GEOTECHNICAL ENGINEERING REPORT

Wilf Campus for Senior Living – Proposed Solar Field

Franklin Township, Somerset County, New Jersey

January 2022

Prepared For:

MENLO ENGINEERING ASSOCIATES, INC.
261 Cleveland Avenue
Highland Park, New Jersey 08904

Attn: Mr. William A. Lane, P.E.

Prepared By:

GEO-TECHNOLOGY ASSOCIATES, INC.
Geotechnical and Environmental Consultants
14 Worlds Fair Drive, Suite A
Somerset, New Jersey 08873

GTA Job No: 31211972

GEO-TECHNOLOGY ASSOCIATES, INC.

GEOTECHNICAL AND
ENVIRONMENTAL CONSULTANTS

A Practicing Geoprofessional Business Association Member Firm

January 12, 2022

Menlo Engineering Associates, Inc.
261 Cleveland Avenue
Highland Park, New Jersey 08904

Attn: Mr. William A. Lane, P.E.
Executive Vice President

Re: Geotechnical Engineering Report
Wilf Campus for Senior Living – Proposed Solar Field
Franklin Township, Somerset County, New Jersey

Dear Bill:

In accordance with our agreement dated August 12, 2021, and executed on October 15, 2021, Geo-Technology Associates, Inc. (GTA) has performed a geotechnical exploration for the planning and design of a proposed solar field to be constructed at the Wilf Campus for Senior Living in Franklin Township, Somerset County, New Jersey. The exploration consisted of excavating 7 test pits throughout the site, visually classifying the encountered soils, and performing limited laboratory testing. The results of the field and laboratory testing and GTA's recommendations regarding design and construction of the proposed solar field are included in this report.

GTA appreciates the opportunity to have been of assistance to you on this project. Please contact our office at (732) 271-9301 if you have questions or require additional information.

Very truly yours,
GEO-TECHNOLOGY ASSOCIATES, INC.

Allison Tether

Allison Tether, P.G.
Geotechnical Project Manager

Dennis C. Loh, P.E.
Vice President

AFS/AMT/DCL
Job No. 31211972
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FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY
JANUARY 2022

INTRODUCTION

This report presents the results of a geotechnical exploration performed by Geo-Technology Associates, Inc. (GTA) for a proposed solar field to be constructed in Franklin Township, Somerset County, New Jersey. The site is located at the eastern terminus of Levinson Boulevard and is identified as Lots 54.04 in Block 386.07 on the Franklin Township tax map. The general location of the site is shown on the Site Location Map, which is Figure 1 in Appendix A of this report.

GTA was provided with plans prepared by Menlo Engineering Associates, Inc. titled "Subdivision Plan" dated December 9, 2013 and a concept plan dated August 3, 2021. The plans indicate the site boundaries, existing site features and topography, and the layout and dimensions of proposed solar panels, and stormwater management (SWM) basin areas.

The scope of this study included a field exploration, laboratory testing, and geotechnical engineering analyses. The field exploration included 7 test pit excavations adjacent to the proposed development areas and within proposed and potential SWM basin areas. The test pits extended to depths ranging from approximately 3 to 6 feet below the existing surface grades. Limited laboratory testing was performed on soil samples obtained from the test pits to assist in characterizing the general subsurface conditions. The conclusions and recommendations presented in this report were derived from engineering analyses of field and laboratory data, and preliminary information for the proposed development as detailed herein.

SITE CONDITIONS

The site is bounded by residential properties along Cedar Brook Drive to the south, an existing 2-story assisted living facility to the north, and wooded areas to the west and east. At the time of our study, the subject site was densely wooded and contained underbrush consisting of bushes, low growing shrubs, and weeds.

Based on our visual observations and review of the ground surface topography shown on the plan provided to us, the ground surface slopes moderately from about Elevation (EL) 96 feet in the western portion of the site down to about EL 82 feet along the southern boundary.

PROPOSED CONSTRUCTION

Details about the panel construction, installation, and support were not available at the time this report was prepared. Based on the plans provided to us, we understand that the proposed solar field will include 11 rows of solar arrays oriented in an east-west alignment, with lengths ranging from about 44 to 530 feet. We anticipate that inverter pads will be supported on slabs-on-grade. Two proposed stormwater management (SWM) basins are sited in the southeastern and eastern portions of the site. Based on scaled measurements, the proposed SWM basins will each have a footprint area of approximately 8,770 square feet.

Based on our experience with other solar projects, the solar arrays are typically supported by galvanized steel posts (H piles) driven into the ground approximately 4 to 6 feet deep with post spacing typically about 12 to 20 feet depending on the soil type and density. It is possible that concrete bases or ballasted systems may be used to support the steel posts in areas where subsurface obstructions or shallow bedrock are encountered, or to provide additional capacity to resist lateral and/or uplift loads. Based on our experience on projects of similar scope, we anticipate the proposed solar panel systems will have uplift, axial, and lateral loads of approximately 1.5, 7.0, and 0.65 kips, respectively.

