ADDENDUM NO. 4
July 23, 2021
925014

RE: **TOWN OF JERICHO, VERMONT**
JERICHO EWP 5038-007
DRY LAID STONE MASONRY WALL RESCONSTRUCTION

FROM: DDK ENGINEERING-JV
28 North Main Street
Randolph, Vermont 05060
(802) 728-3376

TO: **Prospective Bidders**

This Addendum forms part of the Contract Documents and modifies the original Bidding Documents issued by the Town of Jericho for the Jericho EWP 5038-007 Dry Laid Stone Masonry Wall Reconstruction project dated June 17, 2021. **Acknowledge receipt of this Addendum in the space provided on Page 2 of the Bid Form. Failure to do so will subject the Bidder to disqualification.**

I. Additional Information/Clarifications

1. Attachment A – Monitor Existing Structures Program of the Rebid Documents references Image 1, however it was not included. Refer to **Attachment 1** for Image 1.

2. Refer to **Attachment 2** for the Report of Detailed Geologic Investigation dated October 6, 2020.

This document constitutes Addendum 4 for this project.

ATTACHMENT 1

Image 1: Approximate location of survey targets (ST-#) and crack monitors (CM-#)

ATTACHMENT 2

Report of Detailed Geologic Investigation

Emergency Watershed Protection Site 5038-007
Jericho, Vermont
Contract No. 12SPEC18D0006
Order for Supplies or Services No. 12FPC320F0147
October 6, 2020

Submitted to:

USDA United States Department of Agriculture

Natural Resources Conservation Service

USDA is an equal opportunity provider, employer, and lender.

Vermont State Office
365 Mountain Drive
Colchester, Vermont 05446

Submitted by:

DDK Engineering-JV

28 North Main Street
Randolph, VT 05060

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1.0 INTRODUCTION

D'Appolonia Engineering, as part of DDK Engineering – JV (DDK) completed a subsurface investigation and developed geotechnical recommendations for the Jericho Emergency Watershed Protection Site 5038-007 (Jericho EWP Site) located on the Browns River in Jericho, Vermont. The latitude and longitude in decimal degrees to the center of the site are 44.504557 and -72.99949, respectively. Refer to Figure 1 for a project location plan. DDK performed the subsurface investigation at the Jericho site from July 29, 2020 to July 31, 2020. The subsurface investigation consisted of completing three borings to characterize subsurface conditions at the project site to support the design of the proposed stacked stone wall repair. Refer to Figure 2 for as-drilled boring locations.

DDK is under contract with the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) as the Architect-Engineer (A-E) to provide design and construction services for the Emergency Watershed Protection Site 5038-007 project. NRCS authorized DDK to perform the services described herein via Order for Supplies or Services No. 12FPC320F0147 dated July 10, 2020. DDK performed the services in general accordance with the NRCS Request for Proposal No. 2020-09 dated May 7, 2020, the Statement of Work provided to DDK by NRCS on May 7, 2020, and our revised Price Proposal dated June 24, 2020. This Report of Detailed Geologic Investigation is the instrument of service for the Subsurface Investigation completed by DDK as part of Task No. 1 – Preliminary Design of our revised Price Proposal dated June 24, 2020.

The project consist of repairing an approximately 35 feet long portion of damaged, stacked stone wall along the Browns River that is on the Old Red Mill property located at 4 Red Mill Drive in Jericho, Vermont. The 35 feet long stacked stone wall reportedly failed in October 2019 when the bedrock foundation became dislodged or broke and fell into Browns River. As shown on Figure 2, the existing stacked stone wall begins at Route 15 and extends to the north approximately 135 feet where it terminates at the Old Red Mill building. The southern 60 feet of the stacked stone wall was previously re-constructed by the Vermont Agency of Transportation (VTrans). The next portion of the stacked stone wall, which is approximately 30 feet in length, is undamaged and will remain in place. The next portion of the stacked stone wall, which is approximately 35 feet in length, is damaged and will be repaired as part of this project. The northern most portion of the stacked stone wall, which is approximately 10 feet in length, is undamaged and will remain, and connects to the Old Red Mill building.

Per the Statement of Work provided to DDK on May 7, 2020, the Old Red Mill building and parking lot are of historical significance and are on the National Historic Registry. The proposed stacked stone wall repair classifies as a Group B structure (Grade Stabilization Structure) per Chapter 2 of the NRCS Part 631 National Engineering Handbook. This report summarizes the subsurface investigation and geotechnical laboratory testing program completed by DDK, provides discussion of available geologic documents as they pertain to the project site, describes subsurface conditions encountered in the borings completed by DDK, provides DDK's evaluation of site conditions as they pertain to the design of the proposed stacked stone wall repair, and provides DDK's geotechnical design recommendations for the design of the stacked stone wall repair.

As shown in Figure 2, the proposed stacked stone wall repair will include re-constructing the approximately 35 feet long portion of stone wall between the existing undamaged portions of stone wall. Alternative earth retention structures and systems other than a stacked stone wall were not considered for a repair solution because the preservation of the historic nature of the stacked stone wall is a primary design requirement. Figure 3 presents the conceptual stacked stone wall re-construction that is expected to include a concrete leveling pad doweled to the underlying bedrock, a stacked stone wall on top of the concrete leveling pad, an aggregate drain behind the stacked stone wall, and rock bolts below the concrete leveling pad. The conceptual stacked stone wall re-construction proposed for this project as shown on Figure 3 is generally consistent with the approximately 60 feet-long portion of stacked stone wall re-constructed by VTrans, except for the rock dowels that will connect the concrete leveling pad to the bedrock below. VTrans previously completed three borings, shown on Figure 2, which indicate that the top of bedrock in the area of the approximately 60 feet long portion of stacked stone wall previously re-constructed by VTrans is sloping downward from east to west, or from the Browns River downward towards the back of the stacked stone wall. Based on the borings and survey completed by DDK, it appears the top of bedrock in the area of the stacked stone wall to be repaired as part of this project is sloping downward from west to east, or from behind the stacked stone wall downward towards the Browns River. As such, conceptual rock dowels are shown on Figure 3 to prevent the concrete leveling pad from sliding towards the Browns River along the top of bedrock.

2.0 GENERAL

2.1 Subsurface Investigation

DDK completed subsurface investigation activities at the Jericho EWP Site from July 29, 2020 to July 31, 2020. DDK subcontracted drilling services required to complete the borings to New England Boring Contractors (NEBC) out of Derry, New Hampshire. A DDK representative with knowledge of conducting subsurface investigations was on-site full-time during subsurface investigation activities. The DDK representative documented observed subsurface conditions and visually classified the soils and rock encountered.

The subsurface investigation included the completion of three borings (JE-20-401, JE-20-401A, and JE-20-402). The borings were completed to characterize soil, rock, and groundwater conditions at their specific locations, obtain samples for geotechnical laboratory testing, develop geotechnical design parameters for the proposed stacked stone wall repair, and to support the final design of the stacked stone wall repair. The boring logs are included as Appendix A. Borings JE-20-401, JE-20-401A and JE-20-402 were completed from the asphalt parking area immediately to the west of the damaged portion of stacked stone wall as shown on Figure 2. The as-drilled boring coordinates, ground surface elevations, and total drill depths are summarized in Table 1. Boring JE-20-401 was terminated at a depth of 4.0 feet because the drilling subcontractor was concerned about safety considering the proximity of the drill rig and work area relative to the damaged portion of the stacked stone wall in combination with the very loose to loose soils that were encountered. Boring JE-20-401A is an offset boring that was performed to continue the investigation after Boring JE-20-401 was terminated.

NEBC completed borings using a Mobile B47 truck mounted drill rig. All borings were advanced through soil using 2.25-inch inside diameter (ID), 6-inch outside diameter (OD), hollow stem augers. Disturbed soil samples were collected continuously in each boring using a 2-inch OD split-barrel sampler and the standard penetration test (SPT) method with an automatic hammer drop system in accordance with ASTM D1586. Disturbed soil samples were used for field classification, estimation of soil density or consistency, and for laboratory testing. Below the depth at which auger refusal was encountered, a roller bit was used to advance the borings and to socket casing into the underlying bedrock to promote water return for rock coring. All borings were backfilled with a cement-bentonite grout mixture using the tremie method to within approximately 12 inches of the ground surface. An asphalt cold patch was placed above the grout to the approximate ground surface. All borings were grouted immediately following completion of the boring.

2.2 Laboratory Testing Program

DDK subcontracted geotechnical laboratory testing services to Geotechnics, Inc. (Geotechnics) of East Pittsburgh, Pennsylvania. Laboratory testing was completed on select soil and rock samples collected in the borings to support the design of the proposed stacked stone wall repair. The complete laboratory test results are included in Appendix B. The results of laboratory testing completed on soil samples are

summarized in Table 2. The results of laboratory unconfined compressive strength testing completed on rock core samples are summarized in Table 3. The geotechnical laboratory testing program consisted of:

- Water Content (ASTM D2216),
- Sieve Analysis (ASTM D6913),
- Hydrometer Analysis (ASTM D7928),
- Atterberg Limits (ASTM D4318),
- Unified Soil Classification System (ASTM D2487)
- Specific Gravity (ASTM D854), and
- Unconfined Compressive Strength of Rock – Method C (ASTM D7012).

2.3 Physiography and Geology

The Jericho EWP Site is located in the Vermont Lowlands physiographic region, also known as the Champlain Lowland physiographic region, of Vermont just to the west of the boundary with the Green Mountains physiographic region. The Vermont Lowlands physiographic region is bounded on the west by Lake Champlain and the Adirondack Mountains in New York, and is bounded on the east by the Green Mountains. The region is known for the lowest elevations and least metamorphosed bedrock relative to the other physiographic regions of Vermont. The topography of the region is defined by north- and south-running ridges, hills, and low mountains known as "klippes," which formed through thrust faulting of the region and the subsequent erosion of the thrust blocks. Between the ridges, the terrain is dominated by flat lakeshore terraces and delta plains dissected by rivers and their tributaries. Bedrock throughout the region generally consists of sedimentary and metamorphic rocks including shale, limestone, slate, phyllite, and marble (Saint Michael's College).

The bedrock beneath the Jericho EWP Site consists of the Pinnacle Formation which is Cambrian to Neoproterozoic in age. The Pinnacle Formation is described as gray, foliated muscovite-chlorite-biotite-feldspar-quartz schist, phyllite, and metagraywacke. Quartz is commonly blue, and local thin conglomerate horizons are present. Feldspathic biotite phyllitic metawacke is interlayered with lenses of quartz, feldspar, and gneiss-pebble to -cobble conglomerate (Ratcliffe, et al., 2011). The surficial deposits at the Jericho EWP Site consist of delta sand. The delta sand is a glaciolacustrine deposit and is described as littoral sediment composed of predominantly sand (Vermont Agency of Natural Resources). Project specific Surficial and Bedrock Geology maps were created using the Vermont Agency of Natural Resources (ANR) online Natural Resources Atlas, and are included in Appendix D.

The USDA NRCS Web Soil Survey indicates that surficial soils at the Jericho EWP Site consist of Belgrade and Eldridge soils at the southern portion of the site and Hartland very fine sandy loam at the northern portion of the site, with the boundary being approximately at the southern limits of the proposed stacked stone wall repair. Belgrade and Eldridge soils are generally found on terraces on lake plains, consist of coarse-silty or sandy glaciolacustrine deposits over loamy glaciolacustrine deposits, and have typical Unified Soil Classification System (USCS) classifications of ML, CL-ML, and SM. Hartland very fine sandy loam is also found on terraces on lake plains, consists of coarse-silty glaciolacustrine deposits,

and has typical USCS classifications of ML, CL-ML, SC-SM, and SM. The NRCS Web Soil Survey Map, Map Unit Description, and Engineering Properties Table are included as Appendix C.

3.0 SUBSURFACE GEOLOGY

The following section presents a summary of subsurface conditions encountered in the borings completed by DDK and field observations made by DDK at the Jericho EWP Site. Refer to Figure 2 for boring locations. Figure 3 provides sections with the soil and rock lithology encountered by DDK in the borings projected onto the section view. For detailed soil and rock descriptions refer to the boring logs in Appendix A.

DDK completed Borings JE-20-401, JE-20-401A, and JE-20-402 within the parking lot directly above the slope failure to characterize the underlying soil, rock, and groundwater conditions to support the design of the proposed stacked stone wall repair at Red Mill Drive. Based on the data collected from the borings, approximately 0.3 to 0.5 feet of asphalt exists at the ground surface. The asphalt is underlain by an upper sand layer that is generally described as very loose to compact, dry to moist, brown to dark brown, fine to coarse-grained, Sand with varying amounts of Silt and Gravel. Boring JE-20-401 was terminated within the upper sand layer at a depth of 4.0 feet due to encountering very loose to loose soils, which concerned the drilling subcontractor with respect to being in close proximity to the failed stacked stone wall area. The driller moved the rig and resumed the investigation at an offset location, Boring JE-20-401A. At Borings JE-20-401A and JE-20-402, the upper sand layer extended to depths of 6.4 and 10.5 feet, respectively. The upper sand layer is underlain by a lower sand layer that is generally described as very loose to loose, moist, dark brown with black, Silty Sand to Silt with trace organics which extended to depths of 7.5 and 13.2 feet in Borings JE-20-401A and JE-20-402, respectively. In Boring JE-20-402 the lower sand layer was underlain by 2.3 feet of soft, moist to wet, gray Silt which was classified as residual soil based on field observations. The residual soil layer was not encountered in Boring JE-20-401A.

Auger refusal was encountered in Borings JE-20-401A and JE-20-402 at depths of 7.5 and 14.4 feet, respectively. Below the depths at which auger refusal was encountered, casing was socketed into the bedrock and rock coring was performed to collect samples of the underlying bedrock. Rock coring was completed from a depth of 10.0 feet to a depth of 25.0 feet in Boring JE-20-401A and from a depth of 15.5 to a depth of 25.5 feet in Boring JE-20-402. The bedrock is generally described as slightly weathered to unweathered, slightly broken to unbroken, hard, gray Metagraywacke with occasional high angle fractures and quartzite inclusions. The rock quality designation (RQD) of the metagraywacke bedrock ranged from 94 to 100 percent (%). Borings JE-20-401A and JE-20-402 were terminated at a depth of 25.0 feet and 25.5 feet, respectively, after the completion of rock coring. After soil sampling was completed and prior to rock coring, when water is introduced to the borehole to remove cuttings, no groundwater was observed in the borings.

Based on laboratory testing, the upper sand layer has a Unified Soil Classification System (USCS) symbol of either SM or SW-SM with non-plastic fines and an average gravel, sand, and fines content of 18%, 63%, and 19%, respectively. For the upper sand layer, the average water content is 9% and average specific gravity is 2.65. Based on laboratory test results the lower sand layer has a USCS symbol of SM with non-plastic fines and an approximate gravel, sand, and fines content of 1%, 53%, and 46%, respectively. For the lower sand layer, the average water content is 44% and approximate specific gravity

is 2.52. Laboratory unconfined compressive strength testing performed on four intact rock core samples of Metagraywacke bedrock indicates the uniaxial compressive strength of the intact bedrock ranges from 9,630 to 20,920 pounds per square inch (psi) and the total unit weight of intact bedrock ranges from approximately 172 to 176 pounds per cubic feet. Refer to Table 2 for a summary of laboratory testing completed on soil samples, Table 3 for a summary of laboratory testing completed on intact rock core samples, and Appendix B for the completed laboratory testing results as received from the subcontracted geotechnical laboratory.

4.0 INTERPRETATIONS AND CONCLUSIONS (FOR IN-SERVICE USE ONLY)

4.1 Interpretations

Using field data collected during the subsurface exploration and results of geotechnical laboratory testing, DDK developed geotechnical properties and design recommendations for the soil and rock observed at the Jericho EWP Site as they pertain to the proposed stacked stone wall repair design.

Geotechnical properties for use in the proposed stacked stone wall repair design were developed using geotechnical laboratory test results, empirical relationships, and subsurface data for the project site. Geotechnical properties that were estimated for use in the proposed stacked stone wall repair design include unit weight and shear strength for soil and rock materials, rock to grout ultimate bond strength, interface friction angles between various material types, and the active earth pressure coefficient. Refer to Appendix E for the complete geotechnical properties calculation. The calculations for the active earth pressure coefficient assumes the backfill material is either the existing soil that was excavated and placed back into the excavation and re-compacted, or an imported sand or gravel material. If the existing soil is used as backfill, the soil should be free of organics and re-compacted to 95% of the maximum dry density and at 3% +/- the optimum moisture content per Standard Proctor Testing (ASTM D698). The interface friction between the stacked stone wall and the concrete leveling pad assume that the first row of stacked stones are cast into the upper portion of the concrete pad, set in mortar on top of the concrete pad, or the surface of the concrete pad roughened to increase the surface contract area between the stacked stones and concrete pad. The geotechnical properties in Appendix E are specifically prepared for the project site and the current repair configuration generally presented on Figures 2 and 3 for the proposed stacked stone wall repair. If the scope for the proposed stacked stone wall repair changes the geotechnical properties in Appendix E should be re-evaluated to account for changes in the scope.

No groundwater was observed in the borings completed by DDK at the Jericho EWP Site. However, based on laboratory testing completed on two samples collected within the lower sand layer, which is located just above bedrock, it appears that the lower sand layer has a water content significantly higher than the upper sand layer. The increased water content in the lower sand layer just above bedrock could indicate that when groundwater is present at the project site, it approximately runs along the top of bedrock.

Based on the elevation where bedrock was encountered in Borings JE-20-401A and JE-20-402, and the surveyed bedrock outcrop along the west side of the Browns River in the area of the proposed stacked stone wall repair, it appears that the top surface of bedrock is sloping downward from west to east. Based on field observations made by DDK of the bedrock outcrops along the Browns River adjacent to the proposed stone wall repair, it appears that the bedrock is dipping approximately 40 to 60 degrees from the west to the east. The estimated top of bedrock and approximate dip of the bedrock is shown in section view in Figure 3.

4.2 Conclusions (Recommendations)

Based on the subsurface conditions observed during the subsurface exploration described herein, our current design assumptions for the Jericho Emergency Watershed Protection Site 5038-007 project, and the interpretations listed in the previous section, DDK has developed the following conclusions that relate to key geotechnical features of the design and construction.

- Design of the proposed stacked stone wall repair should be completed using the geotechnical properties as presented in Appendix E. If the scope of the proposed stacked stone wall design changes the geotechnical properties in Appendix E need to be re-evaluated to account for changes in the design.

- The proposed stacked stone wall shall be constructed on a concrete pad to provide a level foundation for the stacked stone wall. The concrete pad shall be constructed on bedrock. The bedrock foundation for the concrete pad should be cleaned with a pressure washer, compressed air, or similar and approved by a Professional Engineer prior to the placement of concrete.

- The top of bedrock appears to be sloping downward from west to east, or from behind the proposed stacked stone wall towards Browns River. Additionally, given the hardness of the bedrock encountered and limited work area when considering the use of heavy construction equipment, it is unlikely that the bedrock will be able to be excavated and ripped, without compromising adjacent bedrock, to provide a level bench in the bedrock to construct the concrete pad on top of. As such, the concrete leveling pad shall be dowelled to the bedrock below to prevent potential sliding of the concrete pad on top of bedrock.

- The bedrock appears to be dipping from west to east at approximately 40 to 60 degrees, or from behind the proposed stacked stone wall towards the Browns River. Rock bolts shall be installed in the bedrock below the concrete pad to prevent potential sliding of rock masses in the direction of the bedrock dip.

- An aggregate drain shall be installed along the backside of the concrete pad and proposed stacked stone wall. The aggregate drain should be a minimum of 12 inches wide and extend from the bottom of the concrete leveling pad (top of bedrock) to the top of the stacked stone wall. A perforated collector pipe should be installed at the base of the drain to collect and convey groundwater behind the stacked stone wall. The aggregate surrounding the perforated pipe may be wrapped in geotextile, however no other geotextile should be used behind the proposed stacked stone wall. Per the Federal Highway Administration Rockery Design and Construction Guidelines the friction angle between the backfill soil and back of wall was assumed to be equal to the effective friction angle of the backfill soil. This assumption is only valid for stone walls when no filter/separation fabric is used between the backfill soil and aggregate drain materials.

5.0 REPORT LIMITATIONS

DDK prepared this report for the exclusive use and specific application to the Emergency Watershed Protection Site 5038-007 project located on the Browns River in Jericho, Vermont. DDK is not responsible for use or interpretation of this report by any parties. The evaluation and recommendations contained in this report are based on the data obtained from the referenced subsurface investigation. The borings indicate subsurface conditions only at the specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between such locations. The validity of the recommendations is based in part on assumptions about the stratigraphy between borings made by the geotechnical engineer. Such assumptions shall be confirmed during earthwork as part of construction. If subsurface conditions different from those described herein are noted during construction, recommendations in this report must be reevaluated. DDK must observe earthwork construction, particularly borrow areas and fill areas, to confirm that our assumptions and recommendations are valid, or to modify them accordingly. DDK cannot assume responsibility or liability for the adequacy of recommendations if it does not observe construction.

