Exhibit L
Preliminary Geotechnical Engineering Report

Terracon

August 26, 2020

DICKINSON WRIGHT PLLC

Preliminary Geotechnical Engineering Report

Yellowwood Solar Facility
Clinton County, Ohio
August 26, 2020
Terracon Project No. N4205103

Prepared for:
Invenergy Renewables
Chicago, Illinois

Prepared by:
Terracon Consultants, Inc.
Columbus, Ohio

August 26, 2020

Invenergy Renewables
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Attn: Ms. Lesley Fisher, Senior Staff Engineer, Renewable Engineering
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Re: Preliminary Geotechnical Engineering Report
Yellowood Solar Facility
Clark Township
Clinton County, Ohio
Terracon Project No. N4205103

Dear Ms. Fisher:

We have completed the Preliminary Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PN4205103 dated January 1, 2017. This report presents the findings of the subsurface exploration and provides preliminary geotechnical engineering recommendations for the design and construction of foundations for the proposed solar power facility and the associated site work for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.

Mike Klein

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Environmental ■ Facilities ■ Geotechnical ■ Materials

REPORT TOPICS

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents

Preliminary Geotechnical Engineering Report

Yellowood Solar Facility
Clark Township
Clinton County, Ohio
Terracon Project No. N4205103
August 26, 2020

INTRODUCTION

This report presents the results of our subsurface exploration and preliminary geotechnical engineering services performed for the proposed Yellowood Solar Facility project located in Clinton County, Ohio. The purpose of these services is to provide information and preliminary geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Contributory risk components
- Site preparation and earthwork
- Preliminary foundation design and construction
- Seismic considerations
- Preliminary pile embedment analysis
- Access roadways

The scope of services performed as part of this study are shown in the following table:

Type of Exploration / Test	Number
2020 SPT Borings (Borings B-20-1 through B-20-10)	10
Field Electrical Resistivity Test Locations	3
Thermal Resistivity Test Locations	3
Lateral Pile Load Tests	12
Axial Tension Pile Load Tests	12
Axial Compression Pile Load Test	6

The geotechnical engineering Scope of Services for this project included the advancement of ten test borings to depths of 20 feet below existing site grades.

Maps showing the site and test boring locations are shown in the **SITE LOCATION PLAN AND EXPLORATION PLAN** attachments. The results of the pile load tests are included in **PILE LOAD TEST RESULTS** attachment. The results of the field exploration and laboratory testing performed on soil samples obtained from the site during both the current and previous field explorations are included in the **EXPLORATION RESULTS** section. The field electrical resistivity, corrosion testing and laboratory thermal resistivity test results are also included in this section.

SITE CONDITIONS

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

Item	Description
Parcel Information	The project is located Northwest of Lynchburg in Clinton County, Ohio and consists of two separate parcels. The final size of the project is yet unknown, as land permission is still being negotiated. This site totals about 3,100 ±acres, with only a portion anticipated to be developed with PV Arrays. The project site approximate coordinates between 39.2509 N, 83.8064 W. See **SITE LOCATION PLAN**.
Existing Improvements	Project area mainly consists of agricultural farm fields, that are mostly undeveloped.
Current Ground Cover	Mostly cultivated fields, some drainage features and pocketed areas of vegetations.
Existing Topography	Based on observations during our site visit, the project site appeared to be relatively level to gently sloping with ground surface elevations across the sites ranging from about 1,000 to 1,030 feet (based or Google Earth). A final grading plan was not available as of this report's preparation. However, we anticipate the proposed developments will generally follow the existing site grades.

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

Item	Description
Project Description	We understand that the project site is being considered for development of a 230 Megawatt photovoltaic (PV) solar power facility. The power facility is also anticipated to include invertors, transformers, switchgear and buried or overhead power lines.
Proposed Structures	The steel pile foundations for the solar array are anticipated to consist of wide flange steel piles (W6x9 or similar). In addition, we understand the inverters may also be supported on wide flange steel piles, while transformers, and other appurtenant equipment is anticipated to be supported on shallow spread or mat foundations. Other various aspects of the project include overhead or underground electrical circuits and pads for electrical equipment such as switchgear, transformers, and inverters.
Finished Floor Elevation	Not provided, however, we anticipate finished grade will be within ±3 feet of existing grade.

Item	Description
Maximum Loads (Estimated by Terracon)	The actual loads for this project were not available at the issuance of this report. Therefore, loads from similar projects were used for the pile foundation analysis in this study. ■ Downward: 1 to 7 kips ■ Lateral 1 to 2 kips ■ Uplift: 0.5 to 3 kips (does not include frost heave loads) ■ Moments: 0.1 to 30 kip-ft. ■ O&M Building: Maximum wall loads of 2 kips per foot Substation structures and equipment loads: To be determined (TBD).
Building Construction	We understand the solar structures will be supported on driven steel piles, although other foundation options will be considered, and equipment structures will be supported on mat foundations.
Grading	We understand that where possible, it is desirable to minimize grading, without extensive earthwork or treatment of in-situ soils. Therefore, we anticipate that the solar field final grades will generally follow the existing site grades with nominal grading. (i.e. cut/fill up to 3 feet) Final slope angles no steeper than 3H:1V (Horizontal: Vertical) nor taller than 5 feet are anticipated.
Access Roads	We understand that access road cross sections used for construction of the project will be the responsibility of the EPC, and that only post construction traffic with an allowable rut depth of 2 inches is what we are to design for in this report. We anticipate low-volume, aggregate-surfaced and native soil access roads will have a maximum vehicle load of 30,000 lbs. and will travel over the access roads only once per week.
Estimated Start of Construction	Unknown at the issuance of this report.

GEOTECHNICAL CHARACTERIZATION

Terracon performed a review of available geologic information of the project site. The purpose of this records review was to attempt to establish the extent of the surface and any geological hazards (underground mining, karst) on the property and the depth to these hazards.

SITE GEOLOGY

The project area is located within the glaciated area of Ohio, with the soils being formed in glacial till deposits. Glacial till is a heterogeneous mixture of clay, silt, sand, gravel and rock fragments, which was deposited by glacial ice advancing over bedrock or other glacial deposits. It is believed that glacial till in Clinton County is a product of the Illinoian and late Wisconsinan Glaciation. Glacial till typically becomes more compact with depth within the soil profile.

Based on the USGS Geologic map of Ohio, the overburden soils consist of silty loam till covered with loess and is generally described as flat, continuous ground moraine deposited in the Illinoian Age.

BEDROCK

According to the USGS mapping bedrock at the boring locations with rocks of Ordovician Age and known to consist of generally shale and limestone. **Geological Map of Ohio** can be found in the **Site Location and Exploration Plans** section of the report. Terracon borings were not extended deep enough to confirm the depth to bedrock at the project site.

Based on the USGS Geological map of Ohio, geological hazards that would be detrimental to the development of the site with the proposed improvements were not encountered during our review.

SUBSURFACE SOIL CONDITIONS

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

The surface layer at the site generally consisted of topsoil approximately 3 to 6 inches thick. Beneath this surficial layer subsurface profile consisted of predominately native cohesive soil with some occasional layers of native granular soils to the depths explored. The native cohesive soil encountered generally exhibited medium stiff to hard consistency, and the native granular soil encountered generally exhibited loose to very dense relative density.

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details for each of the borings can be found in the attachment.

The subsurface conditions at the boring locations can be generalized as follows:

Layer	Layer Name (Typical depths layers extend)	General Description
1	**Topsoil** **(Up to 0.5ft bgs)**	Topsoil (due to prior use of the site for agricultural purposes, tilled soils with high organic content should be anticipated to depths deeper than the topsoil depths noted on the logs)
2	**Clay** **(In all borings from 8 to 20 ft bgs)**	Lean Clay, Sandy Lean Clay, Lean Clay with Sand, Gravelly Lean Clay with Sand (CL), Sandy Fat Clay (CH) and Silt (ML)
3	**Sand** **(Intermittent layers below 8 ft bgs in 5 of 10 borings)**	Clayey Sand, Clayey Sand with Gravel (SC) and Well Graded Sand with Gravel (SW)
4	**Gravel** **(Below 10 ft bgs in B-20-07 only)**	Clayey Gravel with Sand (GC)

GROUNDWATER CONDITIONS

The borings were observed while drilling for the presence and level of groundwater. The depth to groundwater was observed at depths ranging from 5 to 13 feet below existing ground surface in the borings. Groundwater was not encountered in borings B-20-2, B-20-3, B-20-6 and, B-20-8 through B-20-10. A summary of the groundwater depths reported to the nearest half foot is listed in the following table:

Boring - ID	Observed Groundwater Level While Drilling (feet bgs)	Observed Groundwater Level after Completion of Drilling (feet bgs)	Final Boring depth (feet bgs)
B-20-1	12.0	5.5	20
B-20-2	No water encountered	No water encountered	20
B-20-3	No water encountered	No water encountered	20
B-20-4	5.0	8.0	20
B-20-5	8.0	5.5	20
B-20-6	No water encountered	No water encountered	20
B-20-7	8.0	13.0	20
B-20-8	No water encountered	No water encountered	20
B-20-9	No water encountered	No water encountered	20
B-20-10	No water encountered	No water encountered	20

bgs – below ground surface

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

FROST CONSIDERATIONS

The soils on this site are frost susceptible, and small amounts of water within the soil can affect the performance of the slabs on-grade, sidewalks, and roadways. Exterior slabs should be anticipated to heave during winter months. If frost action needs to be eliminated in critical areas, we recommend the use of non-frost susceptible (NFS) fill or structural slabs (for instance, structural stoops in front of building doors). Placement of NFS material in large areas may not be feasible; however, the following recommendations are provided to help reduce potential frost heave:

- Provide surface drainage away from the building and slabs, and toward the site storm drainage system.
- Install drains around the perimeter of the building, stoops, below exterior slabs and access roadways, and connect them to the storm drainage system.
- Grade clayey subgrades, so groundwater potentially perched in overlying more permeable subgrades, such as sand or aggregate base, slope toward a site drainage system.
- Place NFS fill as backfill beneath slabs and access roadways critical to the project.
- Place a 3 horizontal to 1 vertical (3H:1V) transition zone between NFS fill and other soils.
- Place NFS materials in critical sidewalk areas.

As an alternative to extending NFS fill to the full frost depth, consideration can be made to placing extruded polystyrene or cellular concrete under a buffer of at least 2 feet of NFS material. More information about the frost depth are presented in the **frost heave potential** section of this report.

SEISMIC CONSIDERATIONS

The seismic design requirements for structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is D**. Subsurface explorations at this site were extended to a maximum depth of 20 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

CORROSIVITY

Corrosivity test results performed on samples collected from bulk samples throughout the site. These values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction. Location of the samples and the test results are included in our results of corrosion analysis included in the appendix of this report.

These test results are provided to assist in determining the type and degree of corrosion protection that may be required. We recommend that a certified corrosion engineer be retained to analyze the need for corrosion protection and to design appropriate protective measures, if required.

As discussed in Section 10.7.5 of the AASHTO LRFD Bridge Manual, 8th Edition, 2017, the following soil or site conditions should be considered as indicative of potential deterioration or corrosion situation for steel piles:

- Soil electrical resistivity less than 2,000 ohm-cm
- pH less than 5.5
- pH between 5.5 and 8.5 with high organic content
- Sulfate concentration greater than 1,000 ppm (mg/kg)

GEOTECHNICAL OVERVIEW

The site could be developed for the proposed construction of a solar PV facility based upon geotechnical conditions encountered at the site provided that the findings and preliminary geotechnical engineering recommendations presented in this report are incorporated into project design and construction. It should be noted that the exploration locations and pile load tests were performed at large distances from each other, therefore actual conditions may vary from those encountered. The General Comments section provides an understanding of the report limitations.

CONTRIBUTORY RISK COMPONENTS

ITEM	DESCRIPTION
Supplemental Exploration and Services	Additional soil test borings should be performed to adequately explore the site as part of a design-level study. Additionally, a full-scale pile load testing (PLT) program should be considered as the project design progresses. The results of a full scale PLT program in conjunction with soil test boring/test pit results are often successful in reducing the design embedment depth when compared to designs solely based on explorative results and analytical methods.
Soil Conditions	Project site subsurface profile consisted of predominately native cohesive soil with some occasional layers of native granular soils to the depths explored. The surface layer at the site generally consists of topsoil approximately 3 to 6 inches thick. Due to prior use of the site for agricultural purposes, tilled soils with high organic content should be anticipated to depths deeper than the topsoil depths noted on the logs. As part of final design study, we recommend performing test pits across the site to determine the depth of these tilled horizon. These soils are not considered suitable for subgrade support or reuse as fill material.
Liquefaction	Sands located below the groundwater table can be subject to liquefaction, a phenomenon characterized by sudden loss of strength and collapse under seismic loading. Settlement can be observed at the surface where significant volume loss occurs in sand layers beneath the surface. Based on the subsurface profile encountered at the project site and very low anticipated ground accelerations as indicated by USGS Seismic Design Maps, our preliminary assessment is that liquefaction should not be expected under an earthquake of the magnitude predicted for the site. Additionally, the soils generally have $(N_1)_{60}$ blow counts that are greater than 20 and/or likely contain at least 15 percent clay contents, therefore would not be susceptible to liquefaction (FHWA Publication FHWA-NHI-11-032). However, the potential for liquefaction should be further evaluated through additional site investigation to provide a better representation of the site and to investigate deeper soil zones in a few locations.
Access	Wet and loose/soft surface conditions due to rainwater will create access issues for vehicles. The site will generally be more accessible in the summer and early fall due to the improved drying conditions. The existing drainage canals have a limited number of crossings, likely designed to facilitate access with agricultural equipment.
Grading	We anticipate very little grading will be required. On-site materials that are used as fill or backfill will likely require drying prior to re-compaction as engineered fill. Alternatively, these materials could be replaced with imported soils containing an appropriate moisture content. We expect localized areas of unsuitable conditions will be encountered prior to placing fill and within the subgrade for roadways and shallow foundations that are planned.

ITEM	DESCRIPTION
	Stabilization measures, such as over-excavation and replacement, should be expected.
Groundwater	Groundwater is currently at depths of 5.0 to >20.0 feet bgs which is typical for the geologic setting of the project site. Based on our experience in the project area, groundwater levels could approach the surface at times during the design period for the project. Excavations, such as trenches for electrical cable and conduit, will likely encounter groundwater and require dewatering. Excavations for shallow foundations could also encounter groundwater, especially if construction is performed during periods of seasonally high groundwater. While precipitation is relatively constant throughout the year, groundwater levels are expected to be deepest during the late summer due to increased evaporation rates.
Site Drainage	The existing perimeter ditches / canals were likely installed to facilitate farming activities and site access. Filling the drainage canals or destruction of other site drainage systems such as field tiles, will result in increased groundwater levels, softer soils, and generally undesirable subsurface conditions.
Corrosion Hazard	Based on field resistivity data and laboratory testing for electrical resistivity and chemical properties, the site soils have moderate corrosion range to buried metal per corrosion guideline from U.S Department of Transportation Federal Highway Administration. The soils have a ‘negligible’ classification for sulfate exposure according to ACI Design Manual. The results of our laboratory testing of soil chemical properties (provided in the attachment) are expected to assist a qualified engineer to design corrosion protection for the production piles and other project elements.
Excavation Hazards	Based on the results of our borings and our experience with the geology of the project site, we do not expect that difficult excavation conditions or widespread obstructions to pile driving operations will be encountered during construction. As previously noted groundwater is expected to be encountered in excavations. Additionally, we expect general instability in the form of caving, sloughing, and raveling to be encountered in excavations. Excavations will likely require bracing, sloping, and/or other means to create safe and stable working conditions.
Slope Hazards	With the exception of the existing, shallow drainage canals, the site is gently rolling to relatively level. Therefore, some sloughing could occur within the slopes for the existing drainage canals.
Anticipated Pile Drivability	There is a very low likelihood of encountering difficulties during pile driving. We do not anticipate pre-drilling to be required.
General Construction Considerations	Based on our findings the near-surface soils consist of primarily clays and are moisture sensitive and subject to degradation with exposure to moisture. To the extent practical, earthwork should be performed during warmer and drier periods of weather to reduce the amount of necessary subgrade remedial

ITEM	DESCRIPTION
	measures for soft and unsuitable conditions beneath access roadways, equipment pads, etc.
Note: The soil properties that can significantly affect the aggressiveness of corrosion to buried metal structures include: pH, oxidation-reduction potential, sulfates, sulfides, total dissolved salts, chlorides, resistivity, and moisture content. These properties were measured, and the results are reported in the attachment. These test results are provided to assist the designers of corrosion protection for the project.	

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

PILE LOAD TESTING

Pile load tests were performed at six locations across the site. The test piles consisted of wide flange W6x9 steel piles. These test piles were installed to embedment depths of 6 and 9 feet. The piles are identified in this report as text “PLT” followed by test number followed by letter “A” (piles embedded to 9 feet below existing ground surface) and “B” (piles embedded to 6 feet below existing ground surface) and “C” (piles embedded to 6 feet below existing ground surface). All pile locations were pre-drilled to the depth of 2 feet prior to pile installations. The piles were tested for axial tension first and lateral load next.

The following table summarizes the pile test location, penetration depth, total pile length and type of test performed on the piles.

Test Location	PILE (A) (W 6X9)		PILE (B) (W 6x9)		PILE (C) (W 6x9)	
	Tests: Axial Tension, Lateral, and Compression					
	Embedment Depth	Total Pile Length	Embedment Depth	Total Pile Length	Embedment Depth	Total Pile Length
	feet	feet	feet	feet	feet	feet
PLT-1	9	11	6	8	6	8
PLT-2	9	11	6	8	6	8
PLT-3	9	11	6	8	6	8
PLT-4	9	11	6	8	6	8
PLT-5	9	11	6	8	6	8
PLT-6	9	11	6	8	6	8

PILE DRIVING

The pile driving operation was performed with a track-mounted, Vermeer 10 pile driver. The pile driving hammer was set up to run at 100 percent of the full driving capacity. The piles were installed to the depths as shown in the previous table. A summary of the time required to advance each pile to its specified embedment depth is summarized in the following table.

Test Location	PILE (A)			PILE (B)			PILE (C)		
	Embedment Depth	Total Drive Time	Avg. Drive Time[1]	Embedment Depth	Total Drive Time	Avg. Drive Time	Embedment Depth	Total Drive Time	Avg. Drive Time
	ft	sec	sec/ft	ft	sec	sec/ft	ft	sec	sec/ft
PLT-1	9	369.0	52.71	6	93.2	23.29	6	78.6	19.66
PLT-2	9	215.8	30.83	6	71.1	17.78	6	70.4	17.59
PLT-3	9	140.4	20.06	6	66.2	16.56	6	52.0	13.00
PLT-4	9	177.2	25.32	6	51.7	12.92	6	40.4	10.09
PLT-5	9	280.1	40.01	6	107.0	26.76	6	91.3	22.82
PLT-6	9	243.5	34.78	6	65.2	16.31	6	95.3	23.82

1. Average Driving Time is calculated based on the embedded depth excluding the 24-inch pre-drill depth

PILE LOAD TEST PROCEDURES AND EQUIPMENT

Pile load tests were performed on August 10, 2020. The oversized holes were pre-drilled utilizing an approximately 10 inch outside diameter hollow stem auger and to an approximate depth of 2 feet below the ground surface. The pile load tests were performed three or more days after the piles were installed. An Enerpac 10-ton hydraulic pull jack and an Enerpac hydraulic pump were used to apply the test loads using chains and other accessories all rated for at least a 10-ton safe working capacity. Deflections were measured with digital dial gauges with magnetic bases. Loads were measured with a Dillon ED Junior Dynamometer 25-kip electronic load cell for tension, compression, and lateral loads. The following types of load tests were performed:

- Axial Tension Load Tests for skin friction evaluation;
- Lateral Load Tests;
- Axial Compression test for tip resistance evaluation.

The sequence of testing is as follows: Axial tension load tests were performed on piles designated as A and B at each pile load test location. For axial tension testing, Terracon's proprietary steel tri-pod system was used to develop the vertical tension reaction. A locking "E"- plate clamp was used to grip the top of the web. Terracon set up a 10-foot long, steel reference beam to rest the gauges and record movements relative to the test pile. The ends of the reference beam were supported such that they were 6-inches above ground and seated firmly on the ground surface. Magnetic bases were attached to the web of the test pile approximately 4 inches above the ground surface to provide a suitable surface for the deflection gauges to rest against. The test loads were applied following a pre-determined load sequence. Deflections and loads were measured using a pair of calibrated Starrett dial gauges.

For lateral load testing, Terracon connected two (2) test piles together to test both piles simultaneously with each pile being the reaction pile for the other. The piles were spaced at an approximate horizontal distance of 10 feet. A flange clamp was set on each of the W-section piles to apply horizontal loading approximately 24 inches above the ground surface. Two reference beams were positioned near the outside edge of each test pile flange. Two calibrated two-inch stroke dial gauges were positioned on each pile along the strong axis horizontally with the magnetic base approximately 4 inches above ground surface to bear on the reference beam. The test loads were applied using a pre-determined cyclic-type load sequence. The load was measured using the electronic readout device from the load cell. The bottom and top deflections were recorded using the electronic readout device. The lateral load was applied in increments and decrements (i.e., loading and unloading cycles). The sequence of loading and unloading cycle includes 500-, 1000-, 1500-, 0-, 1500-, 2000-, 2500-, 0-, 2500-, 3000-, 4000- and 0- lb, and so on. The loads were applied until the maximum lateral load of 7,000 lbs. was reached or the pile reached 2-inch of lateral displacement measured at 6 inches above the ground surface.

The axial compression tests were performed using a ½ inch plate being placed on the top of the pile followed by the Rice Lake DC-390 compression load cell, which was used to record the loads. The compression tests were performed in the shallower embedment piles only. These piles were designated as C piles. The deflection as measured using two calibrated Starrett dial gages. An Enerpac 5-ton cylinder jack was then placed on top of the load cell. The bucket of an excavator was used to provide the reaction load. The axial compression load was applied in load increments of 500 lbs. to a maximum of 13,000 lbs was reached or until the pile reached ¾ of an inch of vertical displacement.

SUMMARY OF PILE LOAD TEST RESULTS

The following table provides a summary of the pile embedment depth and lateral load at 2-inch lateral displacement at 6 inches above ground surface.

Pile Load Test Location (A)	Embedment Depth	Lateral Load at 1" Disp.	Pile Load Test Location (B)	Embedment Depth	Lateral Load at 1" Disp.
	feet	lbs.		feet	lbs.
PLT-1A	9	3,000	PLT-1B	6	2,600
PLT-2A	9	3,700	PLT-2B	6	3,500
PLT-3A	9	2,500	PLT-3B	6	2,00
PLT-4A	9	2,500	PLT-4B	6	1,600
PLT-5A	9	2,700	PLT-5B	6	3,700
PLT-6A	9	2,450	PLT-6B	6	2,200

The following table provides a summary of the axial tension loads for pile movements of about ¼ inch.

Pile Load Test Location (A)	Embedment Depth	Tension Load at 0.25" Disp.	Pile Load Test Location (B)	Embedment Depth	Tension Load at 0.25" Disp.
	feet	lbs.		feet	lbs.
PLT-1A	9	6,600	PLT-1B	6	5,000
PLT-2A	9	8,000	PLT-2B	6	6,250
PLT-3A	9	7,100	PLT-3B	6	4,600
PLT-4A	9	7,800	PLT-4B	6	4,100
PLT-5A	9	10,000	PLT-5B	6	8,200
PLT-6A	9	6,250	PLT-6B	6	4,200

The following table provides a summary of the axial compression loads for pile movements of about ¼ inch.

Pile Load Test Location (C)	Embedment Depth	Compression Load at 0.25" Disp.
	feet	lbs.
PLT-1C	6	10,000
PLT-2C	6	10,500
PLT-3C	6	8,000
PLT-4C	6	4,000
PLT-5C	6	13,000
PLT-6C	6	7,000

PRELIMINARY EMBEDMENT DEPTH ANALYSIS

We have performed preliminary geotechnical and structural analyses for evaluating the embedment depths of driven pile foundations to support the typical NEXTracker and FTC-105 racking systems when installed in soils. This analysis is based on the results of our widely-spaced soil explorations, the structural loads as provided by NEXTracker and FTC, LPILE parameters derived from this preliminary evaluation, and other noted assumptions. Subsequent analyses will be required once design level geotechnical information is available and after other design considerations are more fully defined. Therefore, the results of the analyses described below should not be used for design. Rather, these analyses are intended to assist you in roughly evaluating construction costs and development viability for the proposed project.

Our analyses have not considered the potential loss of steel due to corrosion during the design life of the structure. The final structural design should consider the anticipated steel loss as determined by a qualified Corrosion Engineer. Thicker pile sections or additional corrosion protection measures may be required if steel loss is predicted by corrosion analyses.

FROST HEAVE POTENTIAL

Based on the provided information, the solar arrays for this project are anticipated to be supported by driven piles. The driven piles should be designed to resist design loads including compression, uplift, frost heave action and lateral forces. The soils at this site are frost susceptible. The typical frost depth in this location for foundation design frost considerations is 36 inches (3 feet). Frost heave on pile foundations will be significant. If the anchorage of the foundations and the deadweight of the structure are not sufficient to resist these forces, it can cause uplift to structures. Based on our review of soil samples and published soil maps of the area, we recommend that an adfreeze stress (frost heave) of 1,500 pounds per square foot (psf) acting along the pile perimeter to a depth of 1.6 feet below the ground surface should be considered.

GEOTECHNICAL AXIAL CAPACITY

The axial uplift capacity of driven piles may be estimated based on skin friction developed along the perimeter of the pile, while the compression capacity may be estimated using the skin friction and end bearing. When determining embedment depths, the perimeter of a wide flange beam should be taken as twice the sum of the flange width and section depth. The upper 24 inches of soil for each pile should be neglected in the axial capacity analyses under frost heave load conditions. For compression load conditions, only the upper one foot of soil should be neglected.

