Geotechnical Engineering Report

Sedona Airport Infield Drainage Improvements
235 Air Terminal Drive
Sedona, Arizona

May 4, 2021
Terracon Project No. 65205270

Prepared for:
Dibble & Associates Consulting Engineers, Inc.
Phoenix, Arizona

Prepared by:
Terracon Consultants, Inc.
Tempe, Arizona

EXPIRES 9/30/2023

May 4, 2021

Dibble & Associates Consulting Engineers, Inc.
7878 N 16th St, Ste 300
Phoenix, Arizona 85020

Attn: Ms. Carmen Rose, P.E.
E: carmen.rose@dibblecorp.com

Re: **Geotechnical Engineering Report**
Sedona Airport Infield Drainage Improvements
235 Air Terminal Drive
Sedona, Arizona
Terracon Project No. 65205270

Dear Ms. Rose:

Terracon Consultants, Inc. (Terracon) has completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P65205270 dated November 11, 2020. This geotechnical engineering report provides the geotechnical engineering recommendations concerning excavation, bedding and backfilling for the proposed infield drainage project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Professional Engineer (Civil)
64550
KIRK D.
JACKSON
Date Signed 5/4/2021
ARIZONA, U.S.A.
EXPIRES 9/30/2023

Kirk D. Jackson, P.E.
Project Engineer

Donald R. Clark, P.E.
Sr. Consultant / Sr. Principal

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Sedona, Arizona

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INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Sedona Airport Infield Drainage Improvements project located at the Sedona Airport at 235 Air Terminal Drive in Sedona, Arizona. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil, bedrock and groundwater conditions
- Recommendations for utility installation by open-cut excavation techniques;
- Recommendations for bedding and backfilling of the conveyance system; and,
- Seismic design considerations.

The geotechnical engineering scope of services for this project included the advancement of nine test borings to depths of approximately 10 to 15 feet below existing site grades, laboratory testing of samples collected from our field exploration, engineering analyses and the preparation of this geotechnical engineering report.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Project Location	The project is located at the Sedona Airport located at 235 Air Terminal Drive in Sedona, Arizona. See **Site Location** for additional information.
Existing Improvements	Onsite improvements include Runway 03-21 and associated taxiway and taxiway collectors, apron pavements, and infield drainage areas.

Item	Description
Current Ground Cover	The runway, taxiway, and taxiway connectors are paved with asphalt concrete. The infield drainage areas have low cut grass cover.
Existing Topography	The site slopes gently to the southwest.
Geologic Setting	The project site is located in the Transition Zone or Central Mountain Region (Nations and Stump[1]) physiographic province of Arizona. The Central Mountain Region is a northwest trending structure between the Basin and Range physiographic province to the southwest and Colorado Plateau to the northeast. Landscape features of the Central Mountain Region include the Black Hills near Jerome and Prescott, the Mazatzal and Sierra Ancha Mountains near Roosevelt Lake, and the Salt River Canyon between Show Low and Globe. The Central Mountain Region is characterized by rugged mountains of igneous, metamorphic and deformed sedimentary and volcanic rocks of Precambrian age, with erosional remnants of the Paleozoic age.
Site Specific Geologic Conditions	Specific geologic conditions mapped by the United States Geological Survey at the location of the project include: **Permian to Pennsylvanian sedimentary rocks:** Described as interbedded sandstone, shale, and limestone usually characterized by ledgy outcrops. Orange to reddish sandstone forms cliffs near Sedona. This unit includes Supai Group and Hermit Shale in northern Arizona and Naco Group in southern Arizona. It was deposited in coastal-plain to shallow-marine settings during time of variable and changing sea level. Rocks of this map unit in southern Arizona may be in part equivalent to Permian rocks of map unit P in central and northern Arizona. (280-310 Ma) Other geologic conditions encountered at the site include: **Pliocene to late Miocene basaltic rocks:** Described as mostly dark, inconspicuously flat, low-lying or mesa-forming basalt deposited as lava flows. Rocks included in this unit are located almost entirely in the large volcanic fields south and west of Flagstaff, in smaller fields in northwesternmost Arizona, and in the Hopi Buttes volcanic field on the Navajo and Hopi Indian Reservations north of Holbrook. Original volcanic landforms have been obscured by erosion. (4-8 Ma)

[1] *Nations, Dale and Edmond Stump, 1981,* **"Geology of Arizona"**, *Kendall/Hunt Publishing Co., Dubuque, Iowa.*

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed in the project planning stage. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	The information provided from Dibble and Associates (Dibble) includes the following: ■ Storm Drain Plan & Profile Alternatives 2 & 9, Sheets SD1 through SD6, by Dibble & Associates, dated August 2020; and, ■ Proposed boring locations sent in an email dated November 8, 2020.
Project Description	We understand the proposed project will consist of drainage structure improvements in the infield areas between the taxiways and Runway 03-21. The proposed drainage structure improvements will include regularly spaced drainage inlets. An underground piping system is proposed to carry the drainage from the infield areas to the southwest where the system will be led to a positive gravity outfall and daylight to an outlet area. The drainage pipes are proposed to be buried between 8 and 9 feet in depth. Open trench excavations will be used for construction of the proposed drainage system.

EXPLORATION AND TESTING PROCEDURES

Field Exploration

A total of nine (9) borings were drilled at the project site on March 18 and March 30, 2021. The approximate boring locations at the project site are shown on the **Exploration Plan**, and the location and depth of the borings are summarized in the following table:

Number of Borings	Boring Depth (feet)	Approximate Location
9	10 to 15	Proposed Infield Drainage Improvements

Boring Layout and Elevations: Dibble personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±15 feet). Elevations were estimated at the boring coordinates using Google Earth Pro. If more precise elevations and boring coordinates are desired, we recommend the borings be surveyed.

Subsurface Exploration Procedures: The borings were performed with a truck-mounted CME-75 drill rig and crew subcontracted from Southlands Engineering. The borings were advanced utilizing 8-inch outside diameter hollow-stem augers until the planned depth or prior auger refusal. The borings were then advanced using a combination of Tubex/ODEX percussion drilling with a

5- or 6-inch diameter solid steel casing and the bedrock was cored using HQ3-size (approximately 2.5 inch inside diameter) core barrels.

A continuous lithologic log of each boring was recorded by a Terracon field engineer/geologist during the drilling operations. At selected intervals, samples of the subsurface materials were taken at each boring location by driving split-spoon (SPT) or ring-lined barrel samplers in general accordance with ASTM Standards. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. ring lined sampler was also used for sampling. Ring-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 12 inches of penetration. Bulk samples of subsurface materials were obtained from all the borings.

Bedrock core samples retrieved during the drilling were examined in the field and the percent recovery and Rock Quality Designation (RQD) were measured for the core run. The RQD is a relative measure of rock quality and is determined by dividing the length of all intact pieces of rock core longer than 4-inches by the total length of the core run. The core obtained from the borings was placed into core boxes in sequential order and labeled.

Groundwater conditions were evaluated in the borings during drilling and at the completion of drilling in each borehole. Groundwater was not encountered in any of the borings. For safety purposes, all borings were backfilled with auger cuttings upon completion, and capped with cold mix asphalt where applicable.

Our exploration team prepared field boring logs as part of the drilling operations. The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a geotechnical engineer. Final boring logs were prepared from the field logs. The final boring logs represent the geotechnical engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) as shown in the **Supporting Information** section of this report.

The rock core samples were classified according to the descriptions provided in the Description of Rock Properties table in the **Supporting Information** section of this report. At the time the samples were taken to the laboratory, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

General laboratory tests were conducted on selected soil samples and the test results are presented in the **Exploration Results** section of this report. These results were used for the geotechnical engineering analyses, and the development of foundation, floor slabs, and pavement recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local, or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- ASTM C136 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D2937 Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization forms the basis of our geotechnical engineering and earthwork recommendations. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section.

As part of our analyses, we identified the following subsurface profile:

Stratum	Depth Below Ground Surface to Bottom of Layer (ft)	Description	Consistency / Relative Density
Surface[1]	--	5 to 6 inches of Asphalt Concrete 5 to 9 inches of Aggregate Base Course	N/A
1a[2]	2 to 4	Existing Fill: Silty Sand with Gravel (SM)	Very Dense

Stratum	Depth Below Ground Surface to Bottom of Layer (ft)	Description	Consistency / Relative Density
1b	5 to 12	Lean to Fat Clay (CL/CH) with Variable amounts of Clay and Sand or Clayey Gravel (GC). The gravel and sand content generally increased with depth.	Stiff to Hard / Very Dense
2	Undetermined: Borings B-1, B-2, B-4, B-5 and B-7 terminated in this layer	Poorly Graded Gravel with Silt and Sand (GP-GM), Poorly Graded Gravel with Sand (GP), Silty Sand with Gravel (SM)	Very Dense
3	Undetermined: Borings B-3, B-8 and B-9 terminated in this layer	Moderately to Highly Weathered and highly fractured Basalt Bedrock with clay infilling	–

1. Asphalt pavement was encountered at the locations of Borings B-1, B-4, B-5, B-7 and B-9
2. Existing Fill was only encountered in Borings B-4 and B-7

Laboratory tests were conducted on selected soil samples and the test results are presented in **Exploration Results**. The results of the laboratory testing indicate the near surface soils across the majority of the site consist of Lean to Fat Clay (CL/CH) with Variable amounts of Clay and Sand with Unified Soil Classifications of CL or CH. The cohesive soils exhibit medium to high plasticity characteristics.