If any changes in the nature, design, or location of the structure are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by DDK. DDK is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or reuse of the subsurface data or engineering analyses without the express written authorization of DDK.

Our scope of services excludes testing or engineering evaluations associated with environmental conditions at the site, including the investigation or detection of the presence of any "biological pollutants" in or around the site where the phrase "biological pollutants" includes but is not limited to: molds, spores, fungi, bacteria and viruses, and the byproducts of any such biological organisms.

6.0 REFERENCES

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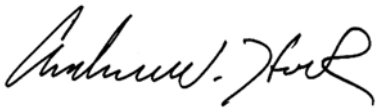
7.0 CLOSING

In preparing this report, the professional services of DDK has been performed, findings obtained, and recommendations prepared per generally accepted engineering principles and practices. This statement is instead of all warranties, either expressed or implied.

If you have questions, please call.

Respectfully Submitted,
DDK ENGINEERING – JV



Andrew T. Hoak, PE, PG
Geologist

Robert M. Shusko, PE
Senior Principal Engineer

TABLES

Table 1
As-Drilled Boring Locations
Emergency Watershed Protection Site 5038-007
Jericho, Vermont
Natural Resources Conservation Service

Boring	Northing (ft)	Easting (ft)	Elevation (ft)	Depth (ft)
JE-20-401	731,039.27	1,510,083.98	537.8	4.0
JE-20-401A	731,022.49	1,510,081.00	537.5	25.0
JE-20-402	731,000.29	1,510,079.85	536.9	25.5

Notes:

1.) Horizontal Datum: North American Datum of 1983 (NAD83)

2.) Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)

Table 2
Summary of Laboratory Test Results
Emergency Watershed Protection Site 5038-007
Jericho, Vermont
Natural Resources Conservation Service

Sample Information				Test Results														
Boring	Sample ID	Depth		Water Content	Sieve Analysis							Hydrometer		Atterberg Limits			Specific Gravity
		From (ft)	To (ft)	(%)	USCS Symbol	USCS Name	<#4 (%)	<#40 (%)	<#200 (%)	Gravel (%)	Sand (%)	Fines (%)	<0.05 mm (%)	<0.002 mm (%)	USCS Symbol [1]	LL (%)	PI (%)	
JE-20-401	SpT-1	0.5	2.0	8.1	SM	Silty Sand with Gravel	81	47	19	19	62	19	13.51	2.88	Non-Plastic			2.60
	SpT-2	2.0	4.0															
JE-20-401A	SpT-1	0.5	2.0	5.5	SW-SM	Well Graded Sand with Silt and Gravel	68	30	11	32	57	11	[2]	[2]	Non-Plastic			2.66
	SpT-2	2.0	4.0															
	SpT-4	6.4	7.5	44.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JE-20-402	SpT-2	2.0	4.0	13.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SpT-4	6.0	8.0	9.1	SM	Silty Sand	97	81	27	3	70	27	13.96	0.77	Non-Plastic			2.68
	SpT-6	10.5	12.0	44.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SpT-7	12.0	13.2	-	SM	Silty Sand	99	86	46	1	53	46	37.43	7.38	Non-Plastic			2.52
	SpT-7	13.2	14.0	22.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

[1] USCS symbol for minus #40 sieve material based on the Plasticity Index (PI), Liquid Limit (LL) and Plasticity Chart.

[2] Insufficient fines to complete hydrometer test.

Table 3

Summary of Laboratory Unconfined Compressive Strength of Rock Test Results

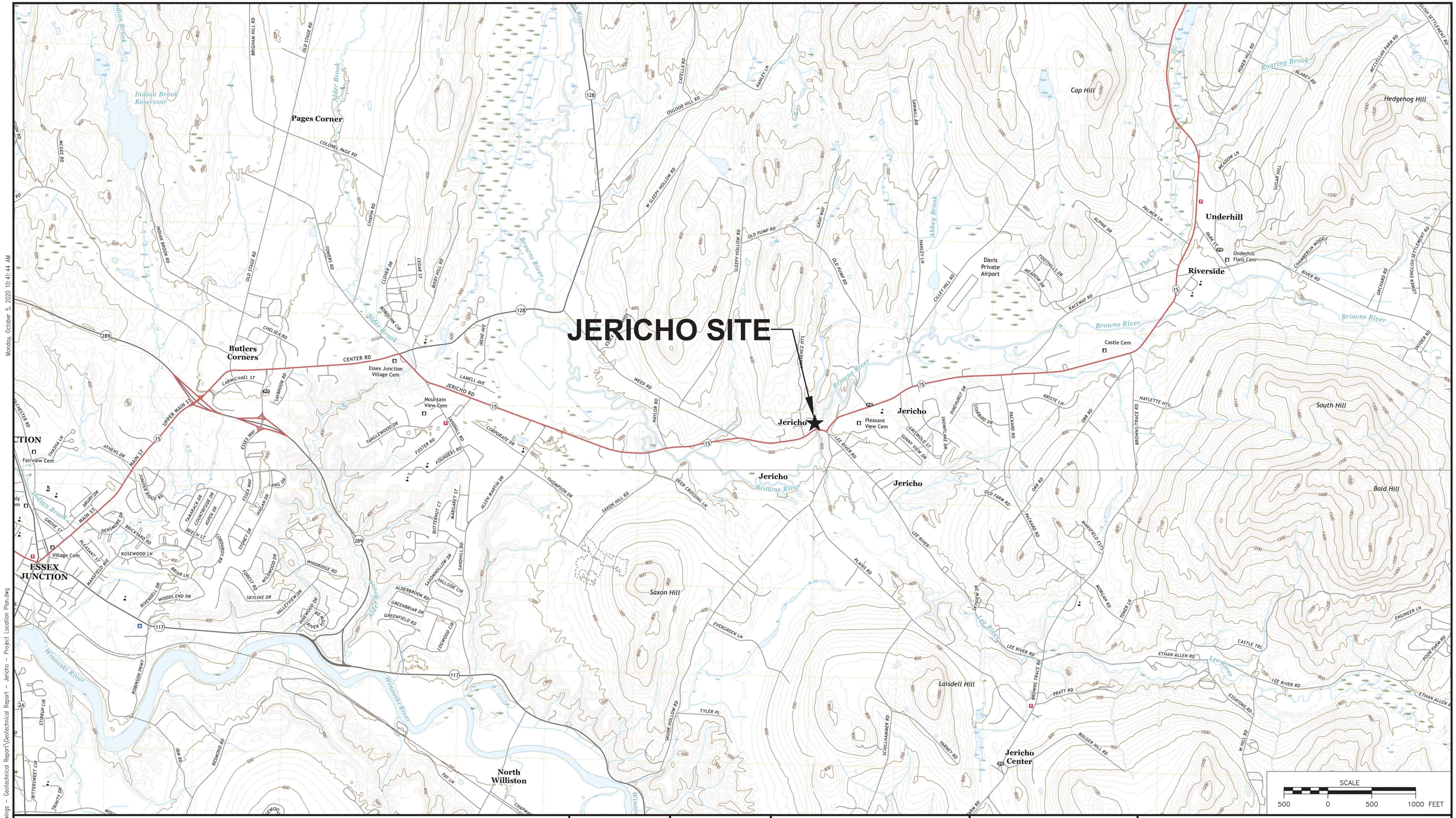
Emergency Watershed Protection Site 5038-007

Jericho, Vermont

Natural Resources Conservation Service

Sample Information					Test Results			
Boring	Sample ID	Depth		Rock Type	Moisture Content	Dry Unit Weight	Uniaxial Compressive Strength	Fracture Type
		From (ft)	To (ft)		(%)	(pcf)	(psi)	
JE-20-401A	R-1	12.1	12.9	Metagraywacke	0.08	174.5	10,690	Cone & Split
	R-3	24.2	25.0	Metagraywacke	0.09	175.5	9,630	Cone & Split
JE-20-402	R-1	18.4	19.2	Metagraywacke	0.12	173.8	9,840	Cone & Split
	R-2	24.4	25.2	Metagraywacke	0.09	171.7	20,920	Cone & Split

FIGURES



Monday, October 5, 2020 10:41:44 AM

R:\2017\172719-24 – Jericho Site\Drawings – Geotechnical Report\Geotechnical Report – Jericho – Project Location Plan.dwg

NOTES / REVISIONS

1. BACKGROUND TOPOGRAPHIC MAPS ARE THE 2018 ESSEX CENTER, ESSEX JUNCTION, RICHMOND, AND UNDERHILL QUADRANGLES 7.5 MINUTE SERIES MAPS, OBTAINED FROM THE UNITED STATES GEOLOGIC SURVEY (USGS) NATIONAL GEOLOGIC MAP DATABASE.

ISSUED FOR	DATE	REV.	REVISION DESCRIPTION	MADE BY	CHKD BY	DATE
		4				
		3				
		2				
		1				

SEAL:

N

DDK Engineering-JV

USDA United States Department of Agriculture

Natural Resources Conservation Service

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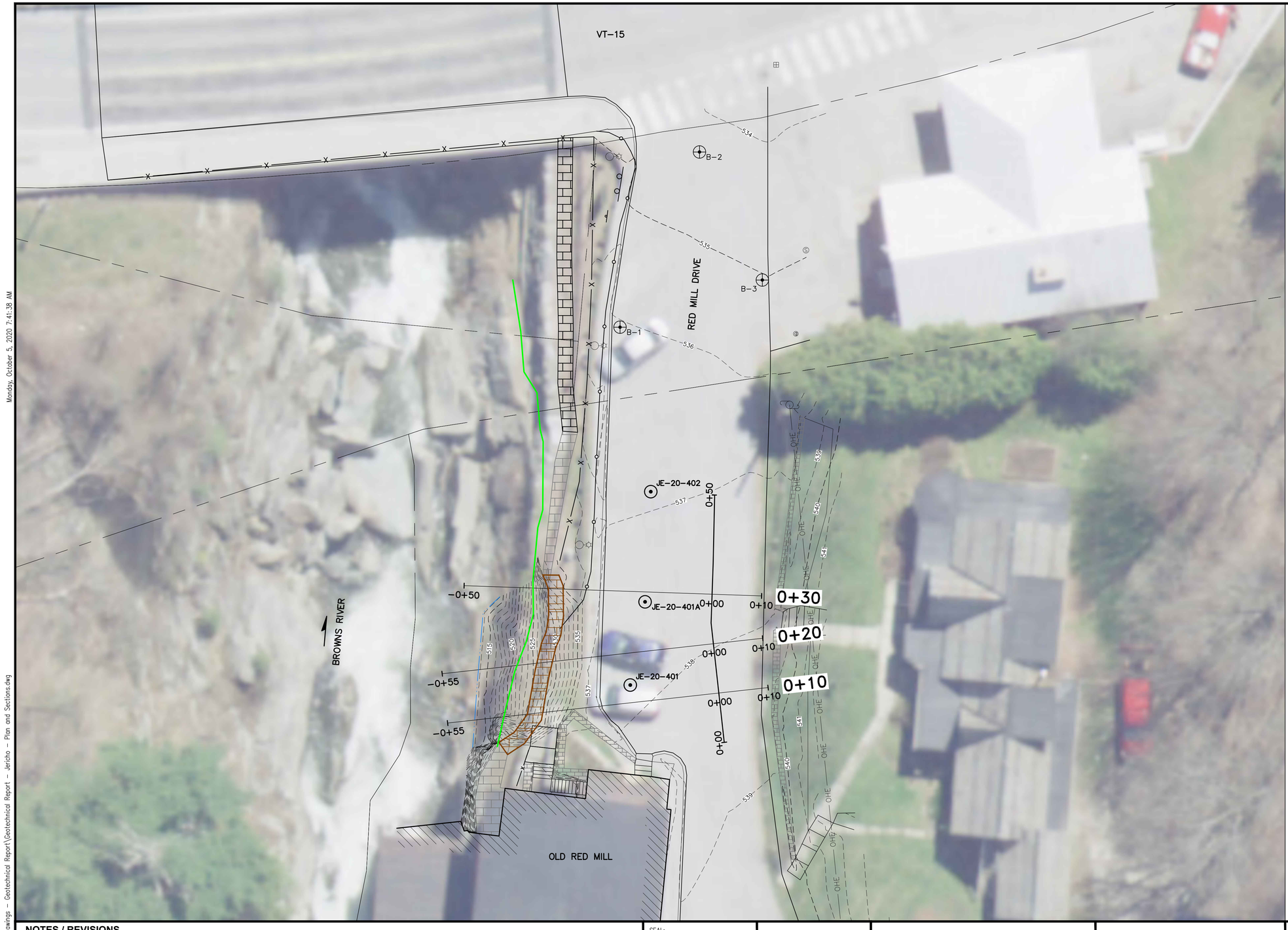
PROJECT NUMBER: 172719-24		
FILE NAME: Geotechnical Report – Jericho – Project Location Plan.dwg	DRAWN BY: QDW	DATE: 9/14/2020
	CHECKED BY: RMS	DATE: 9/25/2020

JERICHO EWP SITE 5038-007

JERICHO, CHITTENDEN COUNTY, VERMONT

FIGURE 1
PROJECT LOCATION PLAN

SCALE: AS SHOWN	DRAWING: 1	REV 0



LEGEND

- EXISTING GROUND CONTOUR (2020 DDK SURVEY)
- PROPERTY LINE (APPROX.)
- SURVEYED TOP OF BEDROCK (2020 DDK SURVEY)
- SURVEYED EDGE OF WATER (2020 DDK SURVEY)
- EXISTING GUARD RAIL
- EXISTING FENCE
- TOP OF EXISTING STONE WALL PREVIOUSLY RE-CONSTRUCTED BY VTRANS (APPROX.)
- TOP OF EXISTING STONE WALL
- TOP OF PROPOSED STONE WALL TO BE RE-CONSTRUCTED (1)
- JE-20-401 BORING COMPLETED BY DDK (2020)
- B-1 BORING COMPLETED BY VTRANS (2006)

NOTES
(1) ACTUAL WALL LOCATION AND DIMENSIONS MAY VARY BASED ON THE FINAL DESIGN.

SCALE
10 0 10 20 FEET

NOTES / REVISIONS

1. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 (NAD83). VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. PROPERTY LINES ARE APPROXIMATE AND WERE OBTAINED FROM THE VERMONT CENTER FOR GEOGRAPHIC INFORMATION (VCGI)
3. ORTHO IMAGERY, DATED 2018, WAS OBTAINED FROM THE VERMONT CENTER FOR GEOGRAPHIC INFORMATION (VCGI)

ISSUED FOR	DATE	REV.	REVISION DESCRIPTION	MADE BY	CHKD BY	DATE
		4				
		3				
		2				
		1				

SEAL:

Engineering-JV

PROJECT NUMBER: 172719-24
FILE NAME: Geotechnical Report - Jericho - Plan and Sections.dwg

USDA United States Department of Agriculture
Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and lender.

DRAWN BY: AA DATE: 9/14/20
CHECKED BY: RMS DATE: 9/25/20

JERICHO EWP SITE 5038-007
JERICHO, CHITTENDEN COUNTY, VERMONT

FIGURE 2
SUBSURFACE INVESTIGATION PLAN

SCALE: AS SHOWN | DRAWING: 2 | REV 0

Monday, October 5, 2020 7:41:38 AM

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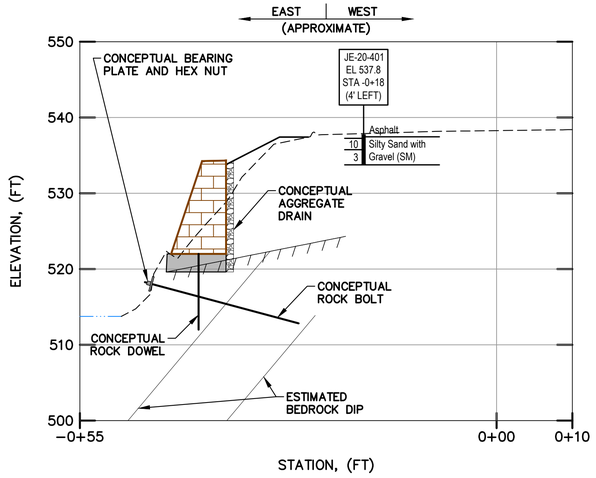

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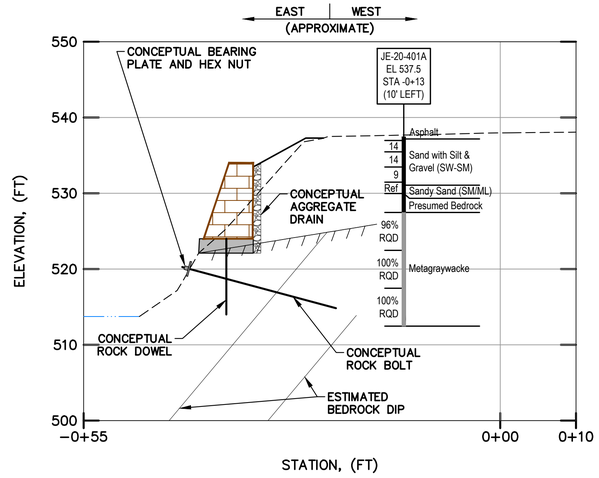

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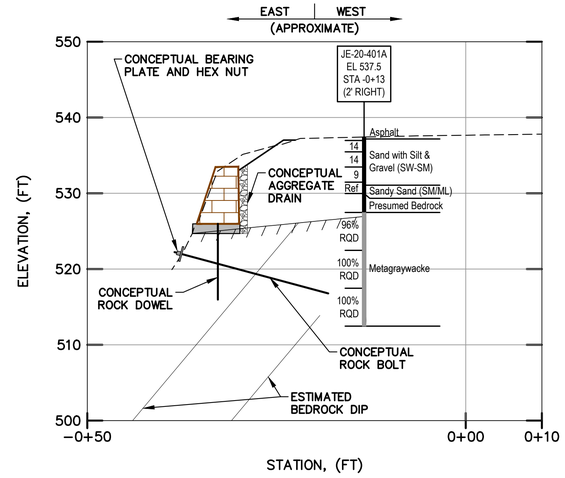

0+30

LEGEND

EXISTING GROUND (2020 DDK SURVEY)

ESTIMATED TOP OF BEDROCK

SURVEYED WATER LEVEL (2020 DDK SURVEY)

CONCEPTUAL STONE WALL TO BE RE−CONSTRUCTED (1)

CONCEPTUAL CONCRETE LEVELING PAD (2)

CONCEPTUAL FINAL GRADING (3)

NOTES
(1) ACTUAL STONE WALL LOCATION AND DIMENSIONS MAY VARY BASED ON THE FINAL DESIGN.
(2) ACTUAL CONCRETE LEVELING PAD LOCATION AND DIMENSIONS MAY VARY BASED ON THE FINAL DESIGN.
(3) ACTUAL FINAL GRADING MAY VARY BASED ON THE FINAL DESIGN.

SCALE
10 0 10 20 FEET

NOTES / REVISIONS

1. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. ALL PROPOSED REPAIR COMPONENTS, INCLUDING BUT NOT LIMITED TO THE STACKED STONE WALL, CONCRETE LEVELING PAD, ROCK BOLTS, ROCK DOWELS, AGGREGATE DRAIN, AND FINAL GRADING ARE SHOWN FOR PRESENTATION PURPOSES ONLY AND ARE CONCEPTUAL. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION.

ISSUED FOR	DATE	REV.	REVISION DESCRIPTION	MADE BY	CHKD BY	DATE
		4				
		3				
		2				
		1				

SEAL:

DDK Engineering-JV

USDA United States Department of Agriculture
Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and lender.

