. White Pine County or the BLM may require that final sections be based on R-value tests performed at subgrade. Therefore, final pavement sections may vary depending on those R-value test results.

5.8.2 On-site Pavements (Parking Areas)

Based on our experience and test results, the on-site soils should have an R-value on the order of 40. Therefore, based on the assumed R-value and default traffic values, the following minimum pavement sections are recommended for on-site paved areas:

Description	Automobile Traffic	Main Corridors & Truck Access
Asphalt (in)	3.0	3.5
Type II Base Course (in)	4.0	8.0

Pavement sections presented are preliminary. If extensive paving is designed, field and laboratory testing of asphalt and base materials should be performed to determine whether specified requirements have been met.

5.8.3 Aggregate Base Parking Areas

The subgrade should be properly prepared as outlined in the Earthwork section of this report before placing any base materials. The parking areas must be maintained for durability and integrity during their life. Therefore, periodic regrading and/or placing and compacting additional aggregate base may be required. Based on the soil classifications, the following minimum aggregate base pavement section is recommended for parking areas:

Traffic Area*	Type II Base Course	Compacted Native Subgrade
Automobile Parking (Low Traffic)	8.0	12.0

*AASHTO Guide for Design of Pavement Structures 1993, Appendix A, Table 5

5.9 Plan Review

UES should be retained to provide a general review of final design plans and specifications so that grading and foundation recommendations may be interpreted and implemented. If any changes to the proposed project are planned, the conclusions and recommendations contained in this report should be reviewed and the report modified or supplemented as necessary.

5.10 Construction Items

UES should also be retained to provide services during excavation, grading, foundation, and construction phases of work. Observation of foundation excavations should be performed prior to placement of reinforcing and concrete to confirm that satisfactory bearing materials are present. Field and laboratory testing of concrete and soils should be performed to determine whether applicable requirements have been met.

6.0 GEOTECHNICAL RISK AND LIMITATIONS

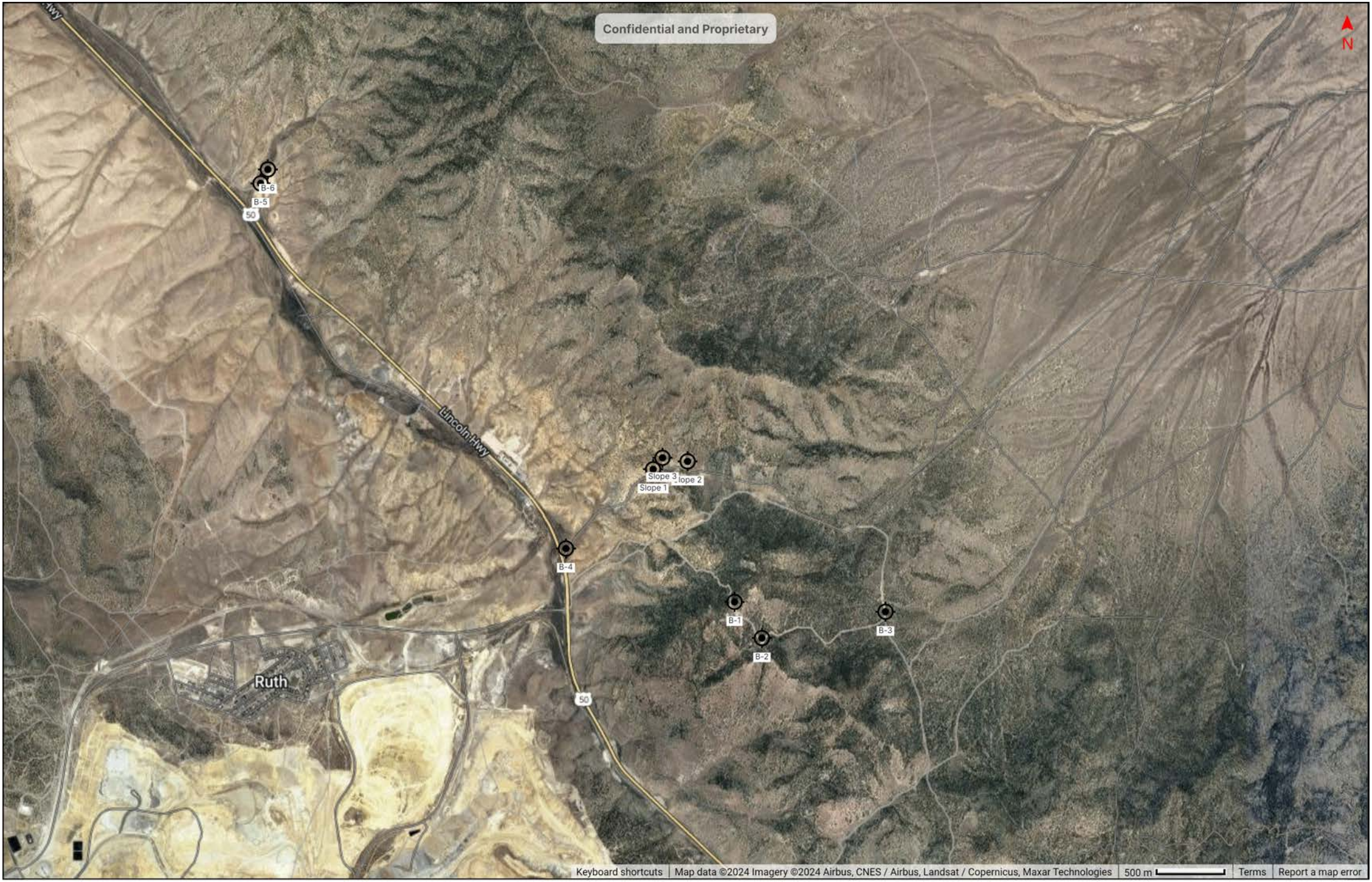
Our recommendations are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used prudent engineering and geologic judgment based upon the information provided and the data generated from our investigation. This report has been prepared in substantial

compliance with generally accepted geotechnical engineering practices that exist in the area of the project at the time the report was prepared. No warranty, either express or implied, is provided.