As indicated by the results of the field penetration testing, the near surface sand soils are very dense in relative density and the cohesive soils are generally stiff to hard in consistency. Within the depths of exploration, the measured RQD of the bedrock ranged from 0 to 45 indicating very poor to poor quality rock. See **Description of Rock Properties** in the **Supporting Documents** for additional information.

Groundwater Conditions

Groundwater was not observed in the test borings at the time of field exploration. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

Based on information obtained from the United States Geologic Survey (USGS) – National Water Information System (https://maps.waterdata.usgs.gov/mapper/), the depth to groundwater was

measured in 2009 to be approximately 315 feet below the ground surface at an USGS monitored well site located approximately ½ mile to the southeast of the site.

GEOTECHNICAL OVERVIEW

Geotechnical engineering recommendations have been developed for the project to address the following:

- Recommendations for utility installation by open-cut excavation techniques;
- Recommendations for bedding and backfilling of utilities; and,
- Seismic considerations.

Our geotechnical engineering recommendations are contained in the following sections of this report.

The **General Comments** section provides an understanding of the report limitations.

EXCAVATION CONSIDERATIONS

We understand the planned excavation depths will likely be fairly consistent across the alignment of the project. In general, excavation depths for the pipeline are anticipated to be approximately 8 to 9 feet below existing site grades to the invert of the proposed drainage line.

Basalt bedrock was encountered in several of the borings at depths ranging from 5 to 9 feet below the ground surface The change from the sandy lean to fat clay surficial soils to hard bedrock generally occurs gradually with depth. The frequency of cobbles encountered in the borings increases with depth and the plasticity and fines content of the soils decreases with depth. This transition reflects the various stages of decomposition of the basalt bedrock into the lean to fat clay surficial soils. Within the depths of exploration, the measured RQD of the bedrock ranged from 0 to 45 indicating very poor to poor quality rock.

It is anticipated that excavations into the Stratum 1 and 2 soils for the proposed construction can be accomplished with conventional earthmoving equipment capable of handling very stiff and very dense soils. However, some additional effort may be necessary to extract cobble or boulder sized materials, particularly in deep narrow excavations such as utility pipeline trenches. Excavations penetrating the Stratum 3 basalt bedrock may require the use of specialized heavy-duty equipment, together with jack-hammering or light drilling and blasting to facilitate rock break-up and removal.

Depending upon depth of excavation and seasonal conditions, perched groundwater may be encountered in excavations on the site. Pumping from sumps may be necessary to control water within excavations.

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottoms. Excavations should be sloped or shored in the interest of safety following local, state and federal regulations, including current OSHA excavation and trench safety standards. Instability in the form of caving should be expected. The contractor should be advised that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations. Flatter slopes than those dictated by these regulations may be required depending upon the soil conditions encountered and other external factors. These regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties. Under no circumstances should the information provided in this report be interpreted to mean that Terracon is assuming any responsibility for construction site safety or the contractor's activities. Construction site safety is the sole responsibility of the contractor who shall also be solely responsible for the means, methods, and sequencing of the construction operations.

OSHA Health and Safety Standards for Excavations classify soils into three basic types (i.e., Type A, B, and C). Depending upon the soil type, OSHA required excavation slopes range from:

- 3/4H:1V (horizontal:vertical) for Type A soils;
- 1H:1V for Type B soils; and,
- 1-1/2H:1V for Type C soils.

OSHA dictates that any excavation extending to a depth of more than 20 feet shall be designed by a Registered Professional Engineer. Based upon the subsurface conditions encountered at the boring locations, it appears the excavations will extend primarily into lean to fat clay soils with variable amounts of clay and sand. The excavations are also anticipated to encounter cobbles, especially below depths of 4 feet. Some locations may also encounter very dense granular soils.

The cohesive soils are generally stiff to hard and are anticipated to have unconfined compressive strength greater than 0.5 tsf. These soils will generally classify as Type B. Other cohesive granular soils encountered on the site will generally classify as Type C. For planning purposes, we recommend assuming a Type B soils for the majority of the project alignment. For excavations encountering layered materials, the slope must be based on the most stringent slope requirements of any underlying layer penetrated based on OSHA requirements.

In lieu of trench slopes as defined by OSHA, trench shoring or shields (trench boxes) may be utilized to increase excavation slopes. We anticipate that trench boxes will be utilized where the pipeline

alignment lies adjacent to existing runways and taxiways. The contractor would be responsible for the design of the temporary shoring in accordance with applicable regulatory requirements.

Care should be taken during excavation to protect the structural integrity of any existing structures, pavements, or adjacent underground utilities. Depending upon factors such as the depth of excavation, the location of the existing improvements, groundwater and soil conditions, temporary sheeting and/or shoring may be required. For preliminary designs, excavations should not be performed within a surface defined as 5 feet horizontal from the nearest edge of existing foundations or other settlement sensitive structures and then downward at 2 horizontal to 1 vertical slope. Flatter slopes may be required, and the contractor should be advised to consult with a Registered Professional Engineer to provide specific recommendations regarding measures to protect existing improvements.

Particular caution should be exercised when excavations are performed in existing fill or near existing utility lines. The OSHA trench safety guidelines for adequate side slopes based on soil types may not apply in these situations. Existing underground utilities should be shored and braced as required to maintain their integrity and appropriately designed trench boxes or sheeting and bracing should be used to provide for worker safety.

All vehicles and soil piles should be kept a sufficient lateral distance from the crest of the trench slope to maintain safe working conditions. Vehicles and soil piles located adjacent to trenches would significantly influence the stability of the slopes as outlined by the OSHA regulations. A detailed stability analysis would be required for these conditions. Additionally, vibrations from traffic, construction equipment, pile driving, or similar sources can influence slope stability. The exposed slope faces should be protected from the elements. Surface water should be diverted from all excavations. If water enters an excavation it should be removed along with any loosened or softened soil. The length of open trench should be held to a minimum.

The materials which may be encountered in any of the excavations will and should be expected to vary significantly. The borings completed to date represent soil conditions at discrete locations and are not necessarily representative of conditions throughout the entire area. Thus, the stability of the excavation slopes should be reviewed continuously by qualified personnel during construction. The generalized guidelines provided above are based solely upon the materials encountered in the widely spaced exploratory borings.

Terracon is not responsible for excavation or site safety. OSHA dictates that a competent person responsible for site safety must have knowledge of soil analysis, the use of protection systems, and OSHA standards and have the authority to take prompt measures to abate excavation hazards. This would require daily on-site inspection before workers enter the excavation, inspections periodically throughout the day and after rainfall or other hazard increasing occurrences. We recommend the person or persons responsible for performing the excavations become familiar with the appropriate OSHA guidelines and the excavation plans for the project.

Monitoring considerations for the project should include the following:

- Daily inspections should be made of the excavation and adjacent areas, particularly at the tops of the cut slopes, by a competent person as defined by OSHA in 29 CFR Part 1926. Inspections should be made to evaluate conditions as outlined in applicable parts of the regulations. Any abnormal conditions should be evaluated for the potential impact on slope stability.
- Raveling of the excavation face may occur during construction, including dislodging of sand and gravel. Therefore, rock fall protection should be provided for workmen safety.
- The stability of the slopes in the excavations on the project is highly dependent upon maintaining relatively dry (or existing) conditions. Surface drainage should be directed away from the face of all excavations. Ponding should not be allowed above any of the excavation slopes. On-site engineering observations of excavation conditions are recommended after any precipitation event during construction.
- Spoil piles and other materials should be maintained a sufficient distance from the edge of the excavation. We recommend spoil piles be located laterally from the edge of the excavation a minimum distance equal to the excavation depth.
- Vehicles or other equipment should not be operated in the vicinity of the excavations when workers are in the excavation. Barricades or other such devices should be provided per OSHA to notify operators of their position relative to the edge of the excavation.
- Provisions should be made to collect and evacuate any surface water that may accumulate in excavations during construction.

TRENCH BEDDING

Trench bedding should be provided based on the requirements in the Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5320. Based upon the consistency and relative density of the existing soils at subgrade elevation, the pipeline can be placed on the required amount of bedding directly on top of in-situ soils. Pipe bedding material should consist of granular material with a maximum size of 1.5 inches. Bedding material should be placed at the locations and to the extent indicated and should be a minimum of 4 inches in depth or 1/12 the outside diameter of the pipe, whichever is greater. The bedding should be compacted by approved methods. Complications may be expected where cobbles or bedrock are encountered in the trench. If these types of conditions are encountered during excavation, overexcavation should be completed following the appropriate agency standards. If overexcavation is not feasible, the pipeline should be bedded on concrete or controlled low strength material.