SITE GEOLOGY

The subject site is situated within the Piedmont physiographic province of New Jersey, which is characterized by a low rolling plain divided by a series of higher ridges, and mainly underlain by slightly folded and faulted sedimentary rocks. The site is underlain by the Passaic Formation of the Lower Jurassic and Upper Triassic Period of the Mesozoic Era, as shown on the *Bedrock Geologic Map of the Bound Brook Quadrangle (OFM 89, 2011)* published by the New Jersey Geological Survey. The formation is described as an interbedded sequence of reddish-brown, and less commonly maroon or purple, fine- to coarse-grained sandstone, siltstone, shaly siltstone, silty mudstone and mudstone, separated by olive-gray, dark-gray, or black siltstone, silty mudstone and

shale. The unit is as much as 11,480 feet thick regionally, and generally about 5,800 feet thick in the mapped area.

The surficial geology of the site, as shown on the *Surficial Geology of the Bound Brook Quadrangle, Somerset and Middlesex Counties, New Jersey (OFM 4, 1992)* published by the New Jersey Geological Survey, consists of weathered shale and mudstone residual soils. Residual soils are formed by the decomposition of the underlying parent rock, and typically consist of reddish-brown, red, and reddish-yellow silty clay to clayey silt with some to many angular chips of shale, and are typically less than 10 feet thick in the site locale.

Please refer to the referenced publications for more detailed descriptions of the geologic members.

SUBSURFACE EXPLORATION

The subsurface exploration program consisted of performing 7 test pits throughout the area proposed for development. The test pits were performed on November 11, 2021 by Heritage Contracting Company, Inc. using a Kobelco 135SR track-mounted excavator, and extended to depths ranging from approximately 3 to 6 feet below the existing surface grades.

The exploration locations were selected by GTA, and located in the field using a hand-held GPS unit and existing site features as reference. The approximate locations of the explorations performed by GTA for this study are shown on the Test Pit Location Plan, which is included as Figure 2 in Appendix A. Detailed descriptions of the subsurface conditions encountered in the test pits observed by GTA are indicated on the Logs of Test Pits, which are included in Appendix B. The ground surface elevations indicated on the test pit logs were obtained by interpolating between topographic contours shown on the plan provided to us and should be considered approximate.

The soil samples retrieved from the test pits were delivered to GTA's laboratory for visual classification by a geotechnical engineer and limited laboratory testing. The soil descriptions indicated on the logs are based on visual observations of the individual soil samples as summarized

in the Notes for Exploration Logs included in Appendix B, supplemented by the laboratory test results.

LABORATORY TESTING

Laboratory testing performed for this study included grain size distribution of the soils in accordance with the Unified Soil Classification System (USCS), and natural moisture content determinations. Classification of soils in accordance with the USCS provides information regarding the engineering properties of the on-site soils that will likely support the proposed foundations, slabs, and pavements, and be used as controlled compacted fill and backfill. Detailed results of the laboratory testing performed for this study are shown on the Particle Size Distribution Reports included in Appendix C. The results of the laboratory tests are summarized in the following table:

SUMMARY OF LABORATORY TEST RESULTS

TEST PIT LOCATION	DEPTH (ft.)	USCS CLASSIFICATION	NMC (%)
TP-101	½	Silty GRAVEL with sand (GM)	16.7
TP-103	1	Silty GRAVEL with sand (GM)	16.3
TP-106	¾	Silty SAND with gravel (SM)	15.7

Note: NMC=Natural Moisture Content

SUBSURFACE CONDITIONS

In general, an approximately 8-inch-thick layer of topsoil was encountered at the ground surface in the explorations performed for this study. The natural soils encountered below the topsoil appear consistent with the geologic mapping and generally consisted of residual soils, which graded into highly-weathered shale bedrock. The residual soils typically consisted of silty sands with gravel and silty gravels with sand.

Highly-weathered shale was encountered in the test pits at depths ranging from about 1½ to 3½ feet below the ground surface. When excavated, the shale generally presented as silty gravel with sand and typically graded more competent (shaley) with depth. The test pits were typically able to penetrate a few feet below the initial weathered rock surface. Refusal to further excavation with the

Kobelco 135SR excavator was encountered in the test pits at depths ranging from approximately 3 to 6 feet below the existing surface grades.

Groundwater seepage was not observed in the test pits performed for this study. Long-term groundwater readings were not obtained because the test pits were backfilled upon completion for safety considerations. Perched water seepage was observed in Test Pit TP-107 at a depth of 4 feet below the ground surface. Soil mottling indicative of a seasonal high groundwater level was not observed in the test pits performed for this study. Therefore, we believe the seasonal high groundwater level is below the refusal depths.

STORMWATER MANAGEMENT BASIN EVALUATION

Test Pits TP-101, TP-102, TP-103, and TP-104 were performed within the proposed SWM basin areas. In-situ infiltration testing was attempted at each test pit location at depths ranging from about 1 to 2½ feet below the ground surface using a double-ring infiltrometer in accordance with the ASTM D 3385 test procedure. However, due to the presence of shallow rock, the double-ring infiltrometers could not be properly seated at Test Pits TP-101, TP-102, and TP-104, which resulted in water visibly leaking out of the bottom of the test apparatus. The results of the infiltration tests performed for this study are summarized in the following table.

SUMMARY OF INFILTRATION TEST RESULTS

Test Pit Location	Approximate Test Depth* (ft)	Final Water Level Drop (in)	Time Interval (min)	USCS Soil Type	Measured Infiltration Rate (in/hr)
TP-101	1	N/A	N/A	Silty GRAVEL with sand (GM)	-
TP-102	2½	N/A	N/A	Highly-weathered ROCK (HW)	-
TP-103	1	½	10	Silty SAND with gravel (SM)	3
TP-104	1½	N/A	N/A	Highly-weathered ROCK (HW)	-

*Beneath the existing ground surface.

