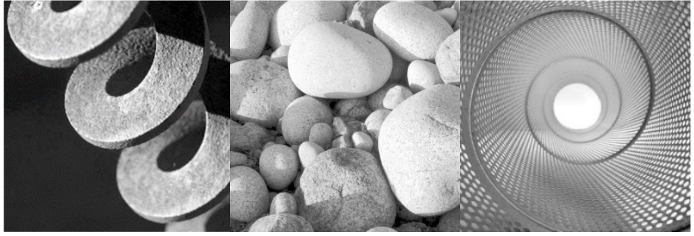


GEI Consultants

Consulting
Engineers and
Scientists

Geotechnical Report

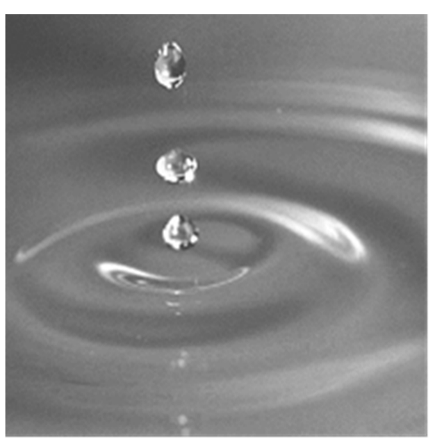
BESS Installation CT9

2 Ella Grasso Turnpike
Windsor Locks, Connecticut

Submitted to:
VHB
100 Great Meadow Road, Suite 200
Wethersfield, CT 06109

Submitted by:
GEI Consultants, Inc.
455 Winding Brook Drive, Suite 201
Glastonbury, CT 06033
860-368-5300

June 9, 2023
Project No. 2301203



Matthew Glunt, P.E.
Senior Geotechnical Engineer

Table of Contents

Figures

Appendices

1. Introduction

1.1 Project Summary

The property slated for development is located at 2 Ella Grasso Turnpike in Windsor Locks, CT. We understand that the proposed battery storage facility will be built directly on the existing gravel lot with no changes to grade, drainage features, or site access.

This report was prepared to address foundation and site preparation recommendations for the proposed BESS development.

1.2 Scope of Services

Our scope of work included the following tasks:

- Reviewed site plans and layout drawings.
- Oversaw an investigation program consisting of three (3) test borings and in-situ resistivity testing at two (2) locations.
- Observed soil samples recovered from the test borings, took groundwater level measurements, and prepared test boring logs.
- Engaged a testing laboratory to perform laboratory analyses on soil samples from the test borings.
- Developed recommendations for earthworks and battery storage unit (BESS) foundation design and construction.
- Prepared this *Geotechnical Report*.

1.3 Authorization

Our work was performed in general accordance with our proposal dated October 10, 2022, and the resulting Subconsultant Agreement executed on January 6, 2023.

1.4 Horizontal and Vertical Reference

Boring locations were located and referenced using handheld GPS with accuracy on the order of 5 to 10 feet. The locations shown on the attached figure should be considered approximate.

Elevations referenced in this report and on the attached test boring were estimated from a provided topographic survey of the property prepared by VHB.

2. Site and Project Description

2.1 Site Description

The proposed development will occur on a 5.1-acre parcel listed in Town records as 2 Ella Grasso Turnpike in Windsor Locks. The property was developed as a gravel parking lot sometime in or about 2012 to 2013. Based on the site contours and investigation results, it appears the eastern side of the lot was cut into a hillside. A natural stream course, Seymour Hollow, was diverted into a 48-inch concrete pipe and the area surrounding was filled to some degree above natural grade.

2.2 Proposed Construction

We were provided by VHB with site plans for the project dated June 2, 2023.

We understand a 5.0 MW/20 MW-h battery energy storage system (BESS) facility is planned for the referenced site. From provided plans, we understand this facility is to consist of the following:

- Battery Energy Storage System (BESS) with up to twelve (12) battery racks, PCS inverters, and supporting equipment pads.
- Underground or overhead electrical tie-in to existing infrastructure on Ella Grasso Turnpike.

The proposed facility will be built directly on the existing gravel lot with no changes to grade, drainage features, or site access.

3. Exploration Procedures

3.1 Test Borings

The boring locations were laid out on the site from the provided site plan using approximate measurements and a GPS-locator with horizontal accuracy on the order of 5 to 10 feet. Approximate boring locations relative to the site plan are shown on Figure 1.

Three (3) soil test borings were conducted at the site on April 5, 2023, by New England Boring Contractors, Inc., under subcontract to GEI, with a truck-mounted drilling rig. The appropriate one-call utility locate service (CBYD) was contacted prior to our arrival. Each boring location was also pre-scanned for utilities using geophysical methods. The borings were advanced to depths of 22 feet to 42 feet each utilizing hollow-stem augering techniques. Soil test boring logs are attached in Appendix A.

Standard Penetration Testing (SPT) and split-spoon sampling were generally performed continuously through the upper 8 feet of the borings and at 5-foot intervals thereafter using an automatic 140-lb. hammer. Representative samples of the soils obtained by the sampler were classified by a GEI representative. The samples were placed in appropriately identified sealed glass jars and transported to our office for storage and laboratory assignment.

3.2 Soil Resistivity Testing

In-situ resistivity testing was performed using the Wenner Four-Electrode Method at two (2) locations, as shown on Figure 1, each including two orthogonal traverses using electrode spacings of 1, 2.5, 5, 10, 20, and 40 feet. Measurements were taken using an L & R Industries MiniRes Instrument. Test results are provided in Appendix C.