PROJECT NUMBER: 172719−24
FILE NAME: Geotechnical Report − Jericho − Plan and Sections.dwg
DRAWN BY: AA | DATE: 9/14/20
CHECKED BY: RMS | DATE: 9/25/20

JERICHO EWP SITE 5038-007
JERICHO, CHITTENDEN COUNTY, VERMONT

FIGURE 3
SECTIONS

SCALE: AS SHOWN | DRAWING: 3 | REV 0

Tuesday, October 6, 2020 10:07:38 AM

R:\2017\172719−24 − Jericho Site\Drawings − Geotechnical Report\Geotechnical Report − Jericho − Plan and Sections.dwg

APPENDIX A

BORING LOGS

DDK ENGINEERING
(a small business joint venture)
28 North Main Street
Randolph, VT 05060

VISUAL CLASSIFICATION LOG

JE-20-401
PAGE 1 OF 1

PROJECT: Jericho EWP Site 5038-007
PROJECT NUMBER: 172719-24
LOCATION: Jericho, VT
CLIENT: NRCS

DATE STARTED: 07/29/2020 **DRILLING CONTRACTOR:** NEBC
DATE COMPLETED: 07/29/2020 **DRILLER:** Mike Matarozzo
LOGGED BY: AA **DRILLING METHOD:** 2.25" ID HSA (6")
CHECKED BY: QDW **CORING METHOD:** N/A

LOCATION:
ELEVATION: 537.8 ft
NORTHING: 731,039.27
EASTING: 1,510,083.98

GROUND WATER LEVELS:
TIME OF DRILLING: N/A
END OF DRILLING: Dry
AFTER DRILLING: N/A

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	FIELD DESCRIPTION	LAB USCS	RECOVERY, ft (%)	SPT BLOW COUNT (N / ft) / RQD, ft (% RQD)	EST q_u (tsf)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
0			0.3 **Asphalt** 537.5					
	SpT-1		**Silty Sand With Gravel**, **(SM)**, Fine To Coarse, Very Loose To Loose, Brown And Dark Brown, Dry To Moist, (10-20% gravel, fine)	SM	0.5 (33)	5-6-4 (10)		NP
	SpT-2		4.0 533.8		0.9 (45)	1-2-1-2 (3)		
5			**Bottom of Boring at 4.0 feet.** **Boring terminated at 4.0 feet due to very loose soils encountered and the proximity of the drill rig to the existing slope failure.**					
10								
15								
20								
25								
30								

Notes:

NRCS - DAPP BORING LOG 172719-24 - JERICHO_2020-08-31 (FINAL).GPJ NOLAN RUN DATABASE TEMP.GDT 10/6/20

DDK ENGINEERING
(a small business joint venture)
28 North Main Street
Randolph, VT 05060

VISUAL CLASSIFICATION LOG

JE-20-401A
PAGE 1 OF 1

PROJECT: Jericho EWP Site 5038-007
PROJECT NUMBER: 172719-24
LOCATION: Jericho, VT
CLIENT: NRCS

DATE STARTED: 07/30/2020 **DRILLING CONTRACTOR:** NEBC
DATE COMPLETED: 07/30/2020 **DRILLER:** Mike Matarozzo
LOGGED BY: AA **DRILLING METHOD:** 2.25" ID HSA (6")
CHECKED BY: QDW **CORING METHOD:** NX (Cuttings Rem. w/Water)

LOCATION:
ELEVATION: 537.5 ft
NORTHING: 731,022.49
EASTING: 1,510,081.00

GROUND WATER LEVELS:
TIME OF DRILLING: Dry (before coring)
END OF DRILLING: N/A
AFTER DRILLING: N/A

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	FIELD DESCRIPTION	LAB USCS	RECOVERY, ft (%)	SPT BLOW COUNT (N / ft) / RQD, ft (% RQD)	EST q_u (tsf)
0			0.3 **Asphalt** 537.2				
	SpT-1		**Sand With Silt And Gravel**, **(SW-SM)**, Fine To Coarse, Loose To Compact, Brown And Dark Brown, Dry To Moist, (10-30% gravel, mostly fine)	SW-SM	1.0 (67)	10-7-7 (14)	
	SpT-2				0.7 (35)	4-3-11-31 (14)	
5	SpT-3				1.2 (60)	4-4-5-7 (9)	
	SpT-4		6.4 531.1		0.8 (53)	1-2-4-50/0.0'	
			7.5 **Silty Sand**, **(SM/ML)**, Loose, Dark Brown With Black, Moist, trace organics 530.0				
			Presumed bedrock based on drilling observations				
10			10.0 527.5				
	R-1		**Metagraywacke**, Slightly Weathered To Unweathered, Slightly Broken To Unbroken, Hard, Gray, No HCl Reaction 10.1' to 10.3': High Angle Fracture 11.6' to 11.8': High Angle Fracture 11.8' to 12.0': Quartzite, Weak HCl Reaction		5.0 (100)	4.8 (96)	
15							
	R-2		16.1' to 16.4': Quartzite, Weak HCl Reaction		5.0 (100)	5.0 (100)	
20							
	R-3				5.0 (100)	5.0 (100)	
25			25.0 512.5				
			Auger Refusal at 7.5 feet. **Bottom of Boring at 25.0 feet.**				
30							

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

NP
>>

Notes:

NRCS - DAPP BORING LOG 172719-24 - JERICHO_2020-08-31 (FINAL).GPJ NOLAN RUN DATABASE TEMP.GDT 10/6/20

DDK ENGINEERING
(a small business joint venture)
28 North Main Street
Randolph, VT 05060

VISUAL CLASSIFICATION LOG

JE-20-402
PAGE 1 OF 1

PROJECT: Jericho EWP Site 5038-007
PROJECT NUMBER: 172719-24
LOCATION: Jericho, VT
CLIENT: NRCS

DATE STARTED: 07/29/2020 **DRILLING CONTRACTOR:** NEBC
DATE COMPLETED: 07/30/2020 **DRILLER:** Mike Matarozzo
LOGGED BY: AA **DRILLING METHOD:** 2.25" ID HSA (6")
CHECKED BY: QDW **CORING METHOD:** NX (Cuttings Rem. w/Water)
LOCATION: **GROUND WATER LEVELS:**
ELEVATION: 536.9 ft ▽ **TIME OF DRILLING:** Dry (before coring)
NORTHING: 731,000.29 **END OF DRILLING:** N/A
EASTING: 1,510,079.85 **AFTER DRILLING:** N/A

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	FIELD DESCRIPTION	LAB USCS	RECOVERY, ft (%)	SPT BLOW COUNT (N / ft) / RQD, ft (% RQD)	EST q_u (tsf)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
0			0.5 **Asphalt** 536.4					
	SpT-1		**Silty Sand**, **(SM)**, Fine To Medium, Very Loose, Brown And Dark Brown, Dry To Moist, (0-5% gravel, fine)		1.0 (67)	5-4-3 (7)		
	SpT-2		SpT-1: loose		1.3 (65)	2-3-2-3 (5)		
5	SpT-3				1.4 (70)	1-2-1-2 (3)		
	SpT-4			SM	1.5 (75)	1-1-2-2 (3)		NP ☐
	SpT-5				0.8 (40)	2-1-1-1 (2)		
10	SpT-6		10.5 526.4 **Silty Sand**, **(SM/ML)**, Very Loose, Dark Brown With Black, Moist, trace organics, clayey lenses		1.3 (65)	0-1-1-1 (2)		
	SpT-7		13.2 523.7	SM	1.5 (75)	2-2-2-8 (4)	0.5 0.5	NP ☐
	SpT-8		**Silt**, **(ML)**, Soft, Gray, Moist To Wet, [Residual Soil], orange and black staining		0.2 (50)	50/0.4'		>>
15			15.5 521.4					
	R-1		**Metagraywacke**, Slightly Weathered To Unweathered, Slightly Broken To Unbroken, Hard, Gray, No HCl Reaction 16.7' to 17.0': High Angle Fracture 17.5' to 17.8': Quartzite, Weak HCl Reaction		5.0 (100)	4.7 (94)		
20								
	R-2				5.0 (100)	4.8 (96)		
25			25.3' to 25.5': Quartzite, Weak HCl Reaction 25.5 511.4					
			Auger Refusal at 14.4 feet. **Bottom of Boring at 25.5 feet.**					
30								

Notes:

NRCS - DAPP BORING LOG 172719-24 - JERICHO_2020-08-31 (FINAL).GPJ NOLAN RUN DATABASE TEMP.GDT 10/6/20

APPENDIX B

LABORATORY TEST RESULTS

August 28, 2020

Project No. 2020-422-001

Mr. Andrew Antell
D'Appolonia
701 Rodi Rd, Floor 2
Pittsburgh, PA 15235

Transmittal
Laboratory Test Results
NRCS-Jericho 172719-24

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens that were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectfully submitted,
Geotechnics, Inc.

Nathan Melaro
Director of Operations

We understand that you have a choice in your laboratory services and we thank you for choosing Geotechnics.

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MOISTURE CONTENT

ASTM D 2216-10

Client: D'Appolonia
Client Reference: NRCS - Jericho 172719-24
Project No.: 2020-422-001

Lab ID:	001	002	003	006	007
Boring No.:	JE-20-401	JE-20-401A	JE-20-401A	JE-20-402	JE-20-402
Depth (ft):	0.5-4.0	0.5-4.0	6.4-7.5	2.0-4.0	6.0-8.0
Sample No.:	SpT-1 & SpT-2	SpT-1 & SpT-2	SpT-4	SpT-2	SpT-4
Tare Number	35	34	30	19	24
Wt. of Tare & Wet Sample (g)	52.14	68.57	45.50	89.33	74.72
Wt. of Tare & Dry Sample (g)	48.88	65.42	34.07	79.60	69.20
Weight of Tare (g)	8.60	8.43	8.47	8.60	8.37
Weight of Water (g)	3.26	3.15	11.43	9.73	5.52
Weight of Dry Sample (g)	40.28	56.99	25.60	71.00	60.83
Water Content (%)	**8.1**	**5.5**	**44.6**	**13.7**	**9.1**

Lab ID	009	011
Boring No.	JE-20-402	JE-20-402
Depth (ft)	10.5-12.0	13.2-14.0
Sample No.	SpT-6	SpT-7
Tare Number	9	45
Wt. of Tare & Wet Sample (g)	66.65	35.60
Wt. of Tare & Dry Sample (g)	48.78	30.63
Weight of Tare (g)	8.20	8.47
Weight of Water (g)	17.87	4.97
Weight of Dry Sample (g)	40.58	22.16
Water Content (%)	**44.0**	**22.4**

Notes :

Tested By SG *Date* 8/17/20 *Checked By* JLK *Date* 8/19/20

DCN: CT-S1 DATE: 3/18/13 REVISION: 4

S:\Excel\Excel Qa\Spreadsheets\Water Content.xls

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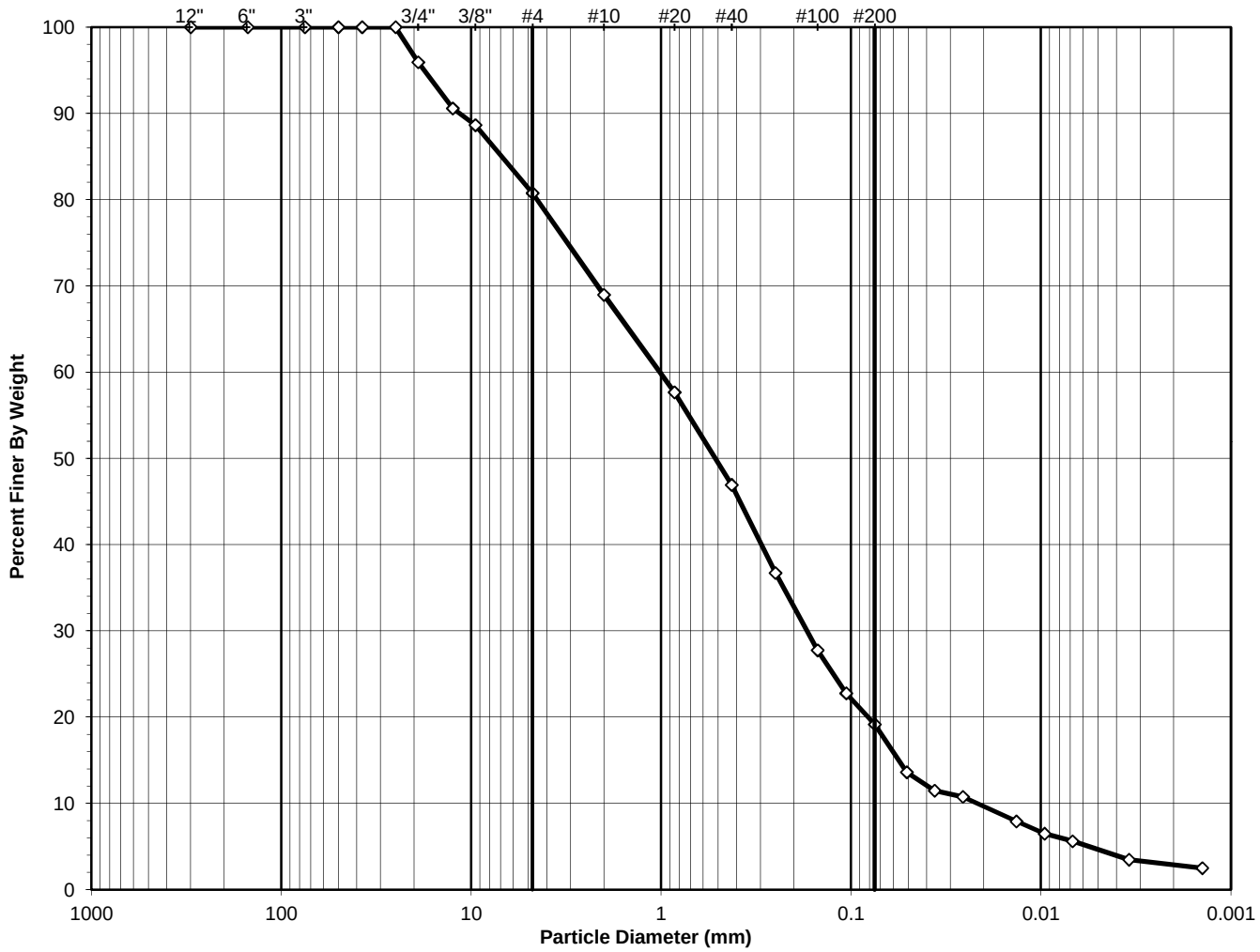
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	D'Appolonia	Boring No.:	JE-20-401
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-001	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
SM, TESTED

D50 = 0.52

USCS Classification:
SILTY SAND WITH GRAVEL
(NON-PLASTIC FINES)

Tested By NR Date 8/21/20 Checked By JLK Date 8/25/20

DCN: CT-S73J, DATE 5/22/17, REV. 1e

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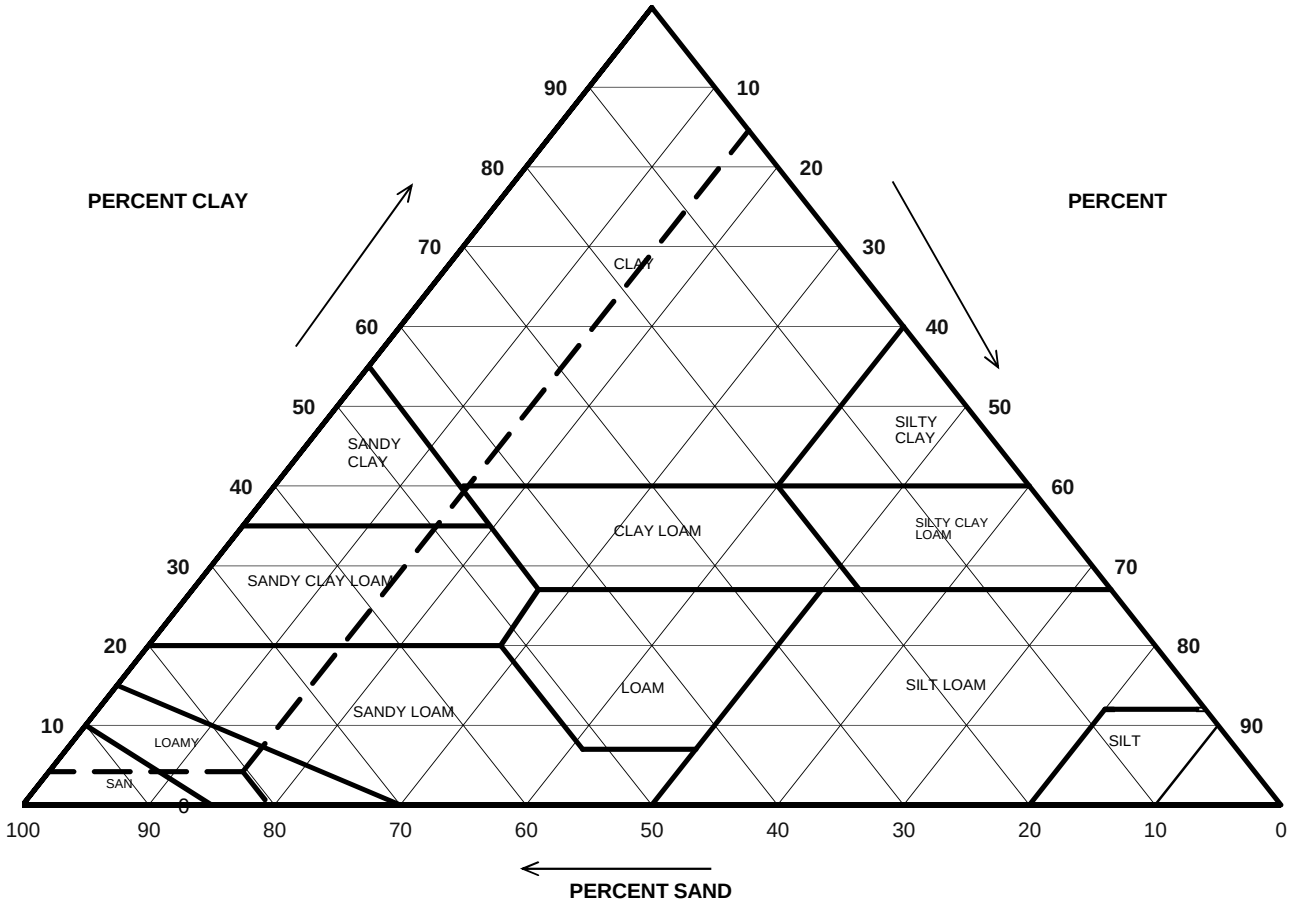
USDA CLASSIFICATION CHART

Client:	D'Appolonia	Boring No.:	JE-20-401
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-001	Soil Color:	Brown



USDA SUMMARY				
Particle Size (mm)	**Percent Finer**		**Actual Percentage**	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	**31.04**	
2	**68.96**	**Sand**	**55.45**	**80.41**
0.05	**13.51**	**Silt**	**10.63**	**15.41**
0.002	**2.88**	**Clay**	**2.88**	**4.18**

USDA Classification: LOAMY SAND

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	D'Appolonia	Boring No.:	JE-20-401
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-001	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	1435	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	437.34	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	437.34	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	145.16	Weight of Tare (g):	NA
Weight of Water (g):	0.00	Weight of Water (g):	NA
Weight of Dry Soil (g):	292.18	Weight of Dry Soil (g):	NA
Moisture Content (%):	**0.0**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	292.18
Tare No. (Sub-Specimen)	1435	Wet Weight of +3/4" Sample (g):	11.90
Wt. of Tare & Wet Sub-Specimen (g):	437.34	Dry Weight of + 3/4" Sample (g):	11.90
Weight of Tare (g):	145.16	Dry Weight of - 3/4" Sample (g):	280.28
Sub-Specimen Wet Weight (g):	292.18	Dry Weight -3/4" +3/8" Sample (g):	21.29
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	258.99
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	11.90		4.07	4.07	95.93	**96**
1/2"	12.5	15.62	(**)	5.35	9.42	90.58	**91**
3/8"	9.5	5.67		1.94	11.36	88.64	**89**
#4	4.75	23.02		7.88	19.24	80.76	**81**
#10	2	34.48		11.80	31.04	68.96	**69**
#20	0.85	33.00	(**)	11.29	42.33	57.67	**58**
#40	0.425	31.37		10.74	53.07	46.93	**47**
#60	0.25	29.83		10.21	63.28	36.72	**37**
#100	0.15	26.20		8.97	72.25	27.75	**28**
#140	0.106	14.56		4.98	77.23	22.77	**23**
#200	0.075	10.52		3.60	80.83	19.17	**19**
Pan	-	56.01		19.17	100.00	-	**-**

Notes : *(*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample*
*(**) The - 3/4" and - 3/8" sieve analysis is based on the Weight of the Dry Specimen*

Tested By NR Date 8/21/20 Checked By JLK Date 8/25/20

DCN: CT-S73J, DATE 5/22/17, REV. 1e

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HYDROMETER ANALYSIS

ASTM D7928-17

Client:	D'Appolonia	Boring No.:	JE-20-401
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-001	Soil Color:	Brown

Elapsed Time (min)	Reading rm	Temp. (C^{0})	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	15.0	23.2	5.45	14.2	0.0509	71.0	13.6
2	13.5	23.2	5.45	14.5	0.0363	59.9	11.5
4	13.0	23.2	5.45	14.6	0.0258	56.2	10.8
15	11.0	23.2	5.45	14.9	0.0135	41.3	7.9
30	10.0	23.2	5.45	15.1	0.0096	33.9	6.5
60	9.5	22.9	5.56	15.2	0.0068	29.3	5.6
240	8.0	22.9	5.56	15.5	0.0034	18.1	3.5
1440	7.5	22.4	5.75	15.6	0.0014	13.0	2.5

Soil Specimen Data

Tare No.:	2331	Percent Finer than # 200:	19.17
Wt. of Tare & Dry Material (g):	110.10		
Weight of Tare (g):	91.49	Specific Gravity:	2.60 Measured
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	13.61		

Notes: Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1819
Cylinder	G- 356
Thermometer	G- 1505
Balance	G- 657
#200 Sieve	G- 1944
Foam Inhibitor Used	No

Tested By TO Date 8/20/20 Checked By JLK Date 8/25/20

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ATTERBERG LIMITS

ASTM D 4318-17

Client:	D'Appolonia	Boring No.:	JE-20-401
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-001	Color:	Brown
			(MInus No. 40 sieve material)