The primary conditions that affect the capacity to infiltrate water are the soil gradation and density properties and the presence of hydraulically restrictive layers such as silt or clay (fines),

rock, or groundwater, each of which would restrict the flow of water into the underlying aquifer. Groundwater seepage was not observed in the explorations performed for this study and perched water seepage was not observed in the test pits performed in the SWM basin areas. In general, the silty sand soil tested in Test Pit TP-103 appeared somewhat receptive to infiltration with a measured infiltration rate of 3 inches per hour.

Chapter 12 requires that infiltration tests be performed within the most restrictive layer within 8 feet of the proposed infiltration elevations. Therefore, per the Chapter 12 guidance, additional basin flood testing should be performed to establish the permeability rate of the bedrock at the test pit locations. A basin flood test involves excavating a "basin" with a minimum bottom area of 50 square feet. If groundwater is observed within the basin, the basin flooding test shall not be used. If no groundwater is observed, the basin shall be filled with 12 inches (about 375 gallons) of water and allowed to drain completely. The basins generally extend at least 2 to 3 feet into bedrock to ensure that, once filled, the 12 inches of water will be fully contained within the excavated rock.

Construction oversight by competent engineering personnel during installation of stormwater management facilities is critical to successful functioning of the system. Ideally, construction oversight should be provided by the geotechnical engineer, or qualified representative, retained by the project owner to document construction operations and assure that project specifications and special construction requirements are met. Periodic inspection and maintenance of the system will be required to maximize the efficiency and design life of the system.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this study, it is GTA's opinion that the use of driven steel posts to support the solar panel arrays may not be feasible due to the presence of shale bedrock at shallow depths. A ballasted support system may be required. Further discussions of these and other items of geotechnical importance are presented in the following sections of this report.

Earthwork

Because ground-supported solar panels can generally be constructed on a gradually sloping surface, mass grading is not anticipated to be required during construction. Site preparation should

generally begin by clearing the trees and their stumps and removing the remaining surface vegetation.

Should any overexcavations be required, the resultant excavations should be backfilled with controlled compacted fill. Controlled backfill should meet USCS designation SM, SP, SW, SC, GP, GM, GC, or GW and be approved by the geotechnical engineer prior to use. The backfill should be spread in layers on the order of 6 to 8 inches in loose thickness and each layer should compacted to at least 95 percent of the maximum dry density as determined by the ASTM D-1557 (modified Proctor) test procedure.

All construction excavations should be sloped and shored in accordance with OSHA excavation regulations or stricter local governing safety codes. It is our opinion that the undisturbed natural soils would generally be classified as "Type C" soils under the OSHA excavation regulations. Significantly flatter excavation side-slopes will be required where groundwater seepage occurs. Permanent slopes should be designed no steeper than 3H:1V (three horizontal to one vertical).

Groundwater was not encountered in the test pits and therefore is not expected to be a concern during construction. However, it should be anticipated that seepage of perched or trapped water may be encountered intermittently and at various depths, but particularly at the soil/rock interface. We anticipate that such seepage will be able to be controlled by pumping from sumps located in the excavations. Positive drainage should be maintained during construction to prevent inundation of subgrade soils by surface water runoff. Excavations to remove wet, soft soils should be backfilled with compacted backfill as previously described, or AASHTO No. 57 stone aggregate.

Foundation Design

Solar Panel Support and Design

Ground-mounted solar panels are typically supported by steel posts driven into the ground, on posts that are supported in cast-in-place concrete piers, or by ballasted systems. Due to the presence of shallow rock across the site, it may not be possible to drive the steel support posts a sufficient distance into the ground to achieve required uplift capacity at some locations. For planning

purposes, the approximate depths below the existing surface grades to the surface of highly-weathered rock are shown at the individual test pit locations on the Test Pit Location Plan in Appendix A.

We recommend that numerous test posts be driven throughout the site to assess drivability prior to installation of the solar panel field. Load testing should be performed on several test posts to determine if the required uplift, axial, and lateral resistances are achieved. In areas where the required depth of the support posts cannot be achieved using the conventional driving equipment, it will likely be necessary to excavate or drill at the individual post locations and support the posts in cast-in-place concrete. Alternatively, if the required depth of the support posts cannot be achieved using the conventional driving equipment, it may be desirable to use a ballasted support system. Ballasted support systems may be a desirable alternative in locations where refusal is encountered over a widespread area. The following table provides recommended soil and rock properties that may be used to estimate lateral and uplift capacities of driven steel posts and unformed, cast-in-place concrete piers:

RECOMMENDED DESIGN PROPERTIES

Material Type	Total Unit Weight (pcf)	Angle of Internal Friction (°)	Cohesion (psf)	Friction Factor Steel Post (°)	Friction Factor Cast-in-Place Concrete (°)
Natural Sand/Gravel Soils (SM, GM)	120	28	0	12	18
Highly-weathered ROCK	140	35	0	22	30

Ancillary Structure Support and Design

Inverters or other electrical equipment may be supported on slabs-on-grade using a design modulus of subgrade reaction (k) of 150 pounds per cubic inch (pci).

Subsurface Utilities

It is our opinion that the existing site soils will be suitable to support subsurface utilities. GTA recommends that a minimum 6-inch-thick granular bedding consisting of AASHTO No. 57 stone aggregate be placed where loose/soft soil or boulders are encountered to provide uniform support as dictated by site conditions.