3.3 Laboratory Testing

Laboratory testing was conducted on representative soil samples to confirm field identification of the soils and establish engineering characteristics for design. Tests performed by GeoTesting Express, under subcontract to GEI, included the following:

- Two (2) grain-size analyses with standard sieve set and hydrometer (ASTM D6913)
- Two (2) natural moisture content (ASTM D2974)

A composite sample obtained between depths of 2 and 8 feet was also subjected to the following tests:

- pH (ASTM G51)
- Laboratory resistivity (ASTM G57)
- Chlorides (ASTM D512)
- Sulfates (ASTM D516)

The laboratory test results are included in Appendix B.

4. Subsurface Conditions

4.1 Geologic Setting

This area in the south end of Windsor Locks lies on a broad glacial outwash plain underlain by 25 to 40 feet of fine sand to silty sand over glacial-lake clays and silts. The site locality is lower in grade than surrounding areas, falling within a narrow valley northeast to southwest in direction, with a small stream course (Seymour Hollow) at its base. Arkose (sandstone) bedrock is noted on historic boring logs at a depth of approximately 60 to 80 feet below the site.

4.2 Subsurface Conditions

The generalized subsurface conditions at the site are described below, in order of increasing depth. The subsurface conditions between test locations may differ. The nature and extent of variations between the sampling points will not become evident until construction.

Surface Materials – Though not sampled in the borings, most of the site is covered with gravel paving approximately 4 to 6 inches in thickness.

Existing Fill – Existing fill was encountered in all borings to depths of about 4 to 6 feet below current grade. As noted in Section 2.1, we assume this fill was placed over low-lying alluvial ground to raise and level grade during construction of the gravel lot in or about 2012. Recovered materials were classified as predominantly sand with about 5 to 20 percent silt fines and occasional debris such as asphalt traces and brick fragments.

Standard Penetration Test (SPT) N-values within the fill ranged from 4 to 23 blows/foot, indicating very loose to medium-dense conditions.

Alluvial Sands and Silts – Interbedded sands and silts consistent with low-lying alluvial ground were encountered beneath the fill to depths on the order of 8 to 10 feet below current grade. Recovered samples were gray to gray-brown and dark gray in color and varied from predominantly (up to about 95 percent) silt fines to silty sand with up to about 40 percent fines.

Standard Penetration Test (SPT) N-values within the sands and silts generally ranged from 8 to 21 blows/foot, indicating loose to medium-dense conditions, with a very loose zone in boring B-3.

Lower Sands – Native silty sands were encountered below the alluvial soils at each location. Borings B-1 and B-2 were terminated in this stratum. Recovered samples were generally classified as gray to brown, fine- to medium-grained silty sand with about 25 to 35 percent non-plastic silt fines.

SPT N-values in these soils varied between 6 and 18 blows/foot, consistent with loose to medium-dense conditions.

Varved Deposits – Stiff to very stiff, layered (varved) silts and clayey silts were encountered at a depth of about 25 feet, and continuing to the boring termination depth of 42 feet.

4.3 Groundwater Conditions

Groundwater was encountered within all borings at depths of about 5 to 8 feet below current grade.

Groundwater levels are subject to seasonal and weather-related variations. Groundwater measurements made at different times and different locations may be significantly different than the measurements taken as part of this investigation.

5. Design Recommendations

5.1 Soil Properties

Recommended in-place soil properties for the site are presented below. We estimated these values based on published correlations to SPT N-values and visual soil descriptions.

Table 1 – In-Place Soil Properties

Stratum	Angle of Internal Friction (ϕ°)	Cohesion (c) (psf)	Moist (Total) Unit Weight (γ_T) (lb/ft^3)	Active Earth Pressure Coeff. (K_a)	Passive Earth Pressure Coeff. (K_p)
I. Existing Fill	32	0	120	0.31	3.25
II. Alluvial Sand and Silt	30	0	115	0.33	3.00
III. Native Sand	34	0	120	0.28	3.54

5.2 Foundation Considerations

The proposed battery units may be supported by drilled-in or conventional shallow foundations. We provide three options below that we believe are feasible given the subsurface conditions and unit constraints.

Foundation design will be further progressed subsequent to this report and the recommendations updated, in coordination with Key Capture and the design team.

5.2.1 Grade Beams

Grade beams, installed either along each long side of the unit or in a grid format, would be suitable for use in supporting the battery units. This type of foundation would not require specialized equipment or expertise, but could pose difficulties associated with undercutting of unsuitable materials, as discussed further below. Depending on the loading requirements, widened bases, more akin to a conventional wall foundation, may be required under this option.

Grade beams should bear on a subgrade consisting of native sands and silts or compacted Structural Fill. Historic fills, where encountered at bearing grade, are unsuitable for support of battery units and should be removed and replaced with Structural Fill, or alternatively, crushed stone underlain by geotextile. From the boring results, undercuts on the order of 0.5

to 2.5 feet below bearing depth would be expected. Subject to approval by the geotechnical engineer, undercut materials, if granular in nature, may be suitable to place back in a controlled manner as Structural Fill.

We caution that native sands and, especially, silts likely to be exposed after removal of fills will be highly susceptible to moisture intrusion and disturbance. Excavations within about 6 inches of finished subgrades should be conducted with a smooth-edged bucket to limit disturbance. In addition, we recommend that all exposed finish subgrades be protected soon after exposure with 6 inches of crushed stone over geotextile fabric. As discussed further in Section 6.2, localized dewatering should be expected and planned for when removing the existing fills to natural subgrade.

We recommend that all footing subgrades be evaluated by a GEI representative prior to concrete placement. The maximum allowable bearing pressures for the design of footings are:

Table 2 - Allowable Bearing Pressure

Bearing Stratum	Net Allowable Bearing Pressure
Native Sand and Silt or Structural Fill	2,500 lb/ft^2

Minimum individual grade beam widths should be at least 18 inches. All grade beams should bear at least 42 inches below exterior grade for frost protection.