If the proposed construction is modified or relocated or, if it is found during construction that subsurface conditions differ from those we encountered at our boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

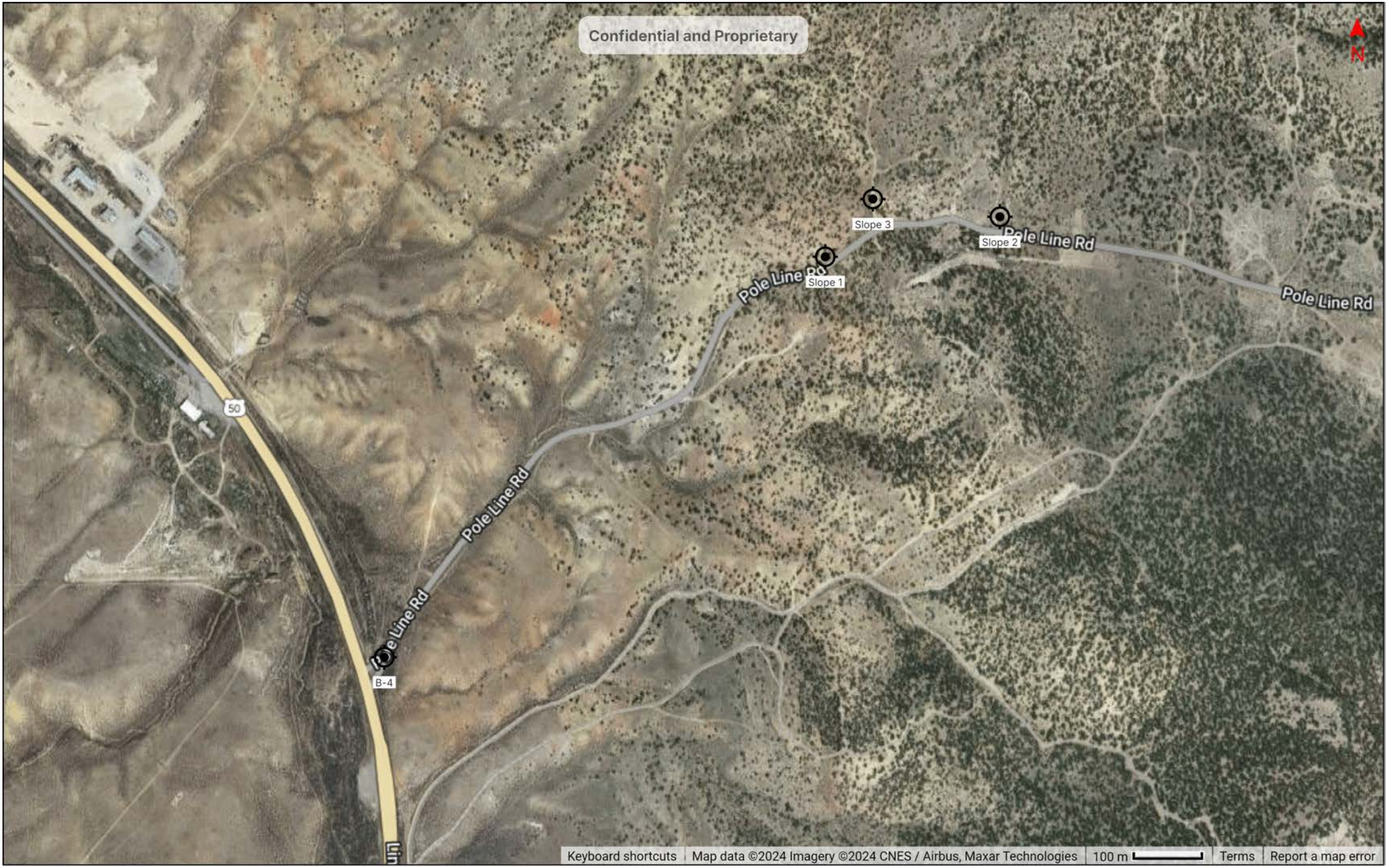
We emphasize that this report is applicable only to the proposed construction and the investigated site. This report should not be utilized for construction on any other site. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction techniques to be used on this project. This report is considered valid for the proposed construction for a period of two years following the date of this report. If construction has not started within two years, we must re-evaluate the recommendations of this report and update the report, if necessary.

FIGURES



UES	**PREPARED BY** Universal Engineering Sciences Sandy, UT	**PROJECT** Name: Garnet Hill Number: 4030.2400162.0000	**LOCATION** 39.283800, -114.946400 39.2838, -114.9464	**SYMBOL KEY** Soil Boring **FIGURE 1**

UES	**PREPARED BY** Universal Engineering Sciences Sandy, UT	**PROJECT** Name: Garnet Hill Number: 4030.2400162.0000	**LOCATION** 39.283800, -114.946400 39.2838, -114.9464	**SYMBOL KEY** Soil Boring **FIGURE 2**



UES	**PREPARED BY** Universal Engineering Sciences Sandy, UT	**PROJECT** Name: Garnet Hill Number: 4030.2400162.0000	**LOCATION** 39.283800, -114.946400 39.2838, -114.9464	**SYMBOL KEY** Soil Boring **FIGURE 3**

UES	**PREPARED BY** Universal Engineering Sciences Sandy, UT	**PROJECT** Name: Garnet Hill Number: 4030.2400162.0000	**LOCATION** 39.283800, -114.946400 39.2838, -114.9464	**SYMBOL KEY** Soil Boring

FIGURE 4

APPENDIX A

Site Exploration

The subsurface conditions of the site were explored by drilling nine (9) borings to depths ranging from 3½ feet (auger refusal on bedrock) to approximately 16.5 feet below existing site grades. Borings were drilled using a track-mounted, rotary drill rig.

Soils were logged during drilling by a graduate geologist/engineer, and samples were obtained to aid in material classification and for possible laboratory testing. Boring logs are presented on Plates 1 through 9. Sampling was performed using a standard split spoon sampler ("SPT" in boring logs). The SPT sampler was driven in three 6-inch intervals into the substrata with blows from a 140-pound automatic hammer free-falling 30 inches. Penetration resistance (blow counts) was recorded for each 6-inch drive. Blow counts for the final 12 inches of the total 18 inches are presented as blows per foot in boring logs at the respective depths the samples were taken. It should be noted that the blow counts from the R sampler are not equivalent to blow counts from the SPT sampler. Bag/bulk samples ("B" in boring logs) were also collected from the borings for laboratory testing. The soils are generally classified by the Unified Soil Classification System. Plate 10 presents an explanation of material classifications used in this report.

Laboratory Testing

Laboratory testing was performed on selected samples of on-site soils. Tests were performed in general accordance with applicable ASTM or local standards.

Field moisture content was performed on select samples. The results of these tests are presented on the boring logs.

Atterberg Limits (liquid limit and plastic limit) tests, along with the percent passing the No. 200 sieve were performed for selected samples to aid in classification. Test results are presented in on Plates 11 through 16 and summarized below.

Sample	Material Description	Liquid Limit	Plasticity Index	Passing #200
B-1 @ 2.5 ft	Clayey Sand	32	12	32
B-2 @ 5 ft	Clayey Sand with Gravel	29	8	13
B-3 @ 10 ft	Silty Sand with Gravel	NV	NP	23
B-4 @ 5 ft	Silt with Sand	NV	NP	84
B-5 @ 7.5 ft	Silty-Clayey Sand	24	7	42.7
B-6 @ 2.5 ft	Sandy-silty Clay	24	7	53.8
Slope 2 @ 15 ft	Silty Sand	NV	NP	37
Slope 3 @ 7.5 ft	Sandy Silt, some Gravel	NV	NP	50.1

Chemical tests were performed on representative samples by UES and Chemtech-Ford Laboratories. Tests were performed to determine the percent chloride, water-soluble sodium, sulfate and sodium sulfate, as well as the soil solubility, pH and resistivity. An additional sample was tested for Arsenic content. Test results are presented on Plates 17 through 21.