Contractors should provide adequate earth support and dewatering for utility trench excavations. Dewatering as described above may be required in some areas to control groundwater or perched/trapped water seepage, especially if utility installation is performed during the wet season or after prolonged periods of inclement weather.

Utilities installed below pavements, inverter pads, and other structural areas should be backfilled using controlled compacted fill in accordance with the recommendations presented in the *Earthwork* section of this report.

Seismic Information

Based on the results of this study, it is GTA's opinion that the subsurface conditions at the site may be categorized as Site Class C per the 2018 International Building Code, New Jersey Edition. This categorization is based on the subsurface conditions encountered in the test pits performed for this study, general geologic information for the region, and the information contained in the Code.

ADDITIONAL SERVICES

We recommended that GTA be retained during the design phase and construction of the subject project to provide geotechnical consultation and construction observation and testing services as outlined below:

- Review final site and structural plans to evaluate if they conform to the geotechnical design recommendations intended in this report.
- Observe test pile installation and load testing.
- Provide on-site observation and testing of compacted backfill.
- Observe footing excavations for compliance with the project drawings and the intent of this geotechnical report.
- Perform observation and materials testing during concrete and steel construction.

LIMITATIONS

This report, including all supporting exploration logs, field data, field notes, laboratory test data, calculations, estimates and other documents prepared by GTA in connection with this Project

have been prepared for the exclusive use of Menlo Engineering Associates, Inc. (Client) pursuant to the Agreement between GTA and Client dated August 12, 2021, and executed on October 15, 2021, and in accordance with generally accepted engineering practice. All terms and conditions set forth in the Agreement and the General Provisions attached thereto are incorporated herein by reference. No warranty, express or implied, is made herein. Use and reproduction of this report by any other person without the expressed written permission of GTA and Client is unauthorized and such use is at the sole risk of the user.

The analysis and recommendations contained in this report are based on the data obtained from limited observation and testing of the encountered materials. Test pits indicate subsurface conditions only at specific locations and times, and only at the depths penetrated. They do not necessarily reflect strata or variations that may exist between the exploration locations. Consequently, the analysis and recommendations must be considered preliminary until the subsurface conditions can be verified by direct observation at the time of construction. If variations of subsurface conditions from those described in this report are noted during construction, recommendations in this report may need to be re-evaluated.

In the event that any changes in the nature, design, or location of the facilities 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 are verified in writing. GTA is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or reuse of the subsurface data or engineering analysis without the expressed written authorization of GTA.

The scope of our services for this geotechnical exploration did not include any environmental assessment or investigation for the presence or absence of wetlands, or hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the logs regarding odors or unusual or suspicious items or conditions observed are strictly for the information of our Client.

This report and the attached logs are instruments of service. The subject matter of this report is limited to the facts and matters stated herein. Absence of a reference to any other conditions or subject matter shall not be construed by the reader to imply approval by the writer.

31211972 **GEO-TECHNOLOGY ASSOCIATES, INC.**

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

APPENDIX A

Figures

Note: Site boundary is approximate.

SITE LOCATION MAP

14 Worlds Fair Drive, Suite A
Somerset, New Jersey 08873
(732) 271-9301
fax (732) 271-9306

GEO-TECHNOLOGY ASSOCIATES, INC.

WILF CAMPUS FOR SENIOR LIVING - PROPOSED SOLAR FIELD

Franklin Township
Somerset County, New Jersey

Prepared For: Menlo Engineering Associates, Inc.

SOURCE: Google Maps		
SCALE: NTS	DATE: JAN. 2022	PROJECT #: 31211972

Figure 1

*Baseplan prepared by Menlo Engineering Associates, Inc. titled "Concept Plan" dated August 3, 2021.

LEGEND:

TP-X

Indicates the numbers and approximate locations of test pits performed by GTA for this study.

(X) Indicates the approximate depth below the ground surface to the surface of highly-weathered rock encountered at each test pit location.

TEST PIT LOCATION PLAN

14 Worlds Fair Drive, Suite A
Somerset, New Jersey 08873
(732) 271-9301
fax (732) 271-9306

GEO-TECHNOLOGY ASSOCIATES, INC.

WILF CAMPUS FOR SENIOR LIVING - PROPOSED SOLAR FIELD

Franklin Township
Somerset County, New Jersey

Prepared For: Menlo Engineering Associates, Inc.