Lateral capacity of shallow foundations includes a soil lateral pressure and coefficient of friction as described in CBC/IBC Section 1806. Footings will predominantly be embedded in material similar to those described as class 4 as described in Table 1806.2. Where foundations are cast neat against the sides of excavations, an allowable lateral bearing pressure of 150 psf per foot depth below natural grade may be used in computations. Assuming subgrades are prepared as recommended herein, an allowable coefficient of friction of 0.45 at the base of the foundations may be used in the calculation of sliding resistance.

5.2.2 Drilled Piers

Individual drilled concrete piers would also be feasible for use in supporting the battery units. Drilled piers, if utilized, should extend below the existing fills and alluvial sands and silts to embed within native sands at a depth of at least 12 feet below current grade. We expect cased drilling would be required to maintain hole stability beneath the groundwater table. Subsurface obstructions or other conditions that may hinder drilling advancement were not encountered during the recent investigation.

For preliminary design and costing, we provide expected capacities for two common pier sizes below. Efficient pier sizing and spacing will be further evaluated with the design team in future phases of this project, if this option is pursued.

Table 3 – Drilled Piers – Preliminary Capacities

Pier Diameter	Depth	Ultimate Axial Capacity (kips)	Allowable Axial Capacity (kips)
18 inches	12 feet	78	26
24 inches	12 feet	42	14

Rebar cages or individual center bars would also likely be required for the piers to provide sufficient lateral support.

5.2.3 Helical Piles

Helical, or "screw", piles consist of round or square steel shafts with welded helixes of specified diameter and at specified intervals along the shaft. These piles are well-suited to small to moderate-scale projects, especially where uplift resistance is a primary concern.

Helical piles would be designed and installed by a specialty geotechnical contractor and held to a performance specification that includes a required pile capacity. Based on their experience with similar projects in similar geologic conditions, the specialty contractor would design a system intended to make most efficient use of the piling options.

From our understanding of the project, we believe helical piles would offer the following advantages:

1. *Speed of installation* – the specialized equipment and simple methods result in relatively high production rates.
2. *Single install* – installation of helical piles is a single-step process. The piles would be ready for immediate support, i.e. no curing time required.
3. As noted above, subsurface obstructions or other conditions that may hinder drilling were not encountered during the recent investigation.

Some drawbacks to helical piles may include:

1. *Limited axial and lateral capacity* – readily-available pile sizes may not be of sufficient size to provide the required axial and lateral capacities.
2. *Specialty connection* – a special connection plate would be required to secure the piles to the unit frame.

3. *Material lead time* – there will be lead times associated with ordering of the proprietary piles and connection plates.

If this option is pursued, a specialty contractor should be consulted for further information regarding cost, schedule, and feasibility.

5.2.4 Equipment Pads

The natural soils may be susceptible to frost heave. We recommend that the proposed equipment pads bear on Structural Fill that extends below the frost depth. If some seasonal movement of the equipment pads is acceptable, we recommend that the top 18 inches of existing frost-susceptible material below the slab be removed and replaced with compacted, well-draining Structural Fill.

For pad subgrades prepared in this manner, a modulus of subgrade reaction of 150 pounds per cubic inch (pci) may be assumed.

5.3 Settlement

Subject to further evaluation, we expect battery units supported by one of the options listed above would be expected to settle less than 1 inch, with differential settlements between each unit of less than ½-inch. We expect nearly all expected settlement will occur during construction or soon after.

6. Construction Considerations

6.1 Subgrade Preparation

6.1.1 General

Aside from where battery units or equipment pads are to be constructed, we understand the remainder of the development area will be left largely as-is.

6.1.2 Equipment Pads

Excavations to final subgrade for the equipment pads should be performed in such a way that limits disturbing or loosening subgrade soils. After stripping and cutting and prior to placing pad base materials, the resulting subgrade should be firm, stable, and unyielding. Stabilization, where required, may consist of removing unsuitable material and replacement with compacted Structural Fill, or where unsuitable soils are relatively thin, drying and compacting in place.

From the results of this investigation, we expect historic fill soils under the proposed equipment pad areas to be suitable for structural support after proof-rolling as described below. However, the character of these soils will be variable and some undercutting and/or stabilization in place should be expected.

Soil subgrades for equipment pads should be proof-rolled with at least four (4) passes of a minimum 10-ton vibratory roller in open areas, or a 1-ton vibratory roller or large plate compactor, such as Wacker DPU4545 or equivalent, in trenches. Proof-rolling in close proximity to groundwater may need to be accomplished without vibratory action to reduce the potential for disturbance to the subgrade. Final bearing surfaces should be free of standing water, frost, and loose soil.

6.1.3 Unit Foundations

If used to support the battery units, conventional shallow foundations should bear on a subgrade consisting of native sands and silts or compacted Structural Fill. Historic fills, where encountered at bearing grade, are unsuitable for support and should be removed and replaced with Structural Fill, or alternatively, crushed stone underlain by geotextile. Subject to approval by the geotechnical engineer, undercut materials, if granular in nature, may be suitable to place back in a controlled manner as Structural Fill.

After removal of historic fills, a 6-inch layer of crushed stone over geotextile fabric should be placed over all exposed subgrades soon after exposure. Finished bearing surfaces should be free of standing water, frost, and loose soil before placement of reinforcing steel and concrete. We recommend that a GEI representative observe the final preparation of all subgrades prior to footing construction.

6.2 Excavation and Dewatering

Excavations can be accomplished with conventional earthmoving equipment. Excavations should be sloped or shored in accordance with the local, state, and federal regulations, including Occupational Safety and Health Agency (OSHA 29 CFR Part 1926) excavation trench safety standards.