TRENCH BACKFILL

Spoil materials derived from the excavation for the drainage improvements will be used for the trench backfill during construction. All of the materials encountered in the borings should be suitable for use as trench backfill, except for cobbles or boulders. Trench backfill should be limited to materials less than 3 inches in diameter. Preceding the placement of backfill, all loose soil, sheeting, bracing and forms should be removed from the trench.

On-site clay soils may pump or become unstable or unworkable at high water contents. Workability may be improved by scarifying and drying.

Drainage trench backfill should meet the compaction requirements of AC 150/5370-10H. Recommended compaction and moisture content criteria for trench backfill materials are as follows:

Material Type and Location	Per the Standard Proctor Test (ASTM D 698)		
	Minimum Compaction Requirement (%)	Range of Moisture Contents for Compaction (referenced from optimum moisture content)	
		Minimum (%)	Maximum (%)
Non-Cohesive Soils[1]	100	-2	+2
Low Plasticity Cohesive Soils	95	-2	+3
High Plasticity Cohesive Soils	95[2]	0	+4

1. As used in this context, "non-cohesive" should mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.
2. High plasticity cohesive fill should not be compacted to more than 100 percent of standard Proctor maximum dry density.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties encountered at the site and as described on the boring logs, the **Seismic Site Classification is C**. Borings at this site were extended to a maximum depth of 15 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

CORROSIVITY

The following table lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Corrosivity Test Results Summary						
Boring	**Sample Depth (feet)**	**Soil Description**	**Soluble Sulfate (ppm)**	**Soluble Chloride (ppm)**	**Electrical Resistivity (Ω-cm)**	**pH**
B-6	0 – 5	Sandy Fat Clay with Gravel (CH)	49	99	1114	8.1

Results of soluble sulfate testing indicate that samples of the on-site soils tested classify as S0 according to Table 19.3.1.1 of Section 318 of the American Concrete Institute (ACI) Building Code Requirements for Structural Concrete. Therefore, the American Society for Testing and Materials (ASTM) Type I/II portland cement is considered suitable for concrete at the site in contact with similar soluble sulfate concentrations. Concrete should be designed in accordance with the provisions of the ACI Building Code Requirements for Structural Concrete, Section 318, Chapter 19.

These values should be used to help determine potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction. Refer to Summary of Laboratory Results contained in **Exploration Results** for the complete results of the corrosivity testing performed on the site soils in conjunction with this geotechnical exploration. The corrosion information presented is specific to the samples tested. If the actual soils that will be in contact with the structures at the site are different than those tested, then additional corrosion testing should be performed. Terracon is not a corrosion engineer, and our scope of work was limited to performing corrosion laboratory tests on selected samples, presenting these results, and providing a brief comparison of the results to selected criteria. A qualified corrosion engineer should be consulted if corrosion of underground utilities and structures is a concern.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in the report, to provide

observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either expressed or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

PHOTOGRAPHY LOG

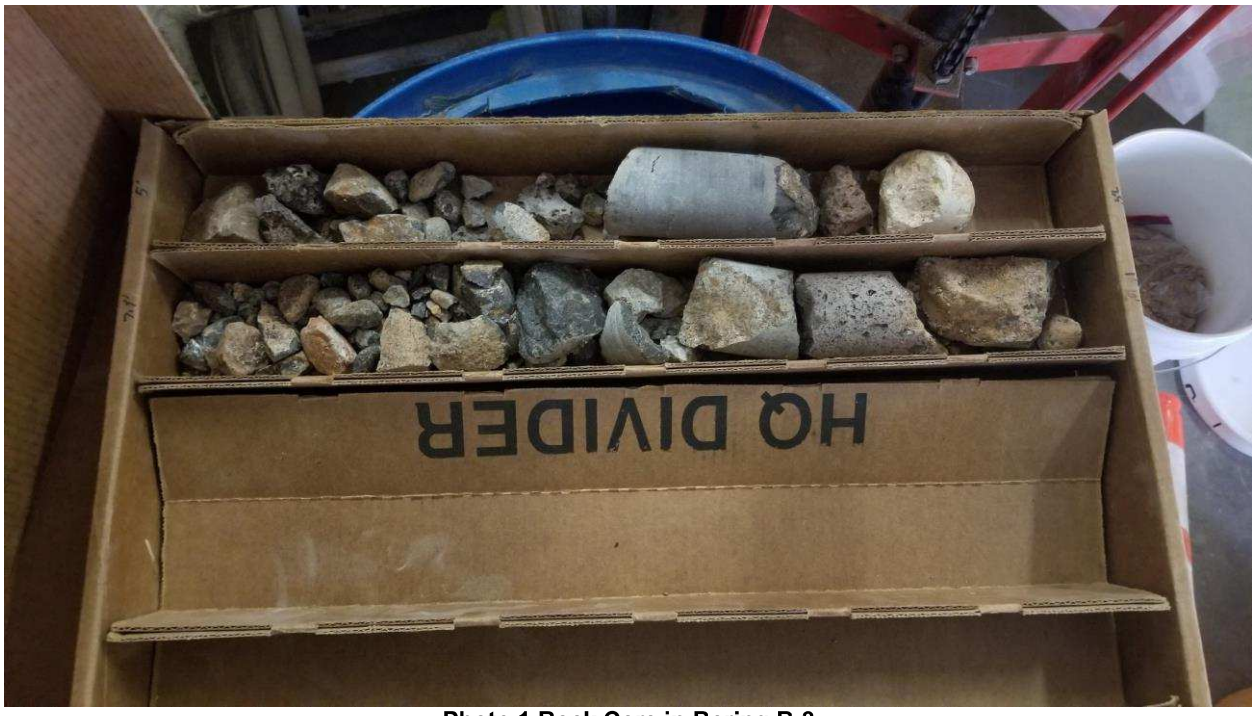


Photo 1 Rock Core in Boring B-3

Photo 2 Rock Core in Boring B-8

Photo 3 Rock Core in Boring B-9

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan
Note: All attachments are one page unless noted above.

SITE LOCATION

Sedona Airport Infield Drainage Improvements ■ Sedona, Arizona
May 4, 2021 ■ Terracon Project No. 65205270