DESIGN BY: *	DRAWN BY: AFS	REVIEWED BY: AMT
SCALE: NTS	DATE: JAN. 2022	PROJECT #: 31211972

Figure 2

APPENDIX B

Exploration Logs

NOTES FOR EXPLORATION LOGS

KEY TO USCS TERMINOLOGY AND GRAPHIC SYMBOLS

MAJOR DIVISIONS (BASED UPON ASTM D 2488)				SYMBOLS GRAPHIC	SYMBOLS LETTER
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 15% PASSING THE NO. 200 SIEVE)			GW
					GP
		GRAVELS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)			GM
					GC
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LESS THAN 15% PASSING THE NO. 200 SIEVE)			SW
					SP
		SANDS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)			SM
					SC
FINE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILT OR CLAY (<15% RETAINED ON THE NO. 200 SIEVE) SILT OR CLAY WITH SAND OR GRAVEL (15% TO 30% RETAINED ON THE NO. 200 SIEVE) SANDY OR GRAVELLY SILT OR CLAY (>30% RETAINED ON THE NO. 200 SIEVE)	SILTS AND LEAN CLAYS LIQUID LIMIT LESS THAN 50			ML
					CL
					OL
		ELASTIC SILTS AND FAT CLAYS LIQUID LIMIT GREATER THAN 50			MH
					CH
					OH
HIGHLY ORGANIC SOILS					PT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE COARSE-GRAINED SOILS WHICH CONTAIN AN ESTIMATED 5 TO 15% FINES BASED ON VISUAL CLASSIFICATION OR BETWEEN 5 AND 12% FINES BASED ON LABORATORY TESTING; AND FINE-GRAINED SOILS WHEN THE PLOT OF LIQUID LIMIT & PLASTICITY INDEX VALUES FALLS IN THE PLASTICITY CHART'S CROSS-HATCHED AREA. FINE-GRAINED SOILS ARE CLASSIFIED AS ORGANIC (OL OR OH) WHEN ENOUGH ORGANIC PARTICLES ARE PRESENT TO INFLUENCE ITS PROPERTIES. LABORATORY TEST RESULTS ARE USED TO SUPPLEMENT SOIL CLASSIFICATION BY THE VISUAL-MANUAL PROCEDURES OF ASTM D 2488.

ADDITIONAL TERMINOLOGY AND GRAPHIC SYMBOLS

	DESCRIPTION		GRAPHIC SYMBOLS
ADDITIONAL DESIGNATIONS	TOPSOIL		
	MAN MADE FILL		
	GLACIAL TILL		
	COBBLES AND BOULDERS		
RESIDUAL SOIL DESIGNATIONS	DESCRIPTION	"N" VALUE	
	HIGHLY WEATHERED ROCK	50 TO 50/1"	
	PARTIALLY WEATHERED ROCK	MORE THAN 50 BLOWS FOR 1" OF PENETRATION OR LESS, AUGER PENETRABLE	

COARSE-GRAINED SOILS
(GRAVEL AND SAND)

DESIGNATION	BLOWS PER FOOT (BPF) "N"
VERY LOOSE	0 - 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	>50

NOTE: "N" VALUE DETERMINED AS PER ASTM D 1586

FINE-GRAINED SOILS
(SILT AND CLAY)

CONSISTENCY	BPF "N"
VERY SOFT	<2
SOFT	2 - 4
MEDIUM STIFF	5 - 8
STIFF	9 - 15
VERY STIFF	16 - 30
HARD	>30

NOTE: ADDITIONAL DESIGNATIONS TO ADVANCE SAMPLER INDICATED IN BLOW COUNT COLUMN:
WOH = WEIGHT OF HAMMER
WOR = WEIGHT OF ROD(S)

SAMPLE TYPE

DESIGNATION	SYMBOL
SOIL SAMPLE	S-
SHELBY TUBE	U-
ROCK CORE	R-

WATER DESIGNATION

DESCRIPTION	SYMBOL
ENCOUNTERED DURING DRILLING	▽
UPON COMPLETION OF DRILLING	▼
24 HOURS AFTER COMPLETION	▼

NOTE: WATER OBSERVATIONS WERE MADE AT THE TIME INDICATED. POROSITY OF SOIL STRATA, WEATHER CONDITIONS, SITE TOPOGRAPHY, ETC. MAY CAUSE WATER LEVEL CHANGES.

LOG OF TEST PIT NO. TP-101

PROJECT: **Wilf Campus for Senior Living - Proposed Solar Field**
PROJECT LOCATION: **Franklin Township, Somerset County, New Jersey**
CLIENT: **Menlo Engineering Associates, Inc.**

PROJECT NO.: **31211972**
GROUNDWATER ENCOUNTERED: **N/E**
GROUND SURFACE ELEVATION: **85 Ft.**
DATUM: **Topo**
LOGGED BY: **AFS**
CHECKED BY: **AMT**

DATE STARTED: **11/11/2021**
DATE COMPLETED: **11/11/2021**
CONTRACTOR: **Heritage Contracting Company, Inc.**
EQUIPMENT: **Kobelco 135SR**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0				
				7 In. of Topsoil	
84.4		GM		Red-brown, moist, Silty GRAVEL with sand (Residual Shale)	- NMC=16.7% - Infiltration test attempted at 1 Ft.
83.0	2	HW		Red-brown, moist, Highly-weathered ROCK (Shale)	
82.0				Test pit complete at 3 Ft. due to refusal on weathered rock.	
	4				
	6				
	8				
	10				
	12				

NOTES: **Location and elevation are approximate.**
Backfilled on completion.

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LOG OF TEST PIT NO. TP-101

LOG OF TEST PIT NO. TP-102

PROJECT: **Wilf Campus for Senior Living - Proposed Solar Field**
PROJECT LOCATION: **Franklin Township, Somerset County, New Jersey**
CLIENT: **Menlo Engineering Associates, Inc.**
DATE STARTED: **11/11/2021**
DATE COMPLETED: **11/11/2021**
CONTRACTOR: **Heritage Contracting Company, Inc.**
EQUIPMENT: **Kobelco 135SR**

PROJECT NO.: **31211972**
GROUNDWATER ENCOUNTERED: **N/E**
GROUND SURFACE ELEVATION: **84 Ft.**
DATUM: **Topo**
LOGGED BY: **AFS**
CHECKED BY: **AMT**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			12 In. of Topsoil	
83.0	2	GM		Red-brown, moist, Silty GRAVEL with sand (Residual Shale)	
81.5	4	HW		Red-brown, moist, Highly-weathered ROCK (Shale)	- Infiltration test attempted at 2-1/2 Ft.
79.0	6			Test pit complete at 5 Ft. due to refusal on weathered rock.	
	8				
	10				
	12				

NOTES: **Location and elevation are approximate.**
Backfilled on completion.