Groundwater should be expected within any site excavations greater than about 4 feet below current grade. Where encountered, we expect that excavation dewatering may be accomplished with filtered sumps and pumps located outside the footing excavations.

6.3 Freezing Conditions

The soils at the sites are frost susceptible. Therefore, if construction is performed during freezing weather, special precautions will be required to prevent the subgrade soils from freezing. Freezing of the soil beneath the foundation during construction may result in subsequent settlement of the structure.

All subgrades should be free of frost before placement of concrete. Frost-susceptible soils that have frozen should be removed and replaced with compacted Structural Fill. The footing and the soil adjacent to the footing should be insulated until they are backfilled. Soil placed as fill should be free of frost, as should the ground on which it is placed.

7. Closure

7.1 Follow-on Services

We recommend that GEI be kept on the project through the final design and construction phases of this project for the following services:

- Review geotechnical-related contractor submittals and assist in developing responses to questions from the contractor (i.e. RFI's).
- Provide periodic site visits during construction to view subgrades and consult on geotechnical-related issues that occur.

7.2 Limitations

This report was prepared for the use of the project team, exclusively. Our recommendations are based on the project information provided to us at the time of this report and may require modification if there are any changes in the nature, design, or location of the proposed building. We cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations, and whether our recommendations have been properly implemented in the design.

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No warranty, expressed or implied, is made.

Figures

LEGEND

APPROX. BORING LOCATION

APPROX. RESISTIVITY TEST LOCATION

SOURCE:

GRADING & DRAINAGE PLAN, "C-3.0" (VHB, 06/02/23)

GEI Consultants

TEST LOCATION PLAN
BESS CT9
Windsor Locks, CT

GEI PROJECT NO: **2300876**

FIGURE NO.
1

Appendix A

Boring Logs

BORING INFORMATION

LOCATION: See plan.

GROUND SURFACE EL. (ft): 102

VERTICAL DATUM:

TOTAL DEPTH (ft): 22.0

LOGGED BY: T. Yurman

DATE START/END: 4/5/2023 - 4/5/2023

DRILLING COMPANY: New England Boring

DRILLER NAME: Dave DeAngelis

RIG TYPE:

BORING B-1

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - semi-automatic

AUGER I.D./O.D.: 3.75 inch / NA

CASING I.D./O.D.: NA/ NA

DRILL ROD O.D.: NM

CORE BARREL TYPE:

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Hollow Stem Auger

WATER LEVEL DEPTHS (ft): ▼ 5.0

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/10	11-8-8-8		FILL	S1: NARROWLY GRADED SAND (SP); ~90% F-sand, ~5% NP fines, ~5% F-gravel, with asphalt traces, brown, dry.
100		S2	2 to 4	24/18	11-11-12-8		FILL	S2: NARROWLY GRADED SAND WITH SILT (SP-SM); 85.0% F-M sand, 8.5% NP fines, 6.5% F-gravel, reddish-brown, moist.
	5	S3	4 to 6	24/8	3-4-4-2		FILL / SAND & SILT	S3A (0-4"): NARROWLY GRADED SAND (SP); ~95% F-M sand, ~5% NP fines, brown, damp to wet. S3B (4-8"): SILTY SAND (SM); ~60% F-sand, ~40% NP fines, dark-gray, wet.
		S4	6 to 8	24/19	3-7-8-7		SAND & SILT	S4A (0-10"): SILT WITH SAND (ML); ~90% NP fines, ~10% F-sand, dark-gray, wet. S4B (10-19"): SANDY SILT (ML); ~70% NP fines, ~30% F-sand, gray, wet.
		S5	8 to 10	24/24	3-6-7-7		SAND	S5: SILTY SAND (SM); ~70% F-sand, ~30% NP fines, gray, wet.
	10	S6	10 to 12	24/14	2-4-6-6		SAND	S6: SILTY SAND (SM); ~65% F-sand, ~35% NP fines, gray, wet.
90							SAND	
	15	S7	15 to 17	24/18	2-4-6-7		SAND	S7: Similar to S6, gray-brown.
	20	S8	20 to 22	24/19	2-6-5-9		SAND	S8: Similar to S6, light brown.
80								Planned depth. Backfilled with drill cuttings.

NOTES:

PROJECT NAME: VHB-Key Capture BESS CT 9

CITY/STATE: Windsor Locks, Connecticut

GEI PROJECT NUMBER: 2301203

GEI Consultants

BORING INFORMATION

LOCATION: See plan.

GROUND SURFACE EL. (ft): 103

VERTICAL DATUM:

TOTAL DEPTH (ft): 22.0

LOGGED BY: T. Yurman

DATE START/END: 4/5/2023 - 4/5/2023

DRILLING COMPANY: New England Boring

DRILLER NAME: Dave DeAngelis

RIG TYPE:

BORING B-2

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - semi-automatic

AUGER I.D./O.D.: 3.75 inch / NA

DRILLING METHOD: Hollow Stem Auger

WATER LEVEL DEPTHS (ft): ▼ 5.0

CASING I.D./O.D.: NA/ NA

DRILL ROD O.D.: NM

CORE BARREL TYPE:

CORE BARREL I.D./O.D. NA / NA

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	0	S1	0 to 2	24/9	10-8-8-8		FILL	S1: NARROWLY GRADED SAND (SP); ~100% F-M sand (mostly F-sand), with asphalt traces, brown, dry.
100		S2	2 to 4	24/14	9-8-7-6		FILL	S2: NARROWLY GRADED SAND (SP); ~95% F-sand, ~5% NP fines, reddish-brown, dry to moist.
	5	S3	4 to 6	24/15	1-1-3-7		FILL	S3A (0-11"): NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% F-sand, ~10% NP fines, brown, damp to wet. S3B (11-15"): SILTY SAND (SM); ~75% F-C sand, ~15% NP fines, ~10% F-gravel, with brick fragments, gray-brown, wet.
		S4	6 to 8	24/19	7-10-11-11		SAND & SILT	S4A (0-11", 14-19"): SILT (ML); ~95% NP-LP fines, ~5% F-sand, gray-brown, wet. S4B (11-14"): SILTY SAND (SM); ~55% F-C sand, ~40% NP fines, ~5% F-gravel, gray-brown, wet.
		S5	8 to 10	24/24	5-8-10-12		SAND	S5: SILTY SAND (SM); ~75% F-M sand, ~25% NP fines, gray-brown, wet.
	10	S6	10 to 12	24/18	3-2-4-6		SAND	S6: SILTY SAND (SM); ~65% F-sand, ~35% NP fines, gray-brown, wet.
90							SAND	
	15	S7	15 to 17	24/23	4-5-8-10		SAND	S7: SILTY SAND (SM); ~70% F-sand, ~30% NP fines, brown, wet.
	20	S8	20 to 22	24/20	4-5-7-11		SAND	S8: Similar to S7.
80								Planned depth. Backfilled with drill cuttings.

NOTES:

PROJECT NAME: VHB-Key Capture BESS CT 9

CITY/STATE: Windsor Locks, Connecticut

GEI PROJECT NUMBER: 2301203

GEI Consultants

BORING INFORMATION		BORING B-3
LOCATION: See plan.		PAGE 1 of 2
GROUND SURFACE EL. (ft): 104	DATE START/END: 4/5/2023 - 4/5/2023	
VERTICAL DATUM:	DRILLING COMPANY: New England Boring	
TOTAL DEPTH (ft): 42.0	DRILLER NAME: Dave DeAngelis	
LOGGED BY: T. Yurman	RIG TYPE:	

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - semi-automatic	CASING I.D./O.D.: NA/ NA	CORE BARREL TYPE:
AUGER I.D./O.D.: 3.75 inch / NA	DRILL ROD O.D.: NM	CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Solid Stem Auger

WATER LEVEL DEPTHS (ft): ▼ 8.0

ABBREVIATIONS:

Pen. = Penetration Length	S = Split Spoon Sample	Qp = Pocket Penetrometer Strength	NA, NM = Not Applicable, Not Measured
Rec. = Recovery Length	C = Core Sample	Sv = Pocket Torvane Shear Strength	Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%	U = Undisturbed Sample	LL = Liquid Limit	
WOR = Weight of Rods	SC = Sonic Core	PI = Plasticity Index	
WOH = Weight of Hammer	DP = Direct Push Sample	PID = Photoionization Detector	
	HSA = Hollow-Stem Auger	I.D./O.D. = Inside Diameter/Outside Diameter	

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
		S1	0 to 2	24/9	8-11-8-7		FILL	S1: NARROWLY GRADED SAND (SP); ~95% F-sand, ~5% NP fines (bottom of sample), with asphalt traces, brown, dry to moist.
		S2	2 to 4	24/11	5-3-2-2		FILL	S2: SILTY SAND (SM); 77.6% F-sand, 22.4% NP fines, brown to dark brown, moist.
100	5	S3	4 to 6	24/0	1-1-1-1		SAND & SILT	S3: No recovery, no sample collected.
		S4	6 to 8	24/4	2-4-8-6		SAND & SILT	S4: SILT WITH SAND (ML); ~85% NP fines, ~15% F-sand, brown to gray, wet.
		S5	8 to 10	24/13	5-7-8-7		SAND & SILT	S5: Similar to S4.
	10	S6	10 to 12	24/15	7-8-9-10		SAND	S6: SILTY SAND (SM); ~70% F-sand, ~30% NP fines, gray, wet.
90	15	S7	15 to 17	24/14	5-8-10-10		SAND	S7: Similar to S6.
	20	S8	20 to 22	24/15	3-4-6-9		SAND	S8: Similar to S6.
80								

NOTES:

PROJECT NAME: VHB-Key Capture BESS CT 9

CITY/STATE: Windsor Locks, Connecticut

GEI PROJECT NUMBER: 2301203

GEI Consultants

LOCATION: See plan.
GROUND SURFACE EL. (ft): 104
VERTICAL DATUM:
DATE START/END: 4/5/2023 - 4/5/2023
DRILLING COMPANY: New England Boring

BORING B-3

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S9	25 to 27	24/14	5-5-8-7		VARVED DEPOSITS	S9: SILT WITH SAND (ML); ~85% NP fines, ~15% F-sand, gray-brown, wet.
	30	S10	30 to 32	24/15	5-6-10-10			S10: Similar to S9.
70	35	S11	35 to 37	24/16	4-6-10-9			S11: CLAYEY SILT (CL-ML); ~95% MP fines with NP seams, ~5% F-sand, gray, wet.
	40	S12	40 to 42	24/13	7-8-7-8			S12: Similar to S11.
								Planned depth. Backfilled with drill cuttings.
60	45							
	50							
50	55							

NOTES:

PROJECT NAME: VHB-Key Capture BESS CT 9
CITY/STATE: Windsor Locks, Connecticut
GEI PROJECT NUMBER: 2301203

GEI Consultants

Appendix B

Laboratory Test Results

Client:	GEI Consultants, Inc.		
Project:	Key Capture Energy Battery Storage		
Location:	Windsor Locks, CT	Project No:	GTX-317151
Boring ID: ---	Sample Type: ---	Tested By:	ckg
Sample ID: ---	Test Date: 05/04/23	Checked By:	ank
Depth : ---	Test Id: 714133		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
WI-TP-1	G- 2	2'	Moist, dark brown silty sand	19.5
WI-TP-4	G- 3	3'	Moist, brown silty sand with gravel	16.8
WL-B-1	S- 2	2-4'	Moist, dark reddish brown sand with silt	6.6
WL-B-3	S- 2	2-4'	Moist, dark brown silty sand	10.0