UES
477 Parkland Dr, Sandy, UT
84070, USA
Office: +1 (801) 448-0322

Garnet Hill

Lat/Lon: 39.283076/-114.949609

SOIL BORING: B-1

Date Started:	09/17/2024	Date Completed:	09/17/2024	Lat Lng:	39.283076, -114.949609
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Method:	Auger
Time Started:	8:00 AM	Time Completed:	9:30 AM		

Rig Type: CMEA 50 Drill
Tooling: 4-1/4" Hollow Stem Auger
Surface Elevation: ~7286.7'

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)	Blow Counts	Pocket Penetrometer (tsf)	Sample Type
	7285		**FILL**, compacted native soils - rhyolitic sand, silt and gravel — 2.0						
			Medium dense, gray, dry, **Clayey Sand** (SC), Rhyolitic — 4.0	32	32-20-12	8.2	6 7 6		Bulk SPT
5	7280		Medium dense to very dense, gray, dry, coarse grained, **Silty Sand** (SM), Rhyolitic, Garnet inclusions from 7.5'-11.5'				8 9 12		SPT
							36 50/3'		SPT
10	7275		— 11.5				23 50/1'		SPT
			Very dense, gray, dry to moist, **Silty Sand** (SM), Rhyolitic — 13.0				18 50/5'		SPT

Auger refusal on bedrock at 13'

DRAFT

SC | SM

Depth	Comment
-	No free water encountered
-	-

UES
477 Parkland Dr, Sandy, UT
84070, USA
Office: +1 (801) 448-0322

Garnet Hill

Lat/Lon: 39.280672/-114.947253 SOIL BORING: B-2

Date Started:	09/17/2024	Date Completed:	09/17/2024	Lat Lng:	39.280672, -114.947253
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Method:	Auger
Time Started:	9:50 AM	Time Completed:	10:50 AM		

Rig Type: CMEA 50 Drill
Tooling: 4-1/4" Hollow Stem Auger
Surface Elevation: ~7171.9'

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)	Blow Counts	Pocket Penetrometer (tsf)	Sample Type
0	7170		**FILL**, compacted native soils - rhyolitic sand, silt and gravel with tree roots						
			2.0						
			Dense to very dense, light gray, dry, fine to coarse grained, **Clayey Gravel** with **Sand** (GC), Rhyolitic: Garnet Inclusions				20 22 22		Bulk SPT
5	7165			13	29-21-8	7.6	26 21 16		SPT
							11 11 16		SPT
10	7160						21 30 50		SPT
15	7155		16.5 End of boring at 16.5'				21 33 34		SPT
20	7150								
25	7145								

DRAFT

Depth	Comment
-	No free water encountered
-	-

GC | -

UES
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Garnet Hill

Lat/Lon: 39.282421 /-114.936626

SOIL BORING: B-3

Date Started:	09/17/2024	Date Completed:	09/17/2024	Lat Lng:	39.282421, -114.936626
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Method:	Auger
Time Started:	11:30 AM	Time Completed:	12:30 PM		

Rig Type: CMEA 50 Drill
Tooling: 4-1/4" Hollow Stem Auger
Surface Elevation: ~6870.1'

Depth (ft)	Elevation (ft)	Visual Classification and Remarks	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)	Blow Counts	Pocket Penetrometer (tsf)	Sample Type
		FILL, compacted native soils - rhyolitic sand, silt and gravel						
		2.5						
		Very dense, gray, dry, fine to coarse grained, **Silty Sand** (SM), Rhyolitic with garnet inclusions. Possible ash at 15'.			6.8	28		Bulk
					4.4	50/5'		SPT
5	6865				4.7	31		SPT
						50/2'		
					7.2	50/5'		SPT
10	6860	-with gravel	23	NP	9.0	34		SPT
						50/2'		
15	6855				8.4	50/3'		SPT
		16.5						
		End of boring at 16.5'						
20	6850							
25	6845							

DRAFT

SM	-

Depth	Comment
-	No free water encountered
-	-

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Garnet Hill

Lat/Lon: 39.286628/-114.964112 SOIL BORING: B-4

Date Started:	09/18/2024	Date Completed:	09/18/2024	Lat Lng:	39.286628, -114.964112
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Method:	Auger
Time Started:	9:30 AM	Time Completed:	10:15 AM		

Rig Type: CMEA 50 Drill
Tooling: 4-1/4" Hollow Stem Auger
Surface Elevation: ~6719.2'

Depth (ft)	Elevation (ft)	Visual Classification and Remarks	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)	Blow Counts	Pocket Penetrometer (tsf)	Sample Type
0		Loose, **Sand**, Vegetated; Near Highway						
		2.0			5.3			
		Loose to medium dense, dark brown, dry, fine grained, **Silty, Clayey Sand** with **Gravel** (SC-SM)			5.3	5 6 10		Bulk SPT
	6715	5.0						
5		Firm to stiff, dark brown, moist, **Silt** with **Sand** (ML)	84	NP	8.6	7 5 4		SPT
					9.0	4 2 3		SPT
	6710	-silty sand lense						
10					8.6	2 3 2		SPT
	6705	15.0						
15		Medium dense, dark brown, dry, coarse grained, **Silty Sand** (SM), Interbedded white sand			6.2	3 6 7		SPT
		16.5						
		End of boring at 16.5'						
20	6700							
	6695							
25								
	6690							

DRAFT

Depth	Comment
-	No free water encountered
-	-

Sand | ML
SC-SM | SM

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Garnet Hill

Lat/Lon: 39.310893/-114.990375 | SOIL BORING: B-5

Date Started:	09/18/2024	Date Completed:	09/18/2024	Lat Lng:	39.310893, -114.990375
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Method:	Auger
Time Started:	12:20 PM	Time Completed:	12:50 PM		

Rig Type: CMEA 50 Drill
Tooling: 4-1/4" Hollow Stem Auger
Surface Elevation: ~6817.6'

Depth (ft)	Elevation (ft)	Visual Classification and Remarks	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)	Blow Counts	Pocket Penetrometer (tsf)	Sample Type
0	6815	**FILL**, **Gravel** with **Sand**						
3.0					6.00	8 18 11		Bulk SPT
4.0		Medium dense, brown, dry, fine grained, **Silty Sand** (SM), Yellow Mineral Inclusions						
5		Loose to medium dense, brown, moist, **Silty, Clayey Sand** with **Gravel** (SC-SM), Yellow Mineral Inclusions				3 2 2		SPT
	6810		42.7	24-17-7	8.80	6 5 6		SPT
9.0								
10		Medium dense, brown, moist, medium to coarse grained, **Silty Sand** (SM), Yellow Mineral Inclusions			7.00	7 7 6		SPT
	6805							
15						8 9 10		SPT
16.5		End of boring at 16.5'						
	6800							
20								
	6795							
25								
	6790							