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

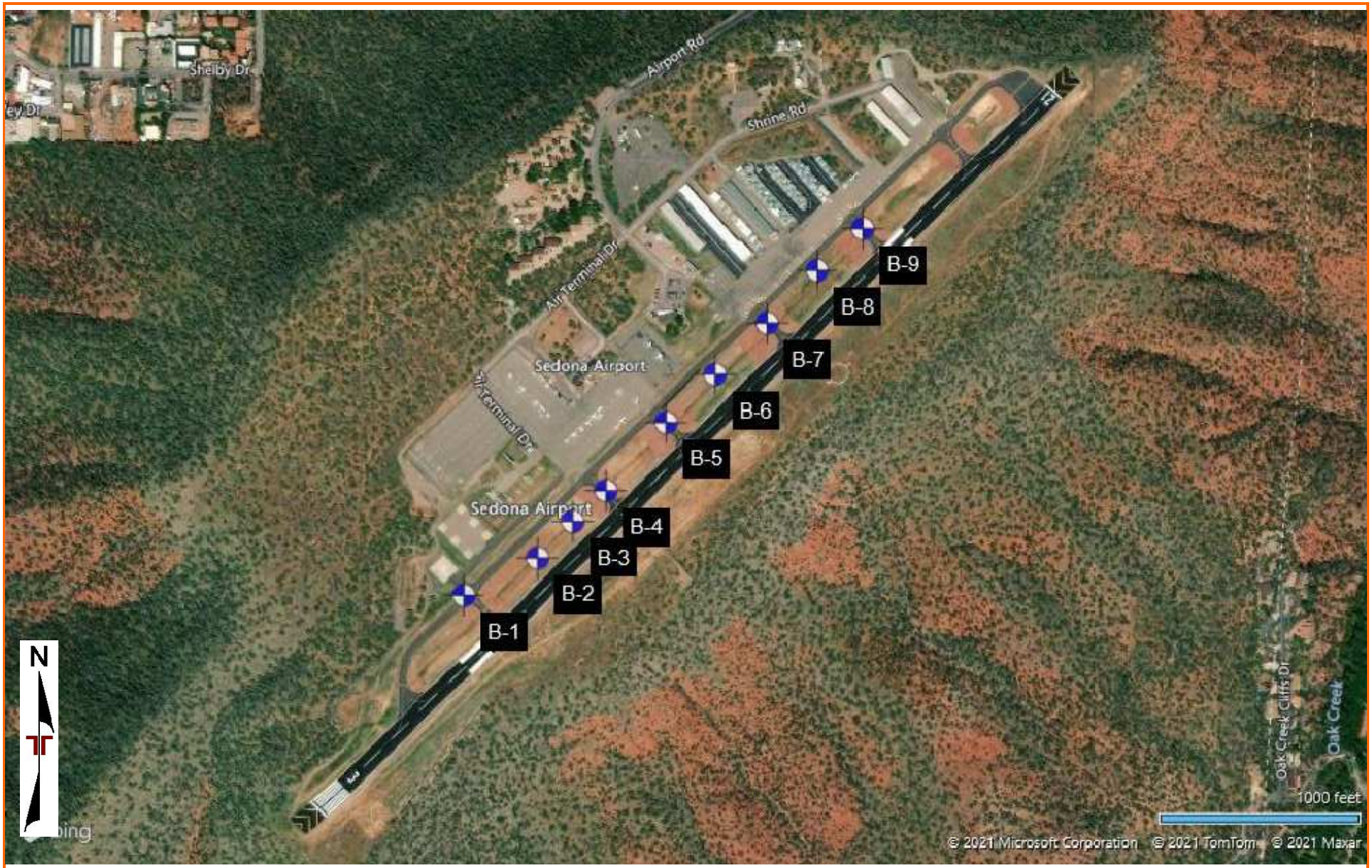


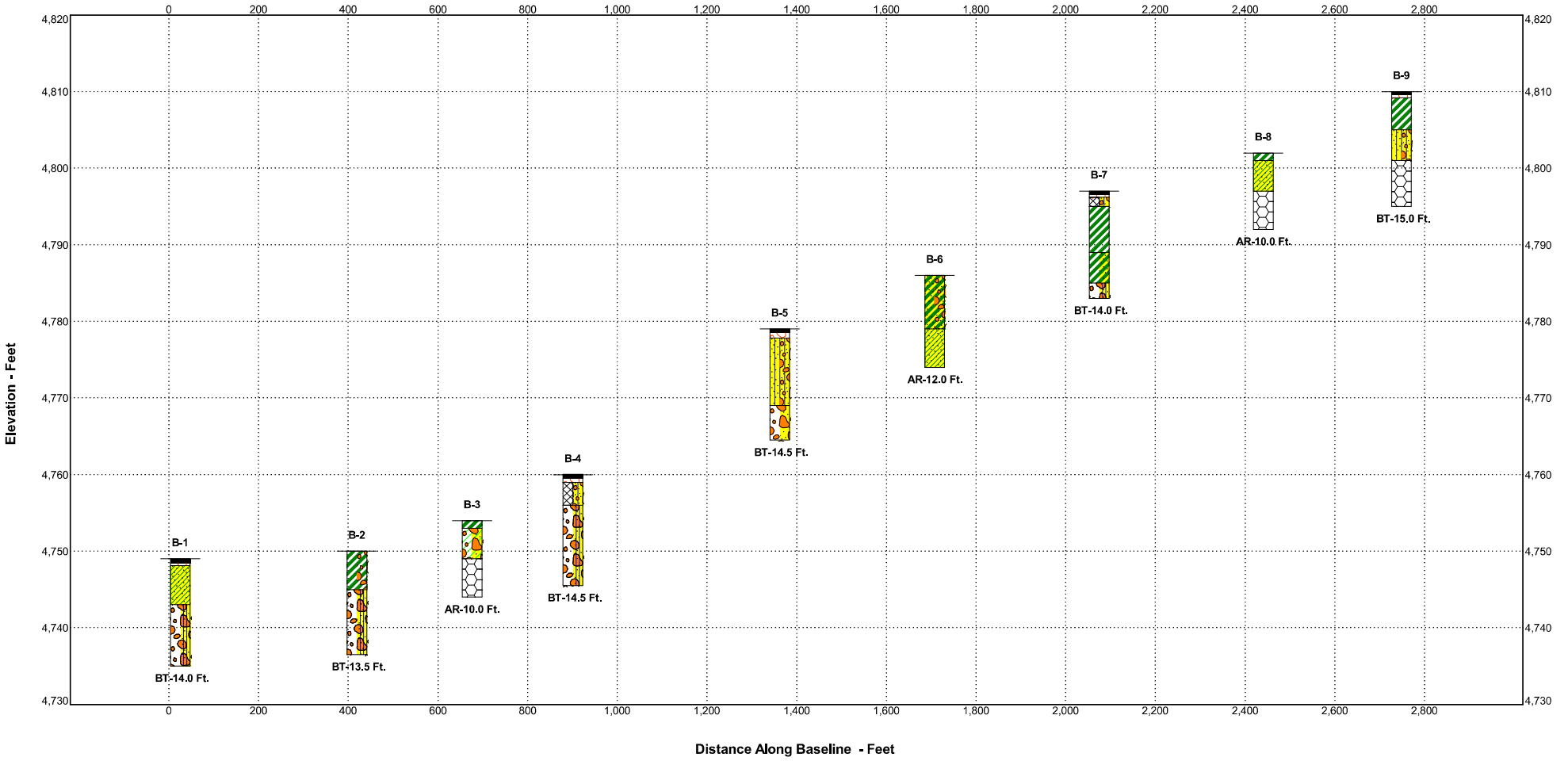
DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Subsurface Profile Fence Diagram
Boring Logs (B-1 through B-9)
Atterberg Limits
Grain Size Distribution (2 pages)
Moisture Density Relationship (3 pages)
Summary of Laboratory Test Results (1 page)
Note: All attachments are one page unless noted above.



Explanation

B-1 — Borehole Number
Moisture Content — %w — LL PL — Liquid and Plastic Limits
Sampling (See General Notes) — Borehole Lithology
AR / BT — Borehole Termination Type
Water Level Reading at time of drilling.
Water Level Reading after drilling.

Asphalt
Aggregate Base Course
Sandy Lean Clay
Poorly-graded Gravel with Silt and Sand
Fat Clay with Gravel
Fat Clay
Clayey Gravel with Sand
Basalt
Silty Sand with Gravel
Poorly-graded Gravel with Sand

NOTES:
See Exploration Plan for orientation of soil profile.
See General Notes in Supporting Information for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project No.: 65205270	Terracon 4685 S Ash Ave, Ste H-4 Tempe, AZ	**SUBSURFACE PROFILE** Along Runway 03-21 SEDONA AIRPORT INFIELD DRAINAGE IMPROVEMENTS 235 AIR TERMINAL DR SEDONA, AZ
Date: 4/21/2021		
Scale: N.T.S.		

BORING LOG NO. B-1

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.8466° Longitude: -111.7922°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.5		**ASPHALT**, 6 inches of asphalt concrete								
0.9		**AGGREGATE BASE COURSE**, 5 inches of aggregate base course								
		SANDY LEAN CLAY (CL), dark brown, damp, stiff to hard, trace fine gravel, fine to medium grained sand				8-10	15	105	42-15-27	52
						50/5"	20	98		
6.0		**POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)**, grayish brown, slightly damp, dense to very dense, fine to coarse sand, gravel to 1 1/2 inch diameter, interlayered with approximately 2 inch thick clay lenses, possible occasional cobble, slow and difficult drilling	5			36-39-50/3"				
14.0		***Boring Terminated at 14 Feet***	10			50/1"				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" O.D. Tubex

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

Boring Started: 03-17-2021 | Boring Completed: 03-17-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

BORING LOG NO. B-2

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.8471° Longitude: -111.7909°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.0									
					29-20	13	92	56-18-38	72
					20-47	15	97		
5.0		5							
		10			50/5"				
13.5					42-50/2"				

FAT CLAY WITH GRAVEL (CH), brown, slightly damp, hard, gravel less than 1 1/2 inch diameter

POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM), grayish brown, slightly damp, very dense, fine grained gravel less than 1 1/2 inch diameter, difficult drilling

Boring Terminated at 13.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8" O.D. Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

Boring Started: 04-01-2021 | Boring Completed: 04-01-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

BORING LOG NO. B-3

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.8476° Longitude: -111.7903°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	RQD	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	1.0										
	FAT CLAY (CH)										
	CLAYEY GRAVEL WITH SAND (GC), grayish brown, very dense, fine grained gravel less than 1 inch diameter					7-13-37 N=50				31-14-17	25
	5.0					20-35-50/3"					
	BASALT, gray, highly fractured with brown clay infilling between joints	5			53.3		8				
	10.0	10									
	Boring Terminated at 10 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8" O.D. Hollow-Stem Auger and Rock Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

Boring Started: 03-31-2021 | Boring Completed: 03-31-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

BORING LOG NO. B-4

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.848° Longitude: -111.7898°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.5	**ASPHALT**, 6 inches of asphalt concrete								
	1.0	**AGGREGATE BASE COURSE**, 6 inches of aggregate base course								
		FILL - SILTY SAND WITH GRAVEL (SM), light brown, damp, very dense, fine to coarse grained sand, gravel up to 2 inch diameter				40-50/5"	6	111	NP	14
	4.0					50/1"				
		POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM), grayish brown, slightly damp, very dense, fine to coarse graded sand, gravel up to 1 1/2 inch diameter, possible cobbles, slow and difficult drilling	5							
		very slow and difficult drilling	10			50/4"				
	14.5					50/5"				
		Boring Terminated at 14.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" O.D. Tubex