Notes: Temperature of Drying : 110º Celsius

Client:	GEI Consultants, Inc.
Project Name:	Key Capture Energy Battery Storage
Project Location:	Windsor Locks, CT
GTX #:	317151
Test Date:	05/01/23
Tested By:	NLB
Checked By:	ank

Laboratory pH of Soil by ASTM G51

Boring ID	Sample ID	Depth, ft	Description	Soil Temperature, ° C	Average pH Reading
EH-B-3	EH-Composite	2-8'	Moist, dark yellowish brown silty sand with gravel	21.8	5.64
WI-B-2	WI-Composite	2-8'	Moist, yellowish brown silty sand with gravel	21.8	5.39
WL-B-2	WL-Composite	2-8'	Moist, dark reddish brown silty sand	22.2	6.61
HA-B-5	HA-Composite	2-8'	Moist, dark reddish brown silty sand	22.5	6.85

Notes:

Client:	GEI Consultants, Inc.
Project:	Key Capture Energy Battery Storage
Location:	Windsor locks, CT
GTX#:	317151
Test Date:	05/05/23
Tested By:	nlb
Checked By:	ank

Laboratory Measurement of Soil Resistivity Using the Wenner Four-Electrode Method by ASTM G57 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(\text{ohm-cm})^{-1}$
EH-B-3	EH-Composite	2-8'	Moist, dark yellowish brown silty sand with gravel	51,652	1.94E-05
WI-B-2	WI-Composite	2-8'	Moist, yellowish brown silty sand with gravel	33,057	3.03E-05
WL-B-2	WL-Composite	2-8'	Moist, dark reddish brown silty sand	10,330	9.68E-05
HA-B-5	HA-composite	2-8'	Moist, dark reddish brown silty sand	10,537	9.49E-05

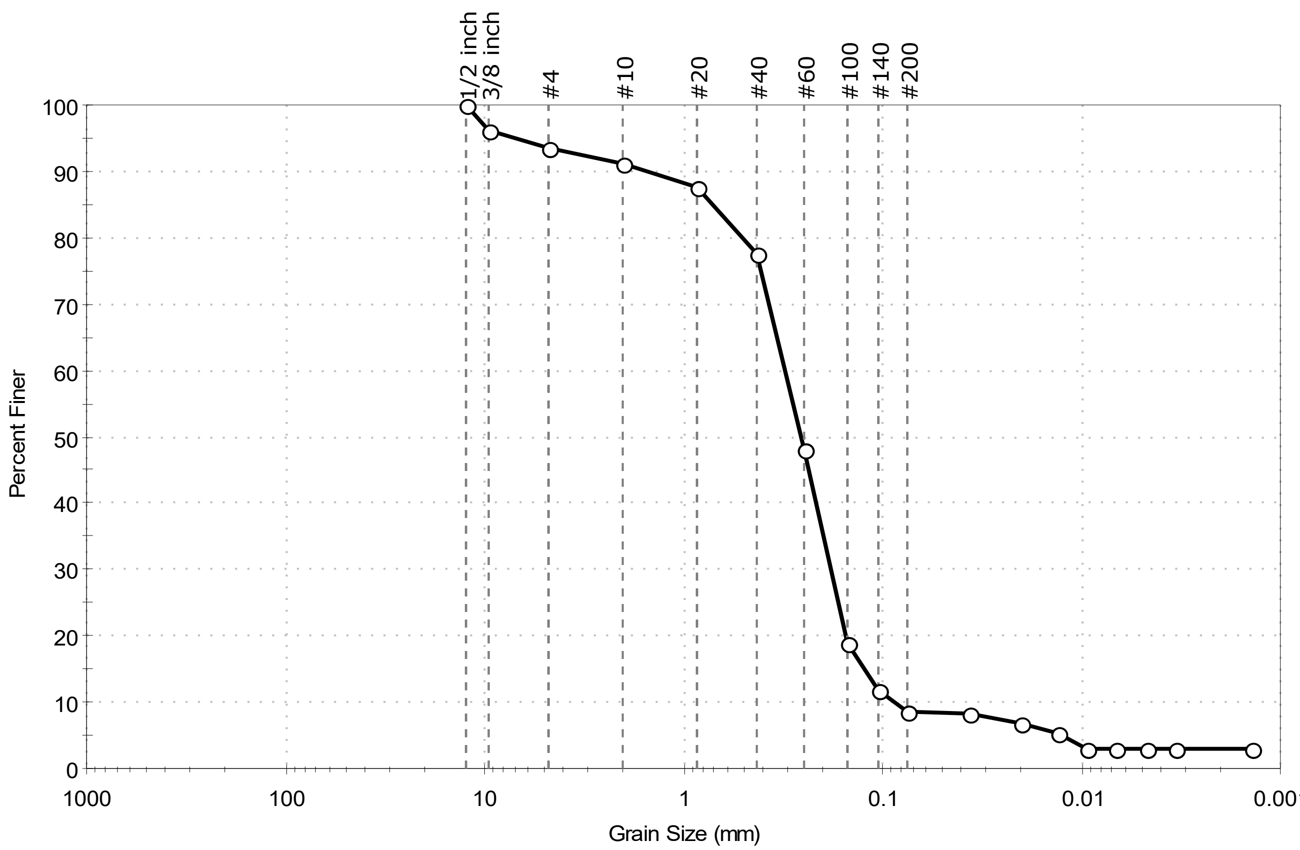
Notes: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box
Water added to sample to create a thick slurry prior to testing (saturated condition).
Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)
Test conducted in standard laboratory atmosphere: 68-73 F