DRAFT

Gravel	SC-SM
SM	-

Depth	Comment
-	No free water encountered
-	-

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Garnet Hill

Lat/Lon: 39.311824/-114.989747

SOIL BORING: B-6

Date Started:	09/18/2024	Date Completed:	09/18/2024	Lat Lng:	39.311824, -114.989747
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Method:	Auger
Time Started:	11:00 AM	Time Completed:	12:10 PM		

Rig Type: CMEA 50 Drill
Tooling: 4-1/4" Hollow Stem Auger
Surface Elevation: ~6830'

Depth (ft)	Elevation (ft)	Visual Classification and Remarks	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)	Blow Counts	Pocket Penetrometer (tsf)	Sample Type
0		**FILL**, compacted native soils - rhyolitic sand, silt and gravel with vegetation						
		2.0						
		Stiff, brownish red, moist, **Sandy Silty Clay** with **Gravel** (CL-ML)	53.8	24-17-7	14.10	3 5 5		Bulk SPT
5	6825					3 5 5		SPT
		6.5						
		Very stiff, light brown, moist, **Silt** (ML), Yellow mineral Inclusion; apparent petroleum smell from borehole from 7'-13'				4 9 17		SPT
10	6820					10 11 12		SPT
		12.5						
		Very dense, light brown, **Silty Sand** (SM)				50 x x		SPT
		14.5						
15	6815	Auger refusal on bedrock at 14.5'						
20	6810							
25	6805							

DRAFT

CL-ML	SM
ML	-

Depth	Comment
-	No free water encountered
-	-

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Garnet Hill

Lat/Lon: 39.291894/-114.956613

SOIL BORING: Slope 1

Date Started:	09/18/2024	Date Completed:	09/18/2024	Lat Lng:	39.291894, -114.956613
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Method:	Auger
Time Started:	8:50 AM	Time Completed:	9:15 AM		

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)	Blow Counts	Pocket Penetrometer (tsf)	Sample Type
			Rig Type: CMEA 50 Drill Tooling: 4-1/4" Hollow Stem Auger Surface Elevation: ~2893.0'						
			FILL, compacted native soils - rhyolitic sand, silt and gravel. Dugout at base of slope						
	2890		2.0 Very dense, white, dry, **Gravel**, Grounded up into flour from drill				21 50/3' x		SPT
5			3.5 Auger refusal on bedrock at 3.5'						
	2885								
10									
	2880								
15									
	2875								
20									
	2870								
25									
	2865								

DRAFT

Depth	Comment
-	No free water encountered
-	-

Gravel | -

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Garnet Hill

Lat/Lon: 39.292420/-114.953643

SOIL BORING: Slope 2

Date Started:	09/17/2024	Date Completed:	09/17/2024	Lat Lng:	39.292420, -114.953643
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Time Started:	1:50 PM
Time Completed:	2:55 PM				

Rig Type: CMEA 50 Drill
Tooling: 4-1/4" Hollow Stem Auger
Surface Elevation: ~6955.4'

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	Lab: % Fines	Lab: Atterberg Limits (LL-PL-PI)	Lab: Moisture Content (%)	Samples: Blow Counts	Samples: Pocket Penetrometer (tsf)	Samples: Sample Type
0			Loose, **Sand** with **Gravel**, Organic Roots						
2.0									
			Medium dense to very dense, brown, dry, fine to coarse grained, **Silty Sand** (SM), Red Clay layer interbedded from 8'-9'			16.6	7 8 12		Bulk SPT
5	6950					11.2	7 7 9		SPT
						23.6	7 10 13		SPT
10	6945						11 16 50		SPT
15	6940			37	NP	11.2	4 50/5' x		SPT
16.5			End of boring at 16.5'						
20	6935								
25	6930								

DRAFT

Sand | SM

Depth	Comment
-	No free water encountered
-	-

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Garnet Hill

Lat/Lon: 39.292654/-114.955804

SOIL BORING: Slope 3

Date Started:	09/18/2024	Date Completed:	09/18/2024	Lat Lng:	39.292654, -114.955804
Location Accuracy:	Not Surveyed	Project No:	4030.2400162.0000	Client Name:	BLM
Driller:	Kylie	Drilling Firm:	Cascade	Hammer Drop:	30
Hammer Weight:	140	Logged By:	Kylie	Method:	Auger
Time Started:	6:30 AM	Time Completed:	8:35 AM		

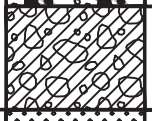
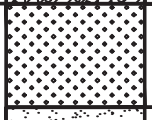
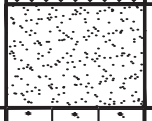
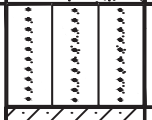
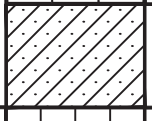
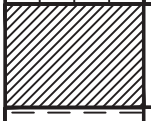
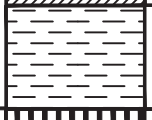
Rig Type: CMEA 50 Drill
Tooling: 4-1/4" Hollow Stem Auger
Surface Elevation: ~6916.0'

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)	Blow Counts	Pocket Penetrometer (tsf)	Sample Type
0	6915		**FILL**, compacted native soils - rhyolitic sand, silt and gravel						
			2.0						
			Medium dense, light brown, dry, fine to coarse grained, **Silty Sand** (SM)				5 4 9		Bulk SPT
5	6910						13 50/4'		SPT
			6.5						
			Very stiff, orangish brown, dry, **Sandy Silt** (ML)	50.1	NP	6.8	34 50/5'		SPT
10	6905						15 19 12		SPT
			11.5						
			Very dense, white, dry, **Silty, Clayey Sand** with **Gravel** (SC-SM)				50/3'		SPT
			13.5						
			Auger refusal on bedrock at 13.5'						
15	6900								
20	6895								
25	6890								