As Received
Water Content

Tare Number	35
Wt. of Tare & Wet Sample (g)	52.14
Wt. of Tare & Dry Sample (g)	48.88
Weight of Tare (g)	8.60
Weight of Water (g)	3.26
Weight of Dry Sample (g)	40.28
Water Content (%)	**8.1**

NON - PLASTIC MATERIAL

Tested By *JP* *Date* *8/18/20* *Checked By* *JLK* *Date* *8/20/20*

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SPECIFIC GRAVITY

ASTM D 854-14

Client:	D'Appolonia	Boring No.:	JE-20-401
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-001	Visual Description:	Gray Sandy Clay

(MInus No.4 sieve material,oven dried)

Replicate Number	**1**	**2**
Pycnometer ID:	G 1917	G 1991
Weight of Pycnometer & Soil & Water (g):	745.6	746.8
Temperature (^{o}C):	25.2	25.4
Weight of Pycnometer & Water (g):	683.95	684.48
Tare Number:	506	706
Weight of Tare & Dry Soil (g):	198.32	197.33
Weight of Tare (g):	96.81	97.35
Weight of Dry Soil (g):	101.51	99.98
Specific Gravity of Soil @ Measured Temperature:	2.546	2.655
Specific Gravity of Water @ Measured Temperature:	0.99700	0.99695
Conversion Factor for Measured Temperature:	0.99879	0.99874
Specific Gravity @ 20^{o} Celsius:	2.549	2.658

Average Specific Gravity @ 20^{o} Celsius	2.60

Tested By TO *Date* 8/19/20 *Checked By* JLK *Date* 8/20/20

DCN: CT-S5 Date: 3/26/18 Revision: 21

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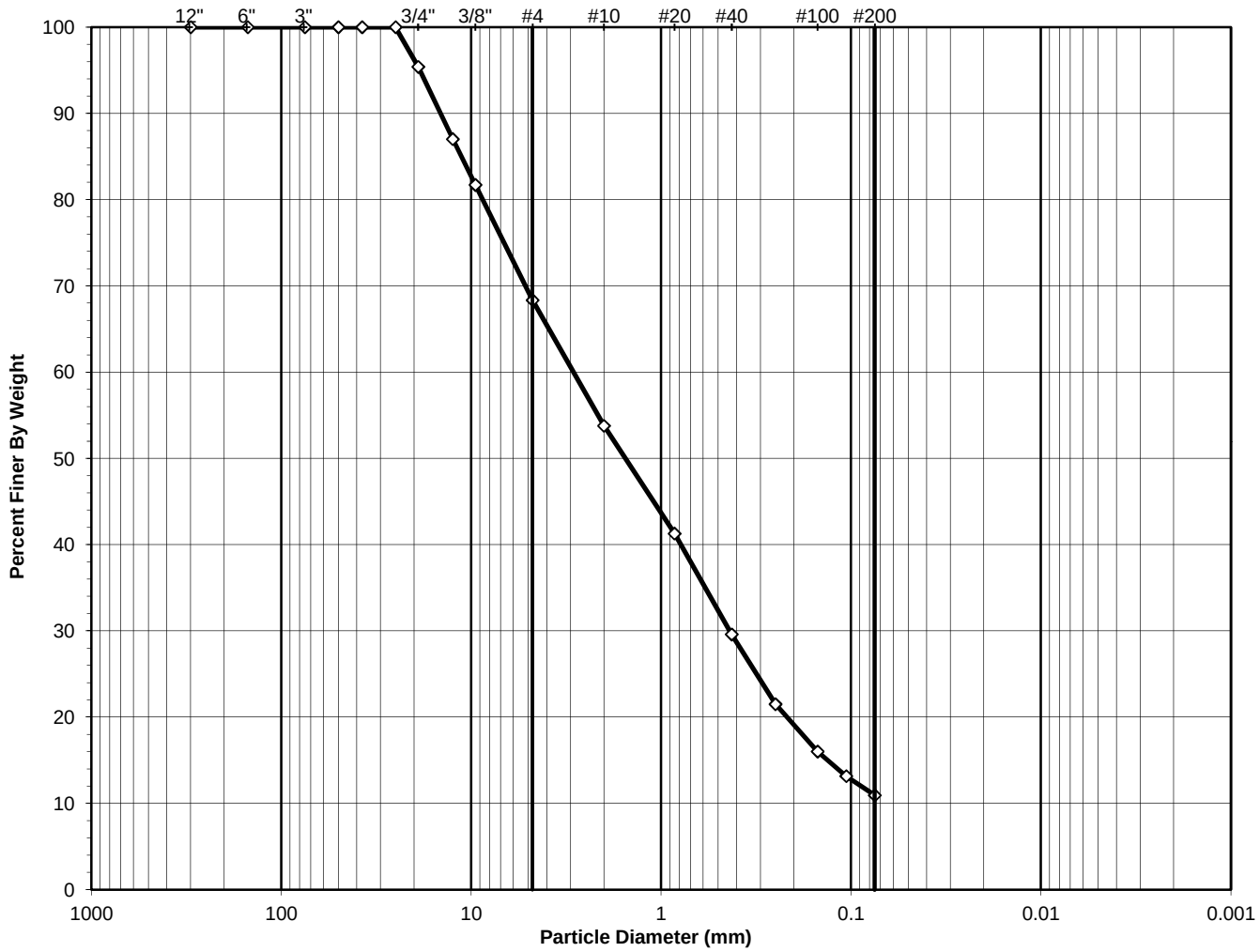
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	D'Appolonia	Boring No.:	JE-20-401A
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-002	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
SW-SM, TESTED

D60 = 2.89 D50 = 1.54

D30 = 0.44 CU = 50.27

USCS Classification:
WELL-GRADED SAND WITH SILT AND GRAVEL
(NON-PLASTIC FINES) Insufficient fines to run hydrometer.

D10 = 0.058

Tested By NR Date 8/21/20 Checked By JLK Date 8/25/20

DCN: CT-S73J, DATE 5/22/17, REV. 1e

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	D'Appolonia	Boring No.:	JE-20-401A
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-002	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	1442	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	483.25	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	483.25	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	145.85	Weight of Tare (g):	NA
Weight of Water (g):	0.00	Weight of Water (g):	NA
Weight of Dry Soil (g):	337.40	Weight of Dry Soil (g):	NA
Moisture Content (%):	**0.0**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	337.40
Tare No. (Sub-Specimen)	1442	Wet Weight of +3/4" Sample (g):	15.53
Wt. of Tare & Wet Sub-Specimen (g):	483.25	Dry Weight of + 3/4" Sample (g):	15.53
Weight of Tare (g):	145.85	Dry Weight of - 3/4" Sample (g):	321.87
Sub-Specimen Wet Weight (g):	337.40	Dry Weight -3/4" +3/8" Sample (g):	46.18
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	275.69
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	15.53		4.60	4.60	95.40	**95**
1/2"	12.5	28.25	(**)	8.37	12.98	87.02	**87**
3/8"	9.5	17.93		5.31	18.29	81.71	**82**
#4	4.75	45.07		13.36	31.65	68.35	**68**
#10	2	49.15		14.57	46.22	53.78	**54**
#20	0.85	42.16	(**)	12.50	58.71	41.29	**41**
#40	0.425	39.44		11.69	70.40	29.60	**30**
#60	0.25	27.30		8.09	78.49	21.51	**22**
#100	0.15	18.52		5.49	83.98	16.02	**16**
#140	0.106	9.62		2.85	86.83	13.17	**13**
#200	0.075	7.50		2.22	89.05	10.95	**11**
Pan	-	36.93		10.95	100.00	-	**-**

Notes : *(*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample*
*(**) The - 3/4" and - 3/8" sieve analysis is based on the Weight of the Dry Specimen*

Tested By NR Date 8/21/20 Checked By JLK Date 8/25/20

DCN: CT-S73J, DATE 5/22/17, REV. 1e

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ATTERBERG LIMITS

ASTM D 4318-17

Client:	D'Appolonia	Boring No.:	JE-20-401A
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-002	Color:	Brown
			(MInus No. 40 sieve material)

As Received
Water Content

Tare Number	34
Wt. of Tare & Wet Sample (g)	68.57
Wt. of Tare & Dry Sample (g)	65.42
Weight of Tare (g)	8.43
Weight of Water (g)	3.15
Weight of Dry Sample (g)	56.99
Water Content (%)	**5.5**

NON - PLASTIC MATERIAL

Tested By *JP* *Date* *8/18/20* *Checked By* *JLK* *Date* *8/20/20*

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SPECIFIC GRAVITY

ASTM D 854-14

Client:	D'Appolonia	Boring No.:	JE-20-401A
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	0.5-4.0'
Project No.:	2020-422-001	Sample No.:	SpT-1 & SpT-2
Lab ID:	2020-422-001-002	Visual Description:	Brown Sandy Clay

(MInus No.4 sieve material,oven dried)

Replicate Number	**1**	**2**
Pycnometer ID:	G 1917	G 1991
Weight of Pycnometer & Soil & Water (g):	745.52	747.86
Temperature (^{o}C):	27.0	27.5
Weight of Pycnometer & Water (g):	683.72	684.20
Tare Number:	966	692
Weight of Tare & Dry Soil (g):	199.46	192.45
Weight of Tare (g):	99.08	91.73
Weight of Dry Soil (g):	100.38	100.72
Specific Gravity of Soil @ Measured Temperature:	2.602	2.718
Specific Gravity of Water @ Measured Temperature:	0.99652	0.99638
Conversion Factor for Measured Temperature:	0.99831	0.99817
Specific Gravity @ 20^{o} Celsius:	2.607	2.723

Average Specific Gravity @ 20^{o} Celsius	2.66

Tested By TO *Date* 8/19/20 *Checked By* JLK *Date* 8/20/20

DCN: CT-S5 Date: 3/26/18 Revision: 21

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UNCONFINED COMPRESSION STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C
This method does not report strain rate or deformation.
Sample Prep and Conformance Verification: ASTM D 4543-08

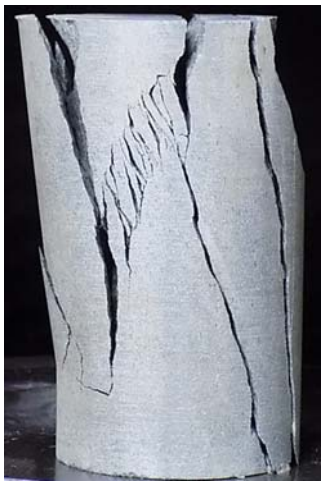
Client:	D'Appolonia	Boring No.:	JE-20-401A
Client Project:	NRCS-Jericho 172719-24	Depth (ft):	12.1-12.9
Project No.:	2020-422-001	Sample ID:	R-1
Lab ID No.:	2020-422-001-004	Moisture Condition:	As Received-Unpreserved

Specimen Weight (g): 567.96

SPECIMEN LENGTH (in)		SPECIMEN DIAMETER (in):	
Reading 1:	4.02	Reading 1:	1.98
Reading 2:	4.02	Reading 2:	1.98
Reading 3:	4.02	Average:	**1.98**
Average:	**4.02**	Area (in^2):	3.08
		L/D:	2.03

MOISTURE CONTENT			
Tare Number:	3501	Total Load (lb):	32,940
Wt. of Tare & Wet Sample (g):	562.01	**Uniaxial Compressive Strength (psi):**	**10,690**
Wt. of Tare & Dry Sample (g):	561.59		
Weight of Tare (g):	8.05	Fracture Type:	**Cone & Split**
Weight of Wet Sample (g):	553.96		
Sample Volume (cm^3):	202.94	Rate of Loading (lb/sec):	173
Moisture Content (%):	0.08	Time to Break (min:sec):	3:10.19
Unit Wet Weight (g/cm^3):	2.799	Deviation From Straightness[3]:	
Unit Wet Weight (pcf):	174.6		
Unit Dry Weight (g/cm^3):	2.797	AXIAL: *Pass*	TOP: *Pass* BOTTOM: *Pass*
Unit Dry Weight (pcf):	174.5		

Physical Description: Rock Core



Notes:

1) Moisture conditions at time of the test are: As Received-Unpreserved
2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
3) Deviation from straightness, Procedure A of ASTM D 4543-08
   Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
4) Temperature is laboratory room temperature.
5) D4543 Prep and D7012 Testing Equipment Used:
6) Tool / Machine List:
   G788 Compression Machine
   G1661 Digital Calipers, G1380 Dial Gauge
   G1616 Straight Edge, G1571 Feeler Gauge
   G1633 V-Block, G1634 Rock Saw, G1635 Grinder

Tested By: JAC Date: 8/18/20 *Checked By:* NJM *Date:* 8/19/20

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UNCONFINED COMPRESSION STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C
This method does not report strain rate or deformation.
Sample Prep and Conformance Verification: ASTM D 4543-08

Client:	D'Appolonia	Boring No.:	JE-20-401A
Client Project:	NRCS-Jericho 172719-24	Depth (ft):	24.2-25.0
Project No.:	2020-422-001	Sample ID:	R-3
Lab ID No.:	2020-422-001-005	Moisture Condition:	As Received-Unpreserved

Specimen Weight (g): 563.50

SPECIMEN LENGTH (in)		SPECIMEN DIAMETER (in):	
Reading 1:	3.98	Reading 1:	1.98
Reading 2:	3.98	Reading 2:	1.98
Reading 3:	3.98	Average:	**1.98**
Average:	**3.98**	Area (in^2):	3.07
		L/D:	2.02

MOISTURE CONTENT

Tare Number:	3103	Total Load (lb):	29,520
Wt. of Tare & Wet Sample (g):	567.25	**Uniaxial Compressive Strength (psi):**	**9,630**
Wt. of Tare & Dry Sample (g):	566.75		
Weight of Tare (g):	8.05	Fracture Type:	**Cone & Split**
Weight of Wet Sample (g):	559.20		
Sample Volume (cm^3):	200.14	Rate of Loading (lb/sec):	164
Moisture Content (%):	0.09	Time to Break (min:sec):	2:59.71
Unit Wet Weight (g/cm^3):	2.815	Deviation From Straightness[3]:	
Unit Wet Weight (pcf):	175.7		
Unit Dry Weight (g/cm^3):	2.813	AXIAL: *Pass*	TOP: *Pass* BOTTOM: *Pass*
Unit Dry Weight (pcf):	175.5		

Physical Description: Rock Core

Notes:

1) Moisture conditions at time of the test are: As Received-Unpreserved
2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
3) Deviation from straightness, Procedure A of ASTM D 4543-08
   Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
4) Temperature is laboratory room temperature.
5) D4543 Prep and D7012 Testing Equipment Used:
6) Tool / Machine List:
   G788 Compression Machine
   G1661 Digital Calipers, G1380 Dial Gauge
   G1616 Straight Edge, G1571 Feeler Gauge
   G1633 V-Block, G1634 Rock Saw, G1635 Grinder

Tested By: JAC Date: 8/18/20 *Checked By:* NJM *Date:* 8/19/20

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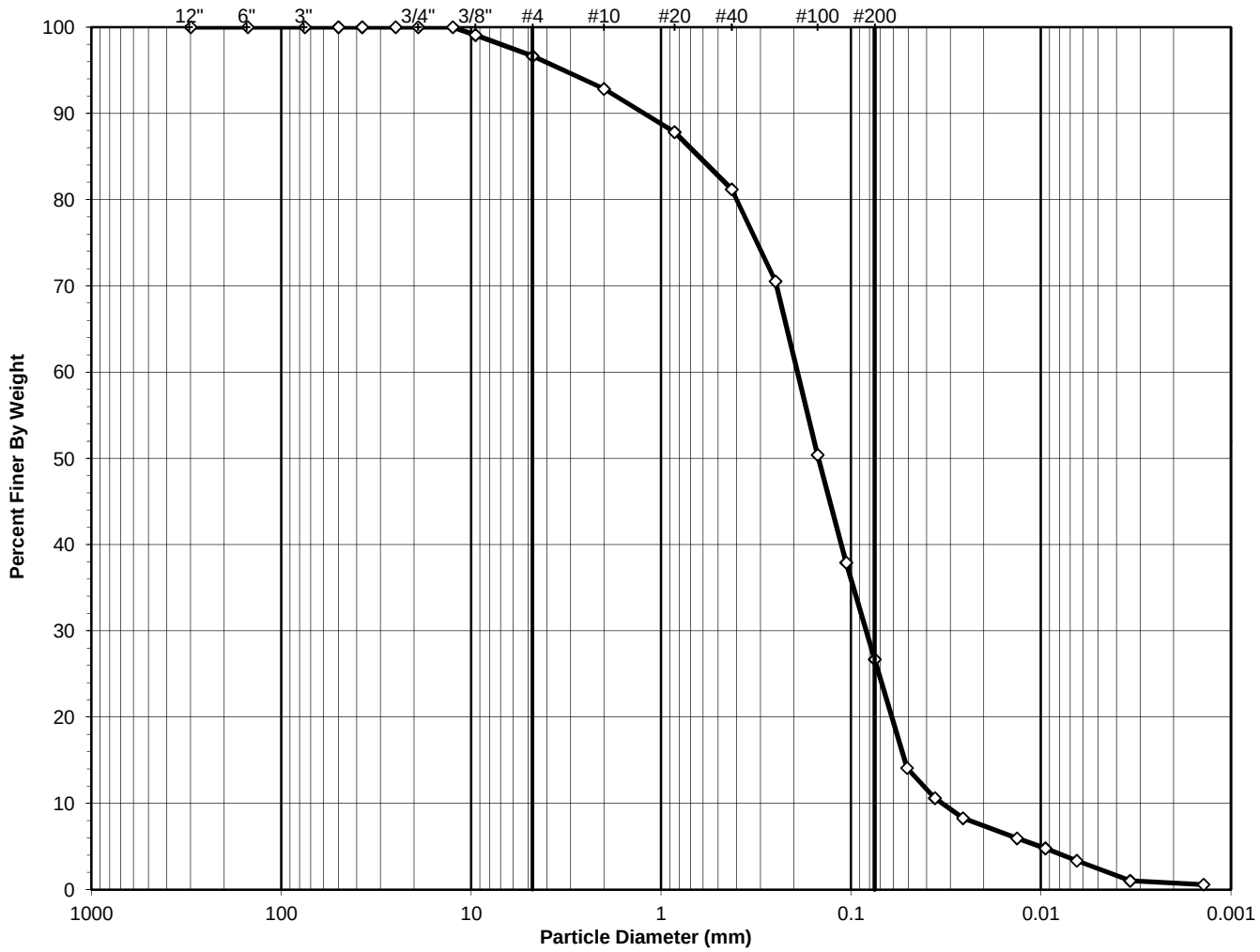
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	6.0-8.0'
Project No.:	2020-422-001	Sample No.:	SpT-4
Lab ID:	2020-422-001-008	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
SM, TESTED

D50 = 0.15

USCS Classification:
SILTY SAND
(NON-PLASTIC FINES)

Tested By NR Date 8/25/20 Checked By JLK Date 8/26/20

DCN: CT-S73J, DATE 5/22/17, REV. 1e

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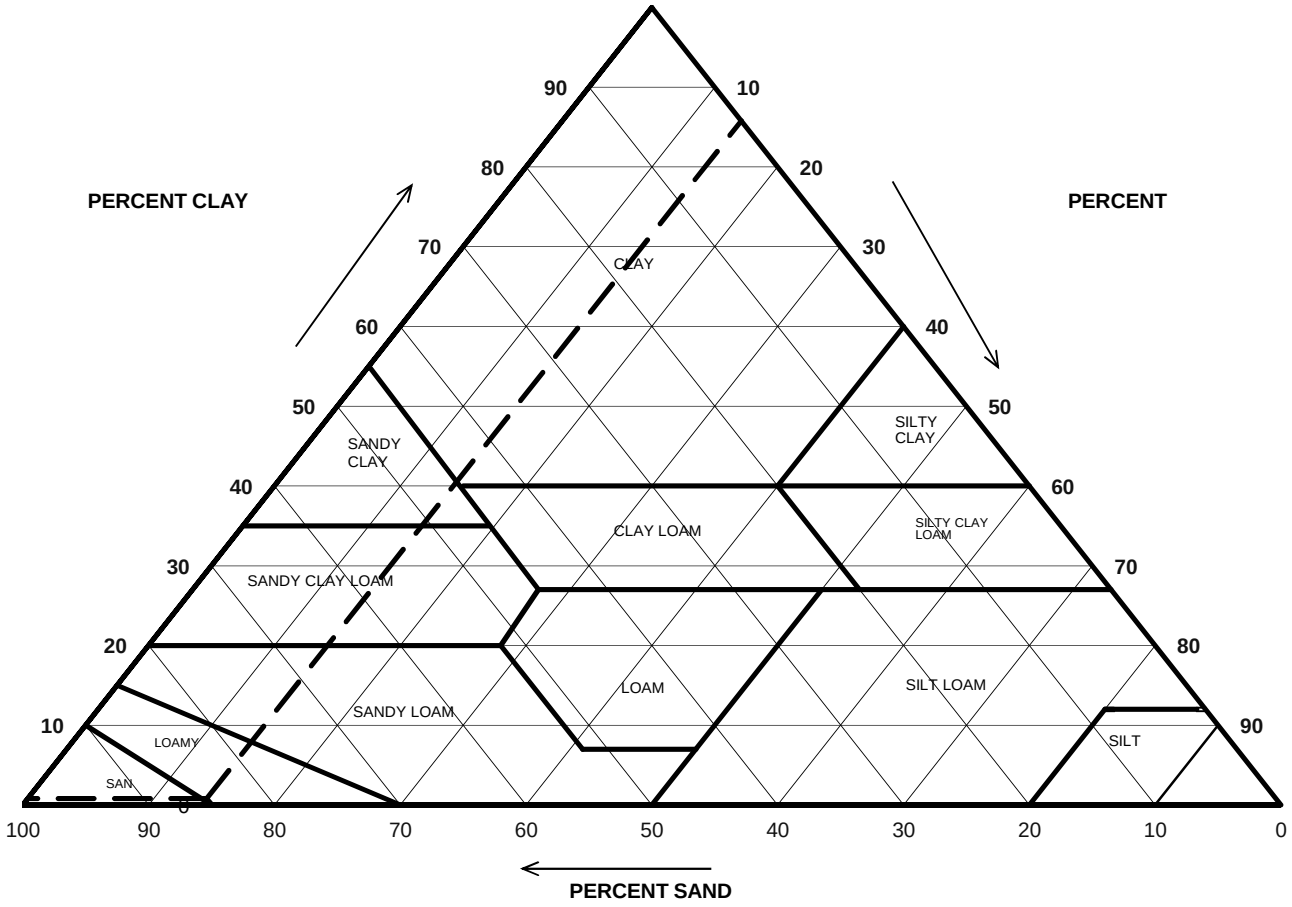
USDA CLASSIFICATION CHART