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LOG OF TEST PIT NO. TP-102

LOG OF TEST PIT NO. TP-103

PROJECT: **Wilf Campus for Senior Living - Proposed Solar Field**
PROJECT NO.: **31211972**
PROJECT LOCATION: **Franklin Township, Somerset County, New Jersey**
CLIENT: **Menlo Engineering Associates, Inc.**
GROUNDWATER ENCOUNTERED: **N/E**
DATE STARTED: **11/11/2021**
GROUND SURFACE ELEVATION: **85 Ft.**
DATE COMPLETED: **11/11/2021**
DATUM: **Topo**
CONTRACTOR: **Heritage Contracting Company, Inc.**
LOGGED BY: **AFS**
EQUIPMENT: **Kobelco 135SR**
CHECKED BY: **AMT**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0				
84.4				7 In. of Topsoil	
		SM		Red-brown, moist, Silty SAND with gravel	
84.0		GM		Red-brown, moist, Silty GRAVEL with sand (Residual Shale)	- Infiltration rate = 3 in/hr at 1 Ft. - NMC=16.3%
	2				
81.5		HW		Red-brown, moist, Highly-weathered ROCK (Shale)	
	4				
79.0	6			Test pit complete at 6 Ft. due to refusal on weathered rock.	
	8				
	10				
	12				

NOTES: **Location and elevation are approximate.**
Backfilled on completion.

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LOG OF TEST PIT NO. TP-103

LOG OF TEST PIT NO. TP-104

PROJECT: **Wilf Campus for Senior Living - Proposed Solar Field**
PROJECT NO.: **31211972**
PROJECT LOCATION: **Franklin Township, Somerset County, New Jersey**
CLIENT: **Menlo Engineering Associates, Inc.**

GROUNDWATER ENCOUNTERED: **N/E**
DATE STARTED: **11/11/2021**
GROUND SURFACE ELEVATION: **85 Ft.**
DATE COMPLETED: **11/11/2021**
DATUM: **Topo**
CONTRACTOR: **Heritage Contracting Company, Inc.**
LOGGED BY: **AFS**
EQUIPMENT: **Kobelco 135SR**
CHECKED BY: **AMT**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0				
				9 In. of Topsoil	
84.3		GM		Red-brown, moist, Silty GRAVEL with sand (Residual Shale)	
83.5		HW		Red-brown, moist, Highly-weathered ROCK (Shale)	- Infiltration test attempted at 1-1/2 Ft.
	2				
81.0	4			Test pit complete at 4 Ft. due to refusal on weathered rock.	
	6				
	8				
	10				
	12				

NOTES: **Location and elevation are approximate.**
Backfilled on completion.

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LOG OF TEST PIT NO. TP-104

LOG OF TEST PIT NO. TP-105

PROJECT: **Wilf Campus for Senior Living - Proposed Solar Field**
PROJECT LOCATION: **Franklin Township, Somerset County, New Jersey**
CLIENT: **Menlo Engineering Associates, Inc.**
DATE STARTED: **11/11/2021**
DATE COMPLETED: **11/11/2021**
CONTRACTOR: **Heritage Contracting Company, Inc.**
EQUIPMENT: **Kobelco 135SR**

PROJECT NO.: **31211972**
GROUNDWATER ENCOUNTERED: **N/E**
GROUND SURFACE ELEVATION: **87.5 Ft.**
DATUM: **Topo**
LOGGED BY: **AFS**
CHECKED BY: **AMT**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			7 In. of Topsoil	
86.9		GM		Red-brown, moist, Silty GRAVEL with sand (Residual Shale)	
	2				
84.5		HW		Red-brown, moist, Highly-weathered ROCK (Shale)	
83.5	4			Test pit complete at 4 Ft. due to refusal on weathered rock.	
	6				
	8				
	10				
	12				

NOTES: **Location and elevation are approximate.**
Backfilled on completion.

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LOG OF TEST PIT NO. TP-105

LOG OF TEST PIT NO. TP-106

PROJECT: **Wilf Campus for Senior Living - Proposed Solar Field**
PROJECT NO.: **31211972**
PROJECT LOCATION: **Franklin Township, Somerset County, New Jersey**
CLIENT: **Menlo Engineering Associates, Inc.**
GROUNDWATER ENCOUNTERED: **N/E**
DATE STARTED: **11/11/2021**
GROUND SURFACE ELEVATION: **88 Ft.**
DATE COMPLETED: **11/11/2021**
DATUM: **Topo**
CONTRACTOR: **Heritage Contracting Company, Inc.**
LOGGED BY: **AFS**
EQUIPMENT: **Kobelco 135SR**
CHECKED BY: **AMT**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0				
				9 In. of Topsoil	
87.3		SM		Red-brown, moist, Silty SAND with gravel	- NMC=15.7%
	2				
85.0		GM		Red-brown, moist, Silty GRAVEL with sand (Residual Shale)	
84.0	4	HW		Red-brown, moist, Highly-weathered ROCK (Shale)	
82.0	6			Test pit complete at 6 Ft. due to refusal on weathered rock.	
	8				
	10				
	12				

NOTES: **Location and elevation are approximate.**
Backfilled on completion.