DRAFT

SM	SC-SM
ML	-

Depth	Comment
-	No free water encountered
-	-

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

UES

CLIENT: S&B Christ Consulting, LLC

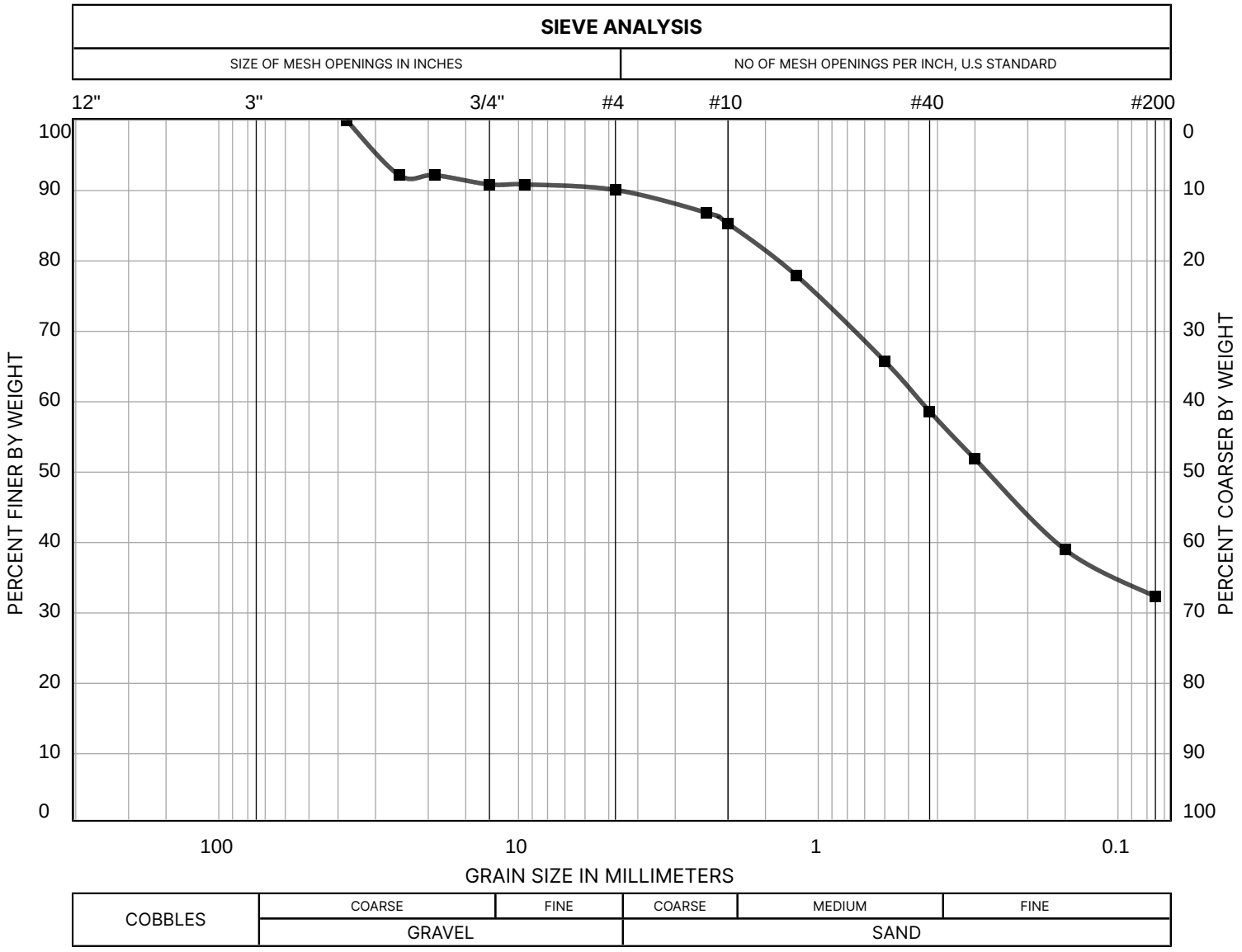
PROJECT: Garnet Hill Recreation Area

Materials Classification

PROJECT NO. 4030.2400162

PLATE NO.: 10

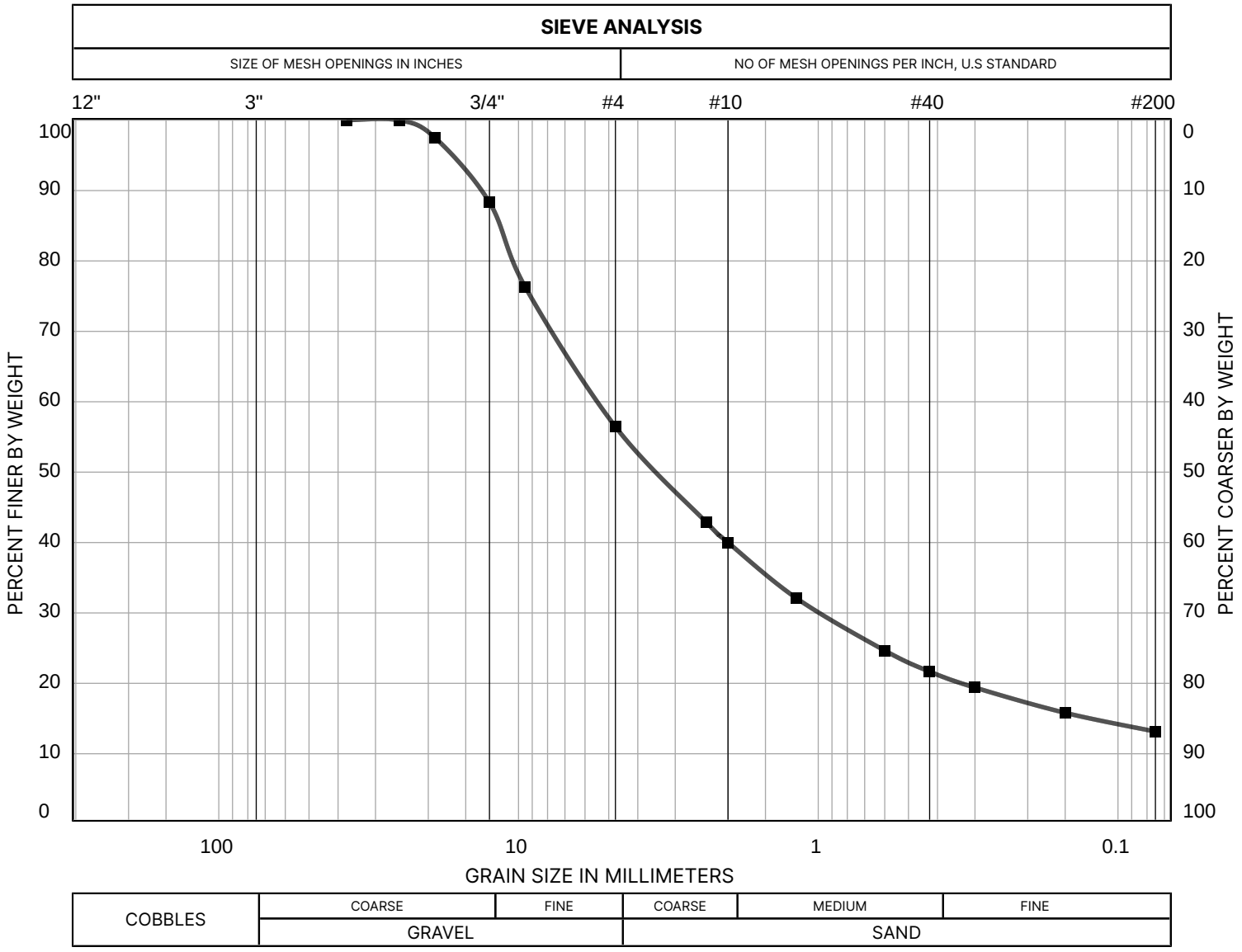
Garnet Hill
39.2838, -114.9464



	EXPLORATION AND SAMPLE NUMBER	DEPT	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	COBE (%)	GRAV (%)	SAND (%)	FINES (%)	CF (%)	NAT WC...	D10	D15	D30	D50	D60	D85	D90	D100	TEST BY/RVW	TEST STD	NOTES
■	B-1	2.5		SM		10	58	32			0.28	0.46	1.97	4.68	37.5						