Based on the results of the preliminary pile load testing program, the majority of the site appears to be relatively uniform. Below is a table of values recommended for the areas in proximity to the pile load tests:

Zone A (PLT- 1 & 2)			
Description	**Depth (feet bgs)**	**Ultimate Side Friction (psf)**	**Ultimate End Bearing (lbs)**
Stratum 1	**0 – 6**	**850**	**2,000**
Stratum 2	**6 – 9**	**350**	

Zone B (PLT- 3, 4, & 6)			
Description	**Depth (feet bgs)**	**Ultimate Side Friction (psf)**	**Ultimate End Bearing (lbs)**
Stratum 1	**0 – 6**	**650**	**1,000**
Stratum 2	**6 – 9**	**560**	

Zone C (PLT- 5)			
Description	**Depth (feet bgs)**	**Ultimate Side Friction (psf)**	**Ultimate End Bearing (lbs)**
Stratum 1	**0 – 6**	**1200**	**3,000**
Stratum 2	**6 – 9**	**360**	

The above values are to be used in the following equations to obtain the ultimate uplift or compression load capacity of a pile:

$$\boldsymbol{Q_{ult\ (compressive)} = Q_{ult\ (end)} + H \times P \times q_s}$$
$$\boldsymbol{Q_{ult\ (uplift)} = H \times P \times q_s}$$

$Q_{ult} = \ Ultimate\ uplift\ or\ compression\ capacity\ of\ post\ (lbs)$
$Q_{ult-(end)} = \ Ultimate\ end\ bearing\ capacity\ per\ the\ table\ above\ (lbs)$
$H = \ Depth\ of\ pile\ embedment\ (ft)$
$P = \ Perimeter\ area\ of\ pile\ (i.e. W6 \times 9 = 1.64\ sqft/ft)$
$q_s = \ Skin\ friction\ per\ depth\ per\ the\ table\ above$

The provided preliminary skin friction values are applicable for piles that are driven using a Vermeer PD-10 pile driver with a hydraulically operated hammer. If a smaller or larger drive hammer is used, we recommend that Terracon be consulted to determine the minimum drive time based on the actual equipment to be used.

For Allowable Stress Design (ASD), we recommend the allowable skin friction values be determined by applying a factor of safety (FOS) of at least 1.5 to the ultimate values. A FOS of 2 should be applied to the ultimate end bearing.

Piles should have a minimum center-to-center spacing of at least 3 times their largest cross-sectional dimension to prevent reduction in the axial capacities due to group effects.

The results of the analyses described above should be supplemented with additional pile load testing to confirm/modify the results prior to use in design. Rather, these analyses are intended to assist you in roughly evaluating construction costs and development viability for the proposed project

Final pile design to be completed by an engineering licensed in the State of Michigan based upon information contained in this preliminary geotechnical report, final design phase study and independent pile load testing.

GEOTECHNICAL LATERAL CAPACITY

Lateral load response of pile foundations was calculated using the computer program *L-Pile 2019*, by Ensoft, Inc. The stiffness of the pile and the stress-strain properties of the surrounding soils determine the lateral resistance of the foundation. We modeled the lateral response of the tested piles to evaluate L-Pile input parameters that can be used for design of the production piles. Recommended L-Pile input parameters for preliminary lateral load analysis for driven pile foundations are shown in the following table:

Description	Depth (feet bgs)	LPILE Soil Model [1]	Effective Unit Weight γ, (pcf) [1]	Estimated Cohesion, c (psf) [1]	Estimated Friction Angle, ϕ (°)[1]	Strain Factor, (ε_{50}) and Static Lateral Subgrade Modulus (k) [1]
Stratum 1	0 - 5	Stiff Clay w/o Free Water	110	1000	--	default
Stratum 2[2]	5 - 10	Stiff Clay w/o Free Water	48	1000	--	default
Stratum 3	10 - 20	Stiff Clay w/o Free Water	58	2000	--	default

Notes for Above Tables:

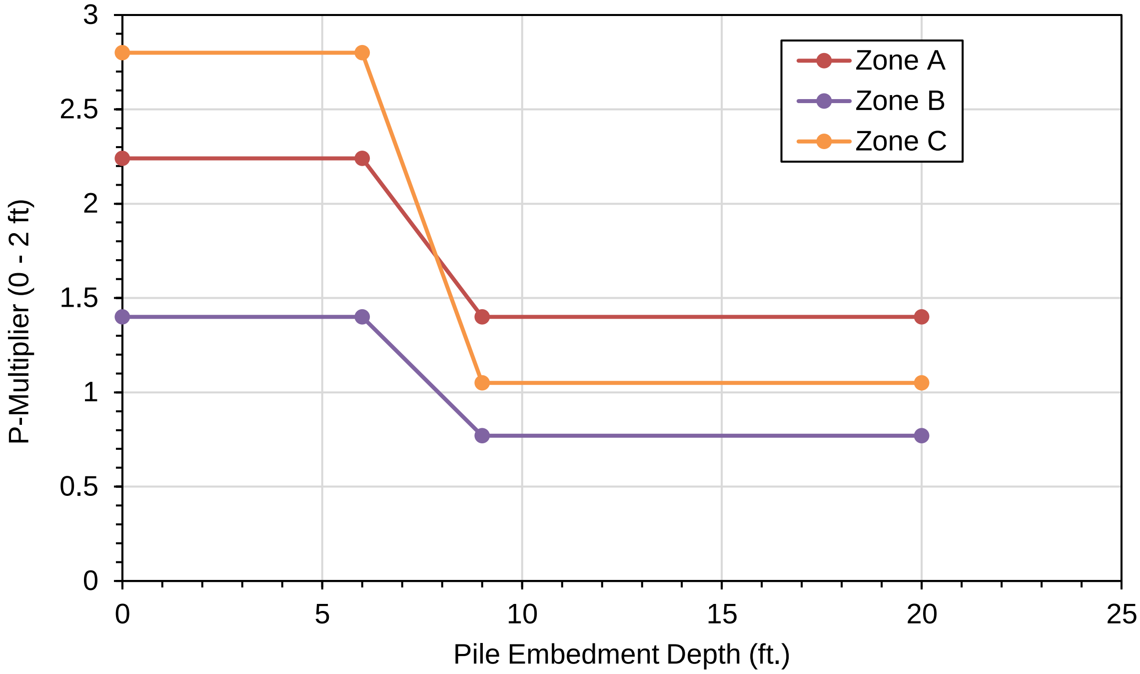
1. Recommended soil model type, strain factor, and static lateral subgrade modulus inputs for use in LPILE software
2. GW level at 5 ft below ground level

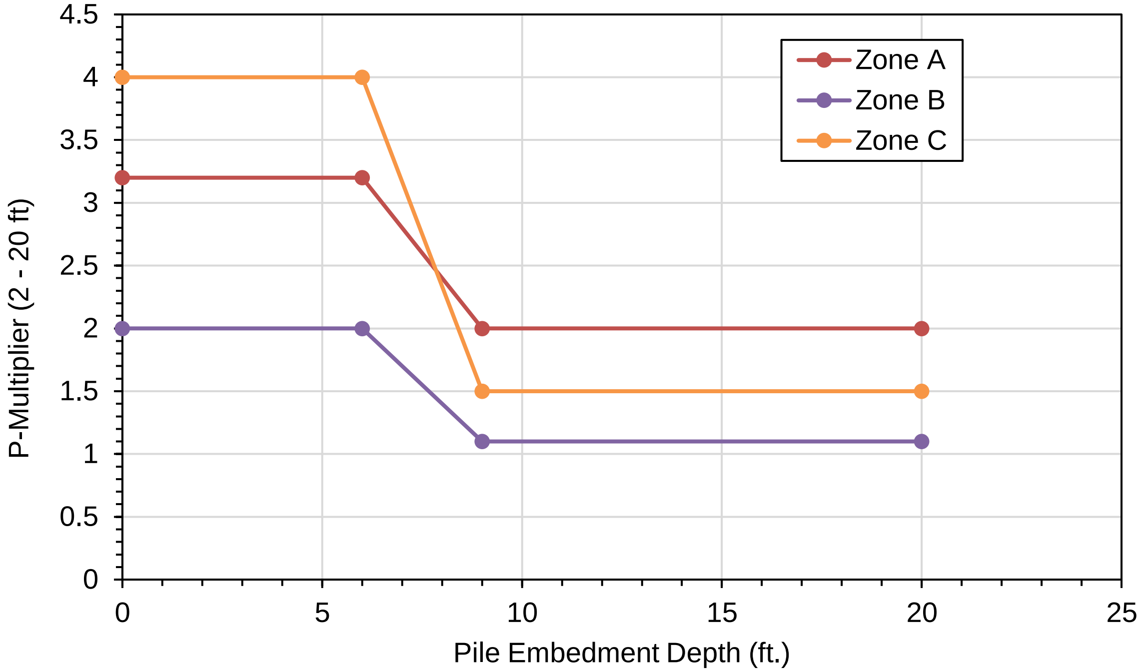
L-PILE analyses were performed by applying the field test load that resulted in approximately 1-inch deflection at a point about six inches above the ground surface. The shear load was applied at approximately 2 feet above the ground surface. The effective unit weight, friction angle was based on the results of the SPT borings. The p- multiplier was then adjusted (by trial and error method) such that the applied load resulted in a deflection value that matched the load test results. Please note that this procedure was based on only one discrete set of data determined at about six inches from the ground surface during the field load testing. These results should be used for

L-PILE analysis only using the 2019 version of L-Pile. These parameters are only applicable to piles embedded between 6 to 9 feet below grade. In our evaluation, the piles were modeled as a Steel AISC Section Strong Axis.

Piles embedded at or below 6 ft.			
Depth (feet bgs)	**P- Multiplier**		
	Zone A	**Zone B**	**Zone C**
0 – 2	2.24	1.40	2.80
2 – 20	3.20	2.00	4.00
Piles embedded between 6 and 9 ft.			
Depth (feet bgs)	**P- Multiplier**		
	Zone A	**Zone B**	**Zone C**
0 – 2	Linear interpolation between above and below tables based on pile embedded depth		
2 – 20			
Piles embedded at or greater 9 ft.			
Depth (feet bgs)	**P- Multiplier**		
	Zone A	**Zone B**	**Zone C**
0 – 2	1.40	0.77	1.05
2 – 20	2.00	1.10	1.50

The following graphs represent the table and it shows changes in p-multiplier values based on the pile embedment depth. The first graph shows the p-multiplier for soil at depth 0 to 2 ft below the ground surface, and the second graph shows p-multiplier value for soil at depth 2 to 20 ft. below the ground surface.





The structural engineer should evaluate the moment capacity of the pile as part of their structural evaluation. Piles should have a minimum center-to-center spacing of at least five times their largest cross-sectional dimension in the direction of the lateral loads, or the lateral capacities should be reduced due to group effects. If piles will be spaced closer than five times their largest cross-sectional dimension, we should be notified to provide supplemental recommendations regarding resistance to lateral loads.

STRUCTURAL CAPACITY ANALYSIS & DISCUSSION

We have performed a preliminary structural embedment analysis using the geotechnical parameters outlined above. This analysis is based on the results of our widely-spaced soil explorations, the structural loads as provided by Nextracker, FTC, LPILE parameters derived from this study, and other noted assumptions. Our analyses have not considered the potential loss of steel due to corrosion during the design life of the structure. The final structural design should consider the anticipated steel loss as determined by a qualified corrosion engineer. Thicker foundation sections or additional corrosion protection measures may be required if steel loss is predicted by the corrosion analyses.

Approximate structural load conditions were analyzed based on top-of-pile load documents for the two single-axis tracker racking systems. Design conditions utilized for Nextracker pile array are 100 mph 3-second wind gust, and a maximum pile reveal of 6 feet. For FTC, the 105 mph 3-second gust was used for analysis. Maximum pile reveal height for FTC are provided in the table. The actual top-of-pile structural loads will vary based on the selected racking system and the manufacturer's load information as determined in accordance with requirements by the applicable building codes and local municipality.

For the NEXTracker pile array, the following table outlines the top-of-pile loads used in our structural analysis and the resulting preliminarily recommended pile section and embedment depths for the pile locations at around bore locations. The pile reveal height used in the analysis for the Nextracker pile array is 6 feet.

Zone A								
Nextracker								
Pile Type	Approximate Factored Loads						Structural Analysis Results	
	Compression	Dead Load	Uplift	Adfreeze Uplift	Shear	Moment	Recommended Pile Section	Recommended Pile Embedment
	(kips)	(kips)	(kips)	(kips)	(kips)	(kip-ft.)		(ft.)
Motor - Exterior	3.153	0.782	1.712	4.896	1.520	14.865	W6x20	7.5
P2 - Exterior	2.510	0.728	1.171	4.008	2.071	0.288	W6x12	7.5
P3 & P5 - Exterior	2.390	0.700	1.096	4.800	2.389	0.308	W6x15	6.0
P4 & P6 - Exterior	2.646	0.674	1.225	4.800	2.920	0.276	W6x15	7.5
P7 - Exterior	0.884	0.474	0.421	3.912	1.013	0.174	W6x8.5	7.5
Motor - Interior	2.215	0.718	0.799	4.008	0.844	9.549	W6x12	7.0
P2 & P7 - Interior	1.948	0.668	0.680	3.912	0.816	0.205	W6x8.5	7.0
P4 - Interior	1.304	0.618	0.484	3.912	0.903	0.203	W6x8.5	7.5
P3, P5 & P6 - Interior	1.641	0.435	0.442	3.912	0.922	0.194	W6x8.5	7.5

Zone B								
Nextracker								
Pile Type	Approximate Factored Loads						Structural Analysis Results	
	Compression	Dead Load	Uplift	Adfreeze Uplift	Shear	Moment	Recommended Pile Section	Recommended Pile Embedment
	(kips)	(kips)	(kips)	(kips)	(kips)	(kip-ft.)		(ft.)
Motor - Exterior	3.153	0.782	1.712	4.896	1.520	14.865	W6x20	10.0
P2 - Exterior	2.510	0.728	1.171	4.008	2.071	0.288	W6x15	8.5
P3 & P5 - Exterior	2.390	0.700	1.096	4.800	2.389	0.308	W6x15	8.5
P4 & P6 - Exterior	2.646	0.674	1.225	4.800	2.920	0.276	W6x25	10.0
P7 - Exterior	0.884	0.474	0.421	3.912	1.013	0.174	W6x8.5	7.0
Motor - Interior	2.215	0.718	0.799	4.008	0.844	9.549	W6x12	8.5
P2 & P7 - Interior	1.948	0.668	0.680	3.912	0.816	0.205	W6x8.5	8.5
P4 - Interior	1.304	0.618	0.484	3.912	0.903	0.203	W6x8.5	8.5
P3, P5 & P6 - Interior	1.641	0.435	0.442	3.912	0.922	0.194	W6x8.5	9.0

Zone C								
Nextracker								
Pile Type	Approximate Factored Loads						Structural Analysis Results	
	Compression	Dead Load	Uplift	Adfreeze Uplift	Shear	Moment	Recommended Pile Section	Recommended Pile Embedment
	(kips)	(kips)	(kips)	(kips)	(kips)	(kip-ft.)		(ft.)
Motor - Exterior	3.153	0.782	1.712	4.896	1.520	14.865	W6x20	5.5
P2 - Exterior	2.510	0.728	1.171	4.008	2.071	0.288	W6x12	5.5
P3 & P5 - Exterior	2.390	0.700	1.096	4.800	2.389	0.308	W6x15	5.5
P4 & P6 - Exterior	2.646	0.674	1.225	4.800	2.920	0.276	W6x15	5.5
P7 - Exterior	0.884	0.474	0.421	3.912	1.013	0.174	W6x8.5	5.5
Motor - Interior	2.215	0.718	0.799	4.008	0.844	9.549	W6x12	5.5
P2 & P7 - Interior	1.948	0.668	0.680	3.912	0.816	0.205	W6x8.5	5.5
P4 - Interior	1.304	0.618	0.484	3.912	0.903	0.203	W6x8.5	5.5
P3, P5 & P6 - Interior	1.641	0.435	0.442	3.912	0.922	0.194	W6x8.5	5.5

For the FTC pile array, the following table outlines the top-of-pile loads used in our structural analysis and the resulting preliminarily recommended pile section and embedment depths for the pile locations at around bore locations. The pile reveal height used in the analysis for the FTC pile array is also shown in the table below.

Zone A									
FTC Voyager (105 mph)									
Pile Type		Approximate Factored Loads						Structural Analysis Results	
	Pile Reveal Height	Compression	Dead Load	Uplift	Adfreeze Uplift	Shear	Moment	Recommended Pile Section	Recommended Pile Embedment
	(ft.)	(kips)	(kips)	(kips)	(kips)	(kips)	(kip-ft.)		(ft.)
Exterior Drive Pile	6.8	6.449	2.035	2.127	5.356	1.680	23.928	W8x18	8.0
Exterior Non-Drive Pile	7.24	6.434	1.199	2.194	4.796	1.891	13.752	W8x13	8.0
Interior Drive Pile	6.91	5.717	1.899	0.849	4.796	0.918	16.667	W8x13	6.0
Interior Non-Drive Pile	7.24	5.650	1.172	1.338	4.732	1.684	12.327	W8x10	7.0

Zone B

FTC Voyager (105 mph)

Pile Type		Approximate Factored Loads						Structural Analysis Results	
	Pile Reveal Height	Compression	Dead Load	Uplift	Adfreeze Uplift	Shear	Moment	Recommended Pile Section	Recommended Pile Embedment
	(ft.)	(kips)	(kips)	(kips)	(kips)	(kips)	(kip-ft.)		(ft.)
Exterior Drive Pile	6.8	6.449	2.035	2.127	5.356	1.680	23.928	W8x24	10.5
Exterior Non-Drive Pile	7.24	6.434	1.199	2.194	4.796	1.891	13.752	W8x21	10.5
Interior Drive Pile	6.91	5.717	1.899	0.849	4.796	0.918	16.667	W8x13	10.5
Interior Non-Drive Pile	7.24	5.650	1.172	1.338	4.732	1.684	12.327	W8x18	10.5

Zone C

FTC Voyager (105 mph)

Pile Type		Approximate Factored Loads						Structural Analysis Results	
	Pile Reveal Height	Compression	Dead Load	Uplift	Adfreeze Uplift	Shear	Moment	Recommended Pile Section	Recommended Pile Embedment
	(ft.)	(kips)	(kips)	(kips)	(kips)	(kips)	(kip-ft.)		(ft.)
Exterior Drive Pile	6.8	6.449	2.035	2.127	5.356	1.680	23.928	W8x18	7.0
Exterior Non-Drive Pile	7.24	6.434	1.199	2.194	4.796	1.891	13.752	W8x10	7.0
Interior Drive Pile	6.91	5.717	1.899	0.849	4.796	0.918	16.667	W8x13	5.5
Interior Non-Drive Pile	7.24	5.650	1.172	1.338	4.732	1.684	12.327	W8x10	6.0

The analyses were performed by starting out with the design pile shape and minimum embedment depth to support the compression and/or tension load for each pile type. The pile embedment was deepened as necessary until a lateral deflection less than or equal to approximately 0.6-inches was achieved at the ground surface. If the deflection criteria could not be met by deepening the pile embedment due to the pile reaching a point of fixity, the next larger size of pile was modeled.

It should be noted that greater quantities of steel (i.e. thicker sections, greater pile lengths) may be required for foundation support if additional geotechnical investigations indicate adverse subsurface conditions. However, a full-scale pile load test program should be performed in order to provide design recommendations for steel sections.

As stated earlier, our analyses have been performed using preliminary information and are intended to assist you in roughly evaluating construction costs and viability for the proposed project. Ultimately, the design of foundations for the solar panel racking system will depend on a number of factors including the actual structural loading conditions, the structural serviceability requirements, anticipated corrosion losses, a detailed understanding of the site soil conditions, and other factors where complete and final information is not available at this time.

SHALLOW FOUNDATIONS

We suggest that a “turned down” concrete slab-on-grade type foundation system be considered for relatively lightly loaded equipment pads that can tolerate movements due to frost heave action of the site soils.

For the heavily loaded structures that are sensitive to movement we recommend reinforced concrete mat/slab foundation should be considered. Also, for heavy equipment loads or slabs that are highly sensitive to movements, a deep foundation system consisting of drilled shaft foundation can be considered.

DESIGN PARAMETERS - COMPRESSIVE LOADS

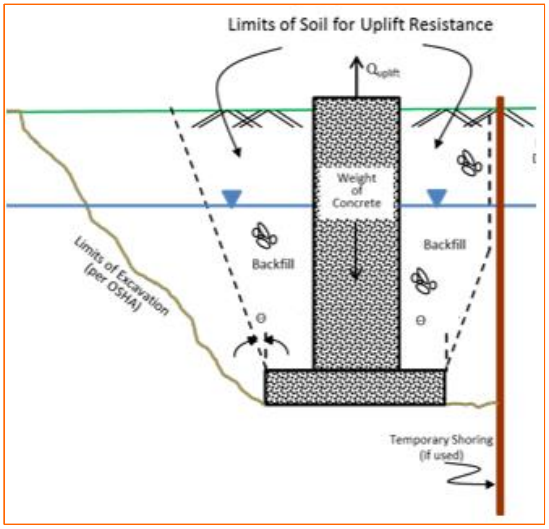
Item	Description
Maximum Net Allowable Bearing pressure [1, 2]	2,000 psf
Required Bearing Stratum [3]	Native soils: at least stiff cohesive soils or at least medium dense granular soils Structural fill
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	300 pcf (cohesive soils/backfill) 430 pcf (granular soils/backfill)
Ultimate Coefficient of Sliding Friction [5]	0.40
Minimum Embedment below Finished Grade [6]	36 inches
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 7]	About 1/2 of total settlement

Item	Description

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented below.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. Passive resistance should be neglected in the uppermost 24 inches below grade.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are estimated over a span of 50 feet.

DESIGN PARAMETERS - UPLIFT LOADS

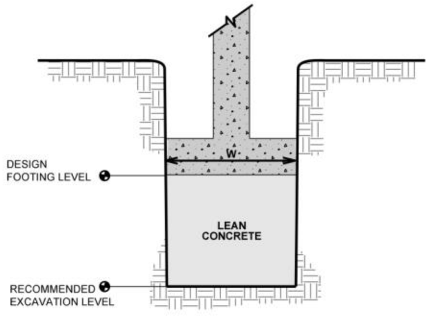
Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, θ, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 120 pcf should be used for the backfill. This unit weight should be reduced to 58 pcf for portions of the backfill or natural soils below the groundwater elevation.



FOUNDATION CONSTRUCTION CONSIDERATIONS

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

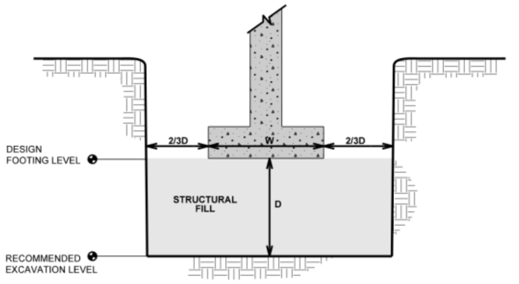
If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



LEAN CONCRETE BACKFILL

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

Over-excavation for structural fill placement below footings should be conducted as shown below. Over-excavation for compacted structural fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of over-excavation depth below footing base elevation. The over-excavation should then be backfilled up to the footing base elevation with granular structural fill material placed in lifts of 8 inches or less in loose thickness (4 inches or less if using hand-guided compaction equipment) and compacted according to the recommendations provided in **Earthwork**.



OVER-EXCAVATION / BACKFILL ZONE

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

For a turned-down concrete slab, we recommend that “footings” at the edges of the slab bear upon or within at least medium stiff or loose native soils or new structural fill at a depth of at least 3 feet below exterior grade for frost depth considerations.

The slab should be supported directly on new base course material consisting of free draining granular material. We recommend a minimum 6-inch thick free draining granular base, such as relatively clean, well-graded crushed limestone. This material will serve as a leveling course, a capillary moisture break, help provide load distribution, and expedite construction. Care will be necessary to avoid contaminating this layer with soil prior to slab placement.

During earthwork procedures, care should be taken to maintain the subgrade moisture content prior to construction of the slab. If the subgrade should become desiccated, the affected material should be removed, or these materials should be scarified, moistened, and re-compacted prior to floor slab placement.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

For design under "point loading" conditions, a subgrade modulus of 110 pci is recommended.

MAT FOUNDATION

We understand the main foundation component in the array area will include driven pile foundations for support of solar arrays; however, some lightly-loaded, inverter structures are typically required across the site. In general, small, lightly-loaded, inverter structures may be supported on driven piles or isolated mat foundation systems.

Mat foundations could be considered for supporting heavy equipment loads or structures that are sensitive to movements. Subgrades for mat foundations should be prepared following the recommendation presented in the **Earthwork** section above**.** We recommend that mat foundations should be supported on a minimum 18-inch thick free draining granular base, such as relatively clean, well-graded crushed limestone.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils (at least stiff consistency or medium dense relative density) and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The footings could also bear on properly compacted backfill extending down to the suitable soils. Over-excavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of over excavation depth below footing base elevation. The over excavation should then be backfilled up to the footing base elevation with structural fill placed in lifts of 8 inches or less in loose thickness and compacted to at least 98 percent of the material's maximum dry density (ASTM D 698). A summary of the design parameters is listed in the table below

MAT/SLAB DESIGN PARAMETERS

Item	Description
Slab Support [1]	Minimum 6 inches of free-draining (less than 6% passing the U.S. No. 200 sieve) crushed aggregate compacted to at least 95% of ASTM D 698 [2, 3]
Estimated Modulus of Subgrade Reaction [2]	110 pounds per square inch per inch (psi/in) for point loads
Minimum Width	3.5 feet
Modulus Correction Factor [4]	$k_c=k((b+1)/2b)^2$
Maximum Design Contact Stress	2,000 psf
Total Estimated Settlement	1 inch or less
Differential Settlement	¾-inch over 4 feet

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3. Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.
4. It is common to reduce the k-value to account for dimensional effects of large loaded areas. Where k_c is the corrected or design modulus value and b is the mat width (short dimension) or tributary loaded area.

If exposed to the exterior grade, the sides of the mat foundation should be backfilled with compacted soil and consideration should also be made with regard to frost protection. A minimum 3 feet foundation embedment should be used for frost protection as indicated in the above table.

If lateral load resistance is required, an allowable coefficient of friction between the bottom of the concrete mat and the underlying granular structural fill can be assumed to be 0.3. This value includes a theoretical safety factor of about 1.5 against sliding. It is recommended that passive pressure resistance along the sides of the foundation be neglected.

FOUNDATION CONSTRUCTION CONSIDERATIONS

Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and recompacted prior to construction.

Based upon the subsurface conditions determined from the geotechnical explorations, subgrade soils exposed during construction are anticipated to be relatively workable depending on the weather. If earthwork is completed during the wet season, we recommend extra precautionary measures to protect subgrade soils due to presence of onsite soft/loose soil which are sensitive to moisture fluctuation. This could include diversion of surface runoff around exposed soils and draining of ponded water on the site. If unstable, soft/loose or wet subgrade conditions develop during construction, suitable methods of stabilization will be required such as chemical treatment, undercutting/replacement and use of geotextile fabric as recommended in the **Earthwork** section above.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations to the completed subgrade.