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LOG OF TEST PIT NO. TP-106

LOG OF TEST PIT NO. TP-107

PROJECT: **Wilf Campus for Senior Living - Proposed Solar Field**
PROJECT NO.: **31211972**
PROJECT LOCATION: **Franklin Township, Somerset County, New Jersey**
CLIENT: **Menlo Engineering Associates, Inc.**
GROUNDWATER ENCOUNTERED: **N/E**
DATE STARTED: **11/11/2021**
GROUND SURFACE ELEVATION: **90.5 Ft.**
DATE COMPLETED: **11/11/2021**
DATUM: **Topo**
CONTRACTOR: **Heritage Contracting Company, Inc.**
LOGGED BY: **AFS**
EQUIPMENT: **Kobelco 135SR**
CHECKED BY: **AMT**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0				
89.9				7 In. of Topsoil	- Slight water seepage at 4 Ft.
		GM		Red-brown, moist, Silty GRAVEL	
88.5	2	HW		Red-brown, moist, Highly-weathered ROCK (Shale)	
	4				
85.5				Test pit complete at 5 Ft. due to refusal on weathered rock.	
	6				
	8				
	10				
	12				

NOTES: **Location and elevation are approximate.**
Backfilled on completion.

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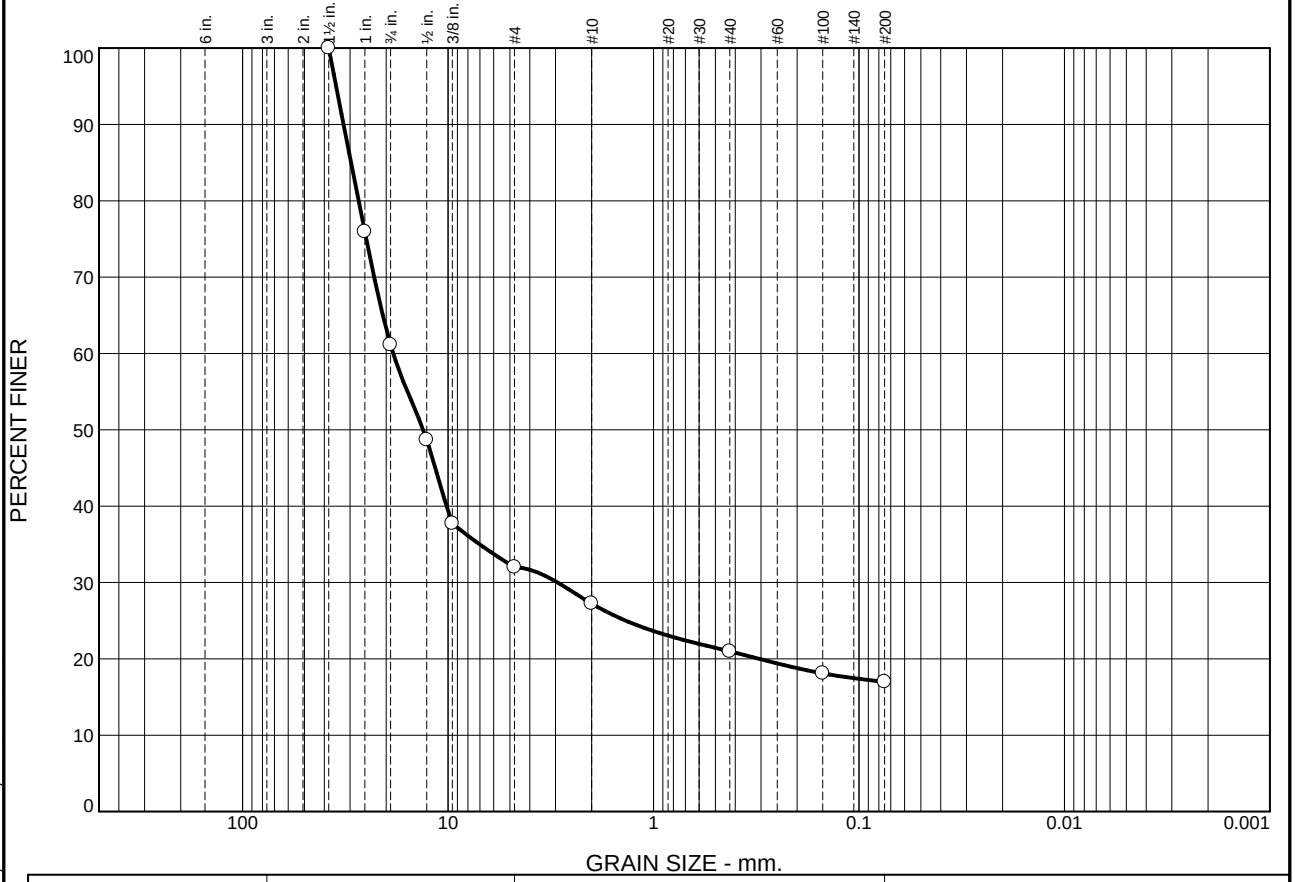
LOG OF TEST PIT NO. TP-107

APPENDIX C

Laboratory Data

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	38.9	29.1	4.8	6.2	4.0	17.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	29.6493	18.4917	13.2127	2.9274				

Material Description	USCS	AASHTO
○ Silty GRAVEL with sand	GM	A-1-b

Project No. 31211972 **Client:** Menlo Engineering Associates, Inc.