Plate 11

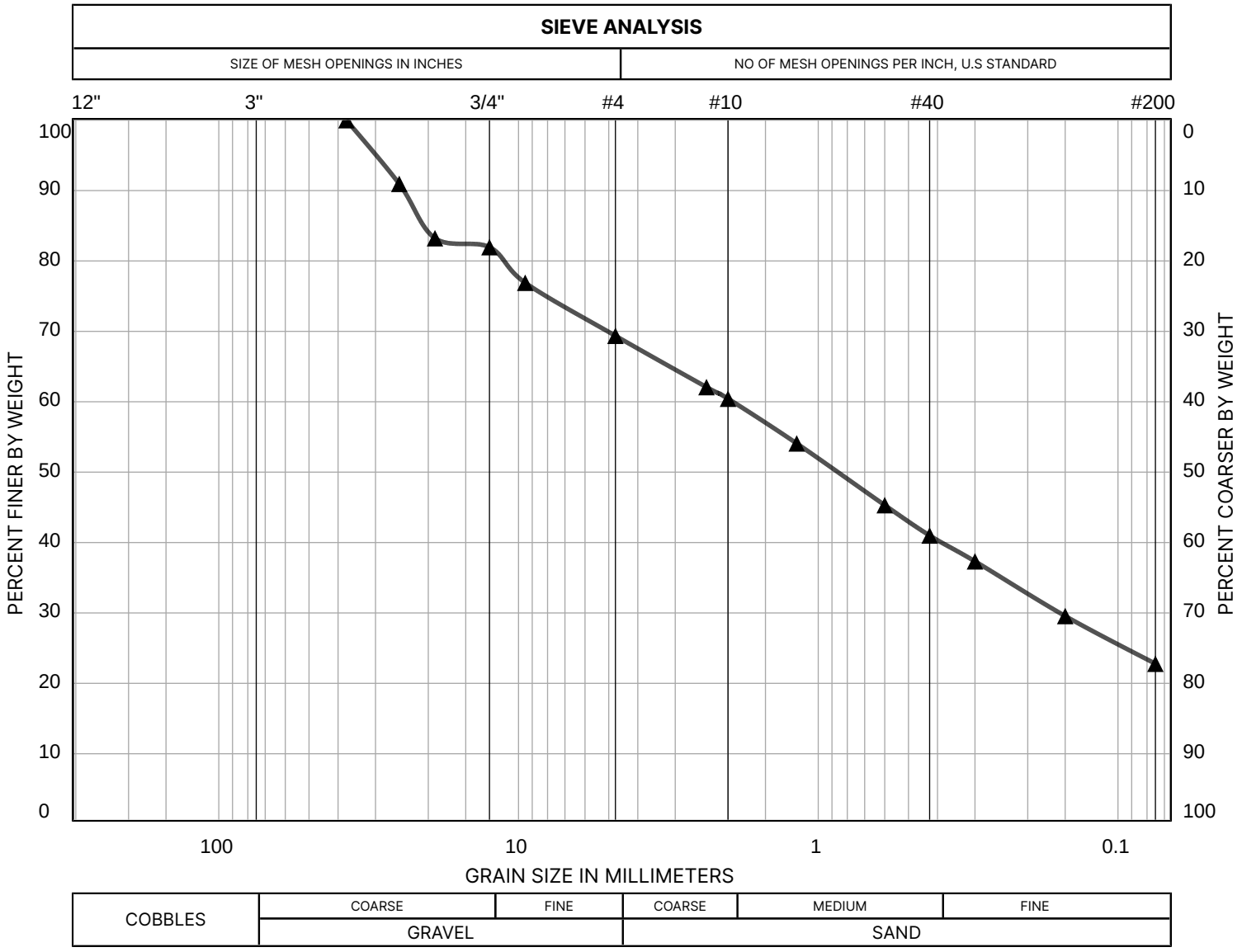
Garnet Hill
39.2838, -114.9464



	EXPLORATION AND SAMPLE NUMBER	DEPT	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	COBB (%)	GRAV (%)	SAND (%)	FINES (%)	CF (%)	NAT WC...	D10	D15	D30	D50	D60	D85	D90	D100	TEST BY/RVW	TEST STD	NOTES
■	B-2	5		SM		44	43	13			0.13	1.03	3.7	5.71	11.71	13.74	31.25				