EARTHWORK

Grading plans were not available at the time of this report. Based on the available information, we have assumed that earthwork for the project will include clearing and grubbing, minimal (less than 3 ft.) excavation and filling for solar arrays, trenching for cables and conduits, cutting and filling to achieve roadway grade, and excavations for stormwater management. The earthwork described in the following sections is preliminary in nature and intended for planning general site grading in the solar array areas, access roadways, drainage, and equipment structure areas (such as the transformer pad areas).

SITE PREPARATION

It is recommended that areas of proposed slab-on-grade or mat foundation structures be stripped of any tilled soil, topsoil, peat/muck, or soft/loose overburden soils containing organic matter. In access roadway, solar array and new fill areas of the site, the tilled soils/topsoil will create difficult access issues, particularly when soil possess high moisture content. These materials can be modified to increase their strength and any planned approaches to improve the strength of these soils should be tested. Please note, that any soil placed over topsoil/tilled soils will settle with time with the magnitude of the settlement being directly related to the thickness of these types of soils. Therefore, any materials consisting of topsoil, tilled soils, vegetation and organic matter should be stripped and wasted off site or could be re-spread in landscaped areas after completion of grading operations. Stripping depths between our boring locations and across the site could vary considerably. We recommend actual stripping depths be evaluated by a representative of Terracon prior to construction by excavating test pits and during construction to aid in preventing removal of excess material.

Existing drainage and field tiles associated with agricultural activities may be present across the site. As much as possible, these drainage features should be preserved to maintain surface and subsurface drainage of the site.

Removal and/or relocation of any “to be abandoned” utilities should also be performed prior to rough site grading activities. We would anticipate removal and relocation, or re-routing, of any existing utilities that may currently exist within the footprint of the proposed development area would interfere with new construction. Where abandoned underground pipes are located beneath any mat or shallow foundations, they should be fully grouted if left in place. Excavations created due to utility relocations should be backfilled with structural fill material, placed and compacted in accordance with the recommendations provided in the following paragraphs, or with lean concrete or flowable fill if lean concrete or controlled density fill (CDF) is used as backfill. The contractor should refer to all of the new build Mechanical-Electrical-Plumbing (MEP) and foundation drawings to confirm that concrete backfill materials will not conflict with any new item installations or construction.

After performing the site grading activities associated with cutting/filling the site to design grade; and prior to placing structural fill in areas to receive fill, the subgrade should be proof-rolled to aid in locating soft or loose areas. Proof-rolling of cohesive soils should be accomplished with a fully loaded, tandem axle dump truck or other suitable pneumatic tired equipment weighing at least 20-tons. Granular soils should be proof-rolled with several passes of a vibratory roller (minimum dead weight of 8 tons on the drum) to help densify those soils. Based on conditions encountered in the borings, significant measures for subgrade stabilization should be anticipated.

Any soft or yielding areas encountered within the new fill areas, solar array areas, substation and access road areas during proof-rolling operations should be undercut to expose firm stable soils or re-worked in place to a suitable acceptable condition. Chemical modification of the subgrade in the access road locations may be an alternative to removal, though any planned modification should be tested prior to implementation. It should be noted that an undercut depth somewhat greater than normal may be needed if the construction occurs during periods of inclement weather. The actual amount of undercut would need to be determined in the field during construction and is dependent on the subsurface conditions encountered, weather conditions and equipment used in the construction. Chemical stabilization is generally considered to be more cost effective than undercut and replacement of large areas.

Once the foundation excavation is made, the exposed subgrade soils should be examined by geotechnical personnel to determine that the suitable bearing materials have been encountered. If unsuitable soils are encountered, these soils should either be undercut to expose suitable soils or stabilized in place. Should the excavation expose materials that can be stabilized with #2 stone or durable dump-rock prior, provisions should be made to “drain” these materials to a nearby storm sewer or other drainage outlet. Any #2 stone or dump rock should be suitably choked-off at the top so as to prevent overlying finer grained materials from migrating into this open-graded material.

Native soils exposed at or within 18 inches below the slab subgrade level which do not meet low volume change material requirements should be undercut and replaced with suitable low volume change material structural fill to provide for a minimum 18-inch thick layer of suitable subgrade. Alternately, the top 18-inches of the subgrade should be chemically stabilized.

The rough soil subgrade elevation should be established with quality controlled cohesive or granular fill placed and compacted in accordance with requirements provided in section **Fill Material Types** and section **Fill Compaction Requirements**.

FILL MATERIAL TYPES

Structural fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Lean Clay	CL (LL<40)	All Locations and Elevations
Fat Clay and moderate plasticity clays	CH (LL>50) and CL with 40<LL<50	>1.5 feet below the finished subgrade elevation
Well Graded Granular	GW[2]	All Locations and Elevations
Low Volume Change Material[3]	CL or GW[2] and (LL<40 & PI<22)	All Locations and Elevations
On-site Soils	CL, ML, SC, SW, GC	Onsite native soils appear suitable for use as engineered fill after drying. During wet season, it will be extremely difficult to dry the soils to suitable moisture condition, thereby making it very difficult to achieve specified compaction. Use of on-site soils as structural fill should meet the requirements for “acceptable location for placement” indicated above.

1. New structural fill should consist of approved materials that are free of organic matter, peat, debris and rock fragments larger than 3 inches in any dimension. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. Similar to Ohio DOT aggregate base or crushed limestone aggregate or granular material such as sand, gravel, or crushed stone containing at least 18% low plasticity fines.
3. Low plasticity cohesive soil or granular soil having at least 18% low plasticity fines.

FILL COMPACTION REQUIREMENTS

Engineered fill should meet the following compaction requirements.

Item	Description
Fill Lift Thickness (Structural Areas)	8-inches or less in loose thickness if heavy self-propelled compaction equipment is used. 4 to 6 inches or less if hand compaction equipment is used.
Compaction Requirements[1] (Structural Areas)	Minimum 98% of the material’s Standard Proctor maximum dry density (ASTM D698)
Compaction Requirements (Landscape Areas)	Minimum 95% of the material’s Standard Proctor maximum dry density (ASTM D 698) provided long-term plans do not include a structure in these areas.

Item	Description
Moisture Content – Cohesive Soil (Low Plasticity)	Within ±3% of optimum moisture content (OMC) as determined by the Standard Proctor test at the time of placement and compaction
Moisture Content[2] – Granular Material	Workable Moisture Levels

1. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proof-rolled.
3. All materials to be used as engineered fill should be tested in the laboratory to determine their suitability and compaction characteristics.

Earthwork Factors

The earthwork factors are based on a comparison of the in-situ dry densities from ring samples to the density of bulk samples compacted to 98, 95, 90, and 85 percent of the maximum dry density as determined by ASTM D698. The estimated shrinkage of the upper roughly 2 feet of the site soils when used as compacted fill is presented in the table below:

Percent Compaction (%)	Shrink/Swell
98	11% shrink
95	9% shrink
90	3% shrink
85	2% swell

These estimates are general in nature, and are based on our experience, limited data from our field exploration, and the soil conditions we encountered at the site. Earthwork factors may vary dependent upon the actual subsurface conditions, which may include variations in soil gradations and gravel contents.

FILL MATERIAL CONSIDERATIONS

In the areas of the proposed solar array panels, fill material may not be needed. These areas should only be receiving driven steel piles for solar panel support and the subgrade should only be prepared in a manner to minimize erosion and provide a stable surface for installation of driven piles.

Where proposed equipment structures are located, structural fill should be placed over a stable subgrade prepared and proof rolled as discussed above. The soils to be used as structural fill should be free of organics, roots, or other deleterious materials. The fill should be non-plastic granular material containing less than 12 percent fines (material passing the No. 200 sieve).

All structural fill should be placed in loose lifts not to exceed 12 inches in thickness and compacted to a minimum of 95% of the soil's standard Proctor maximum dry density (ASTM D698) using the vibratory drum roller discussed previously. Fill brought to the site should ideally be within 3 percent (wet or dry) of the optimum moisture content.

Some manipulation of the moisture content (such as wetting, drying) may be required during the filling operation to obtain the required degree of compaction. The manipulation of the moisture content is highly dependent on weather conditions and site drainage conditions. A sufficient number of density tests should be performed to confirm the required compaction of the fill material.

CONSTRUCTION CONSIDERATIONS

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. Tracked equipment should be considered in areas of the site where wet surface soil conditions are present to help reduce rutting and disturbance of the near surface soils.

Particular attention should be given to the methods for subgrade drainage in consideration of the wet conditions observed on site. The gravel access road should not be recessed into the existing subgrade without methods to drain the subgrade moisture. Roads should incorporate subgrade drainage methods. Maintenance activities should be increased onsite to address the development of rutting in a timely manner. The risk of damaging the underlaying geogrid layers and/or rutting the subgrade soils is significantly increased if delays in grading and other maintenance activities result in the progression of rutting beyond the original design assumptions. More frequent maintenance will be required in areas subject to turning traffic.

We understand the construction of new gravel access roads above grade may inhibit the surface flow drainage capabilities of the site. The use of open graded aggregate on above grade portions of the gravel access roads can be considered as a means of allowing some water flow across the above grade gravel access roads. Based on our observation of roadway performance on previous similar projects, open graded aggregate may be used in above grade portions of the gravel access roads, provided they are fractured/angular and our recommendations for subgrade drainage are implemented. The open graded aggregate will be less stable than aggregate base course, therefore additional thickness and frequency of maintenance activities should be expected. Open graded aggregates are more stable if confined, therefore exposed gravel layer edges may need to be widened to develop stability at the wheel path. Terracon has not performed any surface flow drainage analysis to determine the effect of the open graded aggregate on site drainage, nor do we guarantee that the open graded aggregate will facilitate surface drainage.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of the access roads. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and re-compacted prior to access road construction.

The individual contractors are responsible for designing and constructing stable, temporary excavations (including utility trenches) as required to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations to the completed subgrade.

UTILITY TRENCH BACKFILL

All trench excavations should be made with sufficient working space to permit construction, including backfill placement and compaction. If utility trenches are backfilled with relatively clean granular material, they should be capped with at least 18 inches of low plasticity cohesive fill in non-pavement areas to reduce the infiltration and conveyance of surface water through the trench backfill.

Compaction requirements for bedding and backfilling around utilities may need to be adjusted to the pipe material type and the pipe manufacturer bedding and backfill material recommendation. If utility trenches in non-pavement areas are backfilled with relatively clean granular material, they should be capped with at least 18 inches of cohesive fill to reduce the infiltration and conveyance of surface water through the trench backfill. Granular backfill is recommended for use as backfill in utility trenches in areas beneath pavements.

SITE DRAINAGE

During the dry season, the site should generally remain relatively workable in that since there is little rainfall, the soils stay dry. However, during the wet season, there is frequent heavy rain from thunderstorms. This will make getting the surface soils dry to remain workable will be difficult. Also, during the rainy season, since the near surface soils are silty and clayey, they will be susceptible to erosion if not adequately protected from run off of the heavy rains. Until vegetation to established on the exposed surface soils, they will remain susceptible to erosion even if construction is otherwise complete.

As indicted previously, the existing drainage and field tiles associated with agricultural activities may be present across the site. As much as possible, these drainage features should be preserved to maintain surface and subsurface drainage of the site.

During construction the contractor may want to consider implementing a program to lower groundwater to facilitate access and mobilization around the site. If such a program is implemented, groundwater levels should be lowered to a depth of at least two feet below the surface of any vibratory compaction operations.

EARTHWORK CONSTRUCTION CONSIDERATIONS

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Any water that collects over, or adjacent to, construction areas should be promptly removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and recompacted, prior to slab construction. All these processes should be observed by Terracon.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming any responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

CONSTRUCTION OBSERVATION AND TESTING

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Field density tests should be conducted during placement and compaction of engineered fill. The testing frequency should be in accordance with the following table.

Fill Placement Area	Recommended Testing Frequency (ASTM D6938)
Building Pads	Each vertical foot of fill placed should be tested at a frequency of 1 test per every 2,500 square feet of fill placed, or a minimum of 1 test per building pad per vertical foot of fill placed
Solar Arrays	Each vertical foot of fill placed should be tested at a frequency of 1 test per every 20,000 square feet of fill placed, or a minimum of 1 test per solar array block quadrant per vertical foot of fill placed
Utility Trench Backfill	Each vertical foot of fill placed should be tested at an interval of every 100 linear feet of fill placed

The Geotechnical Engineer may require additional tests as considered necessary to check on the uniformity of compaction. No additional layers of fill should be placed until the field density test results indicate that the specified density has been obtained.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

ACCESS ROADWAYS

General Roadways Comments

On most project sites, the site grading is accomplished relatively early in the construction phase. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy construction traffic disturbs the subgrade and many surface irregularities are filled in with loose soils to improve trafficability temporarily. As a result, the roadways subgrades should be carefully evaluated as the time of construction.

We recommend the moisture content and density of the upper 12 inches of the subgrade be evaluated and the road subgrades be proof-rolled. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to anticipated high traffic areas and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills.

During precipitation events, the subgrade soils become extremely wet causing areas of the site with ponding water. Similar conditions should be anticipated during construction if it occurs during wet season. Therefore, it will be very important to not cut off the surface drainage characteristics of the site by construction of recessed gravel access roads. Additionally, the existing clay drainage tiles should be preserved to maintain the subsurface drainage and additional subsurface drainage measures installed. The gravel access roads should not be constructed below the existing grade and that positive drainage away from the gravel roadway subgrade soils should be maintained.

After proof-rolling and repairing subgrade deficiencies, the entire subgrade should be scarified and compacted as recommended in **Earthwork** section to provide a uniform subgrade for gravel road construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to application of the gravel surfacing. The subgrade should be in its finished form at the time of final review.

We understand that the proposed gravel access road will be primarily used by light duty maintenance vehicles. We recommend the proposed gravel access roads should have minimum 8” to 12” thick aggregate base course over the final prepared subgrade. These are not meant for construction trafficking, which will require significantly thicker sections.

DRAINAGE

The proposed gravel access road should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the road could saturate the subgrade and contribute to premature road deterioration. In addition, the road subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

MAINTENANCE

Crushed stone surfaced roadways, regardless of the section thickness or subgrade preparation measures, will require on-going maintenance and repairs to keep them in a serviceable condition. It is not practical to design a gravel section of sufficient thickness that on-going maintenance will not be required. This is due to the porous nature of the gravel that will allow precipitation and surface water to infiltrate and soften the subgrade soils, and the limited near surface strength of unconfined gravel that makes it susceptible to rutting. When potholes, ruts, depressions or yielding subgrades develop, they must be addressed as soon as possible to avoid major repairs.

Typical repairs could consist of placing additional gravel in ruts or depressed areas. In some cases, complete removal of distressed portions of the existing section will be required along with replacement of the roadway section. Potholes and depressions should not be filled by blading adjacent ridges or high areas into the depressed areas. New material should be added to depressed areas as they develop. Failure to make timely repairs will result in more rapid deterioration of the roadways, making more extensive repairs necessary.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

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

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

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

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

FIELD EXPLORATION

Number of Explorations	Type of Exploration	Depth or Description	Planned Location
10	SPT Borings	20 feet bgs	Array Area
3	Field Electrical Resistivity	2, 4, 6, 8, 12, 20, 30, 50, 100, 150, and 200 feet	Array Area

Boring Layout and Elevations: We used handheld GPS equipment and existing site features to locate borings with an estimated horizontal accuracy of +/-10 feet as shown on the attached **Exploration Plan**.

Subsurface Exploration Procedures: We advanced soil borings with a track-mounted drill rig using rotary wash techniques. Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was performed using a standard 2-inch outer diameter split barrel sampling spoon that was driven into the ground by a 140-pound rope and cathead operated safety hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the middle 12 inches of a 24-inch sampling interval or the last 12 inches of an 18-inch sampling interval was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. The samples were placed in appropriate containers, taken to our soil laboratory for testing, and classified by a geotechnical engineer. In addition, we observed and recorded groundwater levels during sampling.

Our exploration team prepared field boring logs as part of standard drilling operations including sampling depths, penetration distances, and other relevant sampling information. Field logs included visual classifications of materials encountered during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent the geotechnical engineer's interpretation, and include modifications based on observations and laboratory tests.

Field Electrical Resistivity Testing: Field measurements of soil electrical resistivity were performed were performed using the “Wenner Four Electrode Method”. For this EER survey, the electrodes consisted of ½-inch diameter, copper-coated steel grounding rods. The electrodes were inserted into the ground to a depth of 6 inches at electrode spacings of less than 10 feet and 12 inches for electrode spacings of 10 feet and greater.

The resistivity values measured in the field may vary by material type, moisture content, surface temperature, groundwater depth, and other climatic conditions. During the site visit, our field representative indicated that the ground surface cover consisted of moist silty clay at each test location. The weather conditions during the site visit are indicated on the field data sheets.

The soil resistivity testing was performed at the locations identified in the Attachments (section of this report). Results of the soil resistivity measurements and test line location plan are presented in **Field Electrical Resistivity Test Results** section of this report

LABORATORY TESTING

The project engineer reviewed the field data and assigned various laboratory tests to better understand the engineering properties of the various soil strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- (ASTM D698) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
- ASTM D7263 Standard Test Method for Laboratory Determination of Density (Unit Weight of Soil Specimens)

Our laboratory testing program also included examination of soil samples by an engineer. Based on observation and test data, the engineer classified the soil samples in accordance with the **Unified Soil Classification System** (ASTM D2487).

California Bearing Ratio Testing: Bulk soil samples were collected from the upper two feet bgs during preliminary exploration and sent to Terracon’s office for California bearing ratio (CBR) testing (ASTM D1883). This testing will help us in providing geotechnical recommendations for the proposed access roadways. Each sample will be remolded near the optimum moisture content and relative compaction of approximately 95% of the materials standard Proctor maximum dry density as determined by ASTM D698.

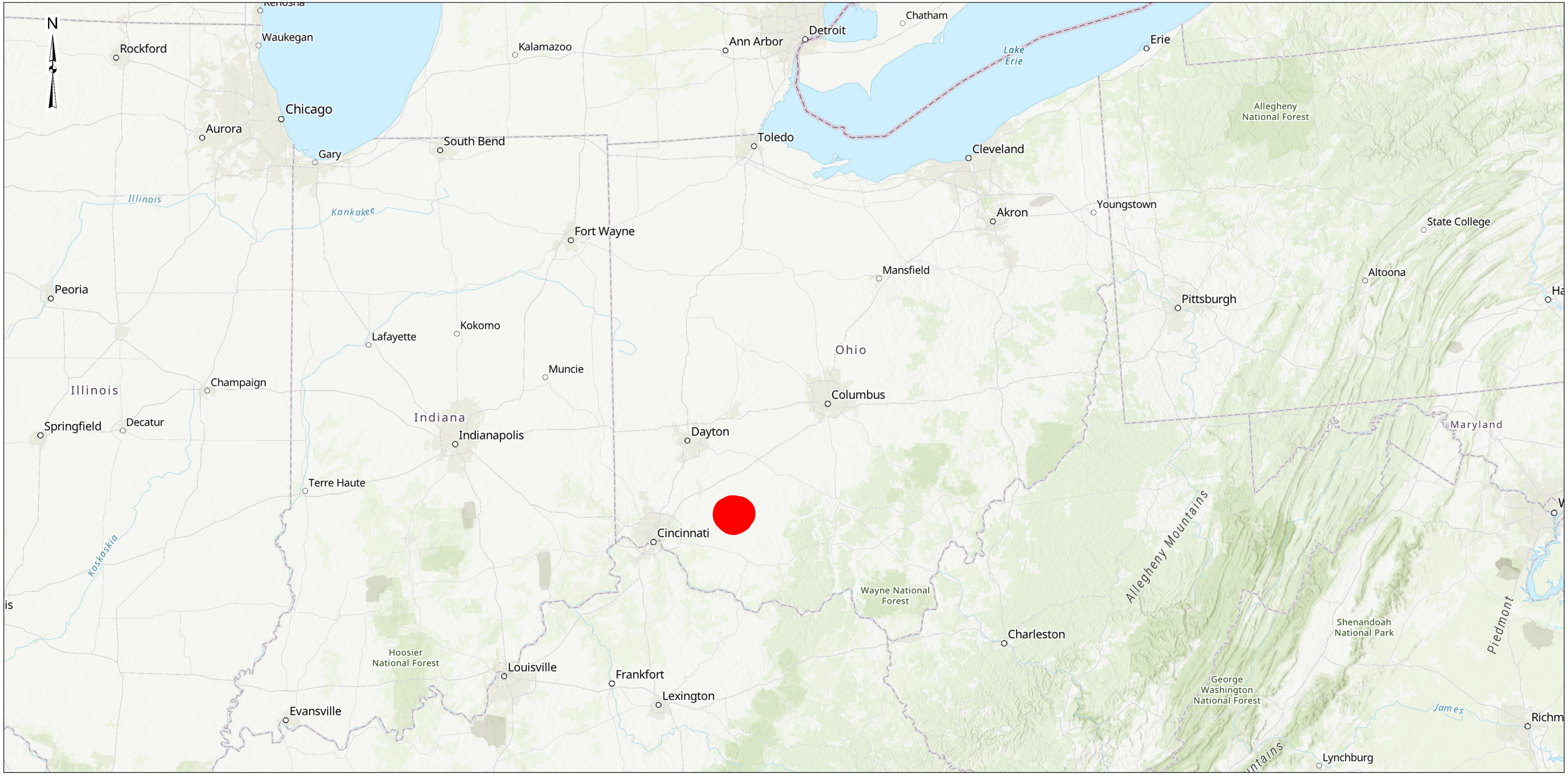
Thermal Resistivity Testing: Laboratory thermal resistivity testing was performed by Geotherm on four soil bulk samples obtained during our current field exploration from a depth of approximately 1 to 4 feet below the existing ground surface and four Shelby tube samples collected from a depth of about 3 to 5 feet below existing ground surface. The thermal resistivity testing was performed in general accordance with the IEEE standard. The dry-out curves were developed from soil specimens compacted to 85% and 95% of the standard Proctor criteria (ASTM D698) at the optimum moisture content and dried to 0% moisture and on the undisturbed Shelby tube samples. The results of these thermal resistivity tests as well as tests performed during the original preliminary study are presented in the **Exploration Results** section.

Corrosion Testing: Bulk soil samples were collected from 1 to 4 feet bgs at five locations at the project site during the original preliminary study and sent to Terracon's office for corrosivity testing. The testing included water-soluble sulfate ion content in soil in accordance with ASTM C1580 presented in percent by weight, water-soluble chloride ion content in accordance with ASTM D512 presented in percent by weight, pH in accordance with ASTM D4972, Sulfides in accordance with ASTM D4658, Oxidation Reduction Potential in accordance with ASTM G200, and electrical resistivity using the "soil box" method in accordance with ASTM G187. The results of the corrosion testing are presented in the **Exploration Results** section

SITE LOCATION AND EXPLORATION PLANS

Contents:

Note: All attachments are one page unless noted above.