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	6.0-8.0'
Project No.:	2020-422-001	Sample No.:	SpT-4
Lab ID:	2020-422-001-008	Soil Color:	Brown



USDA SUMMARY				
Particle Size (mm)	**Percent Finer**		**Actual Percentage**	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	**7.16**	
2	**92.84**	**Sand**	**78.88**	**84.96**
0.05	**13.96**	**Silt**	**13.19**	**14.21**
0.002	**0.77**	**Clay**	**0.77**	**0.83**

USDA Classification: LOAMY SAND

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	6.0-8.0'
Project No.:	2020-422-001	Sample No.:	SpT-4
Lab ID:	2020-422-001-008	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	1485	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	354.45	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	354.45	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	147.75	Weight of Tare (g):	NA
Weight of Water (g):	0.00	Weight of Water (g):	NA
Weight of Dry Soil (g):	206.70	Weight of Dry Soil (g):	NA
Moisture Content (%):	**0.0**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	206.70
Tare No. (Sub-Specimen)	1485	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	354.45	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	147.75	Dry Weight of - 3/4" Sample (g):	206.70
Sub-Specimen Wet Weight (g):	206.70	Dry Weight -3/4" +3/8" Sample (g):	1.88
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	204.82
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	0.00		0.00	0.00	100.00	**100**
1/2"	12.5	0.00	(**)	0.00	0.00	100.00	**100**
3/8"	9.5	1.88		0.91	0.91	99.09	**99**
#4	4.75	5.06		2.45	3.36	96.64	**97**
#10	2	7.86		3.80	7.16	92.84	**93**
#20	0.85	10.35	(**)	5.01	12.17	87.83	**88**
#40	0.425	13.71		6.63	18.80	81.20	**81**
#60	0.25	22.06		10.67	29.47	70.53	**71**
#100	0.15	41.60		20.13	49.60	50.40	**50**
#140	0.106	25.80		12.48	62.08	37.92	**38**
#200	0.075	23.19		11.22	73.30	26.70	**27**
Pan	-	55.19		26.70	100.00	-	**-**

Notes : *(*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample*
*(**) The - 3/4" and - 3/8" sieve analysis is based on the Weight of the Dry Specimen*

Tested By NR Date 8/25/20 Checked By JLK Date 8/26/20

DCN: CT-S73J, DATE 5/22/17, REV. 1e

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HYDROMETER ANALYSIS

ASTM D7928-17

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	6.0-8.0'
Project No.:	2020-422-001	Sample No.:	SpT-4
Lab ID:	2020-422-001-008	Soil Color:	Brown

Elapsed Time (min)	Reading rm	Temp. (C^0)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	11.5	23.2	5.45	14.9	0.0507	52.8	14.1
2	10.0	23.2	5.45	15.1	0.0362	39.7	10.6
4	9.0	23.2	5.45	15.3	0.0257	31.0	8.3
15	8.0	23.2	5.45	15.5	0.0134	22.3	6.0
30	7.5	23.2	5.45	15.6	0.0095	17.9	4.8
65	7.0	22.9	5.56	15.7	0.0065	12.6	3.4
240	6.0	22.9	5.56	15.8	0.0034	3.8	1.0
1440	6.0	22.4	5.75	15.8	0.0014	2.2	0.6

Soil Specimen Data

Tare No.:	697	Percent Finer than # 200:	26.70	
Wt. of Tare & Dry Material (g):	112.21			
Weight of Tare (g):	95.83	Specific Gravity:	2.68	Measured
Weight of Deflocculant (g):	5.0			
Weight of Dry Material (g):	11.38			

Notes: Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1819
Cylinder	G- 356
Thermometer	G- 1505
Balance	G- 657
#200 Sieve	G- 1944
Foam Inhibitor Used	No

Tested By	TO	Date	8/20/20	Checked By	JLK	Date	8/26/20

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ATTERBERG LIMITS

ASTM D 4318-17

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	6.0-8.0'
Project No.:	2020-422-001	Sample No.:	SpT-4
Lab ID:	2020-422-001-008	Color:	Brown
			(MInus No. 40 sieve material)

As Received
Water Content

Tare Number	13
Wt. of Tare & Wet Sample (g)	51.56
Wt. of Tare & Dry Sample (g)	47.78
Weight of Tare (g)	8.49
Weight of Water (g)	3.78
Weight of Dry Sample (g)	39.29
Water Content (%)	**9.6**

NON - PLASTIC MATERIAL

Tested By *JP* *Date* *8/18/20* *Checked By* *JLK* *Date* *8/20/20*

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SPECIFIC GRAVITY

ASTM D 854-14

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	6.0-8.0'
Project No.:	2020-422-001	Sample No.:	SpT-4
Lab ID:	2020-422-001-008	Visual Description:	Brown Sand

(MInus No.4 sieve material,oven dried)

Replicate Number	**1**	**2**
Pycnometer ID:	G 1917	G 1991
Weight of Pycnometer & Soil & Water (g):	743.83	746.76
Temperature (^{o}C):	25.7	26.1
Weight of Pycnometer & Water (g):	683.89	684.39
Tare Number:	633	649
Weight of Tare & Dry Soil (g):	191.34	191.25
Weight of Tare (g):	94.18	93.01
Weight of Dry Soil (g):	97.16	98.24
Specific Gravity of Soil @ Measured Temperature:	2.610	2.739
Specific Gravity of Water @ Measured Temperature:	0.99687	0.99677
Conversion Factor for Measured Temperature:	0.99866	0.99856
Specific Gravity @ 20^{o} Celsius:	2.614	2.743

Average Specific Gravity @ 20^{o} Celsius	2.68

Tested By TO *Date* 8/21/20 *Checked By* JLK *Date* 8/24/20

DCN: CT-S5 Date: 3/26/18 Revision: 21

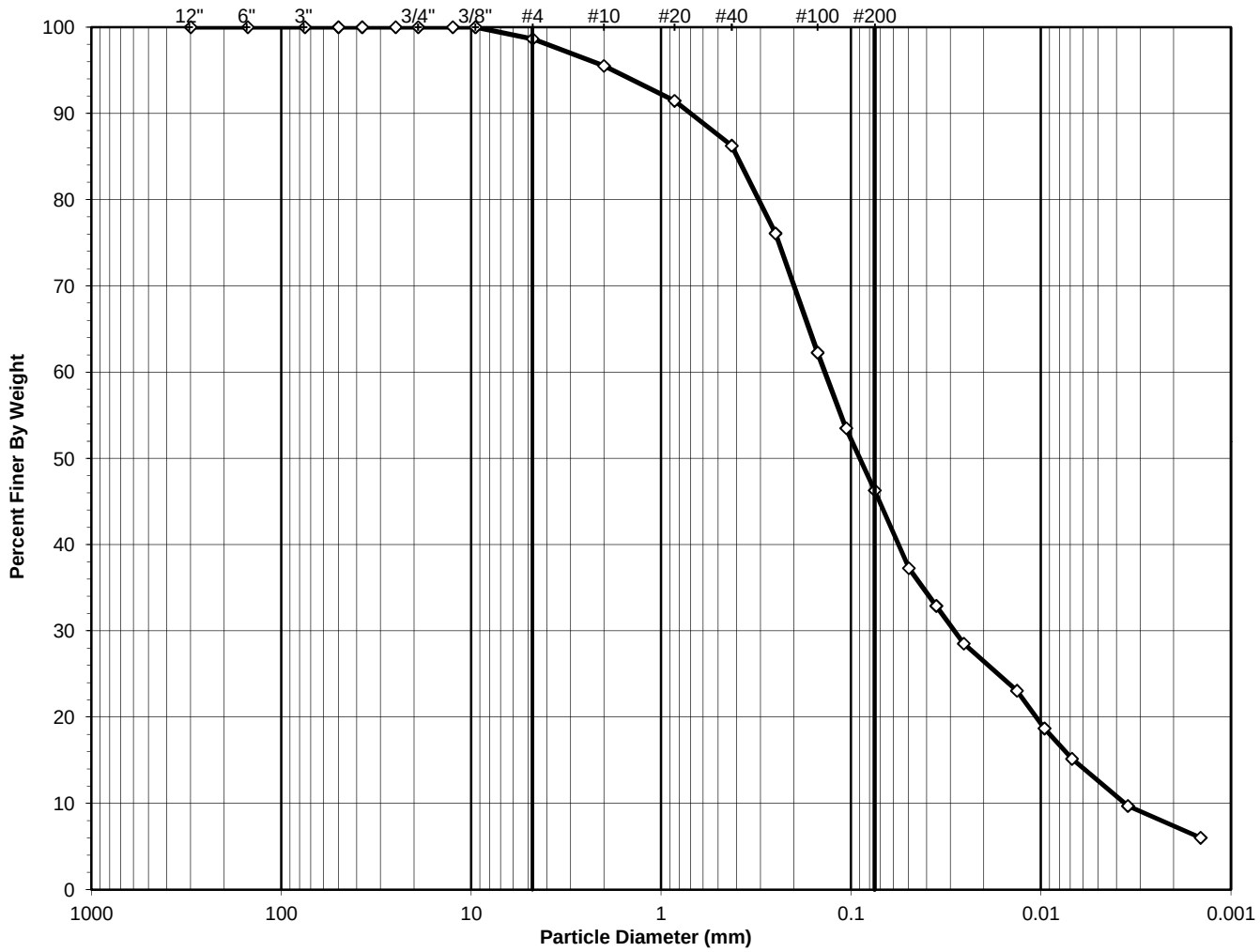
S:\Excel\Excel QA\Spreadsheets\Specific Gravity.xls

SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	12.0-13.2'
Project No.:	2020-422-001	Sample No.:	SpT-7
Lab ID:	2020-422-001-010	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
SM, TESTED

D50 = 0.09

USCS Classification:
SILTY SAND
(NON-PLASTIC FINES)

Tested By NR Date 8/21/20 Checked By JLK Date 8/25/20

DCN: CT-S73J, DATE 5/22/17, REV. 1e

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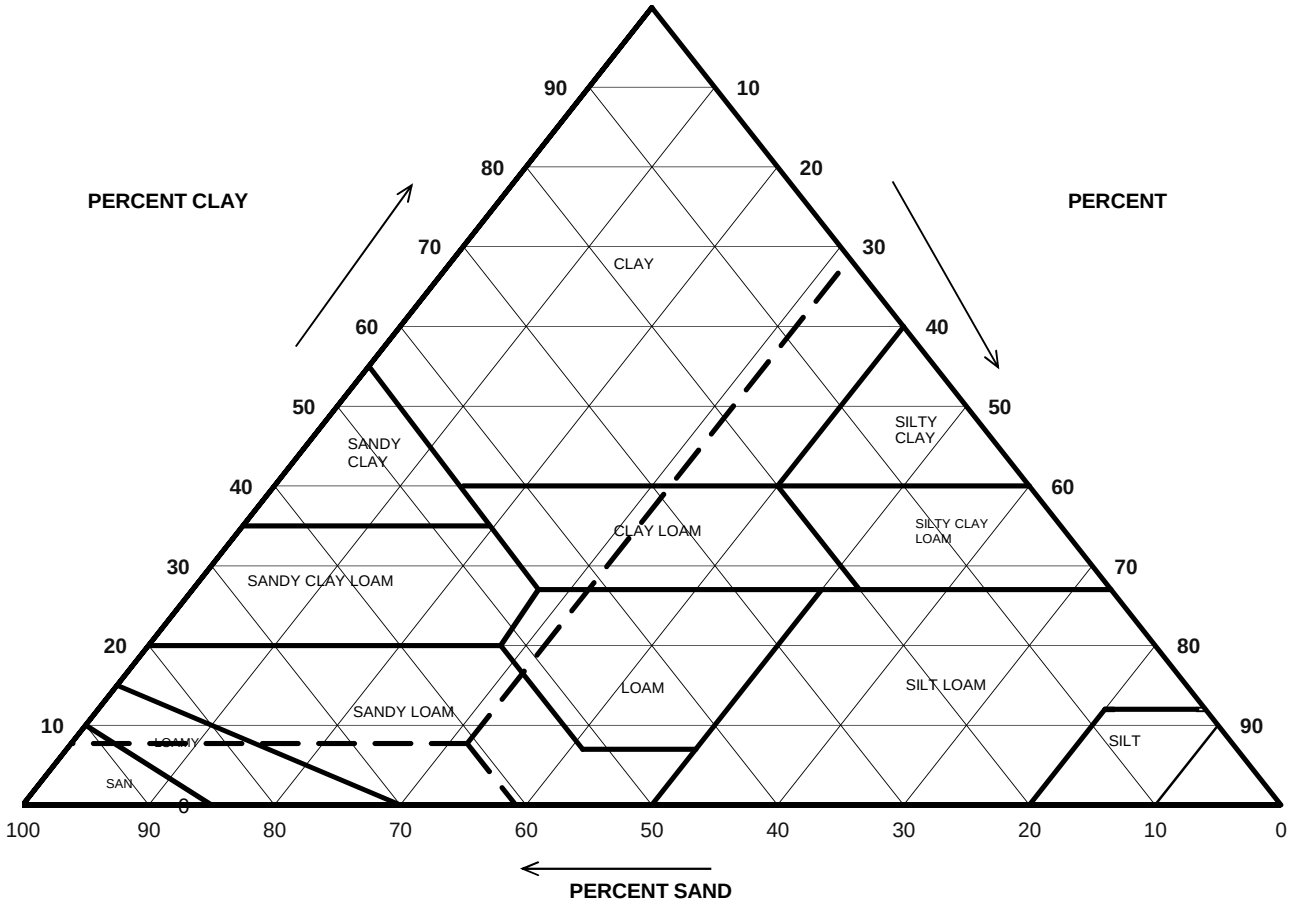
USDA CLASSIFICATION CHART

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	12.0-13.2'
Project No.:	2020-422-001	Sample No.:	SpT-7
Lab ID:	2020-422-001-010	Soil Color:	Brown



USDA SUMMARY				
Particle Size (mm)	**Percent Finer**		**Actual Percentage**	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	**4.49**	
2	**95.51**	**Sand**	**58.08**	**60.81**
0.05	**37.43**	**Silt**	**30.05**	**31.46**
0.002	**7.38**	**Clay**	**7.38**	**7.73**

USDA Classification: SANDY LOAM

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	12.0-13.2'
Project No.:	2020-422-001	Sample No.:	SpT-7
Lab ID:	2020-422-001-010	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	2042	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	293.40	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	293.40	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	147.93	Weight of Tare (g):	NA
Weight of Water (g):	0.00	Weight of Water (g):	NA
Weight of Dry Soil (g):	145.47	Weight of Dry Soil (g):	NA
Moisture Content (%):	**0.0**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	145.47
Tare No. (Sub-Specimen)	2042	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	293.40	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	147.93	Dry Weight of - 3/4" Sample (g):	145.47
Sub-Specimen Wet Weight (g):	145.47	Dry Weight -3/4" +3/8" Sample (g):	0.00
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	145.47
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	0.00		0.00	0.00	100.00	**100**
1/2"	12.5	0.00	(**)	0.00	0.00	100.00	**100**
3/8"	9.5	0.00		0.00	0.00	100.00	**100**
#4	4.75	1.97		1.35	1.35	98.65	**99**
#10	2	4.56		3.13	4.49	95.51	**96**
#20	0.85	5.89	(**)	4.05	8.54	91.46	**91**
#40	0.425	7.57		5.20	13.74	86.26	**86**
#60	0.25	14.79		10.17	23.91	76.09	**76**
#100	0.15	20.11		13.82	37.73	62.27	**62**
#140	0.106	12.75		8.76	46.50	53.50	**54**
#200	0.075	10.49		7.21	53.71	46.29	**46**
Pan	-	67.34		46.29	100.00	-	**-**

Notes : *(*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample*
*(**) The - 3/4" and - 3/8" sieve analysis is based on the Weight of the Dry Specimen*

Tested By NR Date 8/21/20 Checked By JLK Date 8/25/20

DCN: CT-S73J, DATE 5/22/17, REV. 1e

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HYDROMETER ANALYSIS

ASTM D7928-17

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	12.0-13.2'
Project No.:	2020-422-001	Sample No.:	SpT-7
Lab ID:	2020-422-001-010	Soil Color:	Brown

Elapsed Time (min)	Reading rm	Temp. (C^0)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	22.5	23.2	5.45	12.9	0.0496	80.5	37.3
2	20.5	23.2	5.45	13.2	0.0356	71.1	32.9
4	18.5	23.2	5.45	13.6	0.0255	61.6	28.5
15	16.0	23.2	5.45	14.0	0.0134	49.8	23.1
30	14.0	23.2	5.45	14.4	0.0096	40.4	18.7
60	12.5	22.9	5.56	14.7	0.0069	32.8	15.2
240	10.0	22.9	5.56	15.1	0.0035	21.0	9.7
1440	8.5	22.4	5.75	15.4	0.0014	13.0	6.0

Soil Specimen Data

Tare No.:	685	Percent Finer than # 200:	46.29	
Wt. of Tare & Dry Material (g):	123.23			
Weight of Tare (g):	96.37	Specific Gravity:	2.52	Measured
Weight of Deflocculant (g):	5.0			
Weight of Dry Material (g):	21.86			

Notes: Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1819
Cylinder	G- 356
Thermometer	G- 1505
Balance	G- 657
#200 Sieve	G- 1944
Foam Inhibitor Used	No

Tested By	TO	Date	8/20/20	Checked By	JLK	Date	8/25/20

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ATTERBERG LIMITS

ASTM D 4318-17

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	12.0-13.2'
Project No.:	2020-422-001	Sample No.:	SpT-7
Lab ID:	2020-422-001-010	Color:	Brown
			(MInus No. 40 sieve material)

As Received
Water Content

Tare Number	37
Wt. of Tare & Wet Sample (g)	43.77
Wt. of Tare & Dry Sample (g)	33.33
Weight of Tare (g)	8.29
Weight of Water (g)	10.44
Weight of Dry Sample (g)	25.04
Water Content (%)	**41.7**

NON - PLASTIC MATERIAL

Tested By *JP* *Date* *8/18/20* *Checked By* *JLK* *Date* *8/20/20*

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SPECIFIC GRAVITY

ASTM D 854-14

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Reference:	NRCS-Jericho 172719-24	Depth (ft):	12.0-13.2'
Project No.:	2020-422-001	Sample No.:	SpT-7
Lab ID:	2020-422-001-010	Visual Description:	Brown Clay

(MInus No.4 sieve material,oven dried)

Replicate Number	**1**	**2**
Pycnometer ID:	G 1917	G 1991
Weight of Pycnometer & Soil & Water (g):	723.65	727.6
Temperature (^{o}C):	26.5	27.2
Weight of Pycnometer & Water (g):	683.78	684.24
Tare Number:	1019	949
Weight of Tare & Dry Soil (g):	167.07	166.6
Weight of Tare (g):	99.49	95.92
Weight of Dry Soil (g):	67.58	70.68
Specific Gravity of Soil @ Measured Temperature:	2.439	2.587
Specific Gravity of Water @ Measured Temperature:	0.99666	0.99647
Conversion Factor for Measured Temperature:	0.99845	0.99826
Specific Gravity @ 20^{o} Celsius:	2.442	2.592