Plate 12

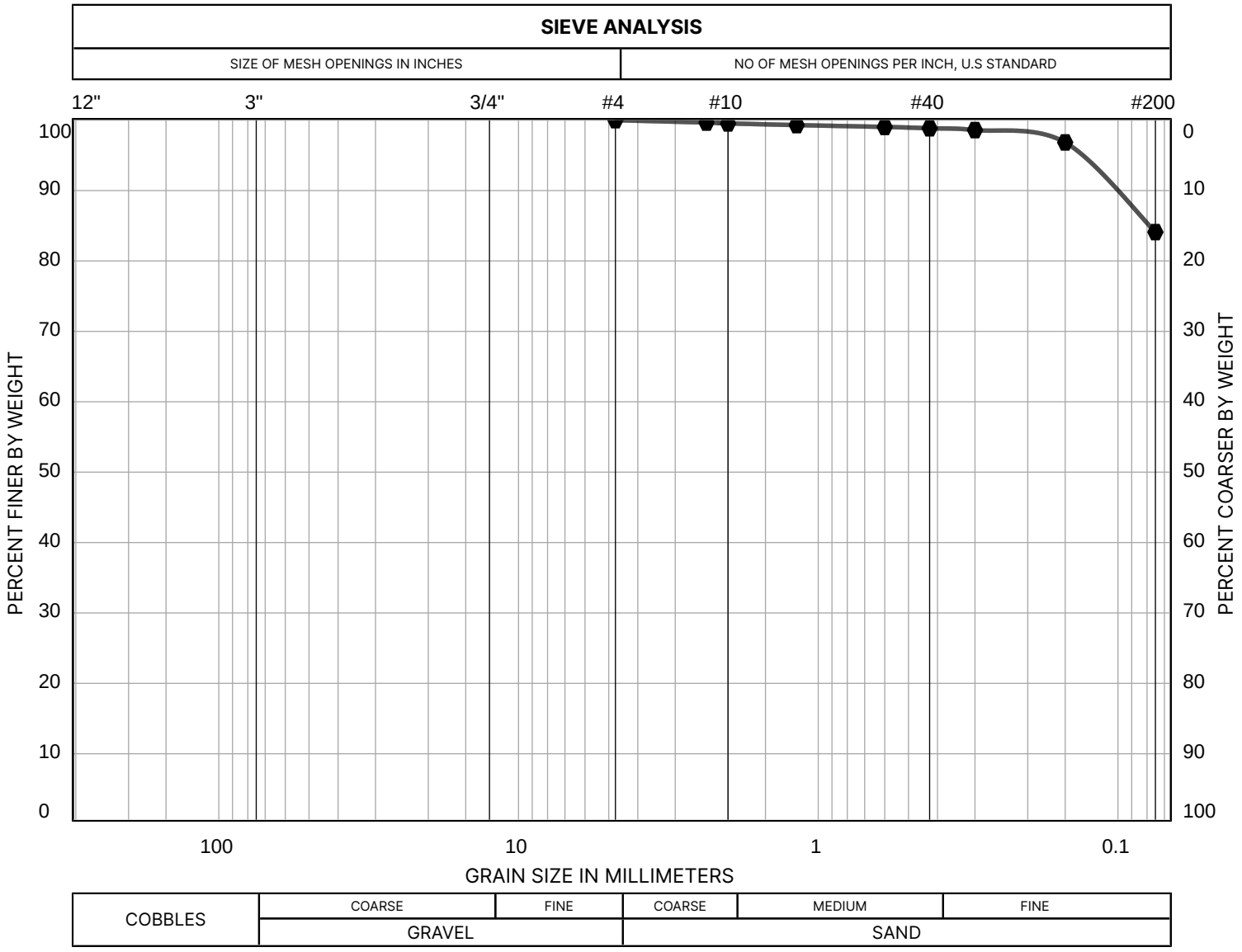
Garnet Hill
39.2838, -114.9464



	EXPLORATION AND SAMPLE NUMBER	DEPT	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	COBB (%)	GRAV (%)	SAND (%)	FINES (%)	CF (%)	NAT WC...	D10	D15	D30	D50	D60	D85	D90	D100	TEST BY/RVW	TEST STD	NOTES
▲	B-3	10		SM		31	47	23			0.16	0.92	1.95	20.4	24.2	9	37.5				

Plate 13

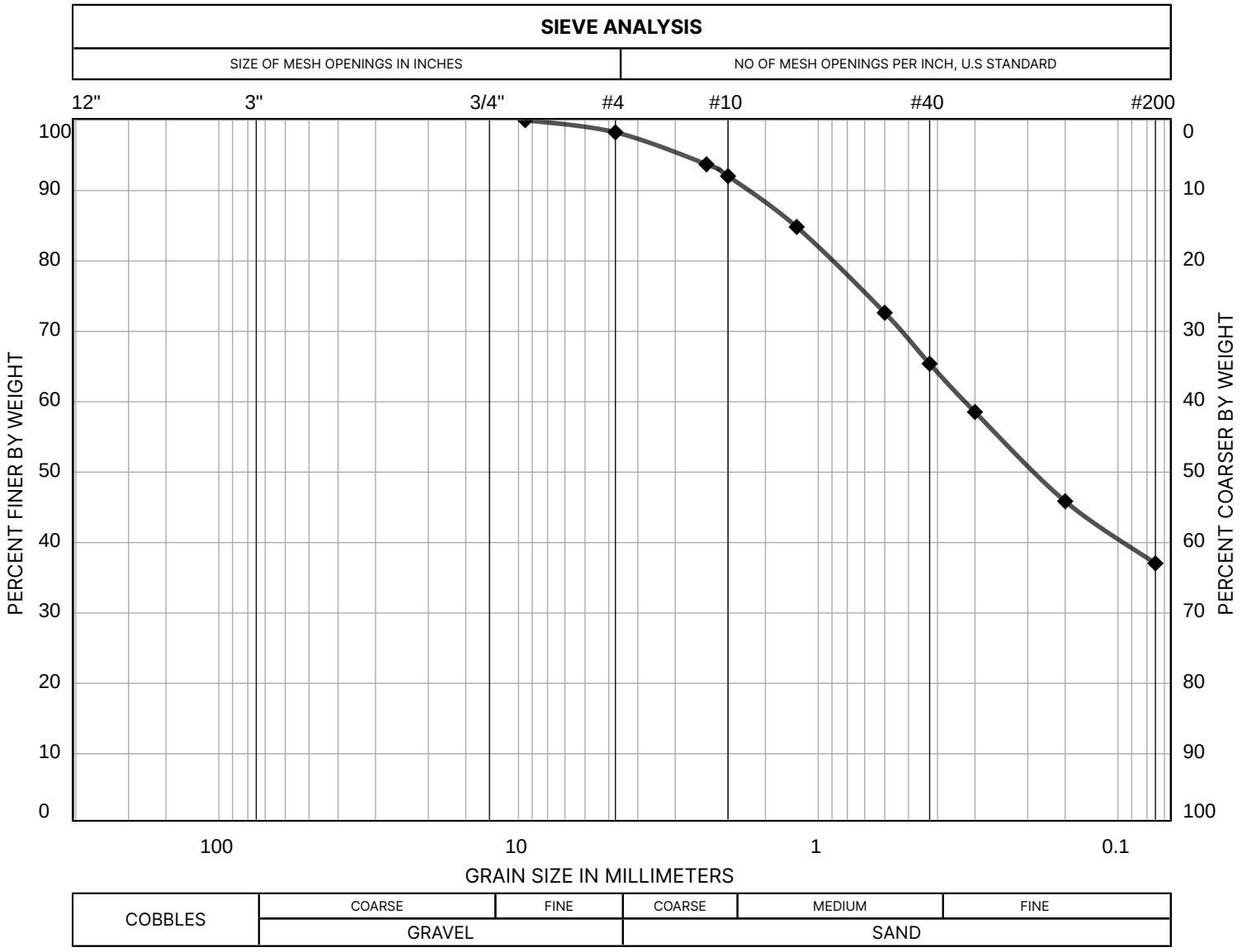
Garnet Hill
39.2838, -114.9464



	EXPLORATION AND SAMPLE NUMBER	DEPT	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	COBE (%)	GRAV (%)	SAND (%)	FINES (%)	CF (%)	NAT WC...	D10	D15	D30	D50	D60	D85	D90	D100	TEST BY/RVW	TEST STD	NOTES
⬢	B-4	5		SM	0	16	84									0.08	0.11	4.75			

Plate 14

Garnet Hill
39.2838, -114.9464



	EXPLORATION AND SAMPLE NUMBER	DEPT	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	COBE (%)	GRAV (%)	SAND (%)	FINES (%)	CF (%)	NAT WC...	D10	D15	D30	D50	D60	D85	D90	D100	TEST BY/RVW	TEST STD	NOTES
◆	Slope 2	15		SM		2	61	37						0.2	0.33	1.2	1.77	9.5			