🟥 Site Boundary

DATA SOURCES:
ESRI WMS - World Topographic, Streets

Miles
0 25 50 100

Project No.:	N4205103
Date:	August, 2020
Drawn By:	JNT
Reviewed By:	YSR

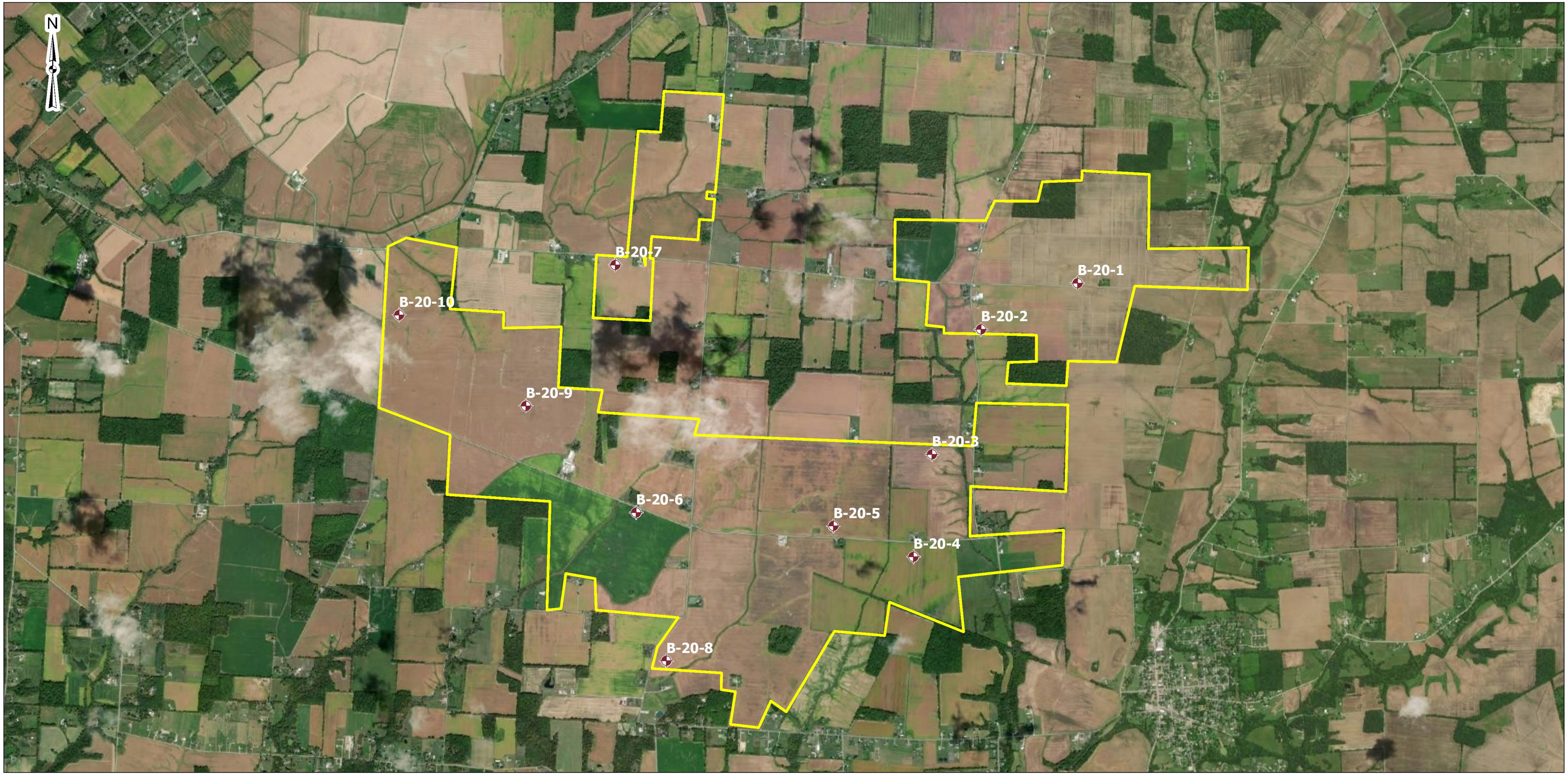
Terracon

800 Morrison Road Gahanna , Ohio 43230
PH. (614) 328-5150 terracon.com

SITE LOCATION PLAN

Yellowood Solar Facility

Invenergy Solar
One South Wacker Drive, Suite 1800
Chicago, IL 60606



🟨 Project Boundary

⊕ Boring Location

DATA SOURCES:
ESRI WMS - World Topographic, Streets

Miles
0 0.3 0.6 1.2

Project No.:
N4205103
Date:
July, 2020
Drawn By:
JNT
Reviewed By:
YSR

Terracon
800 Morrison Road Gahanna , Ohio 43230
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EXPLORATION PLAN

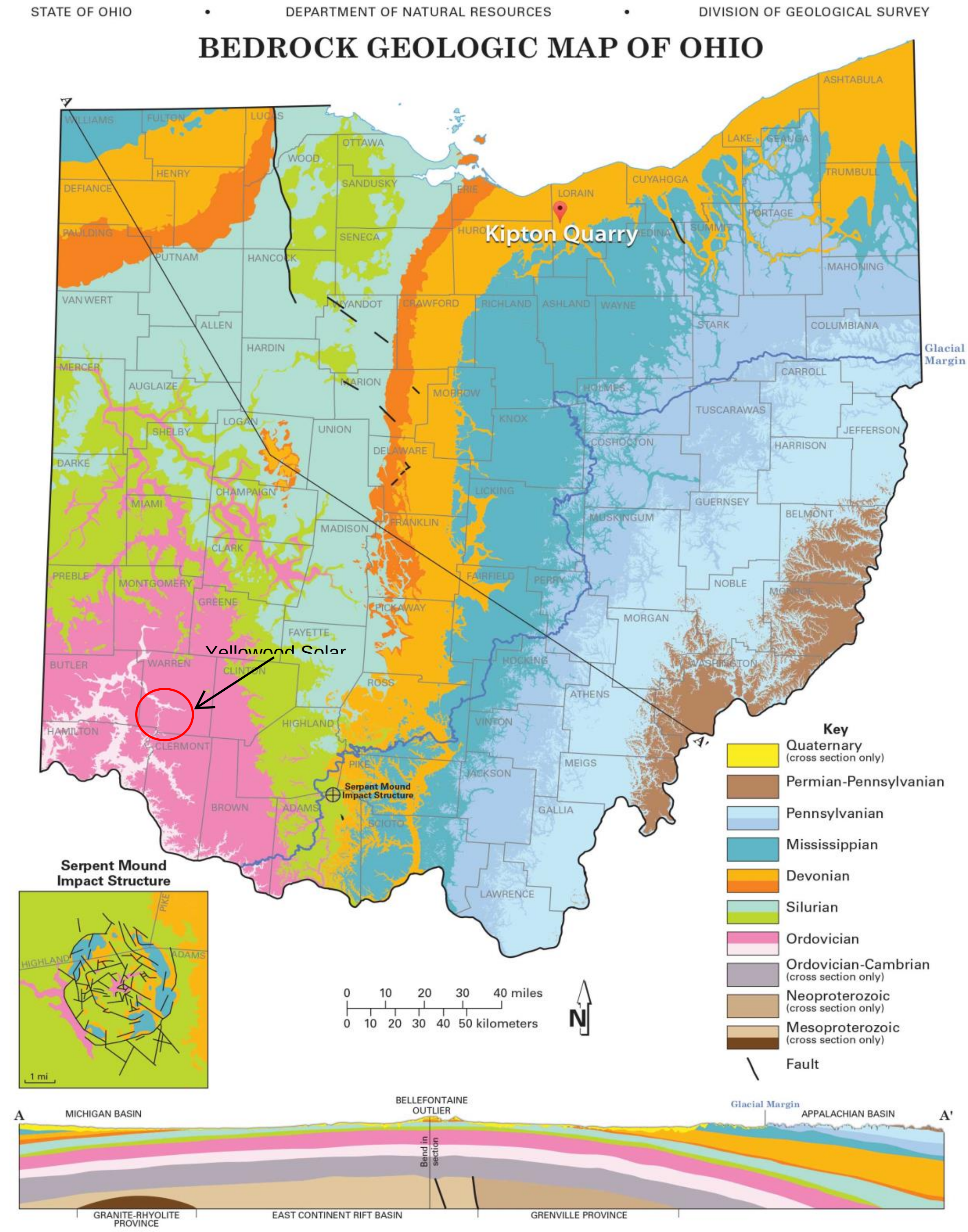
Yellowood Solar Facility

Invenergy Solar
One South Wacker Drive, Suite 1800
Chicago, IL 60606

BEDROCK GEOLOGICAL MAP OF OHIO

Yellowood Solar Facility ■ Clinton County, Ohio
August 26, 2020 ■ Terracon Project No. N4205103

Terracon GeoReport



Recommended citation: Ohio Division of Geological Survey, 2006, Bedrock geologic map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map BG-1, generalized page-size version with text, 2 p., scale 1:2,000,000.

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

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Yellowood Solar - Invenergy-Preliminary ■ Lynchburg, OH
Terracon Project No. N4205103

Terracon GeoReport

SAMPLING

✋ Grab Sample

■ Shelby Tube

☒ Standard Penetration Test

WATER LEVEL

▽	**Water Initially Encountered**
▽	**Water Level After a Specified Period of Time**
▼	**Water Level After a Specified Period of Time**
▨	**Cave In Encountered**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

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

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

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

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

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

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

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

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

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

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

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

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

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

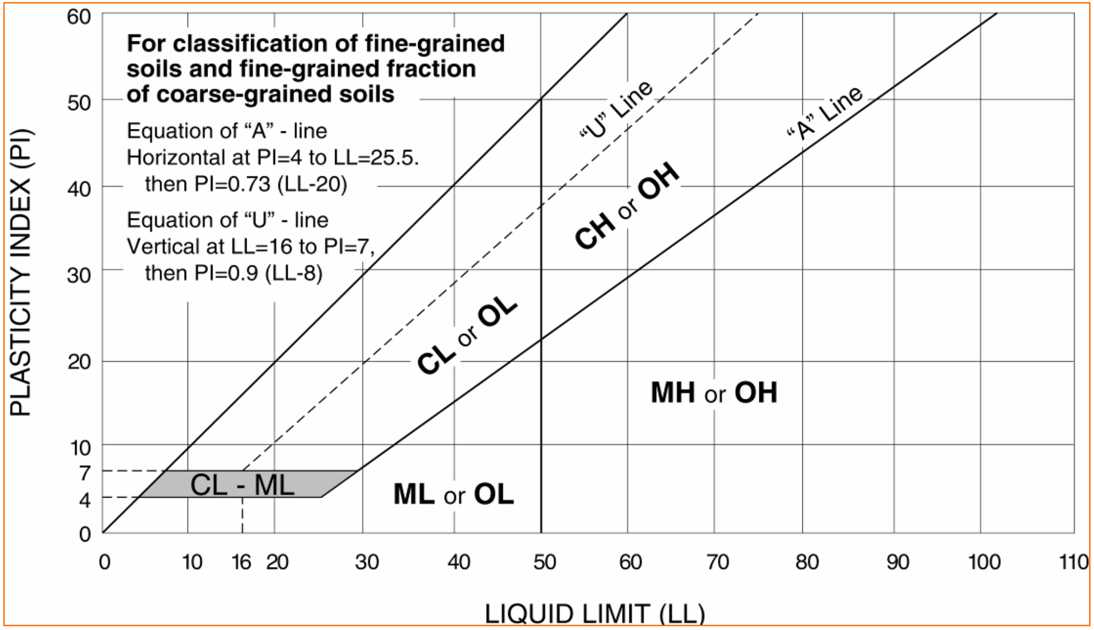
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

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

[O] PI < 4 or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.



BORING LOG NO. B-20-1

Page 1 of 1

PROJECT: Yellowood Solar Facility

CLIENT: Invenergy LLC
Chicago, IL

SITE: County Road 48
Lynchburg, OH

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.2743° Longitude: -83.7986° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	STRENGTH TEST TEST TYPE	STRENGTH TEST COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
		0.5 **TOPSOIL (6.0")** **SANDY LEAN CLAY (CL)**, trace gravel, brown and gray, moist, medium stiff to stiff			☒	18	2-3-3 N=6	66				17.5	99	31-13-18	2
					■	24		55				22.1	103	33-17-16	
			5	▽	☒	24	2-3-5 N=8								
					☒	18	4-6-9 N=15	57				19.6		30-14-16	
		10.0			☒	18	2-2-5 N=7	54				10.6		21-11-10	
		LEAN CLAY WITH SAND (CL), trace gravel, brown and gray, moist, hard	10	▨	☒	24	11-26-36 N=62								
					☒	24	42-28-24 N=52								
		16.0	15		☒	24	10-20-25 N=45								
		CLAYEY SAND WITH GRAVEL (SC), brown, wet, very dense 18.0			☒	24	28-48-48 N=96								
		WELL GRADED SAND WITH GRAVEL (SW), brown and gray, wet, medium dense 20.0			☒	18	5-9-18 N=27								
		Boring Terminated at 20 Feet	20												

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by N. Sharma

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

Organic test completed in topsoil.
Thermal test performed at 2.0' - 4.0'.

WATER LEVEL OBSERVATIONS

▽	*Water encountered at 12.0' while sampling*
▽	*Water observed at 5.5' upon completion*
▨	*Cave-in at 12.0'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-26-2020	Boring Completed: 07-26-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-2

Page 1 of 1

PROJECT: **Yellowood Solar Facility**

CLIENT: **Invenergy LLC**
Chicago, IL

SITE: **County Road 48**
Lynchburg, OH

LOCATION See Exploration Plan

Latitude: 39.2711° Longitude: -83.8083°

DEPTH	MATERIAL DESCRIPTION
0.3	**TOPSOIL (4.0")**
6.0	**SANDY LEAN CLAY (CL)**, trace gravel, brown and gray, moist, medium stiff
8.0	**SANDY LEAN CLAY (CL)**, gray, moist, very stiff to hard
20.0	**CLAYEY SAND (SC)**, brown and gray, moist, very dense
	Boring Terminated at 20 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
		18	3-3-3 N=6	61				8.4		25-11-14	
		10	3-2-4 N=6	53				23.9	93	49-15-34	
5		24	3-4-2 N=6								
		18	2-6-14 N=20	51				7.5		26-12-14	
		18	17-16-42 N=58	46				28.4		22-12-10	
10		18	18-38-43 N=81								
		20	20-38-50/5"								
15	▨	24	11-18-24 N=42								
		24	3-12-32 N=44								
		20	10-24-50/5"								
20											

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by N. Sharma

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

WATER LEVEL OBSERVATIONS

Water was not encountered during drilling
Water was not encountered at completion

▨ *Cave-in at 15.75'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-25-2020	Boring Completed: 07-25-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-3

PROJECT: Yellowood Solar Facility

CLIENT: Invenergy LLC
Chicago, IL

SITE: County Road 48
Lynchburg, OH

LOCATION See Exploration Plan

Latitude: 39.2621° Longitude: -83.8153°

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
		0.5	**TOPSOIL (6.0")**													
			SANDY LEAN CLAY (CL), trace gravel, brown and gray, moist, medium stiff to stiff			☒	20	2-2-5 N=7	69				21.6		25-12-13	
						✋	16	11-6-6 N=12	55				13.5		34-14-20	
				5		☒	20	5-4-5 N=9								
		8.0				☒	20	3-4-5 N=9	57				15.2		27-12-15	
			SANDY LEAN CLAY (CL), gray, moist, hard			☒	24	7-17-33 N=50	53				8.7		23-11-12	
			possible boulders and cobbles	10		☒	12	33-46-50/3"								
						☒	24	20-30-32 N=62								
				15	▨	☒	12	22-32-37 N=69								
						☒	24	15-21-33 N=54								
		20.0				☒		17-27-45 N=72								
			Boring Terminated at 20 Feet	20												

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by N. Sharma

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

WATER LEVEL OBSERVATIONS

Water was not encountered during drilling

Water was not encountered at completion

▨ *Cave-in at 15.5'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-25-2020	Boring Completed: 07-25-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-4

PROJECT: Yellowood Solar Facility

CLIENT: Invenergy LLC
Chicago, IL

SITE: County Road 48
Lynchburg, OH

LOCATION See Exploration Plan

Latitude: 39.254° Longitude: -83.8157°

DEPTH	Description
0.3	**TOPSOIL (3.0")**
8.0	**SANDY LEAN CLAY (CL)**, trace gravel, brown and gray, moist, medium stiff
12.0	**SILTY SAND (SM)**, brown and gray, wet, medium dense to dense
14.0	**SILT (ML)**, gray, wet, hard
16.0	**SILTY SAND (SM)**, gray, wet, dense
20.0	**LEAN CLAY WITH SAND (CL)**, trace gravel, gray, moist, very stiff to hard
	Boring Terminated at 20 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
		24	3-3-3 N=6	66				18.6		24-12-12	2
		18	4-3-3 N=6	56				20.0		28-16-12	
5	▽	24	1-3-3 N=6								
	▽	24	2-3-2 N=5	55				19.6		24-13-11	
		18	4-9-12 N=21	45				17.6		NP	
10	▨	14	16-22-25 N=47								
		18	14-18-22 N=40								
15		20	4-14-33 N=47								
		20	5-17-21 N=38								
20		24	8-13-15 N=28								

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by N. Sharma

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

Organic test completed in topsoil.

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 5.0' while sampling*

▽ *Water observed at 8.0' upon completion*

▨ *Cave-in at 10.5'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-25-2020	Boring Completed: 07-25-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-5

Page 1 of 1

PROJECT: Yellowood Solar Facility

CLIENT: Invenergy LLC
Chicago, IL

SITE: County Road 48
Lynchburg, OH

LOCATION See Exploration Plan

Latitude: 39.2556° Longitude: -83.8324°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
		0.3 **TOPSOIL (4.0")** **SANDY LEAN CLAY (CL)**, trace gravel, brown and gray, moist, medium stiff to stiff			☒	16	2-3-3 N=6	64				19.1		34-13-21	
					■	24		55				26.5	97	44-14-30	
			5	▽	☒	24	2-4-6 N=10								
				▽	☒	15	2-3-5 N=8	64				17.9		31-15-16	
		8.0 **CLAYEY SAND (SC)**, brown and gray, moist, loose to medium dense, Very dense at 14 feet			☒	24	3-3-3 N=6	37				17.1		21-12-9	
			10	▨	☒	18	4-5-4 N=9								
					☒	12	5-11-12 N=23								
		14.0 **LEAN CLAY WITH SAND (CL)**, trace gravel, brown and gray, moist, hard	15		☒	10	10-22-50/5"								
					☒	12	12-50/5"								
		20.0	20		☒		9-22-23 N=45								

Boring Terminated at 20 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by N. Sharma

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

Thermal test performed at 2.0' - 4.0'

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 5.0' while sampling*

▽ *Water observed at 8.0' upon completion*

▨ *Cave-in at 11.5'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-25-2020	Boring Completed: 07-25-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-6

PROJECT: Yellowood Solar Facility

CLIENT: Invenergy LLC
Chicago, IL

SITE: County Road 48
Lynchburg, OH

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.2579° Longitude: -83.8428° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
		0.3 **TOPSOIL (4.0")** **SANDY LEAN CLAY (CL)**, trace gravel, brown to gray, moist, medium stiff to stiff, trace root and organics at 0.33' - 2.0'			☒	20	2-4-4 N=8	62				19.4	103	40-15-25	
					☒	24	3-3-3 N=6	57				18.2		30-13-17	
			5		☒	20	2-2-3 N=5								
					☒	24	2-3-4 N=7	63				17.3		31-13-18	
		10.0			☒	24	5-5-6 N=11	52				8.7		22-11-11	
		LEAN CLAY WITH SAND (CL), trace gravel, brown to gray, moist, very stiff to hard	10		☒	20	5-14-34 N=48								
		possible boulders and cobbles			☒	24	16-22-32 N=54								
			15	▨	☒	22	15-34-37 N=71								
					☒	24	8-19-22 N=41								
		20.0			☒	24	34-45-41 N=86								
		Boring Terminated at 20 Feet	20												

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by N. Sharma

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

WATER LEVEL OBSERVATIONS

Water was not encountered during drilling

Water was not encountered at completion

▨ *Cave-in at 15.5'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-25-2020	Boring Completed: 07-25-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-7

Page 1 of 1

PROJECT: Yellowood Solar Facility

CLIENT: Invenergy LLC
Chicago, IL

SITE: County Road 48
Lynchburg, OH

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.277° Longitude: -83.8438° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	STRENGTH TEST TEST TYPE	STRENGTH TEST COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
	▨	0.4 **TOPSOIL (5.0")** **CLAYEY SAND WITH GRAVEL (SC)**, brown to gray, moist, loose to medium dense			☒	16	3-5-4 N=9	65				16.9	94	37-17-20	
	▨				☒	20	6-11-5 N=16								
	▨		5		☒	18	7-8-5 N=13								
	▨	6.0 **SANDY LEAN CLAY (CL)**, trace gravel, brown to gray, moist, stiff		▽	☒	20	4-5-6 N=11	53				17.2		26-11-15	
	▨	8.0 **CLAYEY SAND WITH GRAVEL (SC)**, brown to gray, moist, dense wet silt seams between 8.0' - 10.0'	10		☒	20	4-5-25 N=30	39				6.9		21-10-11	
	▨	10.0 **GRAVELLY LEAN CLAY WITH SAND (CL)**, brown to gray, moist, very stiff to hard possible boulders and cobbles below 10'			☒	6	29-50/3"								
	▨	12.0 **CLAYEY GRAVEL WITH SAND (GC)**, gray, moist, very dense		▽	☒	4	50/5"								
	▨		15	▨	☒	18	32-42-41 N=83								
	▨				☒	18	21-27-33 N=60								
	▨	20.0	20		☒	20	34-48-50/5"								
		Boring Terminated at 20 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by M. Evener

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 8.0' while sampling*

▽ *Water observed at 13.0' upon completion*

▨ *Cave-in at 15.0'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-26-2020	Boring Completed: 07-26-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-8

Page 1 of 1

PROJECT: **Yellowood Solar Facility**

CLIENT: **Invenergy LLC**
Chicago, IL

SITE: **County Road 48**
Lynchburg, OH

LOCATION See Exploration Plan

Latitude: 39.2468° Longitude: -83.84°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	ORGANIC CONTENT (%)
									TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)			LL-PL-PI	
		0.4 **TOPSOIL (5.0")** **SANDY LEAN CLAY (CL)**, trace gravel, brown to gray, moist, medium stiff to hard			☒	24	2-3-3 N=6	52				25.4	94	52-15-37	3
					✋	20	3-3-4 N=7	57				16.5		27-11-16	
			5		☒	24	2-3-4 N=7								
					☒	20	2-3-3 N=6	54				9.1		24-13-11	
					☒	24	3-12-28 N=40	55				8.8		26-11-15	
		possible boulders and cobbles below 10'	10		☒	24	39-36-50/5"								
		12.0 **GRAVELLY LEAN CLAY WITH SAND (CL)**, gray, moist, hard		▨	☒	20	16-23-43 N=66								
			15		☒	24	14-28-30 N=58								
					☒	20	15-18-22 N=40								
		20.0	20		☒	24	30-34-35 N=69								
		Boring Terminated at 20 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by M. Evener

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

Organic test completed i topsoil.

WATER LEVEL OBSERVATIONS

Water was not encountered during drilling

Water was not encountered at completion

▨ *Cave-in at 14.0'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-26-2020	Boring Completed: 07-26-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-9

PROJECT: **Yellowood Solar Facility**

CLIENT: **Invenergy LLC**
Chicago, IL

SITE: **County Road 48**
Lynchburg, OH

LOCATION See Exploration Plan

Latitude: 39.2666° Longitude: -83.8534°

MODEL LAYER	GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
		0.5	**TOPSOIL (6.0")**													
			SANDY LEAN CLAY (CL), trace gravel, brown and gray, moist, stiff to hard			☒	22	2-5-5 N=10	77				12.1	99	27-16-11	
						☒	16	4-22-25 N=47	53				13.5		23-10-13	
				5		☒	18	13-8-7 N=15								
						☒	20	9-5-8 N=13	58				20.5		34-15-19	
						☒	24	8-4-50/5"	56				8.4		24-12-12	
			possible boulders and cobbles below 10'	10		☒	10	48-50/4"								
						☒	16	19-38-50/5"								
				15		☒	24	20-22-30 N=52								
					▨	☒	10	19-50/4"								
						☒	10	47-48-50/5"								
		20.0	***Boring Terminated at 20 Feet***	20												

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification by M. Evener

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

WATER LEVEL OBSERVATIONS
Water was not encountered during drilling
Water was not encountered at completion

▨ *Cave-in at 17.0'*

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-26-2020	Boring Completed: 07-26-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

BORING LOG NO. B-20-10

PROJECT: Yellowood Solar Facility

CLIENT: Invenergy LLC
Chicago, IL

SITE: County Road 48
Lynchburg, OH

LOCATION See Exploration Plan

Latitude: 39.2737° Longitude: -83.865°

MODEL LAYER	GRAPHIC LOG	DEPTH	LOCATION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	PERCENT FINES	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	ORGANIC CONTENT (%)
		0.5	**TOPSOIL (6.0")**													
		2.0	**LEAN CLAY WITH SAND (CL)**, brown to gray, moist, stiff			☒	24	3-5-5 N=10	67				22.3		39-13-26	3
		4.0	**SANDY FAT CLAY (CH)**, brown to gray, moist			■	24		56				23.7	98	54-15-39	
			SANDY LEAN CLAY (CL), trace gravel, brown to gray, moist, medium stiff to stiff, contains organic material	5		☒	18	4-3-4 N=7								
		8.0				☒	24	2-4-6 N=10	67				18.4		31-13-18	
			SANDY LEAN CLAY (CL), trace gravel, gray, moist, very stiff to hard, possible boulders and cobbles below 8'			☒	20	8-7-9 N=16	61				10.2		26-11-15	
				10		☒	20	10-18-22 N=40								
						☒	18	12-20-24 N=44								
				15	▨	☒	18	30-34-40 N=74								
						☒	24	9-12-15 N=27								
		20.0				☒	24	24-31-32 N=63								
			Boring Terminated at 20 Feet	20												

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

Hammer Type: Automatic 90.8% Energy Ratio

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Notes:

Organic test completed in topsoil.
Thermal test oerformed at 2.0' - 4.0'.

WATER LEVEL OBSERVATIONS

Water was not encountered during drilling

Water was not encountered at completion

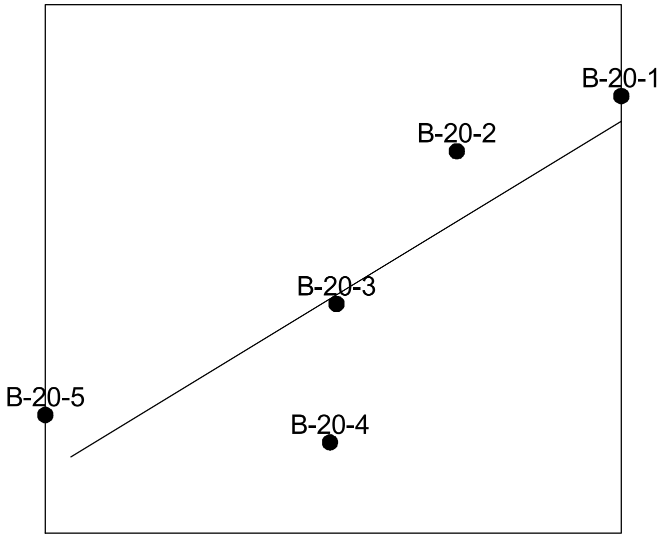
▨ *Cave-in at 15.5'*

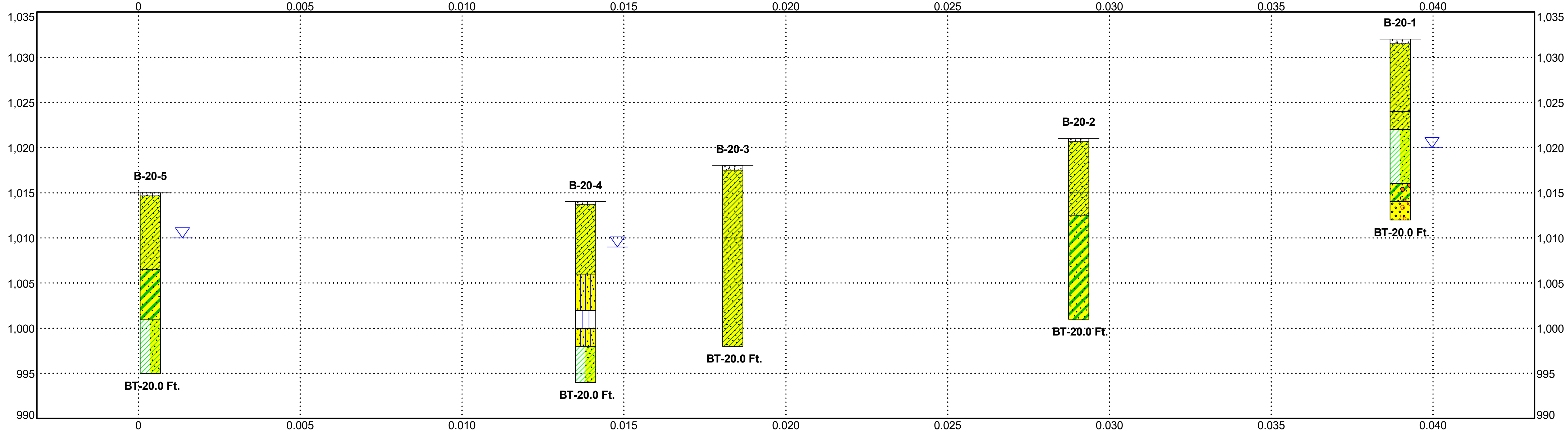
Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 07-26-2020	Boring Completed: 07-26-2020
Drill Rig: B-57	Driller: AV
Project No.: N4205103	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL N4205103 YELLOWOOD SOLAR - .GPJ TERRACON_DATATEMPLATE.GDT 8/24/20

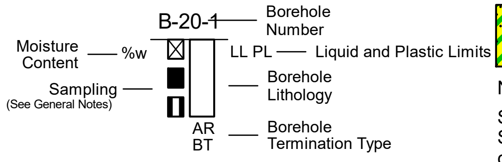
◄ X X ►





Distance Along Baseline - Feet

Explanation



▽ Water Level Reading at time of drilling.