Average Specific Gravity @ 20^{o} Celsius	2.52

Tested By TO *Date* 8/19/20 *Checked By* JLK *Date* 8/20/20

DCN: CT-S5 Date: 3/26/18 Revision: 21

S:\Excel\Excel QA\Spreadsheets\Specific Gravity.xls

UNCONFINED COMPRESSION STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C
This method does not report strain rate or deformation.
Sample Prep and Conformance Verification: ASTM D 4543-08

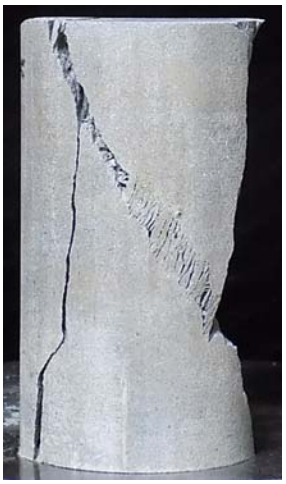
Client:	D'Appolonia	Boring No.:	JE-20-402
Client Project:	NRCS-Jericho 172719-24	Depth (ft):	18.4-19.2
Project No.:	2020-422-001	Sample ID:	R-1
Lab ID No.:	2020-422-001-012	Moisture Condition:	As Received-Unpreserved

Specimen Weight (g): 558.42

SPECIMEN LENGTH (in)		SPECIMEN DIAMETER (in):	
Reading 1:	4.00	Reading 1:	1.97
Reading 2:	4.00	Reading 2:	1.97
Reading 3:	4.00	Average:	**1.97**
Average:	**4.00**	Area (in^2):	3.06
		L/D:	2.03

MOISTURE CONTENT			
Tare Number:	2936	Total Load (lb):	30,070
Wt. of Tare & Wet Sample (g):	545.79	**Uniaxial Compressive Strength (psi):**	**9,840**
Wt. of Tare & Dry Sample (g):	545.12		
Weight of Tare (g):	8.05	Fracture Type:	**Cone & Split**
Weight of Wet Sample (g):	537.74		
Sample Volume (cm^3):	200.20	Rate of Loading (lb/sec):	167
Moisture Content (%):	0.12	Time to Break (min:sec):	2:59.62
Unit Wet Weight (g/cm^3):	2.789	Deviation From Straightness[3]:	
Unit Wet Weight (pcf):	174.1		
Unit Dry Weight (g/cm^3):	2.786	AXIAL: *Pass*	TOP: *Pass* BOTTOM: *Pass*
Unit Dry Weight (pcf):	173.8		

Physical Description: Rock Core



Notes:

1) Moisture conditions at time of the test are: As Received-Unpreserved
2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
3) Deviation from straightness, Procedure A of ASTM D 4543-08
   Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
4) Temperature is laboratory room temperature.
5) D4543 Prep and D7012 Testing Equipment Used:
6) Tool / Machine List:
   G788 Compression Machine
   G1661 Digital Calipers, G1380 Dial Gauge
   G1616 Straight Edge, G1571 Feeler Gauge
   G1633 V-Block, G1634 Rock Saw, G1635 Grinder

Tested By: JAC Date: 8/18/20 *Checked By:* NJM *Date:* 8/19/20

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UNCONFINED COMPRESSION STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C
This method does not report strain rate or deformation.
Sample Prep and Conformance Verification: ASTM D 4543-08

Client:	D'Appolonia	Boring No.:	JE-20-402
Client Project:	NRCS-Jericho 172719-24	Depth (ft):	24.4-25.2
Project No.:	2020-422-001	Sample ID:	R-2
Lab ID No.:	2020-422-001-013	Moisture Condition:	As Received-Unpreserved

Specimen Weight (g): 561.67

SPECIMEN LENGTH (in)		SPECIMEN DIAMETER (in):	
Reading 1:	4.03	Reading 1:	1.98
Reading 2:	4.03	Reading 2:	1.98
Reading 3:	4.03	Average:	**1.98**
Average:	**4.03**	Area (in^2):	3.09
		L/D:	2.03

MOISTURE CONTENT			
Tare Number:	2992	Total Load (lb):	64,590
Wt. of Tare & Wet Sample (g):	458.57	**Uniaxial Compressive Strength (psi):**	**20,920**
Wt. of Tare & Dry Sample (g):	458.17		
Weight of Tare (g):	8.10	Fracture Type:	**Cone & Split**
Weight of Wet Sample (g):	450.47		
Sample Volume (cm^3):	203.96	Rate of Loading (lb/sec):	214
Moisture Content (%):	0.09	Time to Break (min:sec):	5:01.75
Unit Wet Weight (g/cm^3):	2.754	Deviation From Straightness[3]:	
Unit Wet Weight (pcf):	171.8		
Unit Dry Weight (g/cm^3):	2.751	AXIAL: *Pass*	TOP: *Pass* BOTTOM: *Pass*
Unit Dry Weight (pcf):	171.7		

Physical Description: Rock Core

Notes:

1) Moisture conditions at time of the test are: As Received-Unpreserved
2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
3) Deviation from straightness, Procedure A of ASTM D 4543-08
   Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
4) Temperature is laboratory room temperature.
5) D4543 Prep and D7012 Testing Equipment Used:
6) Tool / Machine List:
   G788 Compression Machine
   G1661 Digital Calipers, G1380 Dial Gauge
   G1616 Straight Edge, G1571 Feeler Gauge
   G1633 V-Block, G1634 Rock Saw, G1635 Grinder

Tested By: JAC Date: 8/18/20 *Checked By:* NJM *Date:* 8/19/20

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APPENDIX C

USDA NRCS WEB SOIL SURVEY DATA

Soil Map—Chittenden County, Vermont
(Jericho)

Map Scale: 1:963 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chittenden County, Vermont
Survey Area Data: Version 23, Jun 4, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 17, 2012—Mar 29, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AdB	Adams and Windsor loamy sands, 5 to 12 percent slopes	0.0	0.1%
BIC	Belgrade and Eldridge soils, 8 to 15 percent slopes	0.5	16.3%
CsD	Colton and Stetson soils, 20 to 30 percent slopes	1.0	30.7%
HID	Hartland very fine sandy loam, 12 to 25 percent slopes	1.4	40.8%
W	Water	0.4	12.1%
Totals for Area of Interest		**3.3**	**100.0%**

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Chittenden County, Vermont

AdB—Adams and Windsor loamy sands, 5 to 12 percent slopes

Map Unit Setting

National map unit symbol: 9g2q

Elevation: 90 to 1,200 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 37 to 52 degrees F
Frost-free period: 90 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Adams and similar soils: 44 percent
Windsor and similar soils: 42 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Adams

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand
H2 - 7 to 30 inches: loamy fine sand
H3 - 30 to 65 inches: loamy fine sand

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F142XA005NY - Acidic Dry Outwash Frigid
Hydric soil rating: No

Description of Windsor

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 23 inches: loamy sand
H3 - 23 to 65 inches: coarse sand

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Agawam

Percent of map unit: 5 percent
Hydric soil rating: No

Deerfield

Percent of map unit: 5 percent
Landform: Deltas, terraces
Hydric soil rating: No

Duane

Percent of map unit: 4 percent
Hydric soil rating: No

BIC—Belgrade and Eldridge soils, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9g33
Elevation: 90 to 1,000 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 120 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Belgrade and similar soils: 46 percent
Eldridge and similar soils: 44 percent
Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Belgrade

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Concave
Parent material: Coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 7 inches: very fine sandy loam
H2 - 7 to 23 inches: very fine sandy loam
H3 - 23 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B/D
Ecological site: F142XB018VT - Moist Lake Plain
Hydric soil rating: No

Description of Eldridge

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Concave
Parent material: Sandy glaciolacustrine deposits over loamy glaciolacustrine deposits

Typical profile

H1 - 0 to 9 inches: loamy fine sand
H2 - 9 to 27 inches: loamy fine sand
H3 - 27 to 60 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F142XB003VT - Moist Outwash
Hydric soil rating: No

Minor Components

Raynham

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Enosburg

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

CsD—Colton and Stetson soils, 20 to 30 percent slopes

Map Unit Setting

National map unit symbol: 9g3g
Elevation: 90 to 2,000 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 37 to 52 degrees F
Frost-free period: 90 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Colton and similar soils: 43 percent
Stetson and similar soils: 41 percent
Minor components: 16 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Colton

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 4 inches: gravelly loamy sand
H2 - 4 to 27 inches: very gravelly loamy sand
H3 - 27 to 60 inches: very gravelly coarse sand

Properties and qualities

Slope: 20 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Stetson

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly fine sandy loam
H2 - 8 to 16 inches: gravelly fine sandy loam
H3 - 16 to 25 inches: very gravelly loamy coarse sand
H4 - 25 to 65 inches: very gravelly coarse sand

Properties and qualities

Slope: 20 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Marlow
Percent of map unit: 4 percent
Hydric soil rating: No

Adams
Percent of map unit: 4 percent
Landform: Terraces
Hydric soil rating: No

Windsor
Percent of map unit: 4 percent
Landform: Terraces
Hydric soil rating: No

Agawam
Percent of map unit: 4 percent
Hydric soil rating: No

HID—Hartland very fine sandy loam, 12 to 25 percent slopes

Map Unit Setting
National map unit symbol: 9g4d
Elevation: 90 to 1,000 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 120 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition
Hartland and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hartland

Setting
Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-silty glaciolacustrine deposits

Typical profile
H1 - 0 to 1 inches: very fine sandy loam
H2 - 1 to 23 inches: very fine sandy loam
H3 - 23 to 65 inches: very fine sandy loam

Properties and qualities
Slope: 12 to 25 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F144AY017NH - Well Drained Lake Plain
Hydric soil rating: No

Minor Components

Agawam

Percent of map unit: 5 percent
Hydric soil rating: No

Belgrade

Percent of map unit: 5 percent
Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Data Source Information

Soil Survey Area: Chittenden County, Vermont
Survey Area Data: Version 23, Jun 4, 2020

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Chittenden County, Vermont														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
AdB—Adams and Windsor loamy sands, 5 to 12 percent slopes														
Adams	44	A	0-7	Loamy sand	SM, SP-SM	A-2-4, A-1-b, A-3, A-4	0- 0- 0	0- 0- 0	95-100-100	95-100-100	45-70-85	5-23- 40	0-0 -29	NP-0 -2
			7-30	Fine sand, sand, loamy fine sand	SM, SP-SM	A-2-4, A-1-b, A-3, A-4	0- 0- 0	0- 0- 0	95-100-100	95-100-100	35-85-95	5-25- 40	0-0 -24	NP-0 -2
			30-65	Loamy fine sand, fine sand, sand, loamy sand	SM, SP-SM	A-1-b, A-2-4	0- 0- 0	0- 0- 0	90-100-100	80-100-100	30-75-90	5-25- 30	0-0 -19	NP-0 -2
Windsor	42	A	0-6	Loamy sand	SM	A-1-b, A-2-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	45-68-90	20-28-35	0-0 -25	NP-0 -1
			6-23	Loamy sand, loamy fine sand, sand	SM	A-1-b, A-2-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	45-68-90	15-23-30	0-0 -20	NP-0 -1
			23-65	Sand, fine sand, loamy sand, coarse sand	SM, SP, SW-SM	A-1-b	0- 0- 0	0- 0- 0	90-100-100	80-100-100	35-50-60	2-10- 15	0-0 -14	NP

Engineering Properties–Chittenden County, Vermont														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
BIC—Belgrade and Eldridge soils, 8 to 15 percent slopes														
Belgrade	46	B/D	0-7	Very fine sandy loam	ML	A-4	0- 0- 0	0- 0- 0	100-100 -100	93-100-100	90-95-100	50-55-70	17-27 -37	1-5 -10
			7-23	Silt loam, very fine sandy loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100 -100	93-100-100	90-95-100	50-55-70	16-25 -33	1-3 -10
			23-60	Very fine sandy loam, silt loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100 -100	93-100-100	90-95-100	50-55-70	0-23 -33	NP-3 -11
Eldridge	44	C/D	0-9	Loamy fine sand	SM	A-2-4, A-4	0- 0- 0	0- 0- 0	100-100 -100	98-100-100	60-68-80	20-35-55	0-22 -27	NP-1 -2
			9-27	Loamy fine sand, fine sand, sand	SM, SP-SM	A-1-b, A-2-4	0- 0- 0	0- 0- 0	100-100 -100	98-100-100	50-68-80	10-30-35	0-18 -22	NP-1 -2
			27-60	Very fine sandy loam, silt loam	CL-ML, ML, SC-SM, SM	A-2-4, A-4	0- 0- 0	0- 0- 0	100-100 -100	98-100-100	70-85-100	35-63-80	0-22 -30	NP-3 -12

Engineering Properties–Chittenden County, Vermont														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
CsD—Colton and Stetson soils, 20 to 30 percent slopes														
Colton	43	A	0-4	Gravelly loamy sand	SM, SP	A-1-b, A-2-4	0- 0- 0	5-10- 20	65-75-80	55-70-70	25-50-60	2-14- 25	0-24 -31	NP-1 -2
			4-27	Gravelly loamy fine sand, very gravelly sand, cobbly coarse sand, very gravelly loamy sand	GM, SM, SP-SM, SW-SM	A-1-b, A-1-a	0- 0- 1	5-10- 20	45-75-75	40-50-60	20-35-50	2-11- 20	0-0 -19	NP-0 -2
			27-60	Very gravelly sand, very cobbly sand, very gravelly coarse sand, gravelly fine sand	GP, GW, SW	A-1-a	0- 1- 1	10-15-45	30-38-65	20-30-40	10-20-30	0- 3- 5	0-0 -17	NP-0 -1
Stetson	41	A	0-8	Gravelly fine sandy loam	GM, SM	A-1-b, A-2-4, A-4	0- 0- 0	0-10- 15	70-80-90	55-70-90	50-65-85	20-30-40	17-25 -32	1-3 -5
			8-16	Gravelly fine sandy loam, gravelly loamy sand, loam	GM, GP-GM, SM, SW-SM	A-1-b, A-2-4, A-4	0- 0- 0	0-10- 20	50-75-85	45-55-80	25-50-75	10-28-45	0-22 -29	NP-2 -4
			16-25	Very gravelly loamy coarse sand, gravelly fine sandy loam, loam	GM, GW-GM, SM, SP-SM	A-1-a, A-1-b, A-2-4, A-3	0- 0- 0	0-10- 20	50-68-85	45-55-80	15-30-65	5-15- 35	0-0 -24	NP-0 -4
			25-65	Very gravelly coarse sand, gravelly sand, very gravelly sand	GP, GP-GM, GW, GW-GM	A-1-b, A-1-a	0- 0- 0	0-18- 35	30-50-60	20-40-50	10-20-35	0- 8- 15	0-0 -14	NP

Engineering Properties–Chittenden County, Vermont														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
HlD—Hartland very fine sandy loam, 12 to 25 percent slopes														
Hartland	90	B	0-1	Very fine sandy loam	ML	A-4	0- 0- 0	0- 0- 0	100-100 -100	95-98-1 00	85-94-1 00	50-55-60	0-29 -40	NP-3 -6
			1-23	Silt loam, very fine sandy loam	ML, CL-ML	A-4	0- 0- 0	0- 0- 0	100-100 -100	95-98-1 00	85-94-1 00	50-55-60	0-22 -29	NP-3 -6
			23-65	Very fine sandy loam, very fine sand, loamy very fine sand, silt loam	CL-ML, ML, SC-SM, SM	A-4	0- 0- 0	0- 0- 0	100-100 -100	95-98-1 00	85-94-1 00	45-55-65	0-22 -29	NP-3 -10

Data Source Information

Soil Survey Area: Chittenden County, Vermont
Survey Area Data: Version 23, Jun 4, 2020

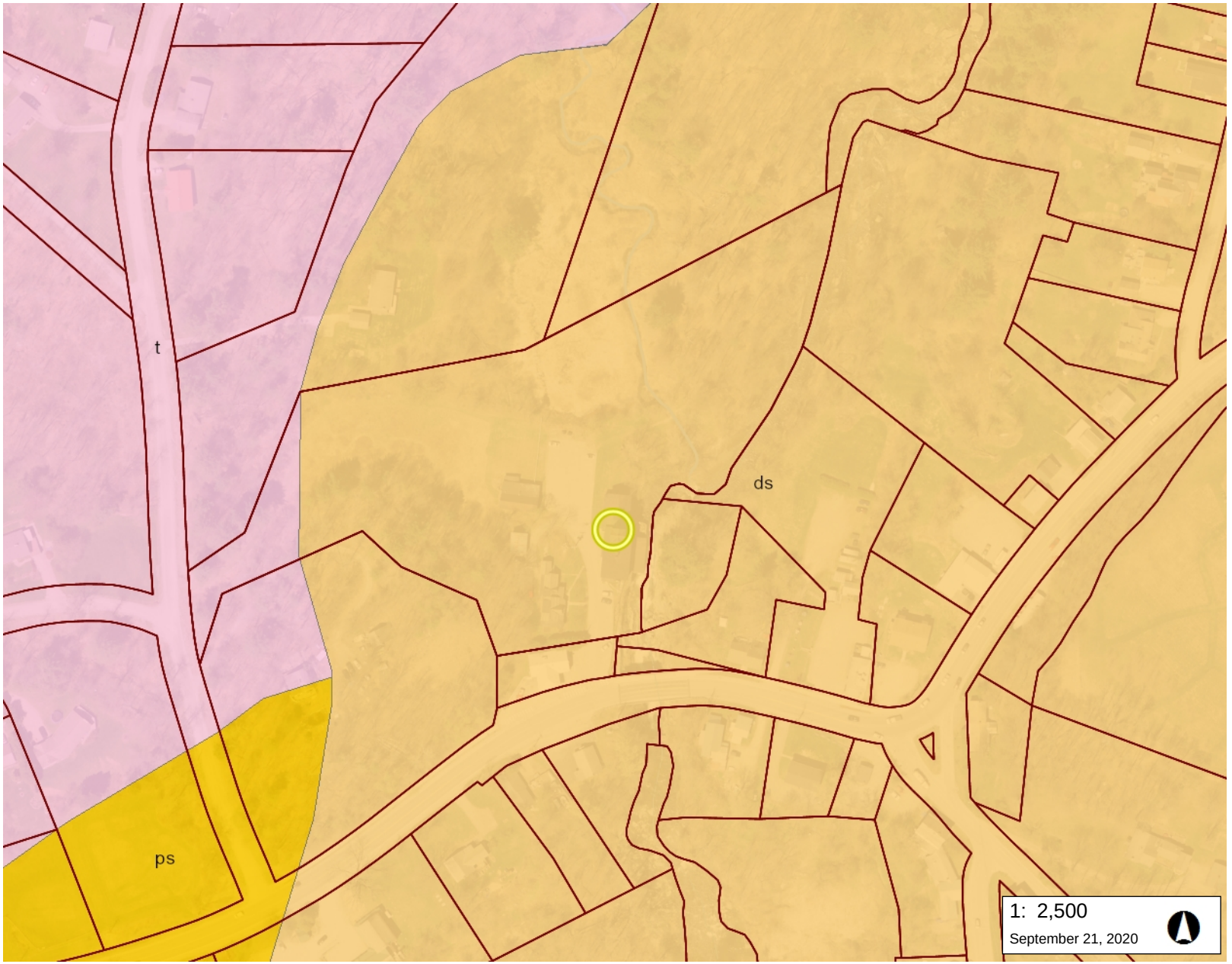
APPENDIX D

GEOLOGY MAPS

Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov



LEGEND

Surficial Geology (Lithology)

- till
- terminal moraine
- moraine
- isolated kame
- kame terrace
- kame moraine
- outwash
- esker
- eolian sand
- lake gravel
- beach gravel
- delta gravel
- delta
- lake sand
- pebbly sand
- boulders in sand
- delta sand
- silt, silty clay, and clay
- varved clay
- boulders in clay
- wave-washed till
- fluvial gravel
- fluvial sand
- alluvium
- marine beach gravel
- marine sand