Plate 15

PROJECT Garnet Hill
CLIENT BLM
PROJECT NO. 4030.2400162.0000
LOCATION 39.2838, -114.9464

Boring ID	Depth (ft)	Moisture Content (%)	LL	PL	PI	%Gravel	% Sand	% Fines	USCS
B-1	2.5-4	8.2	32	20	12	10	58	32	SC
B-2	5-6.5	7.6	29	21	8	44	43	13	SC
B-3	2.5-8.5	6.8							SM
B-3	5-8	4.7							SM
B-3	7.5-13.5	7.2							SM
B-3	10-13	9	0	NP	NP	31	47	23	SM
B-3	15-16.5	8.4							
B-4	2.5-4								SM
B-4	5-6.5	8.6	0	NP	NP	0	16	84	ML
B-4	7.5-9	9							ML
B-4	10-11.5	8.6							SM
B-4	15-16.5	6.2							SM
B-5	2.5-4								
B-5	7.5-9	8.8	24	17	7			42.7	SC-SM
B-5	10-11.5	7.0							SM
B-5	15-16.5								SM
B-6	2.5-4	14.1	24	17	7			53.8	CL-ML
B-6	5-6.5								
B-6	7.5-9								ML
B-6	10-11.5	7.8							ML
B-6	15-16.5	5.2							SM
Slope 2	2.5-TD	16.6							SM
Slope 2	5-6.5	11.2							SM
Slope 2	7.5-9	23.6							CL
Slope 2	10-11.5								SM
Slope 2	15-16.5	11.2	0	NP	NP	2	61	37	SM
Slope 3	7.5-13.5	6.8	0	NP	NP	9.9	40	50.1	ML

Plate 16

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Certificate of Analysis

Universal Engineering Science
Sarah Schick
477 Parkland Drive
Sandy, UT 84070

PO#: **4030.2400162**
Receipt: **9/23/24 13:04 @ 28.7** °C
Date Reported: 9/30/2024
Project Name: **Garnet Hill: Elly, NV**

Sample ID: **B02 @ 2.5 ft**
Matrix: **Solid**
Lab ID: **24I1916-01**
Date Sampled: **9/17/24 10:00**
Sampled By: **Kylie Arcans**

	Result	Units	Minimum Reporting Limit	Method	Preparation Date/Time	Analysis Date/Time	Flag(s)
Inorganic							
Chloride, Soluble (IC)	35	mg/kg dry	11	EPA 300.0	9/24/24	9/25/24	
pH	8.8	pH Units	0.1	EPA 9045D	9/24/24 12:22	9/24/24 15:20	
Resistivity	22.1	ohm m	1.0	SSSA 10-3.3	9/24/24	9/24/24	
Sulfate, Soluble (IC)	26	mg/kg dry	11	EPA 300.0	9/24/24	9/25/24	
Total Solids	87.0	%	0.1	CTF8000	9/25/24	9/25/24	

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(702) 873-3478

SUMMARY OF SOIL AND AGGREGATE TEST RESULTS

CLIENT: S&B Christ Consulting, LLC
9555 Hillwood Drive
Las Vegas, NV 89134

REPORT DATE: 10/15/2024
PROJECT: Garnet Hill Recreation Area – Various Impr

PROJECT NO.: **4030.2400162.0000**

Tested By: J. Sloan
Sample Loc.: B5 @ 0'-5'
Sample Description:

CHEMICAL LABORATORY TEST RESULTS

Laboratory Test	Results	Spec's.	Pass/Fail
Soluble Sodium, ASTM D2791, %	<0.01		
Soluble Sulfate, 4500 E, %	<0.01		
Soluble Sodium Sulfate, AWWA SM3500 & SM 4500 by Calc., %	<0.01		
Solubility, AWWA 2540 C, %	0.03		
Chloride, 4500 CL B, mg/kg	18.3		

Comments:

Reviewed By: John Sloan
For John Sloan
Chemistry Laboratory Director

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PO#:
Receipt: **9/19/24 14:08 @ 24.3** °C
Date Reported: 9/26/2024
Project Name: **[none]**

Sample ID: **B05 @ 5**

Matrix: **Solid**
Lab ID: **24I1759-01**

Date Sampled: **9/18/24 12:30**
Sampled By: **Kylie Arcans**

	Result	Units	Minimum Reporting Limit	Method	Preparation Date/Time	Analysis Date/Time	Flag(s)
Inorganic							
Chloride, Soluble (IC)	ND	mg/kg dry	11	EPA 300.0	9/23/24	9/24/24	
pH	9.0	pH Units	0.1	EPA 9045D	9/20/24 18:28	9/20/24 18:31	
Resistivity	22.3	ohm m	1.0	SSSA 10-3.3	9/20/24	9/20/24	
Sulfate, Soluble (IC)	ND	mg/kg dry	11	EPA 300.0	9/23/24	9/24/24	
Total Solids	92.3	%	0.1	CTF8000	9/20/24	9/20/24	
Metals							
Arsenic, Total	3.95	mg/kg dry	4.46	EPA 6010D/3050B	9/23/24	9/24/24	J

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PO#:
Receipt: **9/19/24 14:08 @ 24.3** °C
Date Reported: 9/25/2024
Project Name: **[none]**

Sample ID: **B06 @ 7.5'**

Matrix: **Solid**
Lab ID: **24I1756-01**
Date Sampled: **9/18/24 11:30**
Sampled By: **Kylie Arcans**

	Result	Units	Minimum Reporting Limit	Method	Preparation Date/Time	Analysis Date/Time	Flag(s)
Inorganic							
Total Solids	95.0	%	0.1	CTF8000	9/20/24	9/20/24	
Metals							
Arsenic, Total	4.58	mg/kg dry	4.10	EPA 6010D/3050B	9/23/24	9/24/24	

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PO#: **4030.2400162**
Receipt: **9/23/24 13:04 @ 28.7** °C
Date Reported: 9/30/2024
Project Name: **Garnet Hill: Elly, NV**

Sample ID: **Slope3 @ 2.5 ft**
Matrix: **Solid**
Lab ID: **24I1916-02**
Date Sampled: **9/18/24 6:30**
Sampled By: **Kylie Arcans**

	Result	Units	Minimum Reporting Limit	Method	Preparation Date/Time	Analysis Date/Time	Flag(s)
Inorganic							
Chloride, Soluble (IC)	32	mg/kg dry	10	EPA 300.0	9/24/24	9/25/24	
pH	8.5	pH Units	0.1	EPA 9045D	9/24/24 12:22	9/24/24 15:21	
Resistivity	21.6	ohm m	1.0	SSSA 10-3.3	9/24/24	9/24/24	
Sulfate, Soluble (IC)	16	mg/kg dry	10	EPA 300.0	9/24/24	9/25/24	
Total Solids	96.3	%	0.1	CTF8000	9/25/24	9/25/24	