Client:	GEI Consultants, Inc.
Project:	Key Capture Energy Battery Storage
Location:	Windsor Locks, CT
Project No:	GTX-317151

Boring ID:	WL-B-1	Sample Type:	bag	Tested By:	ckg
Sample ID:	S-2	Test Date:	05/04/23	Checked By:	ank
Depth :	2-4'	Test Id:	714051		

Test Comment: ---
Visual Description: Moist, dark reddish brown sand with silt
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	6.5	85.0	8.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1/2 inch	12.50	100		
3/8 inch	9.50	96		
#4	4.75	94		
#10	2.00	91		
#20	0.85	88		
#40	0.42	78		
#60	0.25	48		
#100	0.15	19		
#140	0.11	12		
#200	0.075	8.5		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0371	8		
---	0.0202	7		
---	0.0132	5		
---	0.0095	3		
---	0.0067	3		
---	0.0047	3		
---	0.0033	3		
---	0.0014	3		

Coefficients

D_{85} =0.7093 mm
D_{30} =0.1822 mm
D_{60} =0.3103 mm
D_{15} =0.1237 mm
D_{50} =0.2594 mm
D_{10} =0.0877 mm
C_u =3.538
C_c =1.220

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

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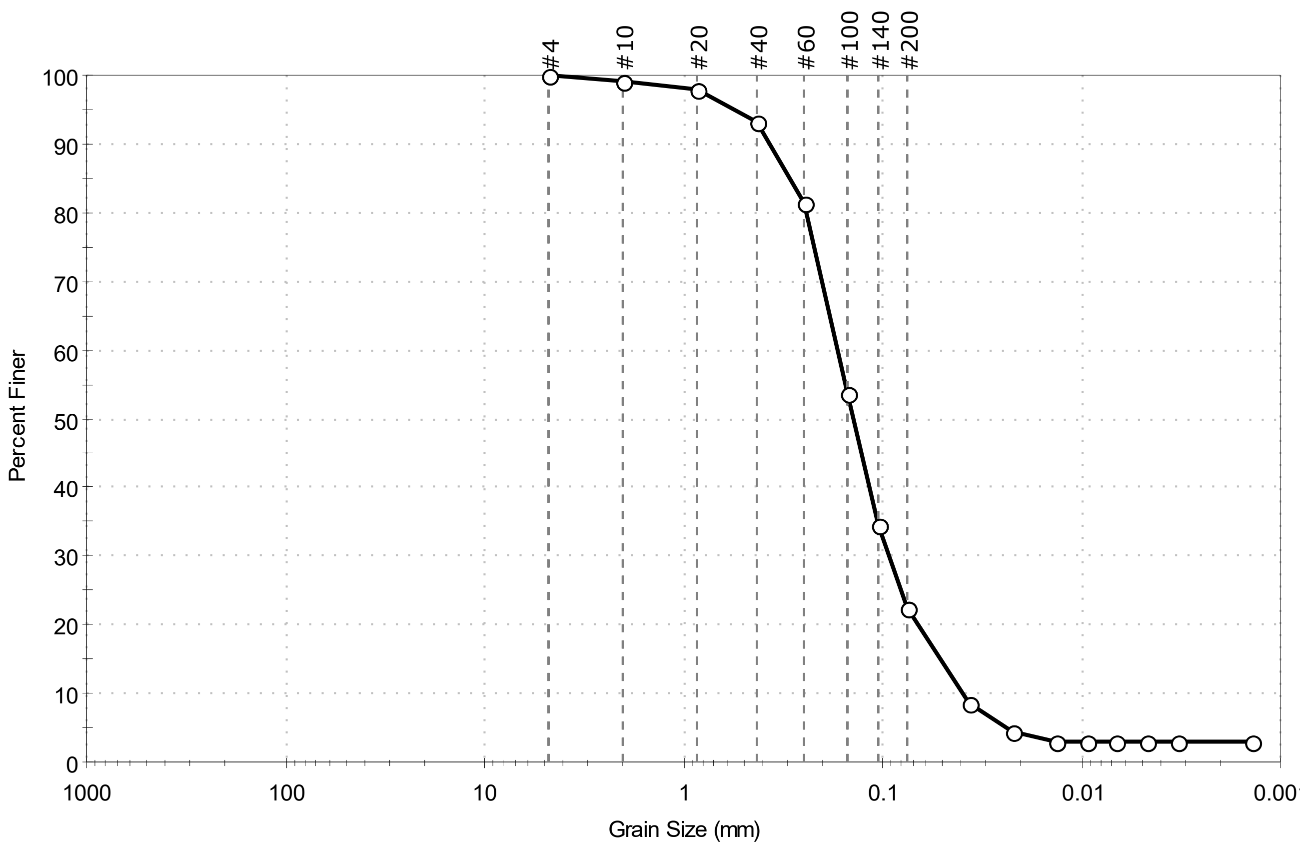
Client: GEI Consultants, Inc.			
Project: Key Capture Energy Battery Storage			
Location: Windsor Locks, CT		Project No:	GTX-317151
Boring ID: WL-B-3	Sample Type: bag	Tested By:	ckg
Sample ID: S-2	Test Date: 05/04/23	Checked By:	ank
Depth : 2-4'	Test Id: 714050		
Test Comment: ---			
Visual Description: Moist, dark brown silty sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	77.6	22.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	98		
#40	0.42	93		
#60	0.25	82		
#100	0.15	54		
#140	0.11	35		
#200	0.075	22		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0371	9		
---	0.0221	4		
---	0.0134	3		
---	0.0095	3		
---	0.0067	3		
---	0.0047	3		
---	0.0033	3		
---	0.0014	3		