▼ Water Level Reading after drilling.

▨ Topsoil
▨ Sandy Lean Clay
▨ Lean Clay with Sand
▨ Clayey Sand with Gravel
▨ Well-graded Sand with Gravel
▨ Clayey Sand
▨ Silty Sand
▨ Silt

NOTES:

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

Project No.: N4205103
Date: 8/19/2020
Scale: N.T.S.

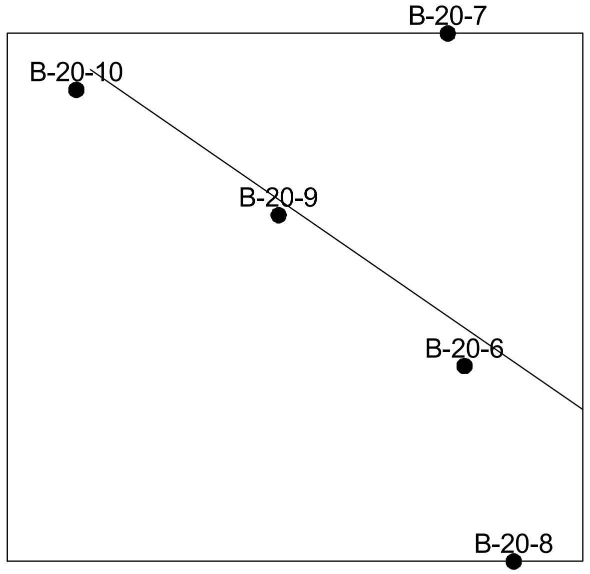
Terracon
800 Morrison Rd
Gahanna, OH

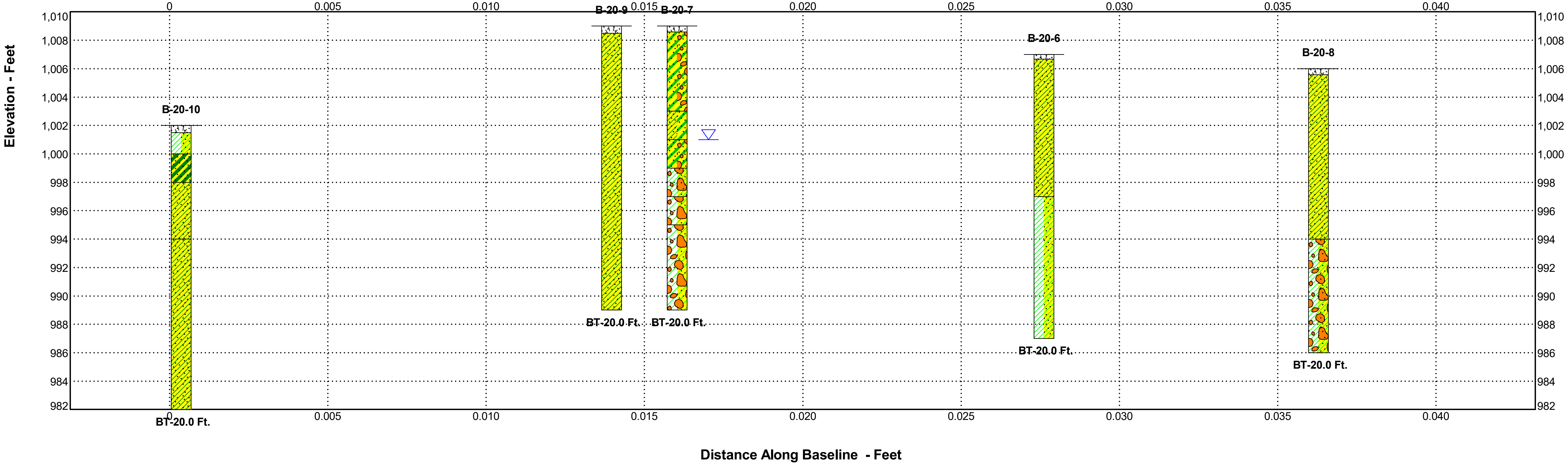
SUBSURFACE PROFILE

YELLOWOOD SOLAR FACILITY
COUNTY ROAD 48
LYNCHBURG, OH

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SMART FENCE WITH SITE MAP N4205103 YELLOWOOD SOLAR.GPJ TERRACON_DATATEMPLATE.GDT 8/19/20

◄ X X ►





Explanation

▨ Topsoil

▨ Sandy Lean Clay

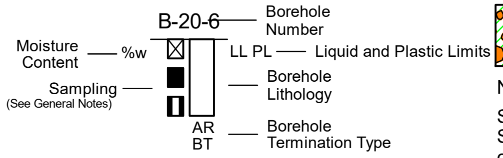
▨ Lean Clay with Sand

▨ Clayey Sand with Gravel

▨ Gravelly Lean Caly with Sand

▨ Clayey Gravel with Sand

▨ Sandy Fat Clay



▽ Water Level Reading at time of drilling.

▼ Water Level Reading after drilling.

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

Project No.: N4205103

Date: 8/19/2020

Scale: N.T.S.

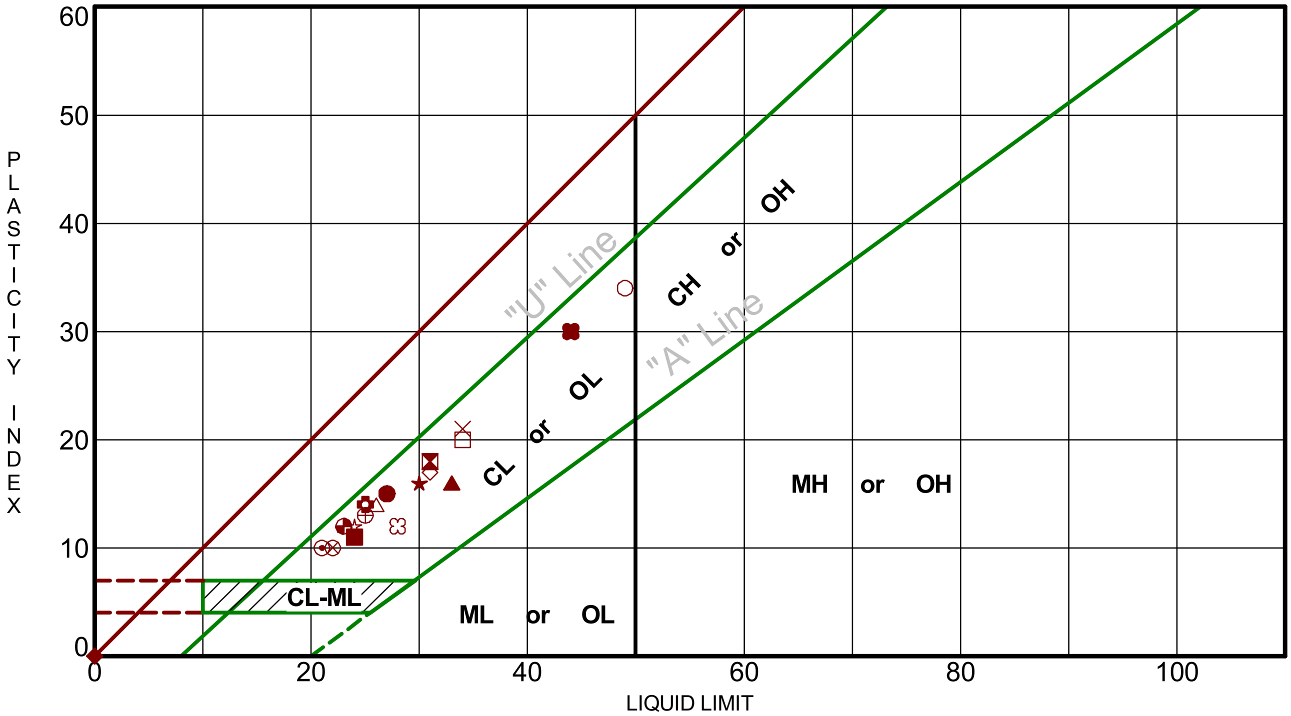
Terracon
800 Morrison Rd
Gahanna, OH

SUBSURFACE PROFILE

YELLOWOOD SOLAR FACILITY
COUNTY ROAD 48
LYNCHBURG, OH

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-20-1	0 - 2	27	12	15	51.4	CL	SANDY LEAN CLAY
⧗	B-20-1	1	31	13	18	65.7	CL	SANDY LEAN CLAY
▲	B-20-1	2 - 4	33	17	16	54.6	CL	SANDY LEAN CLAY
★	B-20-1	6 - 8	30	14	16	56.6	CL	SANDY LEAN CLAY
⦿	B-20-1	8.5	21	11	10	53.6	CL	SANDY LEAN CLAY
✿	B-20-2	0 - 2	25	11	14	53.4	CL	SANDY LEAN CLAY
○	B-20-2	1	49	15	34	61.1	CL	SANDY LEAN CLAY
△	B-20-2	6 - 8	26	12	14	50.7	CL	SANDY LEAN CLAY
⊗	B-20-2	8.5	22	12	10	46.1	SC	CLAYEY SAND
⊕	B-20-3	0 - 2	25	12	13	54.7	CL	SANDY LEAN CLAY
□	B-20-3	1	34	14	20	69.0	CL	SANDY LEAN CLAY
◕	B-20-3	6 - 8	27	12	15	57.5	CL	SANDY LEAN CLAY
◕	B-20-3	8.5	23	11	12	53.0	CL	SANDY LEAN CLAY
☆	B-20-4	0 - 2	24	12	12	55.7	CL	SANDY LEAN CLAY
✿	B-20-4	1	28	16	12	66.0	CL	SANDY LEAN CLAY
■	B-20-4	6 - 8	24	13	11	55.4	CL	SANDY LEAN CLAY
◆	B-20-4	8.5	NP	NP	NP	44.5	SM	SILTY SAND
◇	B-20-5	0 - 2	31	14	17	58.2	CL	SANDY LEAN CLAY
×	B-20-5	1	34	13	21	64.4	CL	SANDY LEAN CLAY
✖	B-20-5	2 - 4	44	14	30	55.1	CL	SANDY LEAN CLAY

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

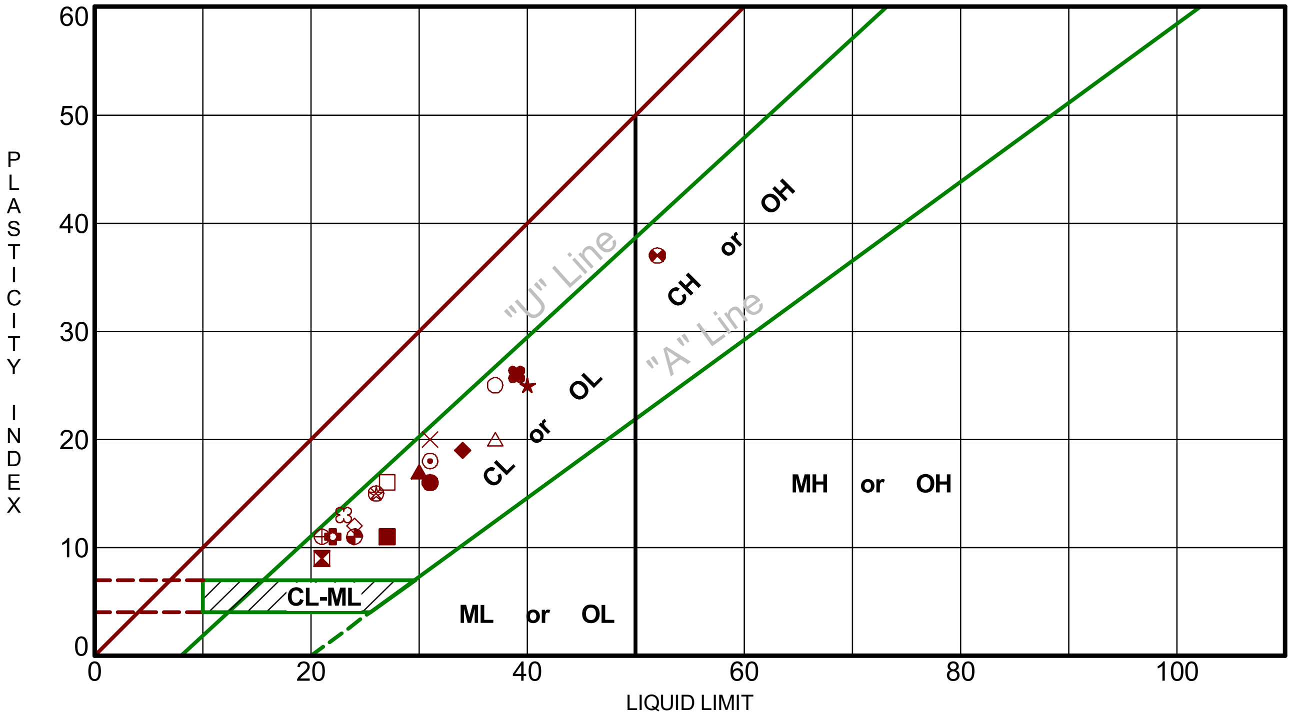
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-20-5	6 - 8	31	15	16	63.6	CL	SANDY LEAN CLAY
⧗	B-20-5	8.5	21	12	9	37.4	SC	CLAYEY SAND
▲	B-20-6	0 - 2	30	13	17	57.2	CL	SANDY LEAN CLAY
★	B-20-6	1	40	15	25	62.4	CL	SANDY LEAN CLAY
⊙	B-20-6	6 - 8	31	13	18	63.2	CL	SANDY LEAN CLAY
✿	B-20-6	8.5	22	11	11	51.6	CL	SANDY LEAN CLAY
○	B-20-7	0 - 2	37	12	25	48.8	SC	CLAYEY SAND
△	B-20-7	1	37	17	20	64.8	CL	SANDY LEAN CLAY
⊗	B-20-7	6 - 8	26	11	15	53.0	CL	SANDY LEAN CLAY
⊕	B-20-7	8.5	21	10	11	38.5	SC	CLAYEY SAND with GRAVEL
□	B-20-8	0 - 2	27	11	16	56.5	CL	SANDY LEAN CLAY
✪	B-20-8	1	52	15	37	52.1	CH	SANDY FAT CLAY
◐	B-20-8	6 - 8	24	13	11	54.4	CL	SANDY LEAN CLAY
☆	B-20-8	8.5	26	11	15	54.9	CL	SANDY LEAN CLAY
❀	B-20-9	0 - 2	23	10	13	52.9	CL	SANDY LEAN CLAY
■	B-20-9	1	27	16	11	76.9	CL	LEAN CLAY with SAND
◆	B-20-9	6 - 8	34	15	19	58.0	CL	SANDY LEAN CLAY
◇	B-20-9	8.5	24	12	12	55.7	CL	SANDY LEAN CLAY
✕	B-20-10	0 - 2	31	11	20	54.5	CL	SANDY LEAN CLAY
✖	B-20-10	1	39	13	26	67.1	CL	SANDY LEAN CLAY

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

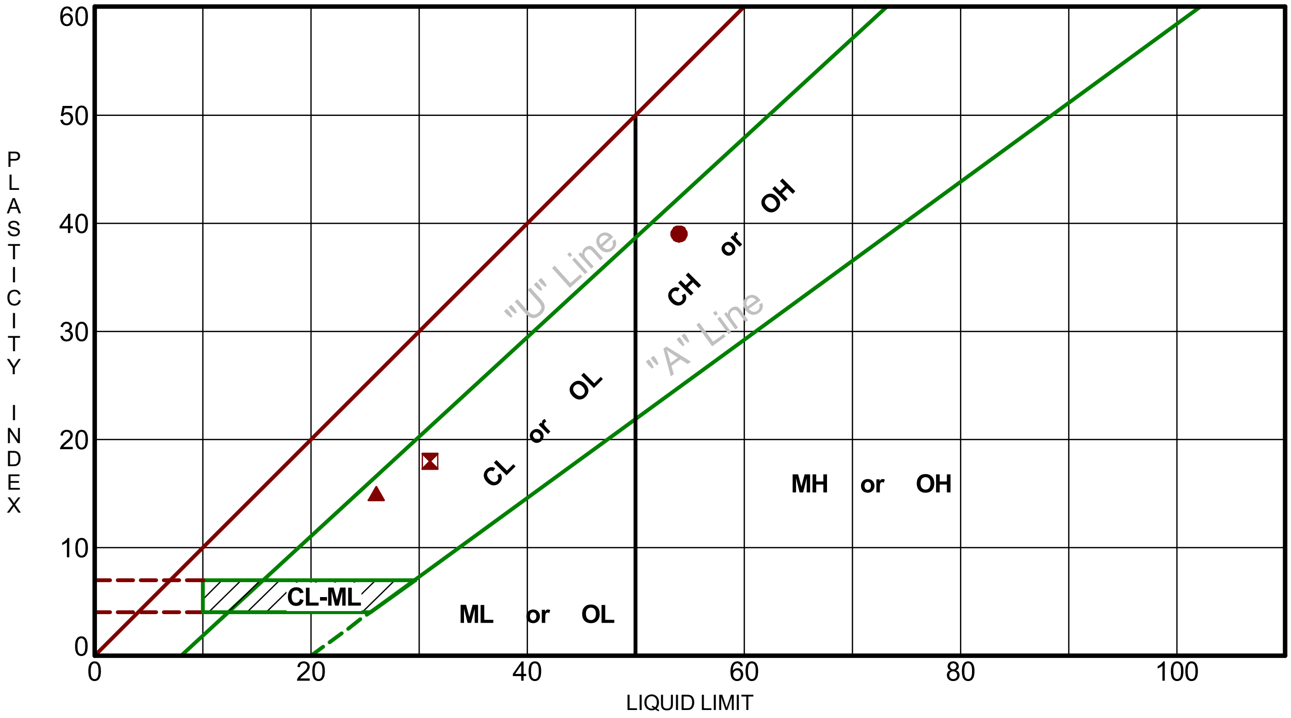
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-20-10	2 - 4	54	15	39	56.2	CH	SANDY FAT CLAY
☒	B-20-10	6 - 8	31	13	18	66.9	CL	SANDY LEAN CLAY
▲	B-20-10	8.5	26	11	15	61.2	CL	SANDY LEAN CLAY

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

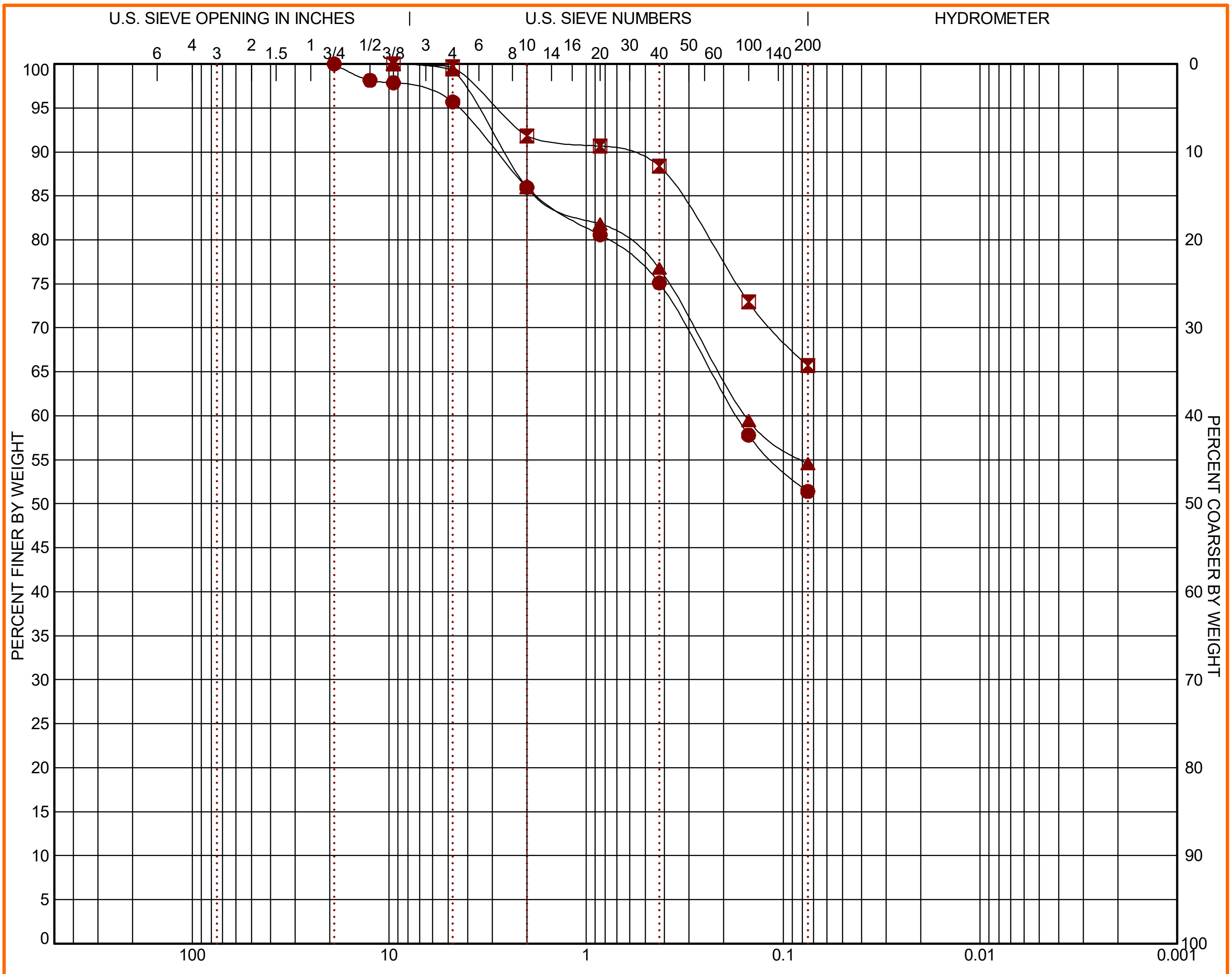
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	B-20-1	39.27432 / -83.79862	0 - 2	0.0	4.3	44.3		51.4	
☒	B-20-1	39.27432 / -83.79862	1	0.0	0.3	34.0		65.7	
▲	B-20-1	39.27432 / -83.79862	2 - 4	0.0	0.7	44.7		54.6	

GRAIN SIZE			
	●	☒	▲
D_{60}	0.171		0.155
D_{30}			
D_{10}			

COEFFICIENTS			
	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/4"	100.0	3/8"	100.0	3/8"	100.0
1/2"	98.14	#4	99.66	#4	99.33
3/8"	97.86	#10	91.79	#10	85.93
#4	95.68	#20	90.67	#20	81.81
#10	85.95	#40	88.4	#40	76.77
#20	80.58	#100	72.94	#100	59.47
#40	75.1	#200	65.7	#200	54.59
#100	57.81				
#200	51.4				

SOIL DESCRIPTION	
●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	SANDY LEAN CLAY (CL)

REMARKS	
●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

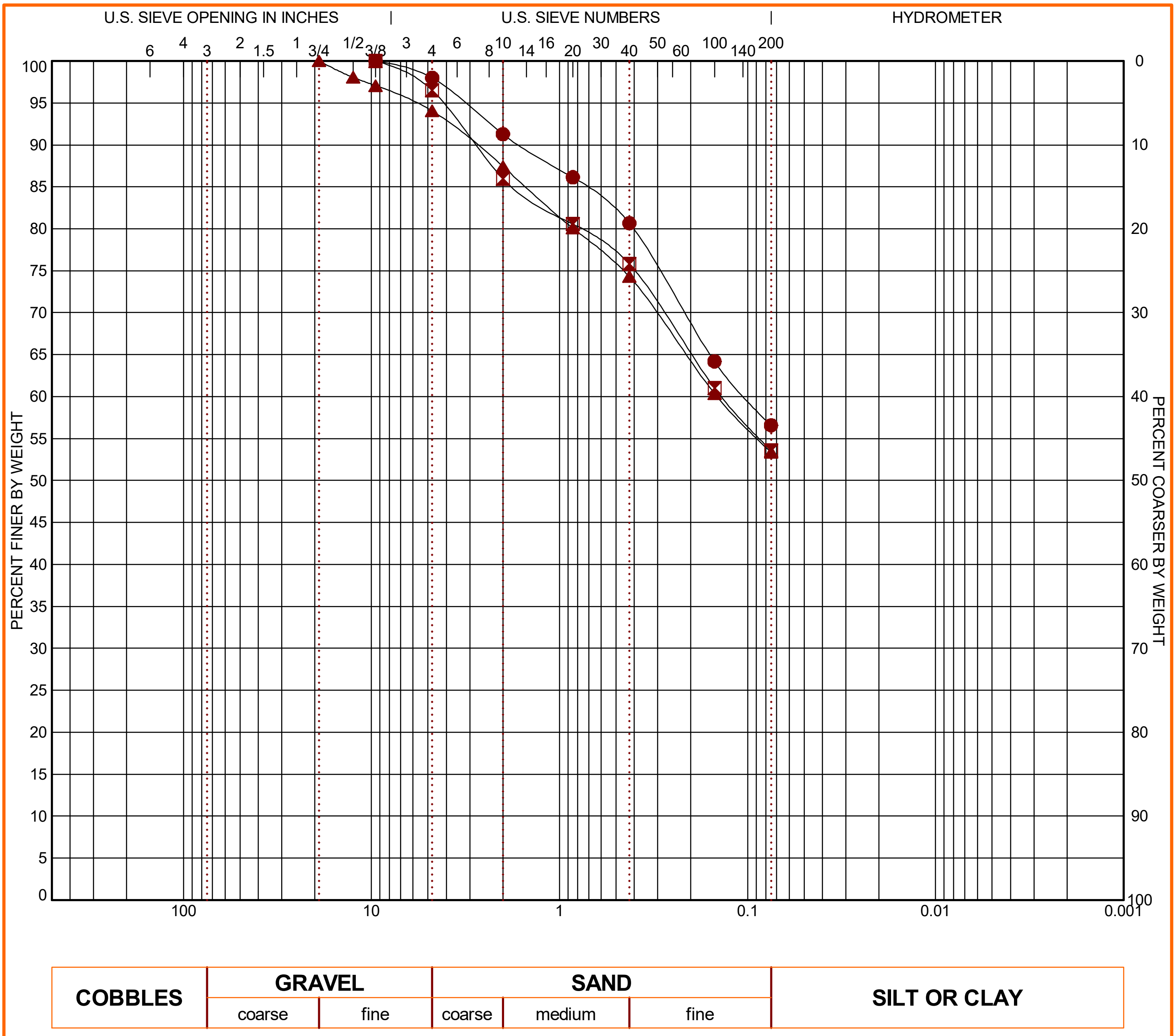
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-1**	**39.27432 / -83.79862**	**6 - 8**	**0.0**	**2.0**	**41.4**		**56.6**	
☒	**B-20-1**	**39.27432 / -83.79862**	**8.5**	**0.0**	**3.5**	**42.9**		**53.6**	
▲	**B-20-2**	**39.27108 / -83.80828**	**0 - 2**	**0.0**	**6.0**	**40.7**		**53.4**	