NOTES

Map created using ANR's Natural Resources Atlas

127.0 0 64.00 127.0 Meters

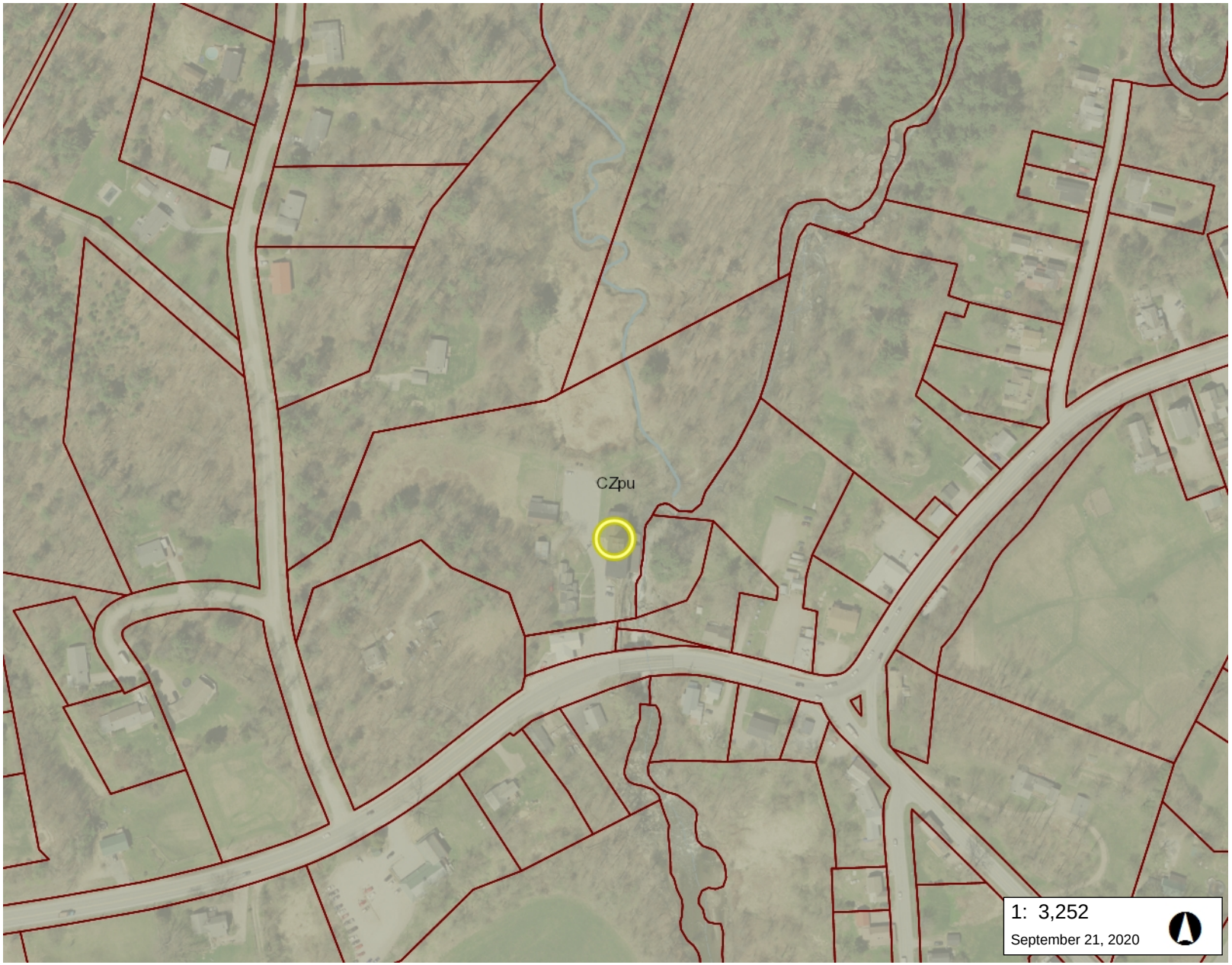
WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 208 Ft. 1cm = 25 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov



LEGEND

Bedrock Faults and Contacts

- <all other values>
- concealed contact
- contact
- dashed contact
- fault
- fault ?
- high angle fault
- normal fault
- scratch boundary
- strike slip fault
- thrust fault open barb
- thrust fault solid barb

Parcels (standardized)

Parcels (non-standardized)

Stream/River

- Stream
- Intermittent Stream
- Other

NOTES

Map created using ANR's Natural Resources Atlas

165.0 0 82.00 165.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 271 Ft. 1cm = 33 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Pinnacle Formation (Cambrian and Neoproterozoic)

€Zpu

Pinnacle Formation, undivided—Gray, foliated muscovite-chlorite-biotite-feldspar-quartz schist, phyllite, and metagraywacke. Quartz is commonly blue, and local thin conglomeratic horizons are present. Feldspathic biotite phyllitic metawacke is interlayered with lenses of quartz, feldspar, and gneiss-pebble to -cobble conglomerate (€Zpc)

APPENDIX E

GEOTECHNICAL PROPERTIES FOR STACKED STONE WALL DESIGN

Geotechnical Properties for Stacked Stone Wall Design
Emergency Watershed Protection Site 5038-007
Jericho, Vermont
Natural Resources Conservation Service

Introduction

The purpose of this calculation is to estimate geotechnical properties to be used in the stacked stone wall design at the National Resources Conservation Service (NRCS) Emergency Watershed Protection (EWP) Site 5038-007 located in Jericho, Vermont. DDK Engineering - JV (DDK) estimated geotechnical material properties using empirical relationships, geotechnical laboratory testing, and subsurface data for the project site.

References

1. Carter and Bentley, 2016, "Soil Properties and Their Correlations," John Wiley & Sons.
2. Naval Facilities Engineering Command (NAVFAC), 1986, "Design Manual 7.02, Foundations and Earth Structures."
3. AASHTO, 2012, "LRFD Bridge Design Specifications", Publication Code: LRFDUS-6.
4. New Hampshire Department of Transportation, 2016, "Bridge Design Manual, Chapter 4, Loads and Load Factors", January 2015 - v 2.0 (Revised March 2016).
5. RocLab, 2013, "Rock mass strength analysis using the Hoek-Brown failure criterion," Rocscience.
6. Post-Tensioning Institute, 2014, "Recommendations for Prestressed Rock and Soil Anchors, PTI DC-35: Prestressed Rock and Soil Anchor Committee," PTI DC-35.1-14, Farmington Hills, MI.
7. Federal Highway Administration, 2006, "Rockery Design and Construction Guidelines", U.S. Department of Transportation, Central Federal Lands Highway Division, Lakewood, CO.

Attachments

1. SPT N Value Calculation
2. Sections for Active Earth Pressure Coefficient Calculations with Broken Backslope
3. RocLab Output

Existing Soil (In-Situ)

The Existing Soil behind the proposed stacked stone wall at the Jericho site was encountered by DDK in Borings JE-20-401, JE-20-401A, and JE-20-402. The Existing Soil is generally described as Silty Sand with Gravel (SM) to Well Graded Sand with Silt and Gravel (SW-SM), very loose to loose with isolated zones being medium dense (compact), with an in-situ water content ranging from approximately 6% to 14%. The Existing Soil may be fill soil, naturally deposited soil, or a combination of both.

Unit Weight

Table 3.1 of Reference 1 provides typical natural densities based on the soil type. The range of natural dry densities for very loose, loose, and medium dense sands, similar to the Existing Soil encountered by DDK, from Table 3.1 or Reference 1 is summarized below. The table below also includes the resulting Total Unit Weight assuming the Existing Soil has an in-situ water content of 10%.

From Table 3.1 of Reference 2					Assuming 10% Water Content			
Material	Dry Density (kN/m^3)		Dry Density (pcf)		Water Content	Total Unit Weight (pcf)		
	min.	max.	min.	max.		min.	max.	avg.
Sand & Gravel - very loose	13	14	83	89	0.1	91	98	95
Sand & Gravel - loose	14	15	89	95	0.1	98	105	102
Sand & Gravel - medium dense	15	18	95	115	0.1	105	126	116

Table 3.2 of Reference 1 provides typical compacted densities for soil based on the soil USCS symbol. For Silty Sand (SM) and Well Graded Sand (SW), similar to the Existing Soil encountered by DDK, the range of maximum dry density (MDD) in Table 3.2 of Reference 1 is summarized in the table below. The table below also includes the resulting Total Unit Weight assuming the Existing Soil was compacted to 90% of the MDD and has an approximate in-situ water content of 10%.

From Table 3.2 of Reference 1					Assuming 90% MDD and 10% Water Content					
USCS	MDD (kN/m^3)		MDD (pcf)		90% MDD (pcf)		Water Content	Total Unit Weight (pcf)		
	min.	max.	min.	max.	min.	max.		min.	max.	avg.
SM	17.5	20	111	127	100	115	0.1	110	126	118
SW	17.5	21	111	134	100	120	0.1	110	132	121

Based on the information above DDK selected the following Total Unit Weight for Existing Soil.

Total Unit Weight	**120 pcf**

Shear Strength

DDK estimated the Effective Friction Angle for the Existing Soil using typical values from Reference 1 based on the soil type and soil density, and using SPT N value shear strength correlations which are included as Attachment 1.

Effective Friction Angle (degrees)	Notes
27 to 33	Typical value for loose silty sand (SM) from Table 6.4 of Reference 1
28 to 32	Approximate range from Attachment 1 using the Peck, Hanson, and Thornburn method.

Based on the information above DDK selected the following Effective Friction Angle for Existing Soil. The Effective Cohesion was assumed to be zero.

Effective Friction Angle	**28 degrees**
Effective Cohesion	**0 psf**

Backfill Material (Existing Soil Re-Compacted or Compacted Gravel/Sand Backfill Material)

The Backfill Material will consist of the Existing Soil Re-Compacted or a Gravel/Sand Backfill Material. The Existing Soil consists mostly of very loose to loose Silty Sand (SM); therefore, when Existing Soil is used as Backfill Material it is assumed that it will be re-compacted to 95% of the maximum dry density per Standard Proctor testing. The Gravel/Sand Backfill Material may be used as a drain or filter soil layer which will consists of a Poorly Graded Gravel (GP) to Poorly Graded Sand (SP).

Unit Weight

Table 3.2 of Reference 1 provides typical compacted densities for soil based on the soil USCS symbol. For Silty Sand (SM), Poorly Graded Gravel (GP) and Poorly Graded Sand (SP), similar to the assumed Backfill Material, the range of maximum dry density (MDD) in Table 3.2 of Reference 1 is summarized in the table below. The table below also includes the resulting Total Unit Weight assuming the Backfill Material is compacted to 95% of the MDD at a water content of 12%. An assumed water content of 12% is within the range of typical optimum moisture contents provided in Table 3.2 of Reference 1.

From Table 3.2 of Reference 1					Assuming 95% MDD and 12% Water Content					
USCS	MDD (kN/m^3)		MDD (pcf)		95% MDD (pcf)		Water Content	Total Unit Weight (pcf)		
	min.	max.	min.	max.	min.	max.		min.	max.	avg.
SM	17.5	20	111	127	106	121	0.12	119	135	127
GP	18.5	20	118	127	112	121	0.12	125	135	130
SP	16	19	102	121	97	115	0.12	108	129	119

Based on the information above DDK selected the following Total Unit Weight for Backfill Material.

Total Unit Weight	**135 pcf**

Shear Strength

DDK estimated the Effective Friction Angle for Backfill Material using typical values from Reference 1 based on the soil type.

Effective Friction Angle (degrees)	Notes
34	For compacted silty sands, sand-silt mix (SM) from Table 6.3 or Reference 1
30 to 34	Typical value for dense silty sand (SM) from Table 6.4 of Reference 1
>37	For compacted poorly graded sand-gravel mixtures (GP) from Table 6.5 from Reference
37	For compacted poorly graded clean sand, gravelly sand (SP) from Table 6.5 from Reference
35	Typical value for loose sandy gravel from Table 6.4 of Reference 1

Based on the information above DDK selected the following Effective Friction Angle for Backfill Material. The Effective Cohesion was assumed to be zero.

Effective Friction Angle	**32 degrees**
Effective Cohesion	**0 psf**

Interface Friction Angles

DDK estimated Interface Friction Angles using Table 1 - Ultimate Friction Factors and Adhesion for Dissimilar Materials on page 7.2-63 of Reference 2. For the stacked stone wall on the concrete leveling pad it is assumed that the first row of stacked stones will be cast into the concrete leveling pad, set in mortar on top of the concrete leveling pad, or the surface of the concrete leveling pad roughened to increase surface contact area between the stacked stones and concrete leveling pad.

Interface Description	Interface Materials	Friction Angle (degrees)	Friction Factor
Concrete leveling pad on bedrock	Mass concrete on clean sound rock	35	0.70
Stacked stone wall on concrete leveling pad	Dressed hard rock on dressed hard rock	29	0.55

Coulomb Active Earth Pressure Coefficient

DDK estimated the active earth pressure coefficient (Ka) using the Coulomb equation from Reference 3. To account for the broken backslope behind the stacked stone wall DDK adjusted the active earth pressure coefficient by substituting the angle β with β' in the Coulomb equation from Reference 3 as outlined in Figure 4.3.3-1 of Reference 4. The value of β' was calculated using the equation shown in Figure 4.3.3-1 of Reference 4 and was verified geometrically in Attachment 2.

Case 1 (Wall Profile Sta 19.5 to 35.9, Concrete Leveling Pad at El. 526.0)

$$k_a = \frac{\sin^2\cdot(\theta + \phi'_f)}{\sin^2\theta\cdot\sin(\theta - \delta)\cdot\left(1 + \sqrt{\frac{\sin(\phi'_f + \delta)\cdot\sin(\phi'_f - \beta)}{\sin(\theta - \delta)\cdot\sin(\beta + \theta)}}\right)^2}$$

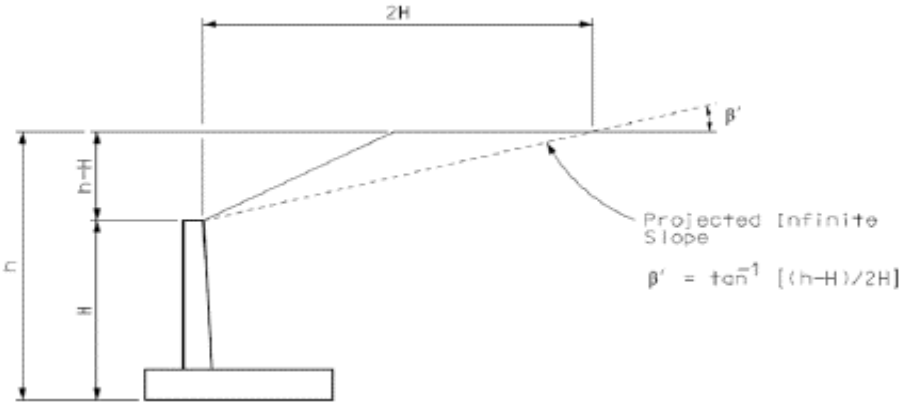
where:

ϕ' = effective friction angle of backfill soil =	32.0	degrees	
β = angle of backfill slope to horizontal =	26.6	degrees	(2H:1V)
θ = angle of the back of wall to horizontal =	90.0	degrees	(assumes infinite slope)
δ = friction angle between backfill soil and back of wall =	32.0	degrees [(1)]	

[(1)] Assumed equal to ϕ' per Reference 7 when no filter/seperation fabric is used between retained soil and crushed rock backfill.

Ka =	0.48	(assuming inifinite slope behind wall)

Adjustment for Broken Backslope:



(Figure 4.3.3-1 of Reference 4)

Case 1A (Wall Profile Sta 0+25)

H = base of wall to top of wall	7.6	ft	
h = base of wall to flat portion of broken backslope =	11.5	ft	
β' = adjusted backfill slope considering broken backslope =	14.4	degrees	Use: 15.0 degrees

Ka =	0.35

Case 1B (Wall Profile Sta 0+35.9)

H = base of wall to top of wall	8.0	ft	
h = base of wall to flat portion of broken backslope =	11.7	ft	
β' = adjusted backfill slope considering broken backslope =	13.0	degrees	Use: 14.0 degrees

Ka =	0.34

Design Ka =	**0.35**

Coulomb Active Earth Pressure Coefficient

DDK estimated the active earth pressure coefficient (Ka) using the Coulomb equation from Reference 3. To account for the broken backslope behind the stacked stone wall DDK adjusted the active earth pressure coefficient by substituting the angle β with β' in the Coulomb equation from Reference 3 as outlined in Figure 4.3.3-1 of Reference 4. The value of β' was calculated using the equation shown in Figure 4.3.3-1 of Reference 4 and was verified geometrically in Attachment 2.

Case 2 (Wall Profile Sta 35.9 to 42.5, Concrete Leveling Pad at El. 524.0)

$$k_a = \frac{\sin^2\cdot(\theta + \phi'_f)}{\sin^2\theta\cdot\sin(\theta - \delta)\cdot\left(1 + \sqrt{\frac{\sin(\phi'_f + \delta)\cdot\sin(\phi'_f - \beta)}{\sin(\theta - \delta)\cdot\sin(\beta + \theta)}}\right)^2}$$

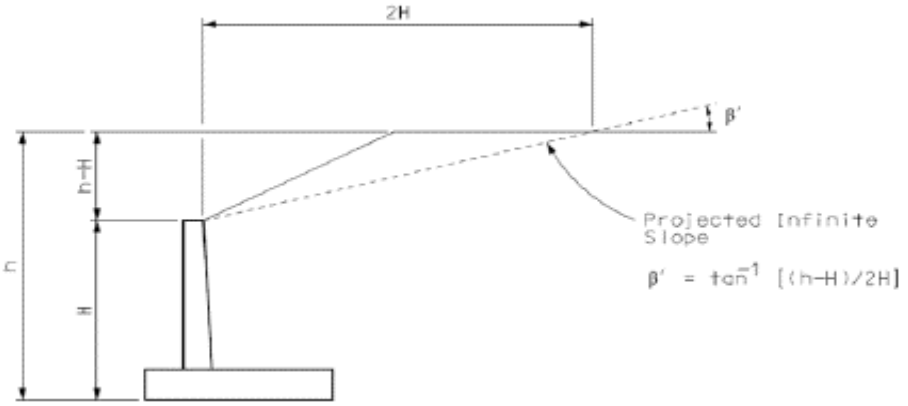
where:

ϕ' = effective friction angle of backfill soil =	32.0	degrees	
β = angle of backfill slope to horizontal =	26.6	degrees	(2H:1V)
θ = angle of the back of wall to horizontal =	90.0	degrees	(assumes infinite slope)
δ = friction angle between backfill soil and back of wall =	32.0	degrees [(1)]	

[(1)] Assumed equal to ϕ' per Reference 7 when no filter/seperation fabric is used between retained soil and crushed rock backfill.

Ka =	0.48	(assuming inifinite slope behind wall)

Adjustment for Broken Backslope:



(Figure 4.3.3-1 of Reference 4)

Case 2A (Wall Profile Sta 0+35.9)

H = base of wall to top of wall	10.0	ft	
h = base of wall to flat portion of broken backslope =	13.8	ft	
β' = adjusted backfill slope considering broken backslope =	10.8	degrees	Use: 11.0 degrees

Ka =	0.33

Case 2B (Wall Profile Sta 0+42.5)

H = base of wall to top of wall	10.2	ft	
h = base of wall to flat portion of broken backslope =	14.0	ft	
β' = adjusted backfill slope considering broken backslope =	10.6	degrees	Use: 11.0 degrees

Ka =	0.33

Design Ka =	**0.35**

Coulomb Active Earth Pressure Coefficient

DDK estimated the active earth pressure coefficient (Ka) using the Coulomb equation from Reference 3. To account for the broken backslope behind the stacked stone wall DDK adjusted the active earth pressure coefficient by substituting the angle β with β' in the Coulomb equation from Reference 3 as outlined in Figure 4.3.3-1 of Reference 4. The value of β' was calculated using the equation shown in Figure 4.3.3-1 of Reference 4 and was verified geometrically in Attachment 2.

Case 3 (Wall Profile Sta 42.5 to 47.8, Concrete Leveling Pad at El. 522.0)

$$k_a = \frac{\sin^2\cdot(\theta + \phi'_f)}{\sin^2\theta\cdot\sin(\theta - \delta)\cdot\left(1 + \sqrt{\frac{\sin(\phi'_f + \delta)\cdot\sin(\phi'_f - \beta)}{\sin(\theta - \delta)\cdot\sin(\beta + \theta)}}\right)^2}$$

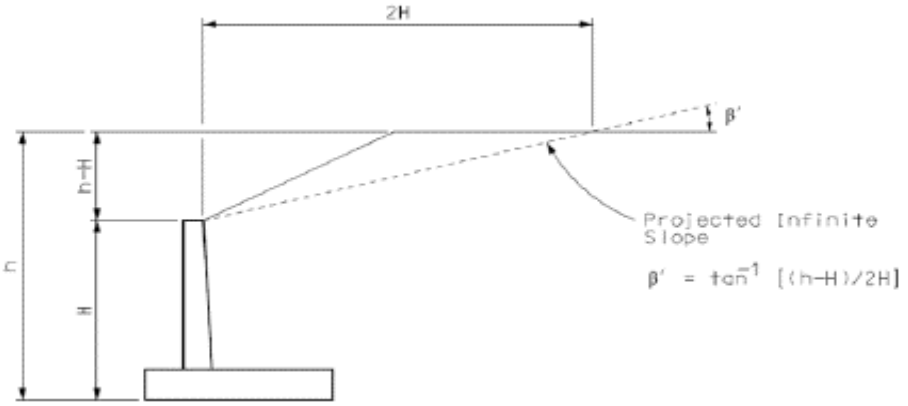
where:

ϕ' = effective friction angle of backfill soil =	32.0	degrees	
β = angle of backfill slope to horizontal =	26.6	degrees	(2H:1V)
θ = angle of the back of wall to horizontal =	90.0	degrees	(assumes infinite slope)
δ = friction angle between backfill soil and back of wall =	32.0	degrees [(1)]	

[(1)] Assumed equal to ϕ' per Reference 7 when no filter/seperation fabric is used between retained soil and crushed rock backfill.