Coefficients

D_{85} =0.2925 mm
D_{30} =0.0930 mm
D_{60} =0.1684 mm
D_{15} =0.0513 mm
D_{50} =0.1403 mm
D_{10} =0.0397 mm
C_u =4.242
C_c =1.294

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

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testing services[sm]

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GEOTESTING EXPRESS INCORPORATED
125 NAGOG PARK
ACTON MA 01720-3451
USA

Analysis No.	TS-A2311113
Report Date	04 May 2023
Date Sampled	28 April 2023
Date Received	03 May 2023
Where Sampled	Acton, MA USA
Sampled By	Client

This is to attest that we have examined: Soil: Project: Key Capture Energy Battery Storage; Site Location: - — -; Job Number: GTX-317151

When examined to the applicable requirements of:

ASTM D 512-12*	"Standard Test Methods for Chloride Ion in Water" Method B
ASTM D 516-16	"Standard Test Method for Sulfate Ion in Water"

Results:

ASTM D 512 - Chloride Method B

Sample		Results		Detection Limit
		ppm (mg/kg)	%[1]	
EH-B-3		24.	0.0024	10.
EH-Composite	2 – 8'			
HA-B-5		15.	0.0015	
HA-Composite	2 – 8'			
WI-B-2		12.	0.0012	
WI-Composite	2 – 8'			
WL-B-2		19.	0.0019	
WL-Composite	2 – 8'			

NOTE: [1]Percent by weight after drying and prepared as per the Standard. *Withdrawn 2021 without Replacement

Testing Services Analytical Laboratory
3455 South 500 West
Salt Lake City, UT 84115-4234 USA
TEL: +1 801 262 2448
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ASTM D 516– Sulfates (Soluble)

Sample		Results		Detection Limit
		ppm (mg/kg)	%[1]	
EH-B-3		12.	0.0012	10.
EH-Composite	2 – 8'			
HA-B-5		< 10.	< 0.0010	
HA-Composite	2 – 8'			
WI-B-2		14.	0.0014	
WI-Composite	2 – 8'			
WL-B-2		16.	0.0016	
WL-Composite	2 – 8'			

NOTE: [1]Percent by weight after drying and prepared as per the Standard.

END OF ANALYSIS

USEPA Laboratory ID UT00930

Merrill Gee P.E. – Engineer in Charge

Appendix C

In-situ Resistivity Testing Results

Resistivity Testing Results
GEI Project Number 2301203-1.1
Site Name: Windsor Locks

Tested By: Majid Mahmoodabadi
Date: 4/7/23
Location: ER-1 (See Plan)
Orientation: East-West
Weather: Sunny, 50°F
Surface: Gravel, dry

Spacing (feet)			Readings			Apparent Resistivity E-W (Ohm-cm)	Notes
"a"	Potential	Current	Potential (Volts)	Current (mAmp)	Resistivity E-W (Ohms)		
1	0.5	1.5	400	10	349.4	66,914	High range.
2.5	1.25	3.75	400	10	59.4	28,439	High range.
5	2.5	7.5	400	10	54.2	51,900	High range.
10	5	15	400	10	-26	-49,793	High range.
20	10	30	400	10	-13	-49,793	High range.
40	20	60	400	10	32.4	248,199	High range.

Resistivity Testing Results
GEI Project Number 2301203-1.1
Site Name: Windsor Locks

Tested By: Majid Mahmoodabadi
Date: 4/7/23
Location: ER-1 (See Plan)
Orientation: North-South
Weather: Sunny, 50°F
Surface: Gravel, dry

Spacing (feet)			Readings			Apparent Resistivity E-W (Ohm-cm)	Notes
"a"	Potential	Current	Potential (Volts)	Current (mAmp)	Resistivity E-W (Ohms)		
1	0.5	1.5	400	10	448	85,797	High range.
2.5	1.25	3.75	400	10	152.2	72,870	High range.
5	2.5	7.5	400	10	59.1	56,592	High range.
10	5	15	400	10	18.7	35,813	High range.
20	10	30	400	10	0.1	383	High range.
40	20	60	400	10	0.9	6,894	High range.

Resistivity Testing Results
GEI Project Number 2301203-1.1
Site Name: Windsor Locks

Tested By: Majid Mahmoodabadi
Date: 4/7/23
Location: ER-2 (See Plan)
Orientation: East-West
Weather: Sunny, 50°F
Surface: Gravel, dry

Spacing (feet)			Readings			Apparent Resistivity E-W (Ohm-cm)	Notes
"a"	Potential	Current	Potential (Volts)	Current (mAmp)	Resistivity E-W (Ohms)		
1	0.5	1.5	400	10	556.8	106,634	High range.
2.5	1.25	3.75	400	10	185.7	88,909	High range.
5	2.5	7.5	400	10	45.9	43,952	High range.
10	5	15	400	10	12.8	24,513	High range.
20	10	30	400	10	4	15,321	High range.
40	20	60	400	10	0.8	6,128	High range.

Resistivity Testing Results
GEI Project Number 2301203-1.1
Site Name: Windsor Locks

Tested By: Majid Mahmoodabadi
Date: 4/7/23
Location: ER-2 (See Plan)
Orientation: North-South
Weather: Sunny, 50°F
Surface: Gravel, dry

Spacing (feet)			Readings			Apparent Resistivity E-W (Ohm-cm)	Notes
"a"	Potential	Current	Potential (Volts)	Current (mAmp)	Resistivity E-W (Ohms)		
1	0.5	1.5	400	10	584.1	111,862	High range.
2.5	1.25	3.75	400	10	192.5	92,165	High range.
5	2.5	7.5	400	10	62.6	59,943	High range.
10	5	15	400	10	12.2	23,364	High range.
20	10	30	400	10	2.3	8,810	High range.
40	20	60	400	10	0.9	6,894	High range.