GRAIN SIZE			
	●	☒	▲
D_{60}	0.102	0.136	0.145
D_{30}			
D_{10}			

COEFFICIENTS			
	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	3/8"	100.0	3/4"	100.0
#4	97.99	#4	96.51	1/2"	98.04
#10	91.28	#10	85.97	3/8"	97.07
#20	86.14	#20	80.58	#4	94.04
#40	80.66	#40	75.79	#10	87.43
#100	64.2	#100	61.04	#20	80.08
#200	56.58	#200	53.59	#40	74.3
				#100	60.37
				#200	53.39

SOIL DESCRIPTION	
●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	SANDY LEAN CLAY (CL)

REMARKS	
●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

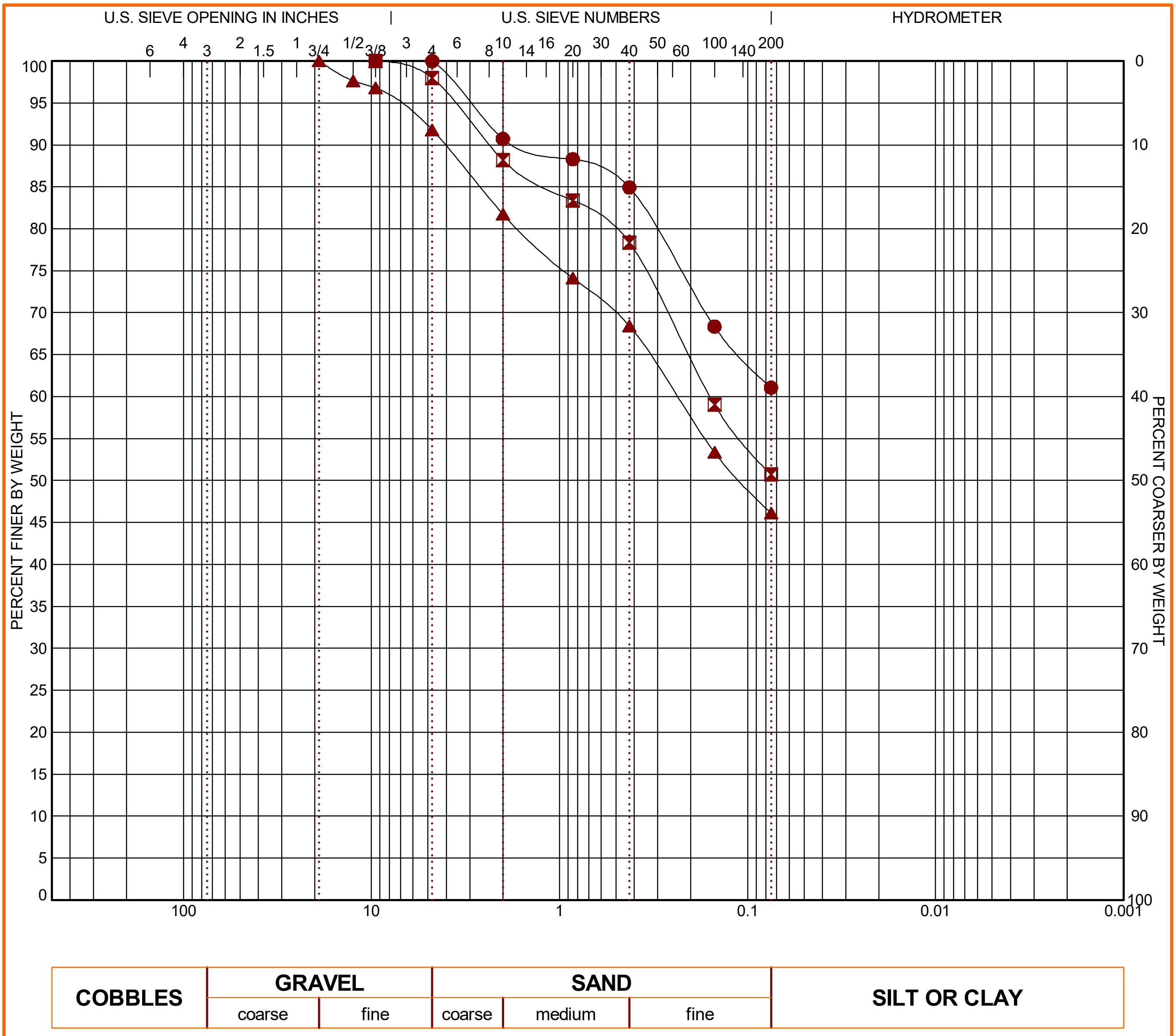
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-2**	**39.27108 / -83.80828**	**1**	**0.0**	**0.0**	**38.9**		**61.1**	
☒	**B-20-2**	**39.27108 / -83.80828**	**6 - 8**	**0.0**	**2.0**	**47.3**		**50.7**	
▲	**B-20-2**	**39.27108 / -83.80828**	**8.5**	**0.0**	**8.2**	**45.7**		**46.1**	

GRAIN SIZE			
	●	☒	▲
D_{60}		0.158	0.237
D_{30}			
D_{10}			

COEFFICIENTS			
	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	**% Finer**	**Sieve**	**% Finer**	**Sieve**	**% Finer**
3/8"	100.0	3/8"	100.0	3/4"	100.0
#4	99.98	#4	97.98	1/2"	97.64
#10	90.71	#10	88.16	3/8"	96.8
#20	88.29	#20	83.39	#4	91.8
#40	84.92	#40	78.37	#10	81.74
#100	68.34	#100	59.03	#20	74.13
#200	61.07	#200	50.7	#40	68.44
				#100	53.36
				#200	46.14

SOIL DESCRIPTION	
●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	CLAYEY SAND (SC)

REMARKS	
●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

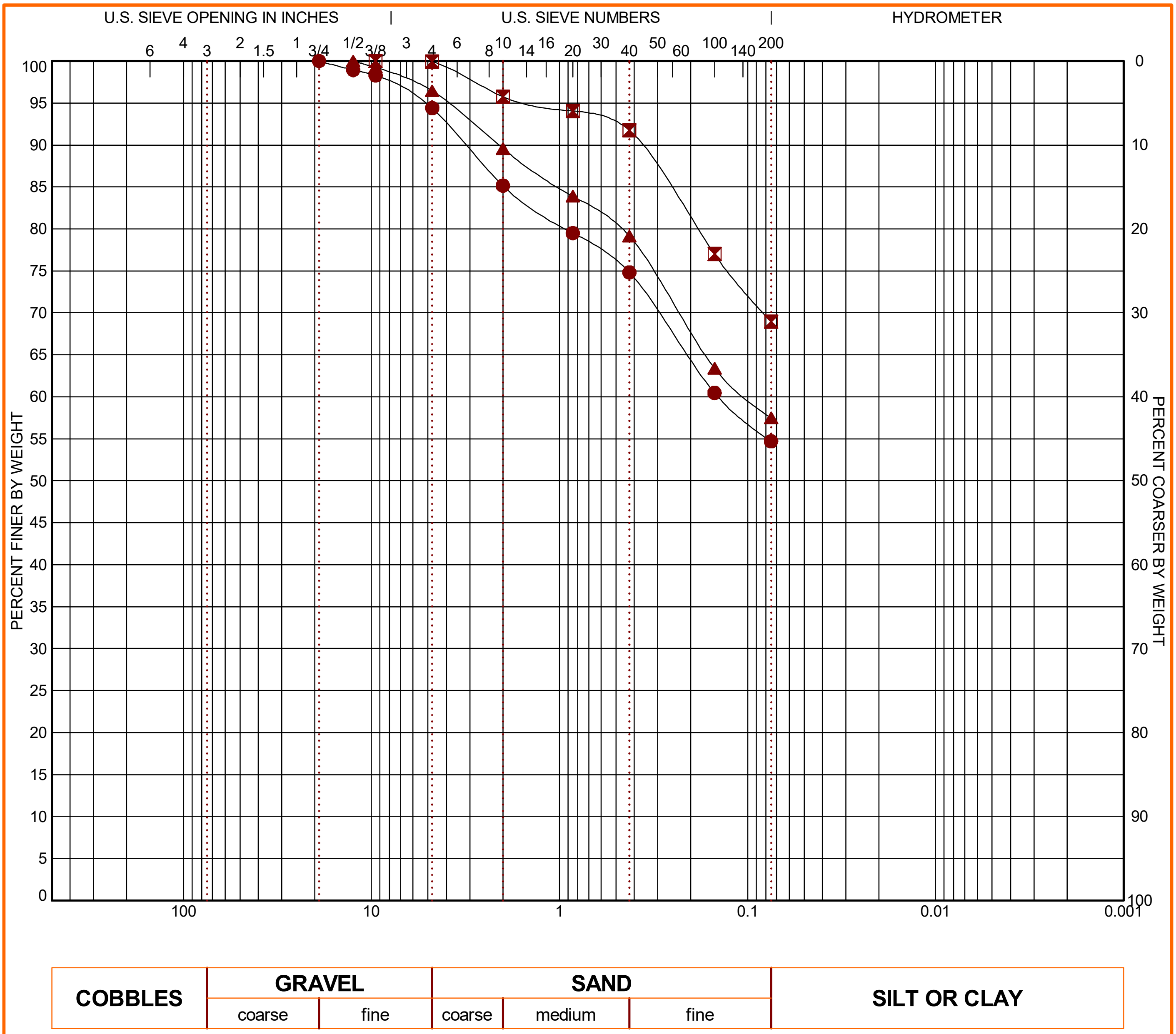
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-3**	**39.26260 / -83.82553**	**0 - 2**	**0.0**	**5.6**	**39.7**		**54.7**	
☒	**B-20-3**	**39.26260 / -83.82553**	**1**	**0.0**	**0.1**	**31.0**		**69.0**	
▲	**B-20-3**	**39.26260 / -83.82553**	**6 - 8**	**0.0**	**3.6**	**38.9**		**57.5**	

GRAIN SIZE

	●	☒	▲
D_{60}	0.142		0.101
D_{30}			
D_{10}			

COEFFICIENTS

	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	**% Finer**	**Sieve**	**% Finer**	**Sieve**	**% Finer**
3/4"	100.0	3/8"	100.0	1/2"	100.0
1/2"	98.94	#4	99.92	3/8"	99.24
3/8"	98.28	#10	95.74	#4	96.44
#4	94.39	#20	94.03	#10	89.58
#10	85.15	#40	91.74	#20	83.89
#20	79.5	#100	77.01	#40	79.16
#40	74.82	#200	68.97	#100	63.41
#100	60.48			#200	57.5
#200	54.71				

SOIL DESCRIPTION

●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	SANDY LEAN CLAY (CL)

REMARKS

●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

PROJECT NUMBER: N4205103

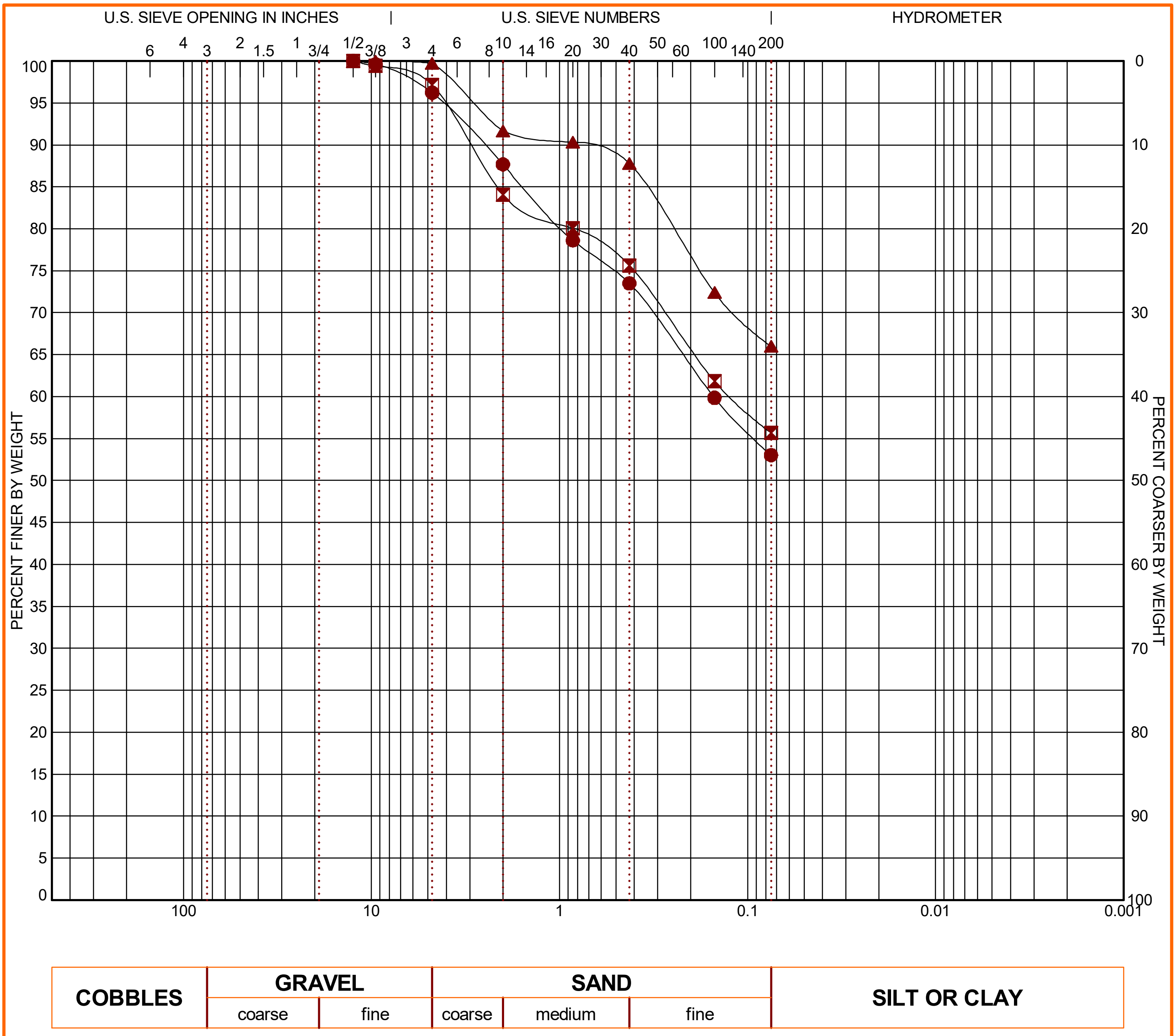
SITE: County Road 48
Lynchburg, OH

Terracon
800 Morrison Rd
Gahanna, OH

CLIENT: Invenergy LLC
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-3**	**39.26260 / -83.82553**	**8.5**	**0.0**	**3.8**	**43.2**		**53.0**	
⊠	**B-20-4**	**39.25400 / -83.81573**	**0 - 2**	**0.0**	**2.9**	**41.5**		**55.7**	
▲	**B-20-4**	**39.25400 / -83.81573**	**1**	**0.0**	**0.3**	**33.7**		**66.0**	

GRAIN SIZE

	●	⊠	▲
D_{60}	0.152	0.122	
D_{30}			
D_{10}			

COEFFICIENTS

	●	⊠	▲
C_C			
C_U			

●		⊠		▲	
Sieve	**% Finer**	**Sieve**	**% Finer**	**Sieve**	**% Finer**
1/2"	100.0	1/2"	100.0	3/8"	100.0
3/8"	99.61	3/8"	99.4	#4	99.73
#4	96.21	#4	97.15	#10	91.66
#10	87.68	#10	84.08	#20	90.31
#20	78.63	#20	80.08	#40	87.78
#40	73.5	#40	75.64	#100	72.4
#100	59.86	#100	61.85	#200	65.98
#200	53.03	#200	55.66		

SOIL DESCRIPTION

●	SANDY LEAN CLAY (CL)
⊠	SANDY LEAN CLAY (CL)
▲	SANDY LEAN CLAY (CL)

REMARKS

●	Location: N E Elevation:
⊠	Location: N E Elevation:
▲	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

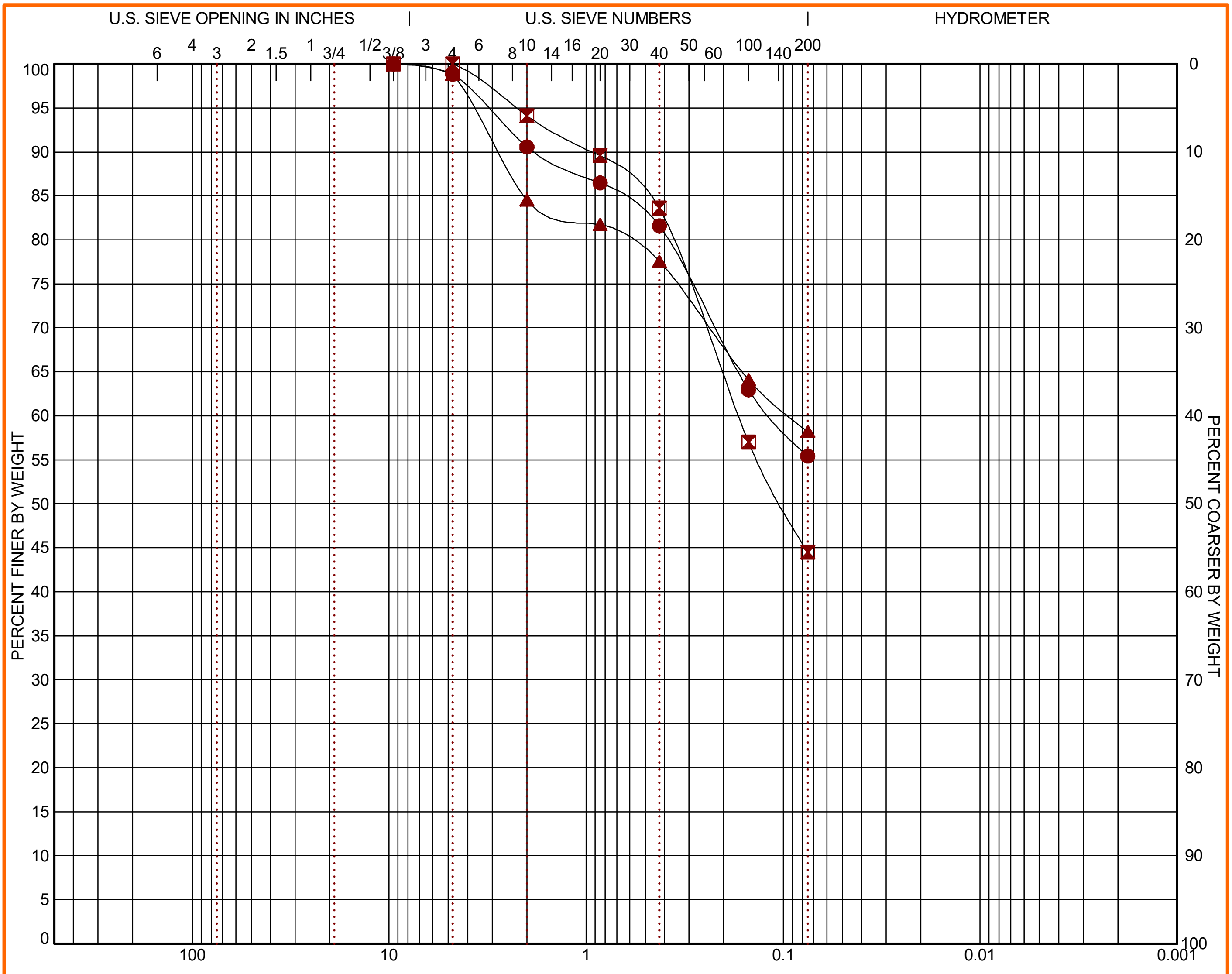
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-4**	**39.25400 / -83.81573**	**6 - 8**	**0.0**	**1.2**	**43.4**		**55.4**	
☒	**B-20-4**	**39.25400 / -83.81573**	**8.5**	**0.0**	**0.0**	**55.5**		**44.5**	
▲	**B-20-5**	**39.25561 / -83.83244**	**0 - 2**	**0.0**	**1.2**	**40.6**		**58.2**	

GRAIN SIZE			
	●	☒	▲
D_{60}	0.114	0.169	0.092
D_{30}			
D_{10}			

COEFFICIENTS			
	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	3/8"	100.0	3/8"	100.0
#4	98.82	#4	99.99	#4	98.79
#10	90.57	#10	94.11	#10	84.54
#20	86.47	#20	89.57	#20	81.74
#40	81.6	#40	83.59	#40	77.57
#100	62.95	#100	57.01	#100	64.12
#200	55.43	#200	44.52	#200	58.22

SOIL DESCRIPTION	
●	SANDY LEAN CLAY (CL)
☒	SILTY SAND (SM)
▲	SANDY LEAN CLAY (CL)

REMARKS	
●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

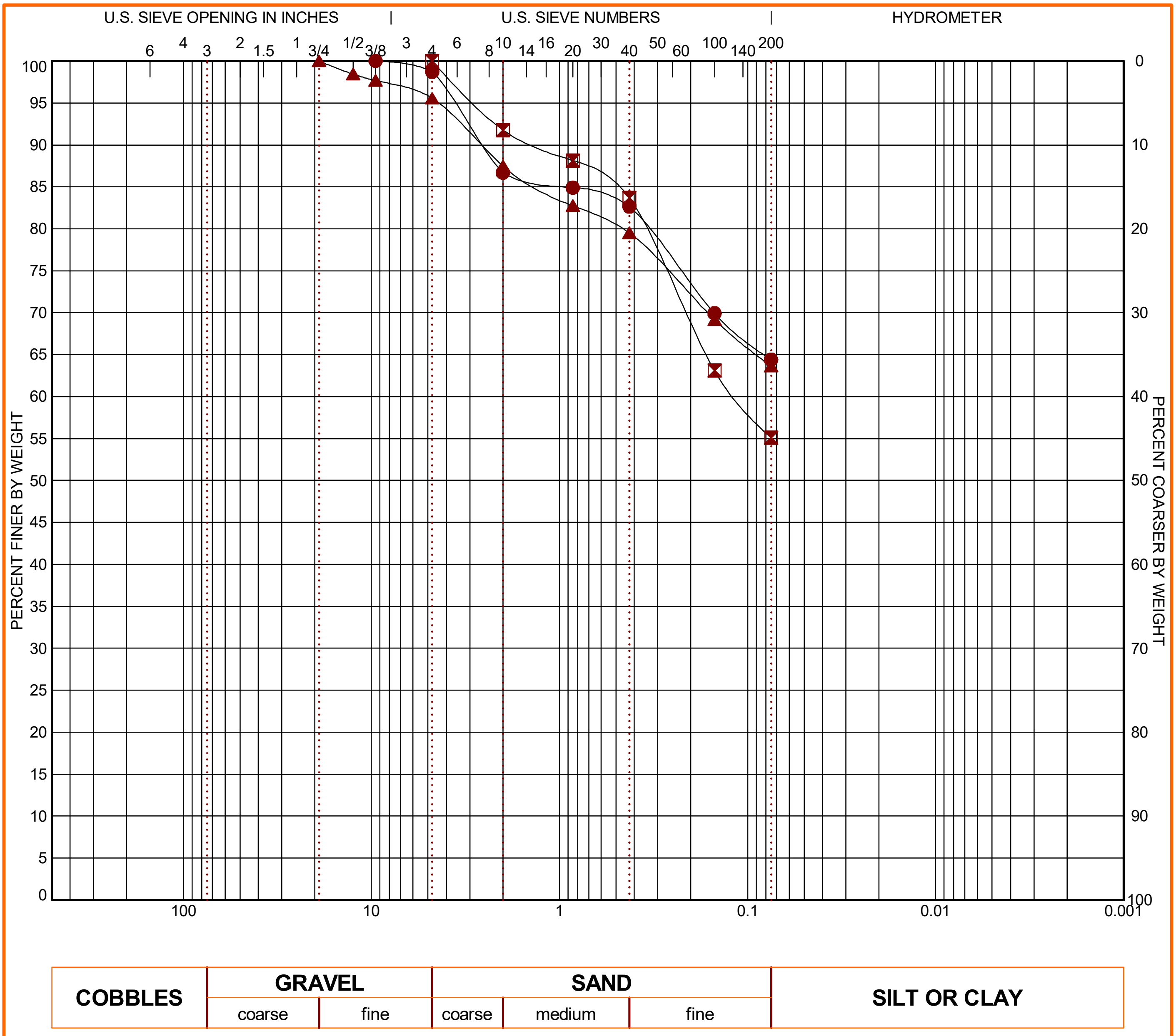
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-5**	**39.25561 / -83.83244**	**1**	**0.0**	**1.3**	**34.3**		**64.4**	
☒	**B-20-5**	**39.25561 / -83.83244**	**2 - 4**	**0.0**	**0.0**	**44.9**		**55.1**	
▲	**B-20-5**	**39.25561 / -83.83244**	**6 - 8**	**0.0**	**4.4**	**31.9**		**63.6**	

GRAIN SIZE

	●	☒	▲
D_{60}		0.115	
D_{30}			
D_{10}			

COEFFICIENTS

	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	**% Finer**	**Sieve**	**% Finer**	**Sieve**	**% Finer**
3/8"	100.0	#4	100.0	3/4"	100.0
#4	98.71	#10	91.78	1/2"	98.42
#10	86.68	#20	88.15	3/8"	97.66
#20	84.9	#40	83.68	#4	95.56
#40	82.65	#100	63.1	#10	87.49
#100	69.92	#200	55.11	#20	82.75
#200	64.4			#40	79.51
				#100	69.17
				#200	63.62