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

Boring Started: 03-17-2021 | Boring Completed: 03-18-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

BORING LOG NO. B-5

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.849° Longitude: -111.7888°

DEPTH	GRAPHIC LOG		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4		**ASPHALT**, 5 inches of asphalt concrete							
1.2		**AGGREGATE BASE COURSE**, 9 inches of aggregate base course							
		SILTY SAND WITH GRAVEL (SM), dark brown, damp, very dense, interbedded layers of fat clay, fine to coarse sand, gravel up to 1 inch diameter			25-25	8	112	NP	21
					10-50/1"	12	90		
		possible cobble at 4 1/2 feet, little to no cobbles from 4 1/2 feet to 9 feet							
5									
					50/5"	18	79		
10.0									
10		**POORLY GRADED GRAVEL WITH SAND (GP)**, grayish brown, slightly damp, very dense, fine to coarse grained sand, gravel up to 1 1/2 inch diameter, possible cobbles							
14.5					50/5"				
		Boring Terminated at 14.5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" O.D. Tubex

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

Boring Started: 03-18-2021 | Boring Completed: 03-18-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

BORING LOG NO. B-6

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.8496° Longitude: -111.788°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SANDY FAT CLAY WITH GRAVEL (CH), brown, damp, stiff, fine to coarse grained sand, gravel less than 1 inch diameter					7-7	22	94	51-17-34	53
					6-12	17	101		
		5							
7.0									
SANDY LEAN CLAY (CL), light brown, hard, strong cementation, trace gravel, fine to coarse grained sand					50/5"	8	87		
hard drilling at 10 feet, likely cobbles		10							
12.0					6-19-50/2"				
Boring Terminated at 12 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8" O.D. Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

Boring Started: 03-31-2021 | Boring Completed: 03-31-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

BORING LOG NO. B-7

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.8503° Longitude: -111.7871°

DEPTH	GRAPHIC LOG		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	RQD	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4		**ASPHALT**, 5 inches of asphalt concrete									
0.8		**AGGREGATE BASE COURSE**, 5 inches of aggregate base course									
2.0		**FILL - SILTY SAND WITH GRAVEL (SM)**									
		FAT CLAY (CH), dark brown, damp, stiff to hard, interbedded with silty sand with gravel layers, fine to coarse grained sand, gravel up to 1 inch diameter				24-45		6	121	29-15-14	13
		trace sand				4-5-7 N=12					
8.0		**FAT CLAY WITH SAND (CH)**, light brown, stiff, weak cementation, fine grained sand				7-13		28	83		
12.0		**POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)**, slightly damp, very dense, possible cobbles									
14.0		***Boring Terminated at 14 Feet***				50/2"					

5

10

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" O.D. Tubex

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

Boring Started: 03-18-2021 | Boring Completed: 03-18-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

BORING LOG NO. B-8

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.851° Longitude: -111.7863°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	RQD	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	1.0 **FAT CLAY (CH)**										
	SANDY LEAN CLAY (CL), light brown, very stiff, weak cementation, fine to coarse grained sand, fine grained gravel up to 1 inch diameter slightly damp, hard, hard drilling					14-26 6-18-50/5"				50-18-32	57
	5.0 **BASALT**, gray, highly fractured, white cementatious infilling between joints	5			70		13				
	10.0 ***Boring Terminated at 10 Feet***	10									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8" O.D. Hollow-Stem Auger and Rock Core

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

Boring Started: 03-30-2021 | Boring Completed: 03-31-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

BORING LOG NO. B-9

PROJECT: Sedona Airport Infield Drainage Improvements

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SITE: 235 Air Terminal Dr
Sedona, AZ

LOCATION See Exploration Plan

Latitude: 34.8516° Longitude: -111.7855°

DEPTH		FIELD TEST RESULTS	RECOVERY (%)	RQD	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4	**ASPHALT**, 5 inches of asphalt concrete							
0.8	**AGGREGATE BASE COURSE**, 5 inches of aggregate base course							
	FAT CLAY (CH), brown, damp, very stiff, stratified with silty sand with gravel, fine to coarse grained sand	3-27			10	103		
		4-23			17	99		
5.0	**SILTY SAND WITH GRAVEL (SM)**, brown, damp, very dense, hard drilling	50/2"	38	0				
9.0	**BASALT**, grey with reddish brown clay infilling between joints, slightly weathered, with layers of highly weathered rock with white cementatious infilling		58	45				
15.0	***Boring Terminated at 15 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8" O.D. Hollow-Stem Auger and Rock Core

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

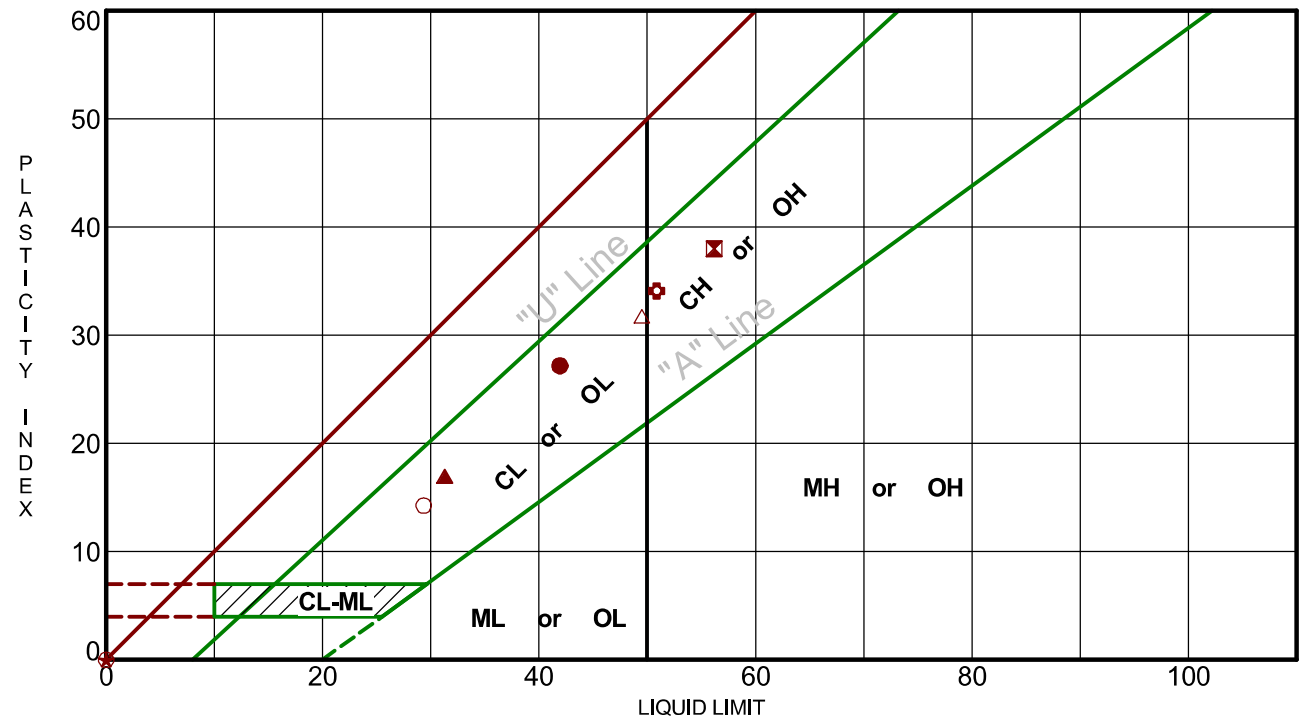
Boring Started: 03-30-2021 | Boring Completed: 03-31-2021

Drill Rig: CME 75 | Driller: Southlands Engineering

Project No.: 65205270

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
B-1	1 - 5	42	15	27	51.7	CL	SANDY LEAN CLAY
B-2	0 - 4	56	18	38	71.8	CH	FAT CLAY with SAND
B-3	1 - 4	31	14	17	25.3	GC	CLAYEY GRAVEL with SAND
B-4	1 - 4	NP	NP	NP	13.6	SM	SILTY SAND with GRAVEL
B-5	1 - 4	NP	NP	NP	20.7	SM	SILTY SAND with GRAVEL
B-6	0 - 4	51	17	34	52.7	CH	SANDY FAT CLAY with GRAVEL
B-7	1 - 4	29	15	14	12.9	SC	CLAYEY SAND with GRAVEL
B-8	1 - 5	50	18	32	56.5	CH	SANDY FAT CLAY