Project: Wilf Campus for Senior Living - Proposed Solar Field

○ **Source of Sample:** TP-101 **Depth:** 0.58

Remarks:

○NMC=16.7%

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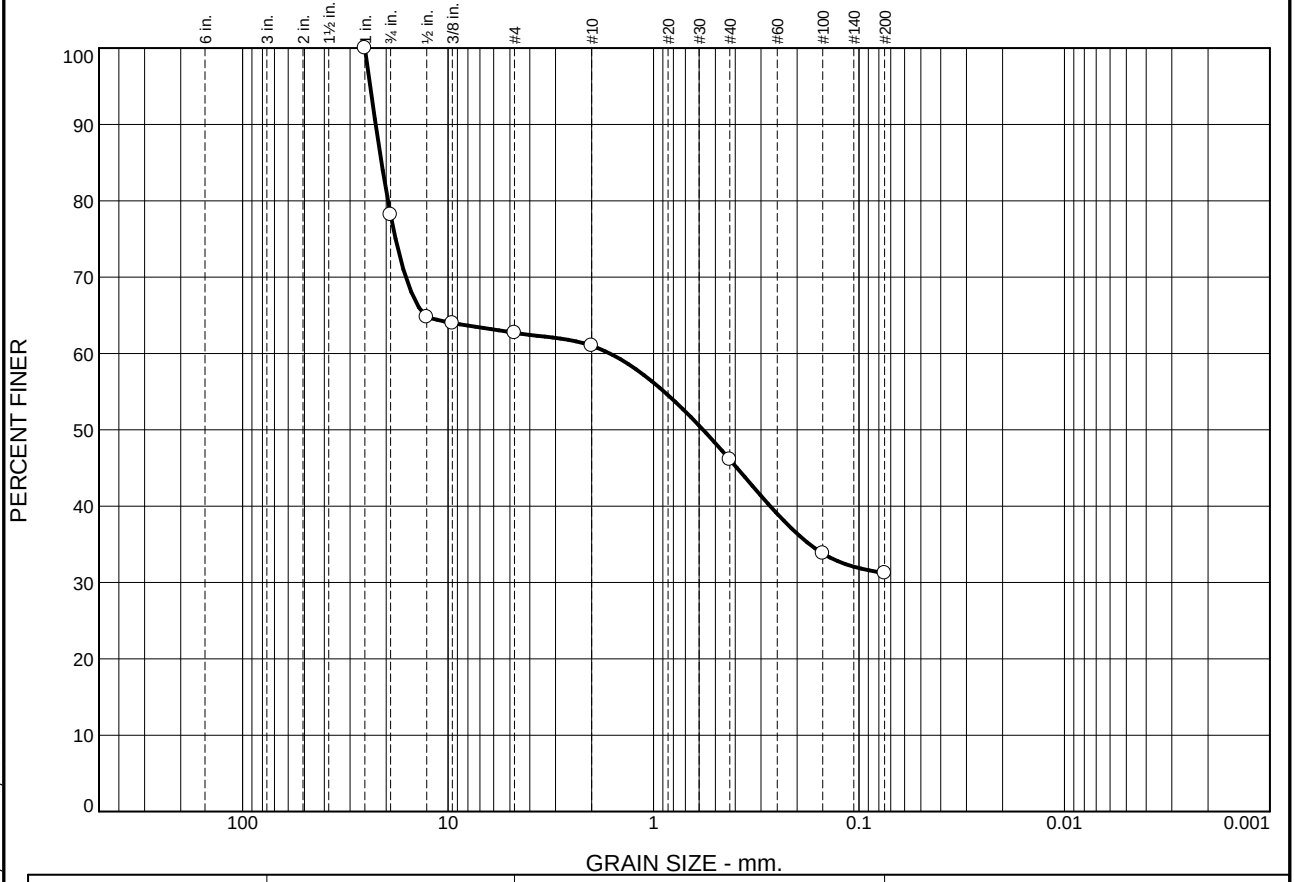
Figure

ASTM Specifications performed my include: D421, D422, D2216, D2217, and D4318.

Tested By: RK **Checked By:** AFS

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	21.8	15.5	1.7	14.9	14.9	31.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	21.0745	1.6305	0.5738					

Material Description	USCS	AASHTO
○ Silty GRAVEL with sand	GM	A-2-4(0)

Project No. 31211972 **Client:** Menlo Engineering Associates, Inc.

Project: Wilf Campus for Senior Living - Proposed Solar Field

○ **Source of Sample:** TP-103 **Depth:** 1

Remarks:

○NMC=16.3%

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Figure

ASTM Specifications performed my include: D421, D422, D2216, D2217, and D4318.

Tested By: RK **Checked By:** AFS

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	18.0	6.8	11.3	20.5	15.0	28.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	22.3556	1.5234	0.7096	0.1232				

	Material Description	USCS	AASHTO
○	Silty SAND with gravel	SM	A-2-4(0)

Project No. 31211972 **Client:** Menlo Engineering Associates, Inc.

Project: Wilf Campus for Senior Living - Proposed Solar Field

○ **Source of Sample:** TP-106 **Depth:** 0.75

Remarks:

○NMC=15.7%

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Figure

ASTM Specifications performed my include: D421, D422, D2216, D2217, and D4318.

Tested By: RK **Checked By:** AFS