SOIL DESCRIPTION

●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	SANDY LEAN CLAY (CL)

REMARKS

●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

SITE: County Road 48
Lynchburg, OH

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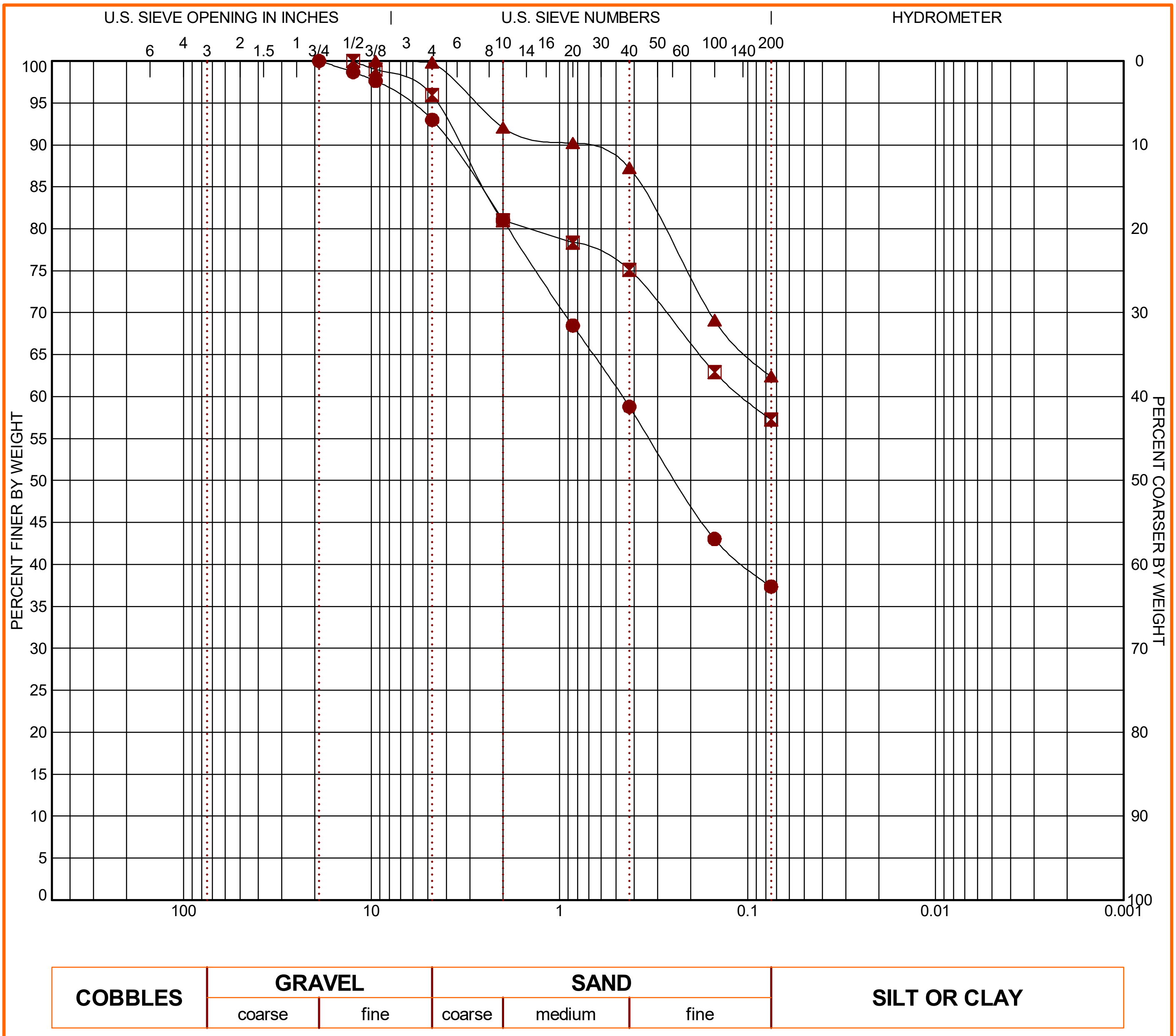
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-5**	**39.25561 / -83.83244**	**8.5**	**0.0**	**7.0**	**55.6**		**37.4**	
⊠	**B-20-6**	**39.25794 / -83.84281**	**0 - 2**	**0.0**	**4.1**	**38.7**		**57.2**	
▲	**B-20-6**	**39.25794 / -83.84281**	**1**	**0.0**	**0.2**	**37.4**		**62.4**	

GRAIN SIZE

	●	⊠	▲
D_{60}	0.463	0.105	
D_{30}			
D_{10}			

COEFFICIENTS

	●	⊠	▲
C_C			
C_U			

●		⊠		▲	
Sieve	**% Finer**	**Sieve**	**% Finer**	**Sieve**	**% Finer**
3/4"	100.0	1/2"	100.0	3/8"	100.0
1/2"	98.67	3/8"	98.99	#4	99.82
3/8"	97.62	#4	95.92	#10	92.06
#4	92.98	#10	81.0	#20	90.22
#10	81.04	#20	78.36	#40	87.26
#20	68.47	#40	75.12	#100	69.09
#40	58.79	#100	62.93	#200	62.41
#100	43.03	#200	57.25		
#200	37.36				

SOIL DESCRIPTION

●	CLAYEY SAND (SC)
⊠	SANDY LEAN CLAY (CL)
▲	SANDY LEAN CLAY (CL)

REMARKS

●	Location: N E Elevation:
⊠	Location: N E Elevation:
▲	Location: N E Elevation:

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Invenergy-Preliminary

SITE: County Road 48
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Gahanna, OH

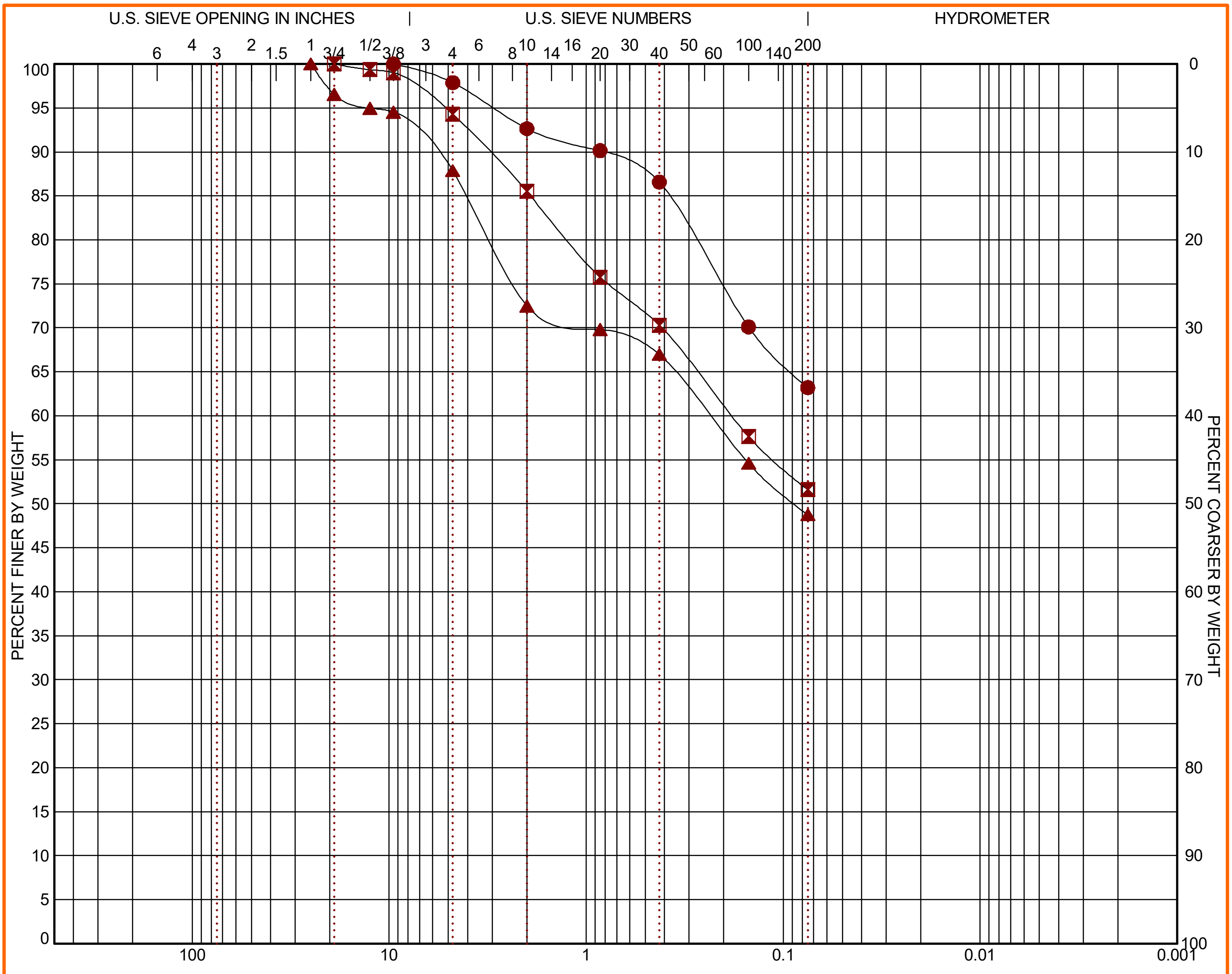
PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. 73191029-GRAIN SIZE-USCS 1 N4205103 YELLOWOOD SOLAR -.GPJ TERRACON_DATATEMPLATE.GDT 8/6/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-6**	**39.25794 / -83.84281**	**6 - 8**	**0.0**	**2.1**	**34.7**		**63.2**	
☒	**B-20-6**	**39.25794 / -83.84281**	**8.5**	**0.0**	**5.7**	**42.7**		**51.6**	
▲	**B-20-7**	**39.27696 / -83.84376**	**0 - 2**	**0.0**	**12.1**	**39.1**		**48.8**	

GRAIN SIZE			
	●	☒	▲
D_{60}		0.182	0.236
D_{30}			
D_{10}			

COEFFICIENTS			
	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	3/4"	100.0	1"	100.0
#4	97.86	1/2"	99.35	3/4"	96.53
#10	92.64	3/8"	99.01	1/2"	94.97
#20	90.14	#4	94.3	3/8"	94.53
#40	86.57	#10	85.51	#4	87.87
#100	70.1	#20	75.77	#10	72.5
#200	63.2	#40	70.3	#20	69.8
		#100	57.66	#40	66.99
		#200	51.59	#100	54.61
				#200	48.76

SOIL DESCRIPTION	
●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	CLAYEY SAND (SC)

REMARKS	
●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

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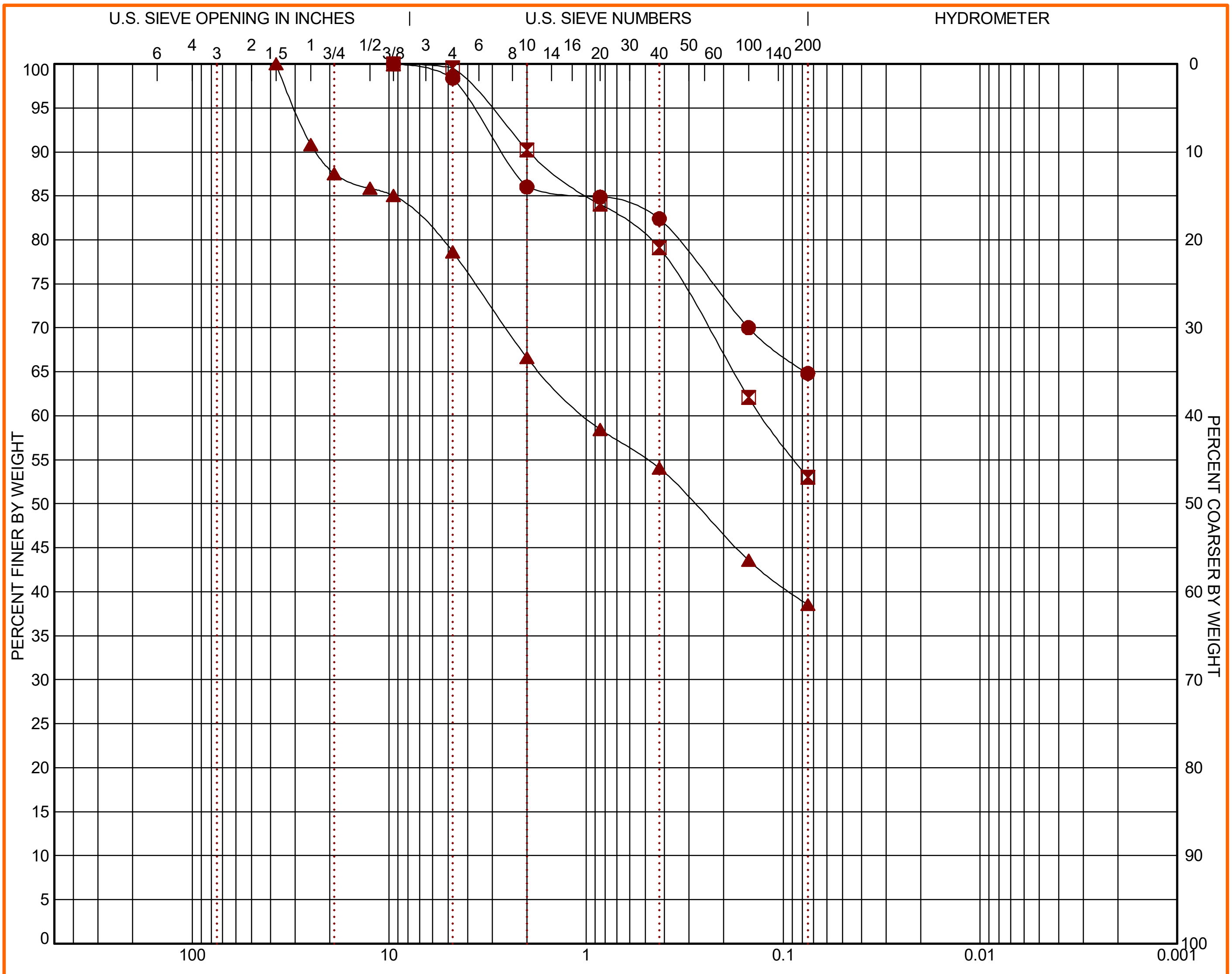
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-7**	**39.27696 / -83.84376**	**1**	**0.0**	**1.6**	**33.5**		**64.8**	
☒	**B-20-7**	**39.27696 / -83.84376**	**6 - 8**	**0.0**	**0.5**	**46.5**		**53.0**	
▲	**B-20-7**	**39.27696 / -83.84376**	**8.5**	**0.0**	**21.4**	**40.1**		**38.5**	

GRAIN SIZE

	●	☒	▲
D_{60}		0.128	0.999
D_{30}			
D_{10}			

COEFFICIENTS

	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	**% Finer**	**Sieve**	**% Finer**	**Sieve**	**% Finer**
3/8"	100.0	3/8"	100.0	1 1/2"	100.0
#4	98.37	#4	99.55	1"	90.83
#10	86.01	#10	90.25	3/4"	87.54
#20	84.86	#20	84.04	1/2"	85.85
#40	82.4	#40	79.1	3/8"	85.05
#100	70.02	#100	62.09	#4	78.63
#200	64.83	#200	53.02	#10	66.6
				#20	58.46
				#40	54.05
				#100	43.59
				#200	38.53

SOIL DESCRIPTION

●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	CLAYEY SAND with GRAVEL (SC)

REMARKS

●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

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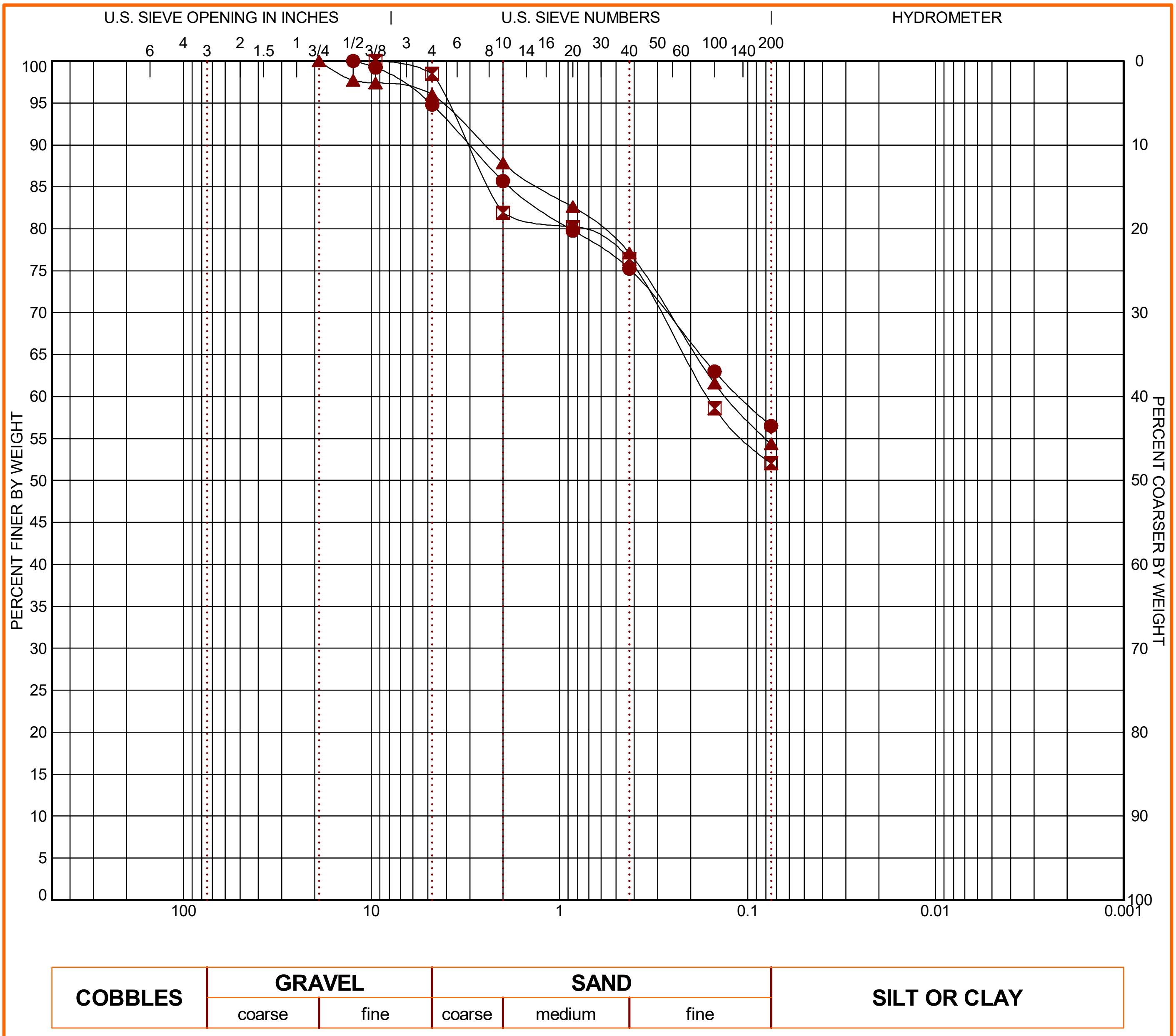
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-8**	**39.24676 / -83.83999**	**0 - 2**	**0.0**	**5.2**	**38.3**		**56.5**	
☒	**B-20-8**	**39.24676 / -83.83999**	**1**	**0.0**	**1.5**	**46.4**		**52.1**	
▲	**B-20-8**	**39.24676 / -83.83999**	**6 - 8**	**0.0**	**4.0**	**41.6**		**54.4**	

GRAIN SIZE

	●	☒	▲
D_{60}	0.109	0.163	0.129
D_{30}			
D_{10}			

COEFFICIENTS

	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	**% Finer**	**Sieve**	**% Finer**	**Sieve**	**% Finer**
1/2"	100.0	3/8"	100.0	3/4"	100.0
3/8"	99.22	#4	98.5	1/2"	97.7
#4	94.8	#10	81.91	3/8"	97.38
#10	85.69	#20	80.21	#4	95.97
#20	79.79	#40	76.37	#10	87.83
#40	75.24	#100	58.61	#20	82.62
#100	62.99	#200	52.06	#40	77.13
#200	56.5			#100	61.58
				#200	54.36

SOIL DESCRIPTION

●	SANDY LEAN CLAY (CL)
☒	SANDY FAT CLAY (CH)
▲	SANDY LEAN CLAY (CL)

REMARKS

●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

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Invenergy-Preliminary

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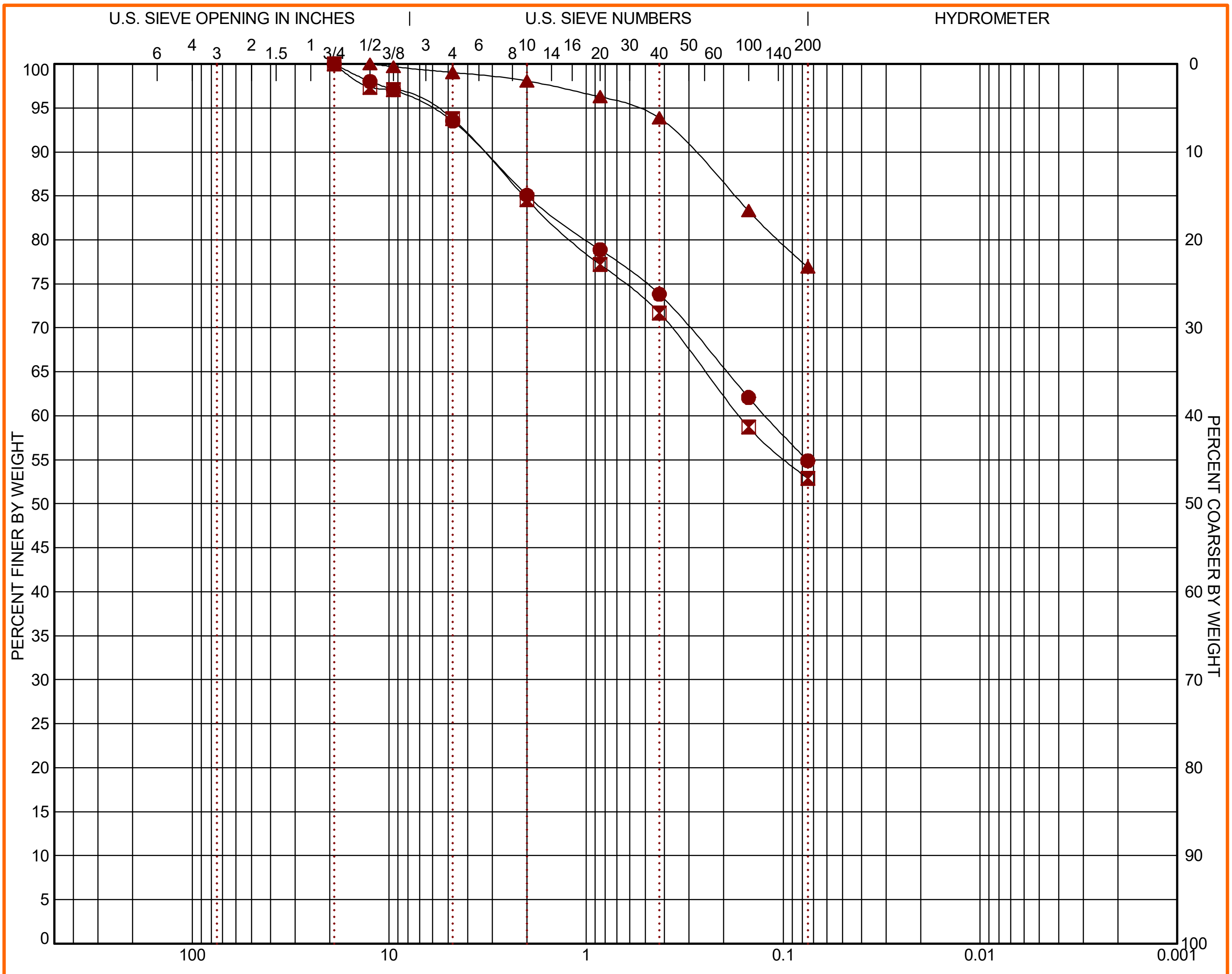
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-8**	**39.24676 / -83.83999**	**8.5**	**0.0**	**6.5**	**38.6**		**54.9**	
☒	**B-20-9**	**39.26657 / -83.85344**	**0 - 2**	**0.0**	**6.2**	**40.9**		**52.9**	
▲	**B-20-9**	**39.26657 / -83.85344**	**1**	**0.0**	**1.0**	**22.1**		**76.9**	

GRAIN SIZE			
	●	☒	▲
D_{60}	0.123	0.166	
D_{30}			
D_{10}			

COEFFICIENTS			
	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/4"	100.0	3/4"	100.0	1/2"	100.0
1/2"	98.01	1/2"	97.34	3/8"	99.68
3/8"	97.05	3/8"	97.09	#4	99.02
#4	93.5	#4	93.76	#10	98.07
#10	85.08	#10	84.58	#20	96.27
#20	78.89	#20	77.19	#40	93.85
#40	73.82	#40	71.71	#100	83.31
#100	62.08	#100	58.71	#200	76.9
#200	54.89	#200	52.91		

SOIL DESCRIPTION	
●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	LEAN CLAY with SAND (CL)