PROJECT: Sedona Airport Infield Drainage Improvements

SITE: 235 Air Terminal Dr
Sedona, AZ

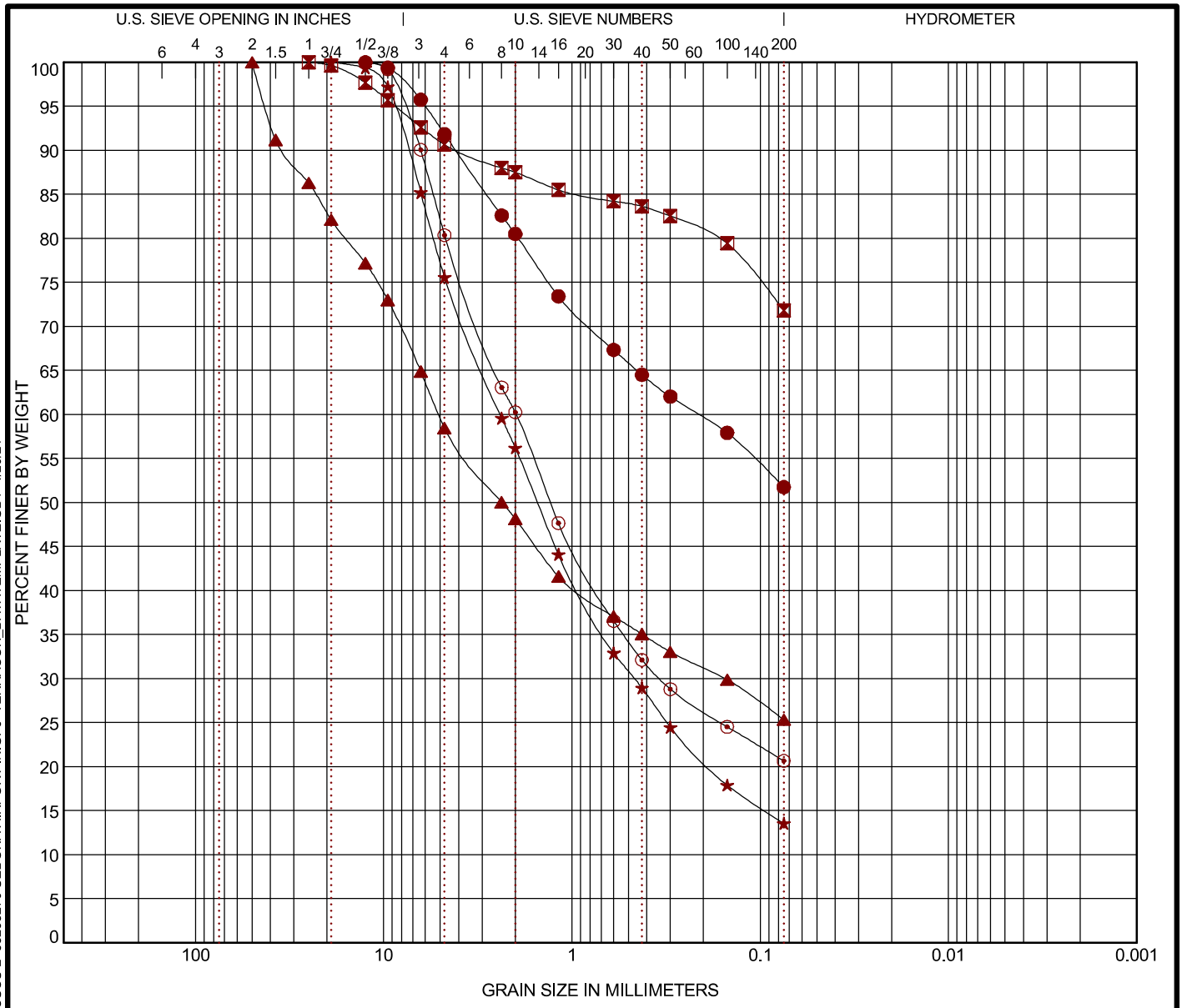
Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

PROJECT NUMBER: 65205270

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-1	1 - 5	SANDY LEAN CLAY (CL)		42	15	27		
⊠	B-2	0 - 4	FAT CLAY with SAND (CH)		56	18	38		
▲	B-3	1 - 4	CLAYEY GRAVEL with SAND (GC)		31	14	17		
★	B-4	1 - 4	SILTY SAND with GRAVEL (SM)		NP	NP	NP		
⊙	B-5	1 - 4	SILTY SAND with GRAVEL (SM)		NP	NP	NP		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-1	1 - 5	12.5	0.213			0.0	8.2	40.1		51.7	
⊠	B-2	0 - 4	25				0.0	9.4	18.8		71.8	
▲	B-3	1 - 4	50	5.094	0.154		0.0	41.5	33.1		25.3	
★	B-4	1 - 4	19	2.404	0.465		0.0	24.4	62.0		13.6	
⊙	B-5	1 - 4	12.5	1.979	0.34		0.0	19.6	59.7		20.7	

PROJECT: Sedona Airport Infield Drainage Improvements

SITE: 235 Air Terminal Dr
Sedona, AZ

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

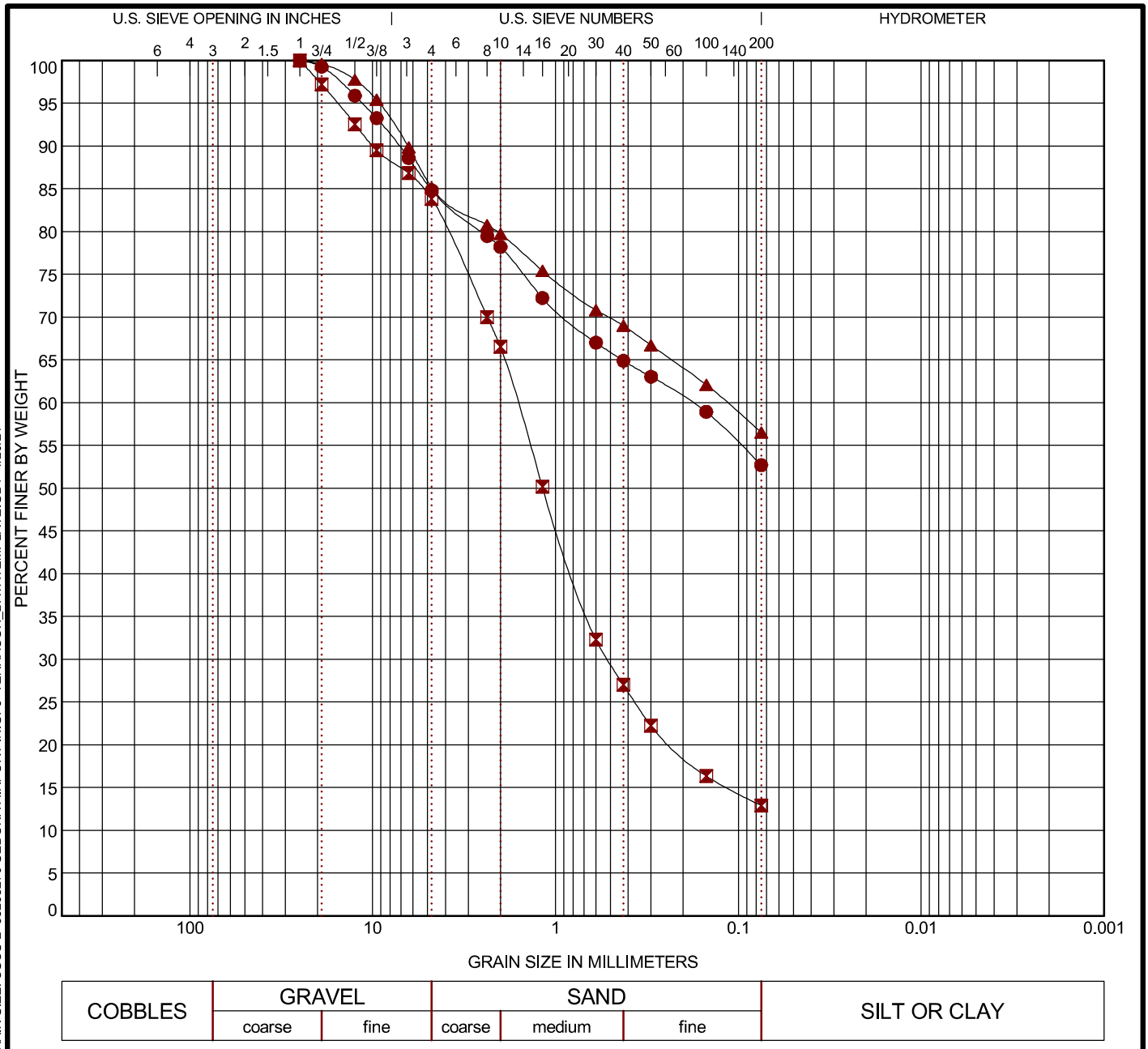
PROJECT NUMBER: 65205270

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 65205270 SEDONA AIRPORT IN.GPJ TERRACON_DATATEMPLATE.GDT 4/20/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
● B-6	0 - 4	SANDY FAT CLAY with GRAVEL (CH)		51	17	34		
⊠ B-7	1 - 4	CLAYEY SAND with GRAVEL (SC)		29	15	14		
▲ B-8	1 - 5	SANDY FAT CLAY (CH)		50	18	32		

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
● B-6	0 - 4	25	0.18			0.0	15.2	32.1		52.7	
⊠ B-7	1 - 4	25	1.621	0.517		0.0	16.2	70.9		12.9	
▲ B-8	1 - 5	25	0.115			0.0	14.9	28.6		56.5	