Ka =	0.48	(assuming inifinite slope behind wall)

Adjustment for Broken Backslope:



(Figure 4.3.3-1 of Reference 4)

Case 3A (Wall Profile Sta 0+42.5)

H = base of wall to top of wall	12.2	ft	
h = base of wall to flat portion of broken backslope =	16.1	ft	
β' = adjusted backfill slope considering broken backslope =	9.1	degrees	Use: 10.0 degrees

Ka =	0.32

Case 3B (Wall Profile Sta 0+47.8)

H = base of wall to top of wall	12.3	ft	
h = base of wall to flat portion of broken backslope =	16.2	ft	
β' = adjusted backfill slope considering broken backslope =	9.0	degrees	Use: 10.0 degrees

Ka =	0.32

Design Ka =	**0.35**

Bedrock

Bedrock was encountered by DDK in Borings JE-20-401A and JE-20-402 at elevations 527.5 and 521.4 feet, respectively. The bedrock was classified as Metagraywacke in both borings. Field observation noted the bedrock condition was slightly weathered to unweathered, and slightly broken to unbroken.

Unit Weight

DDK completed laboratory Unconfined Compressive Strength (UCS) testing on four rock core samples of the Metagraywacke bedrock. The UCS test results also include the laboratory measured unit weight of the rock core samples, which are summarized in the table below.

Boring	Sample	Depth (ft)	Dry Unit Weight (pcf)	Moisture Content (%)	Total Unit Weight (pcf)
JE-20-401A	R-1	12.1-12.9	174.5	0.08	174.6
	R-3	24.2-25.0	175.5	0.09	175.7
JE-20-402	R-1	18.4-19.2	173.8	0.12	174.0
	R-2	24.4-25.2	171.7	0.09	171.9

DDK selected the following unit weight for bedrock. The Total Unit Weight was selected based on information above while also considering that the lab tested rock core sample was intact and the unit weights do not account for fractures.

Total Unit Weight	**170 pcf**

Bedrock

Shear Strength

As previously stated, DDK completed UCS testing on four intact rock core samples of the Metagraywacke bedrock. DDK used UCS test results and the computer program RocLab (Reference 5) to estimate the shear strength parameters for bedrock using the Hoek-Brown Criterion. The results of the UCS tests are summarized in the table below. Complete RocLab outputs are included in Attachment 3.

Summary of Laboratory UCS Test Results					
Sample Information				UCS Test Results	
Boring	Sample	Depth (ft)	Rock Type	Uniaxial Compressive Strength (psi)	Fracture Type
JE-20-401A	R-1	12.1-12.9	Metagraywacke	10,690	Cone & Split
	R-3	24.2-25.0	Metagraywacke	9,630	Cone & Split
JE-20-402	R-1	18.4-19.2	Metagraywacke	9,840	Cone & Split
	R-2	24.4-25.2	Metagraywacke	20,920	Cone & Split

Summary of RocLab Output from Attachment 3				
RocLab Input		RocLab Output		
Uniaxial Compressive Strength (psi)	GSI	Friction Angle (degrees)	Cohesion	
			(ksi)	(psf)
9,000	45	34	0.498	71712

DDK selected the following Effective Shear Strength parameters for bedrock based on the information above.

Effective Friction Angle	**34 degrees**
Effective Cohesion	**20,000 psf**

Rock to Grout Ultimate Bond Strength

The ultimate bond strength for the grout and bedrock interface is listed below and is estimated based on typical values presented in Table C6.1 of Reference 6.

Rock	Average Ultimate Bond Strength - Rock/Grout (psi)	Recommended Value for Use
Sandstones	120 to 250	200 psi

Attachment 1

SPT N Value Calculation

Standard Penetration Test (SPT) N Value Calculation
Emergency Watershed Protection Site 5038-007
Jericho, Vermont
Natural Resources Conservation Service

Purpose

The purpose of this calculation is to estimate the effective friction angle based on Standard Penetration Test (SPT) N values for soils encountered during the subsurface investigation completed by DDK at the National Resources Conservation Service (NRCS) Emergency Watershed Protection (EWP) Site 5038-007 located in Jericho, Vermont. Effective friction angles were estimated using procedures outlined in Reference 1.

References

1. Das, B. 2011. *Principles of Foundation Engineering.* Stamford, CT: Cengage Learning.

Estimation of Effective Friction Angle Based on SPT N Values

The effective friction angle was estimated based on SPT N values in accordance with procedures outlined in Reference 1. The procedures outlined in Reference 1 are summarized below.

Variables:

- N = measured penetration number
- N_{60} = standard penetration number corrected for field conditions
- $(N_1)_{60}$ = standardized value of N_{60}
- C_N = correction factor
- η_H = hammer efficiency (%)
- η_B = correction for borehole diameter
- η_S = sampler correction
- η_R = correction for rod length
- ϕ' = friction angle
- σ'_{vo} = effective overburden pressure to the center of each layer (psf)
- p_a = atmospheric pressure (2000 psf)

$$N_{60} = \frac{N\eta_H\eta_B\eta_S\eta_R}{60}$$

$$C_N = \sqrt{\frac{1}{\frac{\sigma'_{vo}}{p_a}}}$$

$$(N_1)_{60} = C_N N_{60}$$

$$\phi'_1 = 27.1 + 0.3(N_1)_{60} - 0.00054[(N_1)_{60}]^2$$ Peck, Hanson, and Thornburn (1974)

$$\phi'_2 = \tan^{-1}\left[\frac{N_{60}}{12.2 + 20.3\left(\frac{\sigma'_{vo}}{p_a}\right)}\right]^{0.34}$$ Schmertmann (1975)

$$\phi'_3 = \sqrt{20(N_1)_{60}} + 20$$ Hatanaka and Uchida (1996)

DDK Engineering - JV

By:	MMK	Date:	08/04/20	Subject:	SPT N Value Calculation	Sheet No.:	3 of 5
Chkd By:	AA	Date:	08/19/20		Jericho EWP Site 5038-007	Proj. No.:	172719-24

Boring: **JE-20-401**

Ground Water Level (ft): Dry

N Value Correction Factors

η_H = 60 η_R = varies

η_B = 1 (see below)

η_S = 1

Sample	Material Description	Depth (feet)			N	γ	σ'_{vo}/p_a	C_N	η_R	N_{60}	$(N_1)_{60}$	Friction Angle (°)		
		Start	End	Center		(pcf)	(tsf)					$\emptyset'_1$	$\emptyset'_2$	$\emptyset'_3$
SpT-1	Silty Sand (SM)	0.5	2.0	1.25	10	115	0.07	1.70	0.75	7.50	12.8	30.8	39.2	36.0
SpT-2		2.0	4.0	3.00	3	115	0.17	1.70	0.75	2.25	3.8	28.2	27.3	28.7
											Average:	29.5	33.3	32.4

DDK Engineering - JV

By:	MMK	Date:	08/04/20	Subject:	SPT N Value Calculation	Sheet No.:	4 of 5
Chkd By:	AA	Date:	08/19/20		Jericho EWP Site 5038-007	Proj. No.:	172719-24

Boring: **JE-20-401A**

Ground Water Level (ft): Dry

N Value Correction Factors

η_H = 60 η_R = varies

η_B = 1 (see below)

η_S = 1

Sample	Material Description	Depth (feet)			N	γ	σ'_{vo}/p_a	C_N	η_R	N_{60}	$(N_1)_{60}$	Friction Angle (°)		
		Start	End	Center		(pcf)	(tsf)					$\emptyset'_1$	$\emptyset'_2$	$\emptyset'_3$
SpT-1	Sand with Silt and Gravel (SW-SM)	0.5	2.0	1.25	14	115	0.07	1.70	0.75	10.50	17.9	32.3	42.4	38.9
SpT-2		2.0	4.0	3.00	14	115	0.17	1.70	0.75	10.50	17.9	32.3	41.1	38.9
SpT-3		4.0	6.0	5.00	9	115	0.29	1.70	0.75	6.75	11.5	30.5	35.6	35.1
SpT-4	Silty Sand (SM)	6.0	7.5	6.75	6	115	0.39	1.61	0.75	4.50	7.2	29.2	31.0	32.0
											Average:	31.1	37.5	36.2

DDK Engineering - JV

By: MMK Date: 08/04/20 Subject: SPT N Value Calculation Sheet No.: 5 of 5

Chkd By: AA Date: 08/19/20 Jericho EWP Site 5038-007 Proj. No.: 172719-24

Boring: JE-20-402

Ground Water Level (ft): Dry

N Value Correction Factors

η_H = 60 η_R = varies

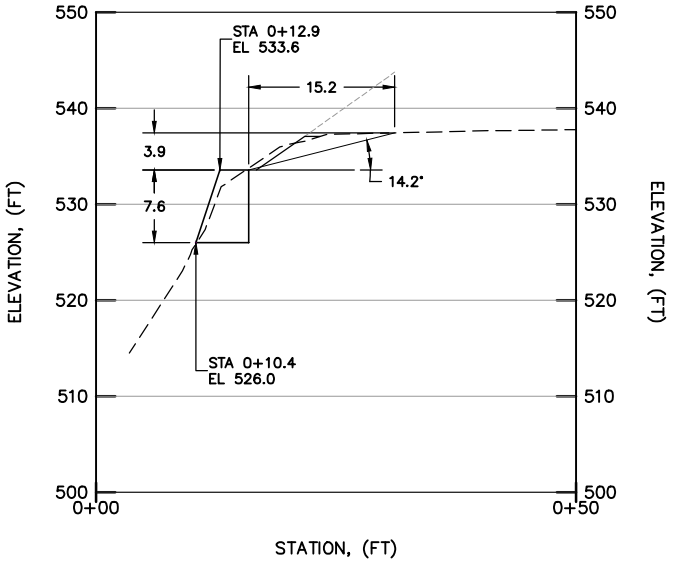
η_B = 1 (see below)

η_S = 1

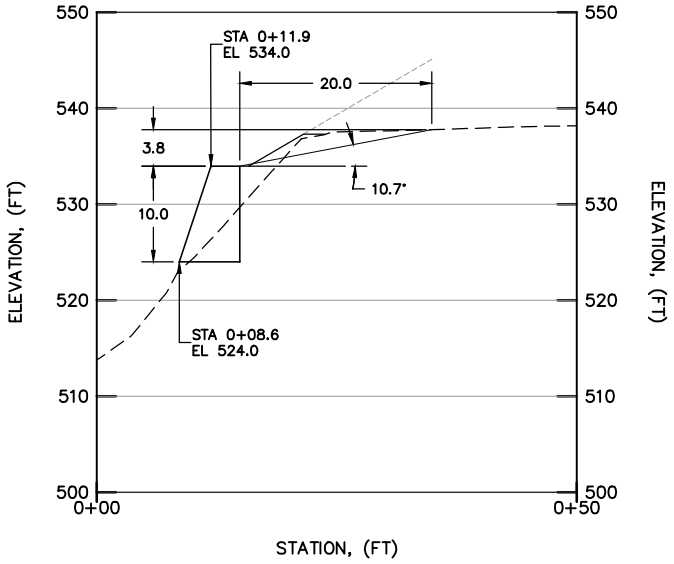
Sample	Material Description	Depth (feet)			N	γ	σ'_{vo}/p_a	C_N	η_R	N_{60}	$(N_1)_{60}$	Friction Angle (°)		
		Start	End	Center		(pcf)	(tsf)					$\emptyset'_1$	$\emptyset'_2$	$\emptyset'_3$
SpT-1	Silty Sand (SM)	0.5	2.0	1.25	7	115	0.07	1.70	0.75	5.25	8.9	29.7	35.8	33.4
SpT-2		2.0	4.0	3.00	5	115	0.17	1.70	0.75	3.75	6.4	29.0	31.6	31.3
SpT-3		4.0	6.0	5.00	3	115	0.29	1.70	0.75	2.25	3.8	28.2	26.2	28.7
SpT-4		6.0	8.0	7.00	3	115	0.40	1.58	0.75	2.25	3.5	28.2	25.3	28.4
SpT-5		8.0	10.0	9.00	2	115	0.52	1.39	0.75	1.50	2.1	27.7	21.7	26.5
SpT-6	Silty Sand (SM)	10.0	12.0	11.00	2	115	0.63	1.26	0.75	1.50	1.9	27.7	21.0	26.1
SpT-7		12.0	14.0	13.00	4	115	0.75	1.16	0.75	3.00	3.5	28.1	25.2	28.3
											Average:	28.4	26.7	29.0

Attachment 2

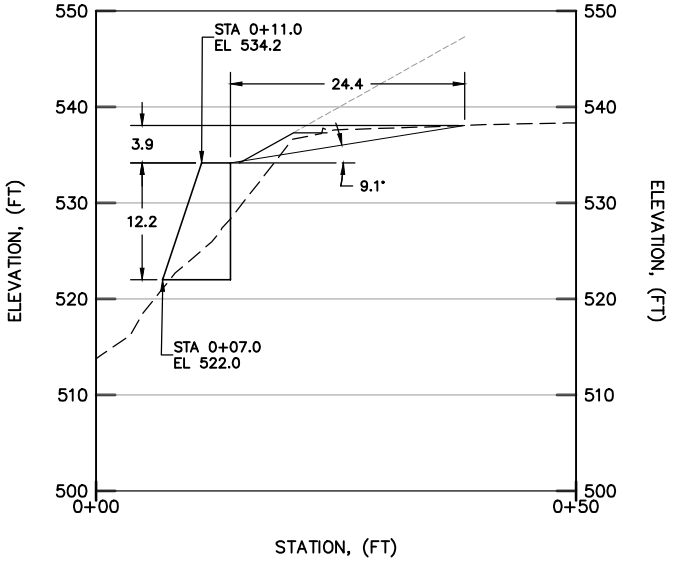
Sections for Active Earth Pressure Coefficient Calculations with Broken Backslope



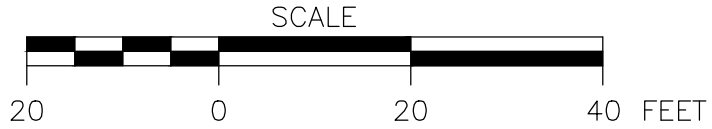
CASE 1A (WALL PROFILE STA 0+25)

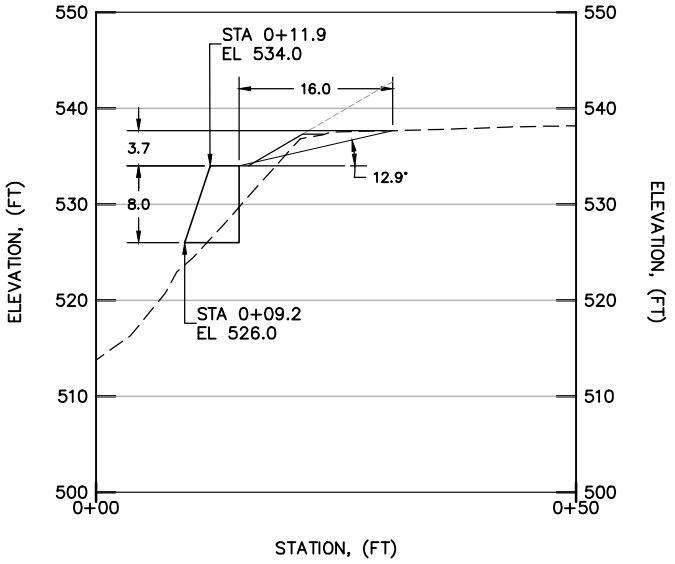


CASE 2A (WALL PROFILE STA 0+35.9)

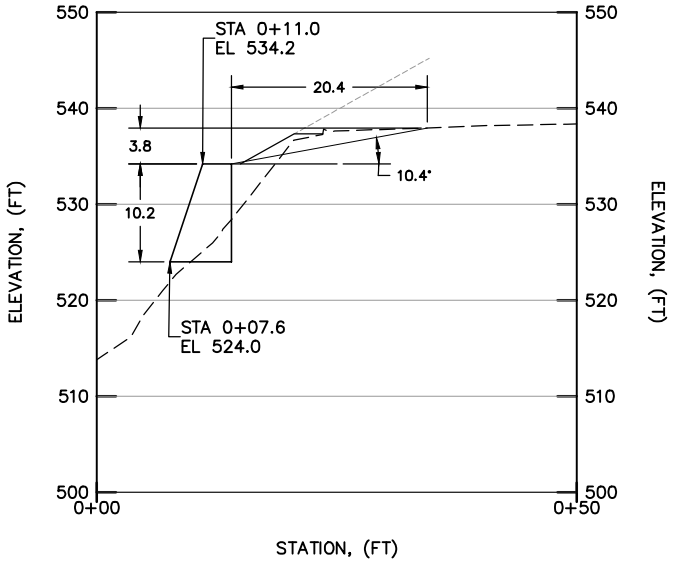


CASE 3A (WALL PROFILE STA 0+42.5)

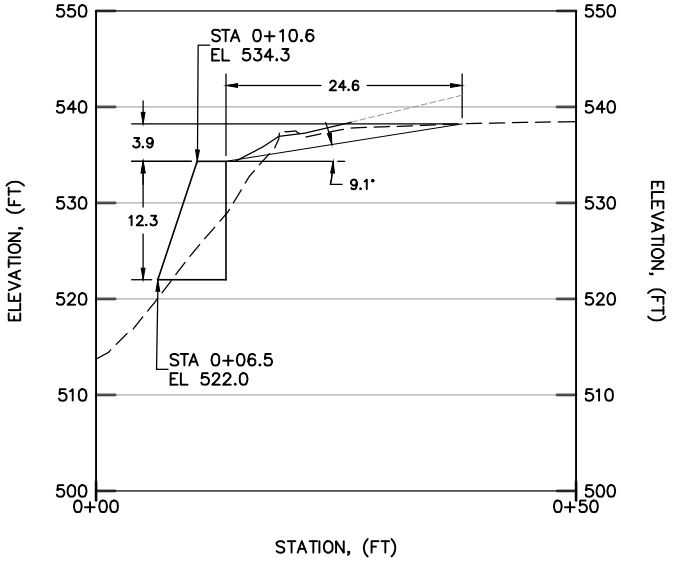




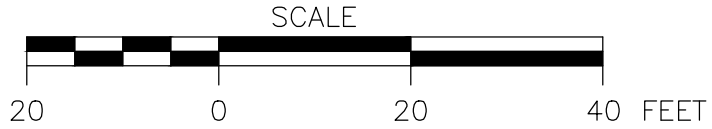
CASE 1B (WALL PROFILE STA 0+35.9)



CASE 2B (WALL PROFILE STA 0+42.5)



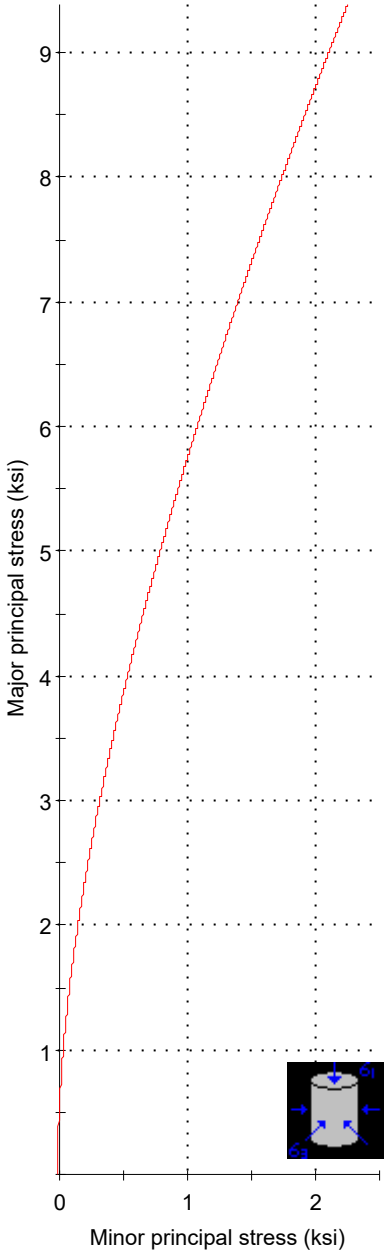
CASE 3B (WALL PROFILE STA 0+47.8)



Attachment 3

RocLab Output

Analysis of Rock Strength using RocLab



Hoek-Brown Classification

intact uniaxial comp. strength (sigci) = 9 ksi
GSI = 45 mi = 18 Disturbance factor (D) = 0
intact modulus (Ei) = 3150 ksi
modulus ratio (MR) = 350

Hoek-Brown Criterion

mb = 2.525 s = 0.0022 a = 0.508

Mohr-Coulomb Fit

cohesion = 0.498 ksi friction angle = 34.07 deg

Rock Mass Parameters

tensile strength = -0.008 ksi
uniaxial compressive strength = 0.403 ksi
global strength = 1.876 ksi
deformation modulus = 704.50 ksi