PROJECT: Sedona Airport Infield Drainage Improvements

SITE: 235 Air Terminal Dr
Sedona, AZ

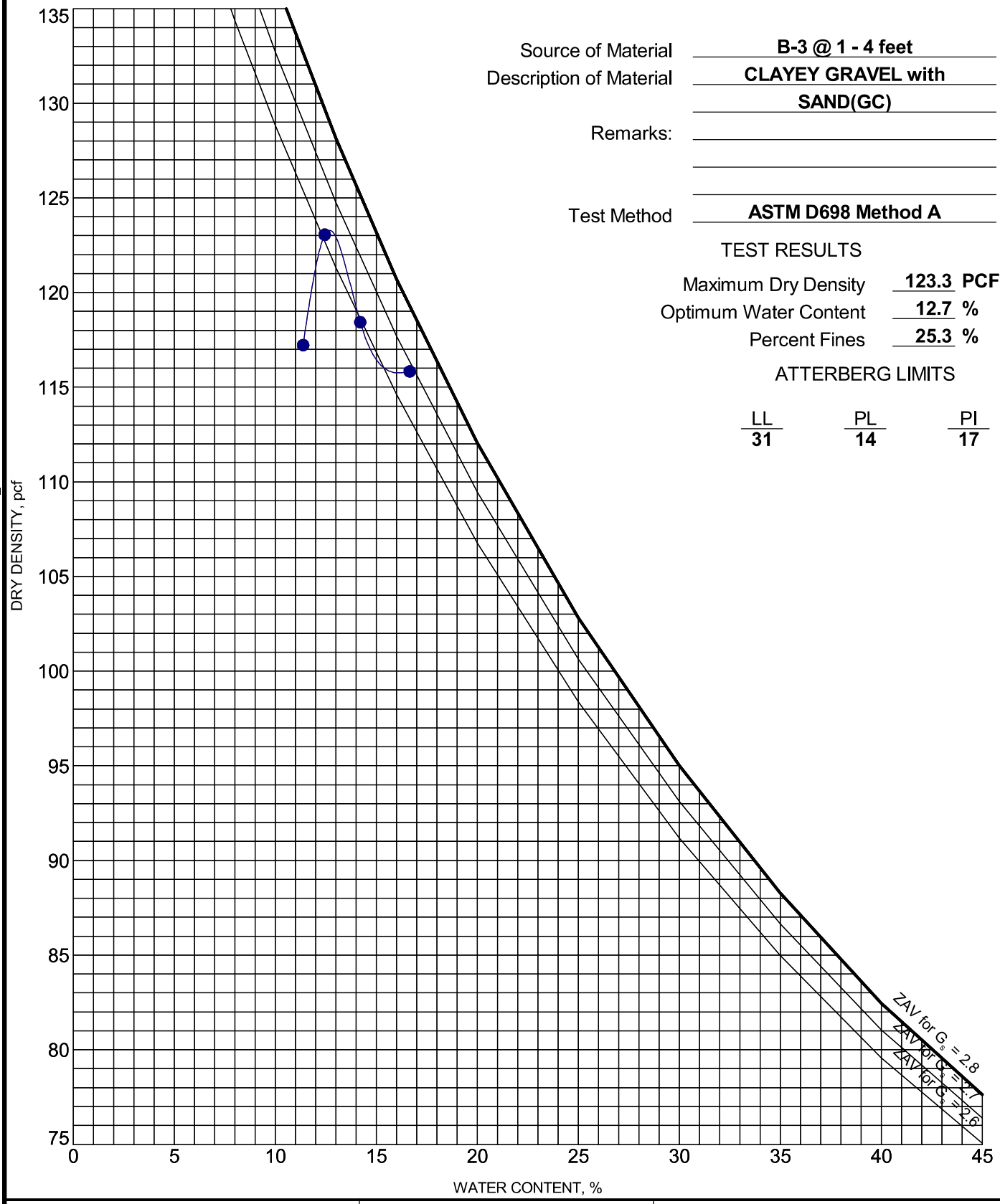
Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

PROJECT NUMBER: 65205270

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**B-3 @ 1 - 4 feet**
Description of Material	**CLAYEY GRAVEL with SAND(GC)**
Remarks:	
Test Method	**ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**123.3 PCF**
Optimum Water Content	**12.7 %**
Percent Fines	**25.3 %**

ATTERBERG LIMITS

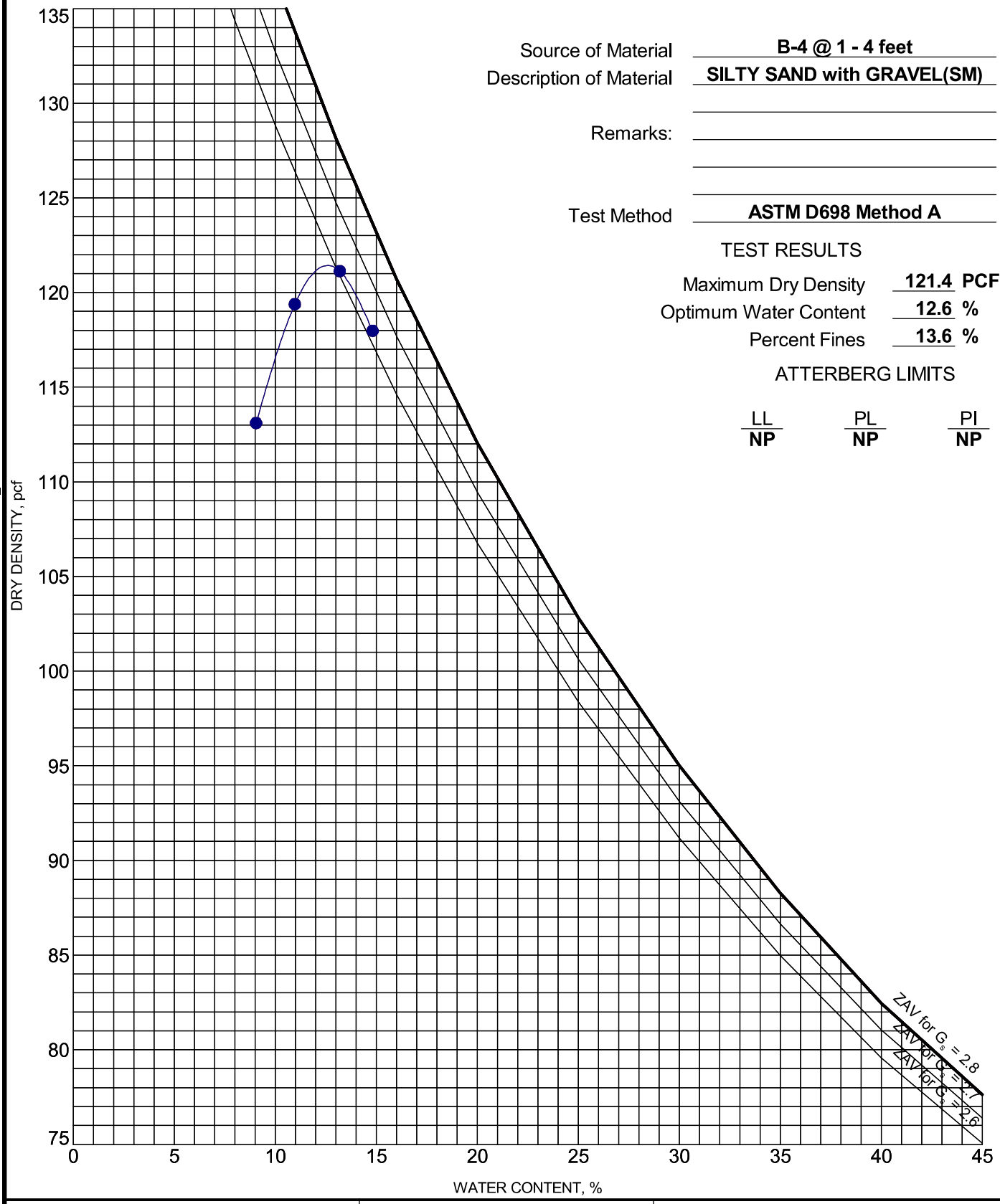
LL	PL	PI
31	**14**	**17**

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 65205270 SEDONA AIRPORT IN.GPJ TERRACON_DATATEMPLATE.GDT 4/20/21

PROJECT: Sedona Airport Infield Drainage Improvements	Terracon 4685 S Ash Ave, Ste H-4 Tempe, AZ	PROJECT NUMBER: 65205270
SITE: 235 Air Terminal Dr Sedona, AZ		CLIENT: Dibble & Associates Consulting Engineers Inc Phoenix, AZ

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-4 @ 1 - 4 feet**

Description of Material: **SILTY SAND with GRAVEL(SM)**

Remarks:

Test Method: **ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**121.4**	**PCF**
Optimum Water Content	**12.6**	**%**
Percent Fines	**13.6**	**%**

ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 65205270 SEDONA AIRPORT IN.GPJ TERRACON_DATATEMPLATE.GDT 4/20/21

PROJECT: Sedona Airport Infield Drainage Improvements

SITE: 235 Air Terminal Dr
Sedona, AZ

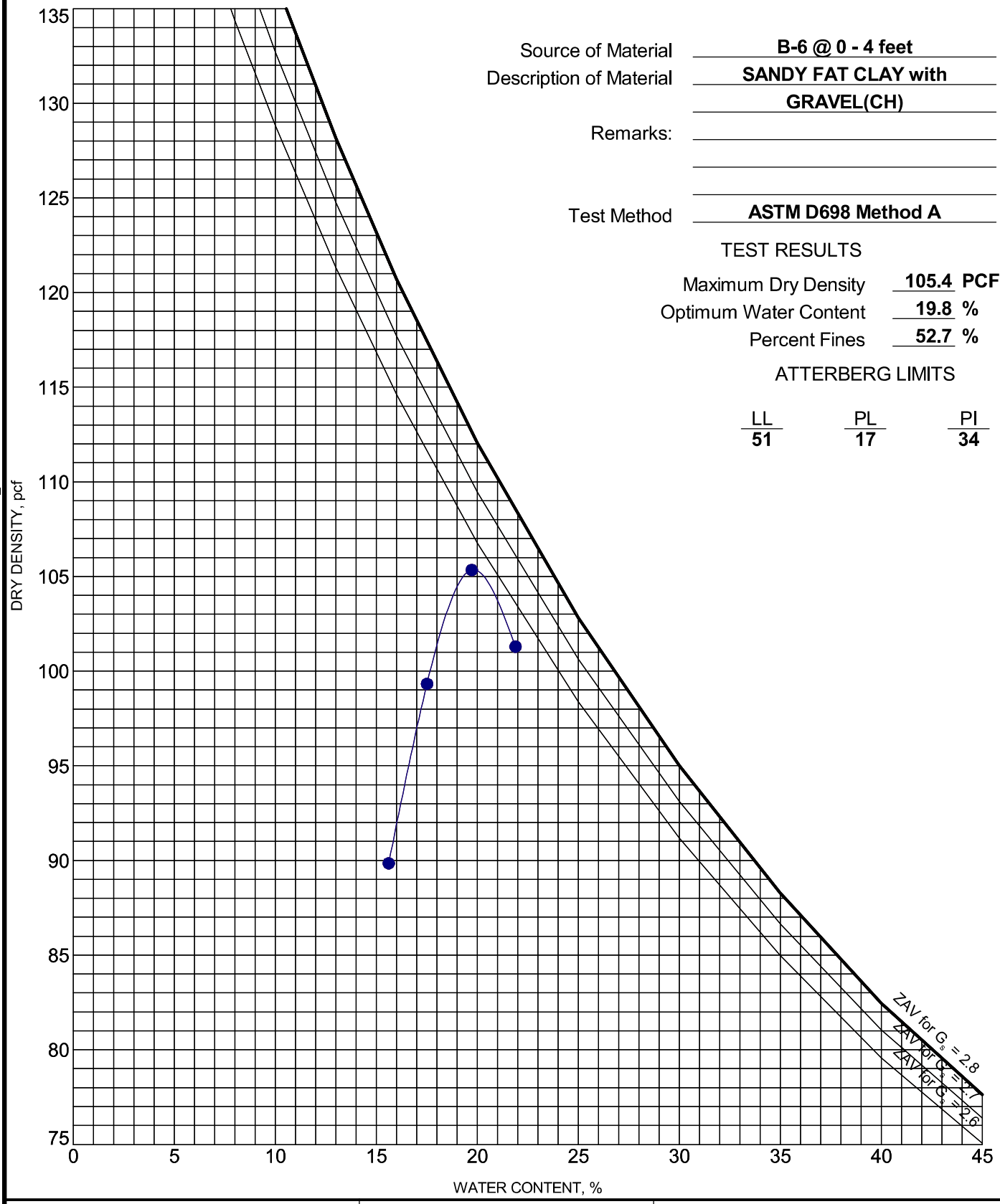
Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

PROJECT NUMBER: 65205270

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-6 @ 0 - 4 feet**

Description of Material: **SANDY FAT CLAY with GRAVEL(CH)**

Remarks:

Test Method: **ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**105.4 PCF**
Optimum Water Content	**19.8 %**
Percent Fines	**52.7 %**

ATTERBERG LIMITS

LL	PL	PI
51	**17**	**34**

PROJECT: Sedona Airport Infield Drainage Improvements

SITE: 235 Air Terminal Dr
Sedona, AZ

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

PROJECT NUMBER: 65205270

CLIENT: Dibble & Associates Consulting Engineers Inc
Phoenix, AZ

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
B-1	1.0 - 5.0	CL			52	42	15	27										
B-1	2.0 - 3.0	CL	105	15														1, 2
B-1	4.0 - 4.4	CL	98	20														1, 2
B-2	0.0 - 4.0	CH			72	56	18	38										
B-2	2.0 - 3.0	CH	92	13														1, 2
B-2	4.0 - 5.0	CH	97	15														1, 2
B-3	1.0 - 4.0	GC			25	31	14	17										
B-4	1.0 - 4.0	SM			14	NP	NP	NP										
B-4	2.0 - 2.9	SM	111	6														1, 2
B-5	1.0 - 4.0	SM			21	NP	NP	NP										
B-5	2.0 - 3.0	SM	112	8														1, 2
B-5	4.0 - 4.6	SM	90	12														1, 2
B-5	9.0 - 9.4	SM	79	18														1, 2
B-6	0.0 - 4.0	CH			53	51	17	34						8.1	1114	49	99	
B-6	2.0 - 3.0	CH	94	22														1, 2
B-6	4.0 - 5.0	CH	101	17														1, 2
B-6	9.0 - 9.4	CL	87	8														1, 2
B-7	1.0 - 4.0	SC			13	29	15	14										
B-7	2.0 - 3.0	CH	121	6														1, 2
B-7	9.0 - 10.0	CH	83	28														1, 2
B-8	1.0 - 5.0	CH			57	50	18	32										
B-9	2.0 - 3.0	CH	103	10														1, 2
B-9	4.0 - 5.0	CH	99	17														1, 2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

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Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ
PH. 480-897-8200 FAX. 480-897-1133

PROJECT NUMBER: 65205270

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Phoenix, AZ

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System
Description of Rock Properties
Note: All attachments are one page unless noted above.

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N] / Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P] / Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

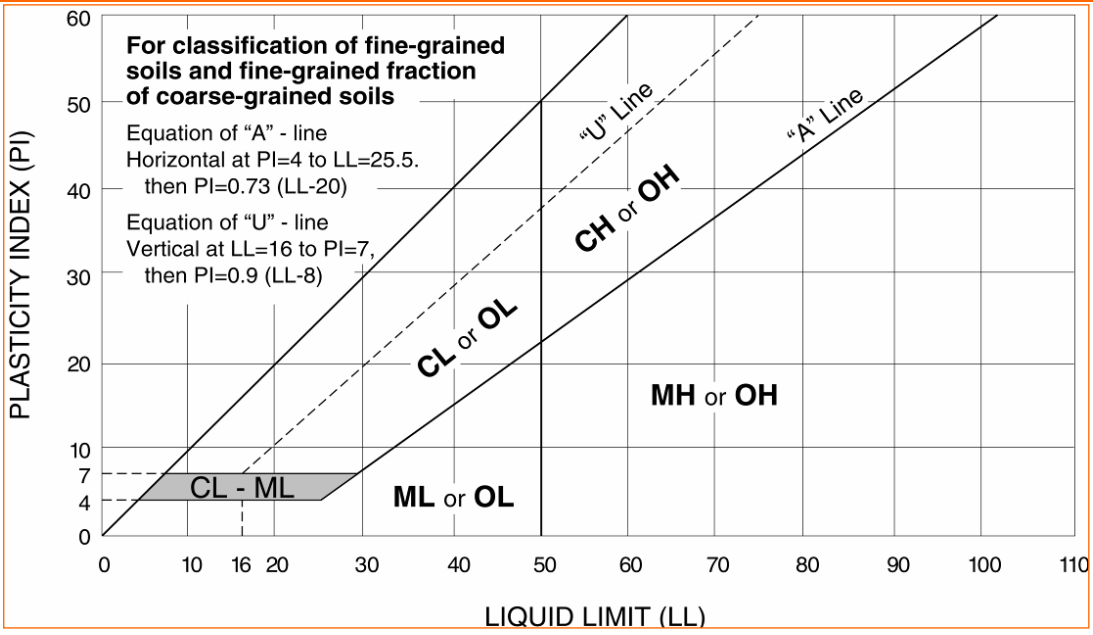
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft. (50 – 300 mm)
Moderate	8 in – 2 ft. (200 – 600 mm)	**Medium**	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	**Thick**	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	**Massive**	> 10 ft. (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009 Technical Manual for Design and Construction of Road Tunnels – Civil Elements