REMARKS	
●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

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Invenergy-Preliminary

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800 Morrison Rd
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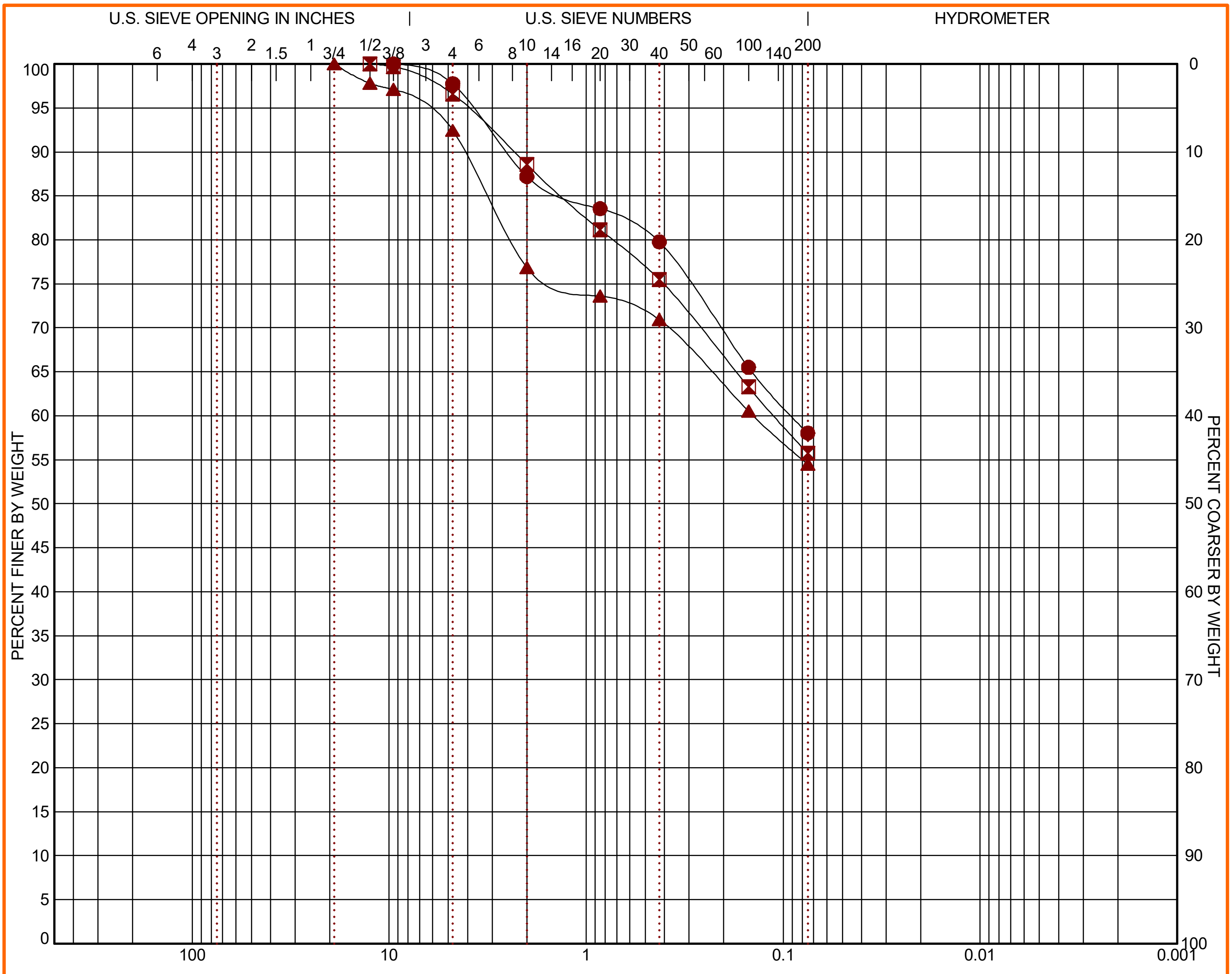
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-9**	**39.26657 / -83.85344**	**6 - 8**	**0.0**	**2.2**	**39.7**		**58.0**	
☒	**B-20-9**	**39.26657 / -83.85344**	**8.5**	**0.0**	**3.4**	**40.8**		**55.7**	
▲	**B-20-10**	**39.27373 / -83.86502**	**0 - 2**	**0.0**	**7.6**	**38.0**		**54.5**	

GRAIN SIZE

	●	☒	▲
D_{60}	0.09	0.111	0.141
D_{30}			
D_{10}			

COEFFICIENTS

	●	☒	▲
C_c			
C_u			

●		☒		▲	
Sieve	**% Finer**	**Sieve**	**% Finer**	**Sieve**	**% Finer**
3/8"	100.0	1/2"	100.0	3/4"	100.0
#4	97.75	3/8"	99.68	1/2"	97.8
#10	87.19	#4	96.59	3/8"	97.09
#20	83.55	#10	88.56	#4	92.45
#40	79.77	#20	81.16	#10	76.83
#100	65.5	#40	75.5	#20	73.62
#200	58.05	#100	63.28	#40	70.94
		#200	55.75	#100	60.52
				#200	54.49

SOIL DESCRIPTION

●	SANDY LEAN CLAY (CL)
☒	SANDY LEAN CLAY (CL)
▲	SANDY LEAN CLAY (CL)

REMARKS

●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

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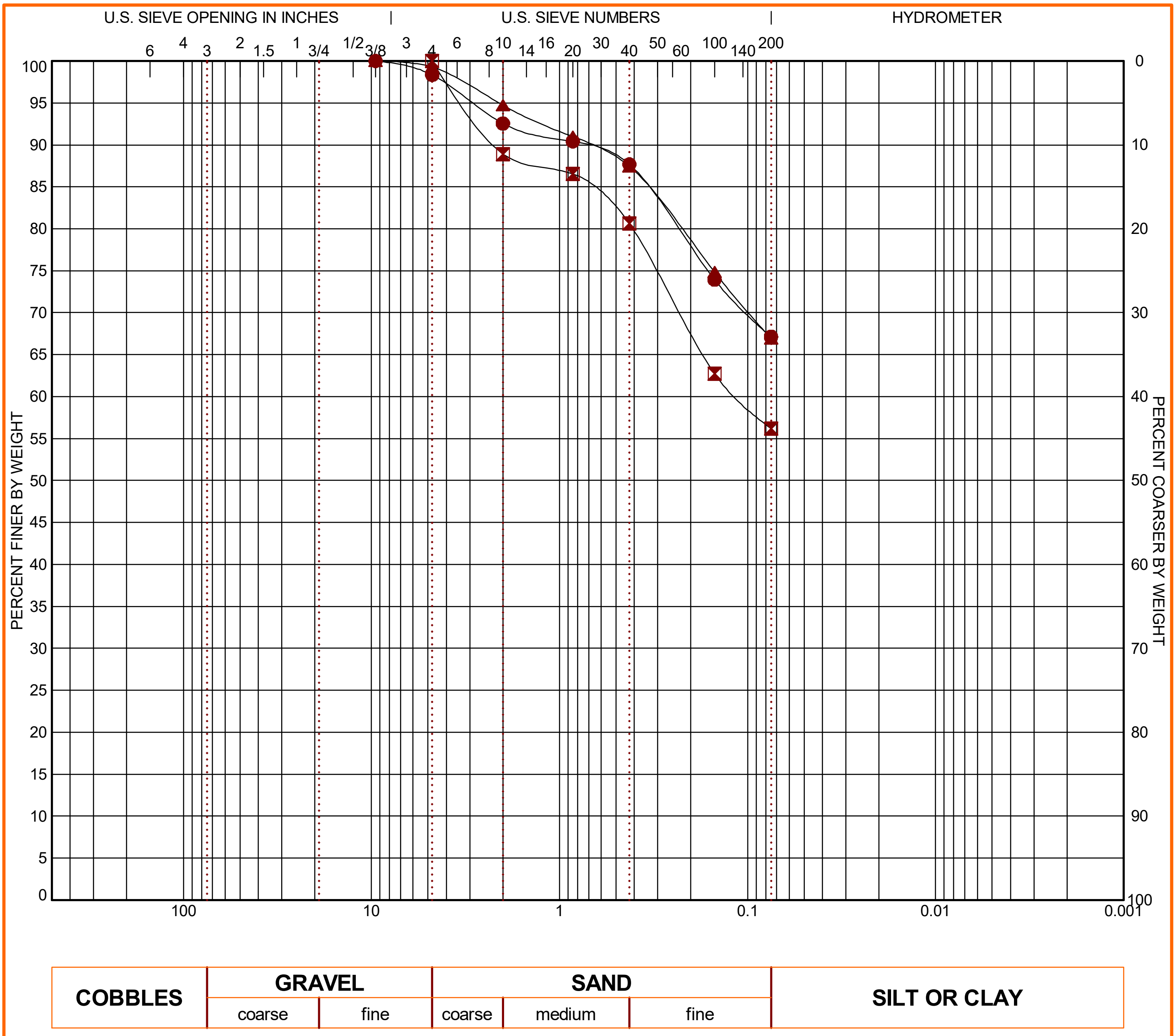
Chicago, IL

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	B-20-10	39.27373 / -83.86502	1	0.0	1.7	31.2		67.1	
☒	B-20-10	39.27373 / -83.86502	2 - 4	0.0	0.0	43.8		56.2	
▲	B-20-10	39.27373 / -83.86502	6 - 8	0.0	0.7	32.4		66.9	

GRAIN SIZE			
	●	☒	▲
D_{60}		0.112	
D_{30}			
D_{10}			

COEFFICIENTS			
	●	☒	▲
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	#4	100.0	3/8"	100.0
#4	98.34	#10	88.92	#4	99.3
#10	92.55	#20	86.55	#10	94.73
#20	90.41	#40	80.62	#20	90.98
#40	87.69	#100	62.75	#40	87.45
#100	73.95	#200	56.2	#100	74.85
#200	67.14			#200	66.94

SOIL DESCRIPTION	
●	SANDY LEAN CLAY (CL)
☒	SANDY FAT CLAY (CH)
▲	SANDY LEAN CLAY (CL)

REMARKS	
●	Location: N E Elevation:
☒	Location: N E Elevation:
▲	Location: N E Elevation:

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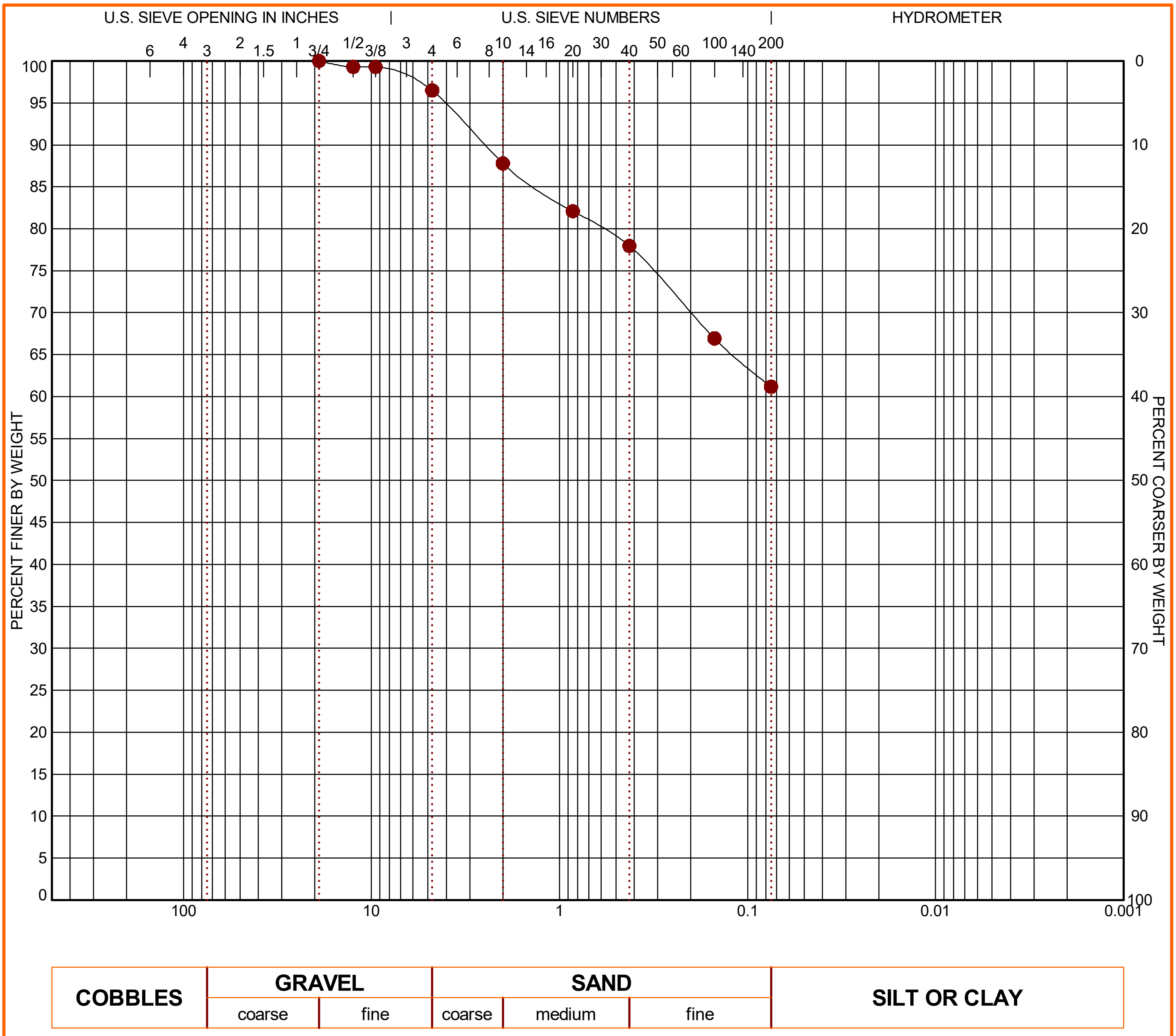
GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	LATITUDE/LONGITUDE	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY
●	**B-20-10**	**39.27373 / -83.86502**	**8.5**	**0.0**	**3.5**	**35.3**		**61.2**	

GRAIN SIZE			
	●		
D_{60}			
D_{30}			
D_{10}			

COEFFICIENTS			
	●		
C_C			
C_U			

●					
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/4"	100.0				
1/2"	99.29				
3/8"	99.29				
#4	96.49				
#10	87.79				
#20	82.1				
#40	77.96				
#100	66.94				
#200	61.18				

	SOIL DESCRIPTION
●	SANDY LEAN CLAY (CL)

	REMARKS
●	Location: N E Elevation:

PROJECT: Yellowood Solar -
Invenergy-Preliminary

SITE: County Road 48
Lynchburg, OH

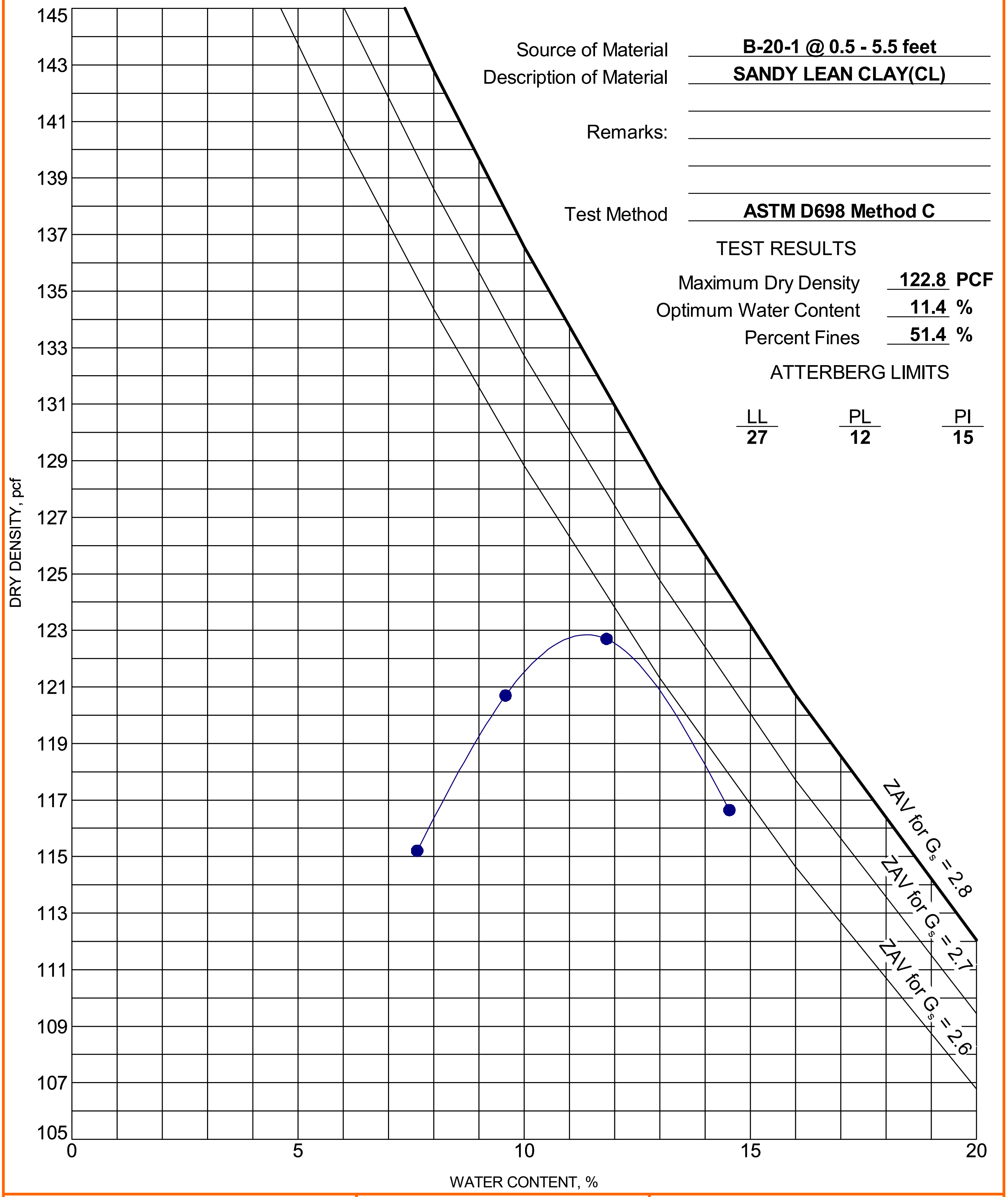
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material **B-20-1 @ 0.5 - 5.5 feet**

Description of Material **SANDY LEAN CLAY(CL)**

Remarks:

Test Method **ASTM D698 Method C**

TEST RESULTS

Maximum Dry Density	**122.8**	**PCF**
Optimum Water Content	**11.4**	**%**
Percent Fines	**51.4**	**%**

ATTERBERG LIMITS

LL	PL	PI
27	**12**	**15**

PROJECT: Yellowood Solar Facility

SITE: County Road 48
Lynchburg, OH

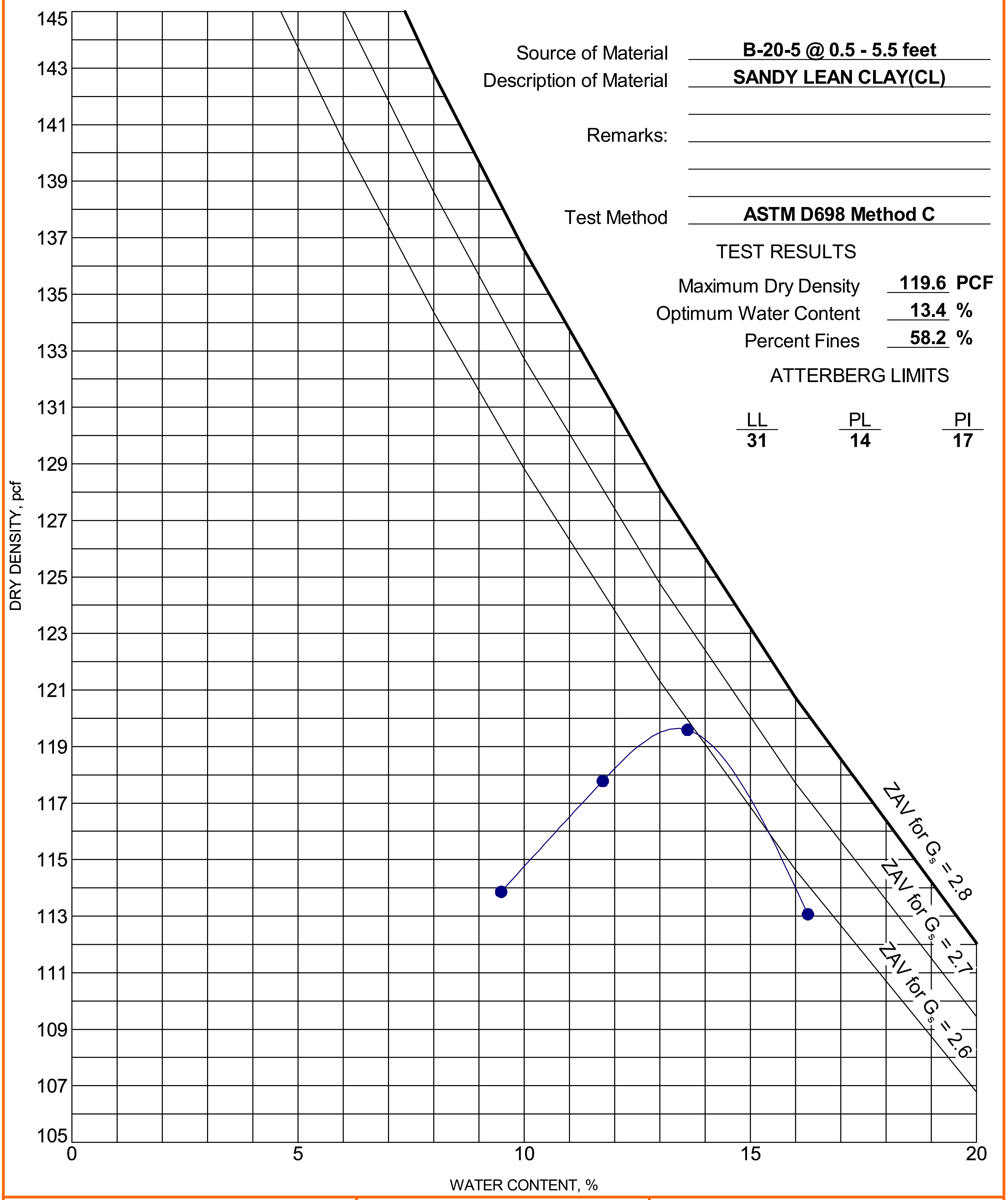
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material **B-20-5 @ 0.5 - 5.5 feet**

Description of Material **SANDY LEAN CLAY(CL)**

Remarks:

Test Method **ASTM D698 Method C**

TEST RESULTS

Maximum Dry Density **119.6 PCF**

Optimum Water Content **13.4 %**

Percent Fines **58.2 %**

ATTERBERG LIMITS

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

PROJECT: Yellowood Solar Facility

SITE: County Road 48
Lynchburg, OH

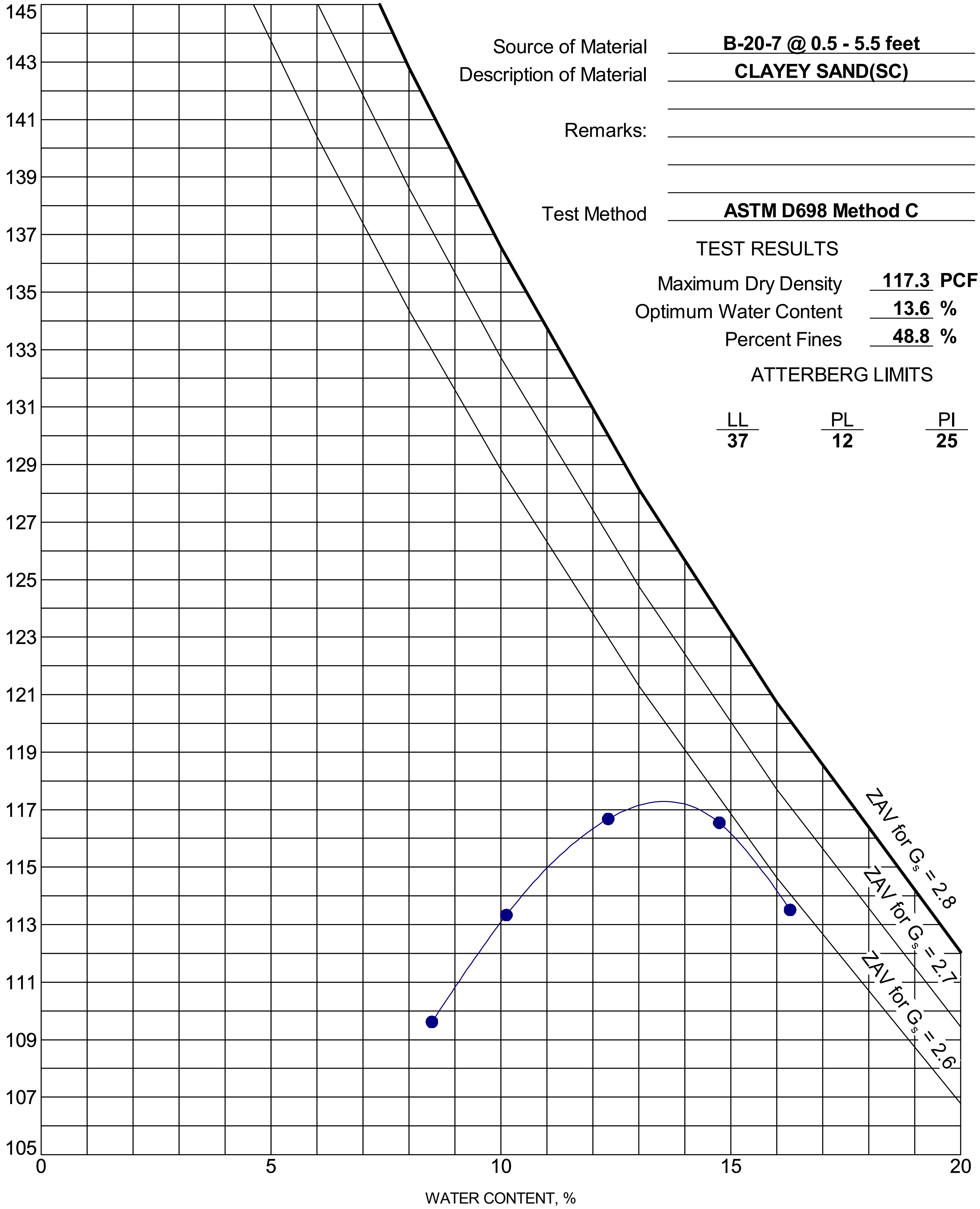
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material **B-20-7 @ 0.5 - 5.5 feet**

Description of Material **CLAYEY SAND(SC)**

Remarks:

Test Method **ASTM D698 Method C**

TEST RESULTS

Maximum Dry Density	**117.3**	**PCF**
Optimum Water Content	**13.6**	**%**
Percent Fines	**48.8**	**%**

ATTERBERG LIMITS

LL	PL	PI
37	**12**	**25**

PROJECT: Yellowood Solar Facility

SITE: County Road 48
Lynchburg, OH

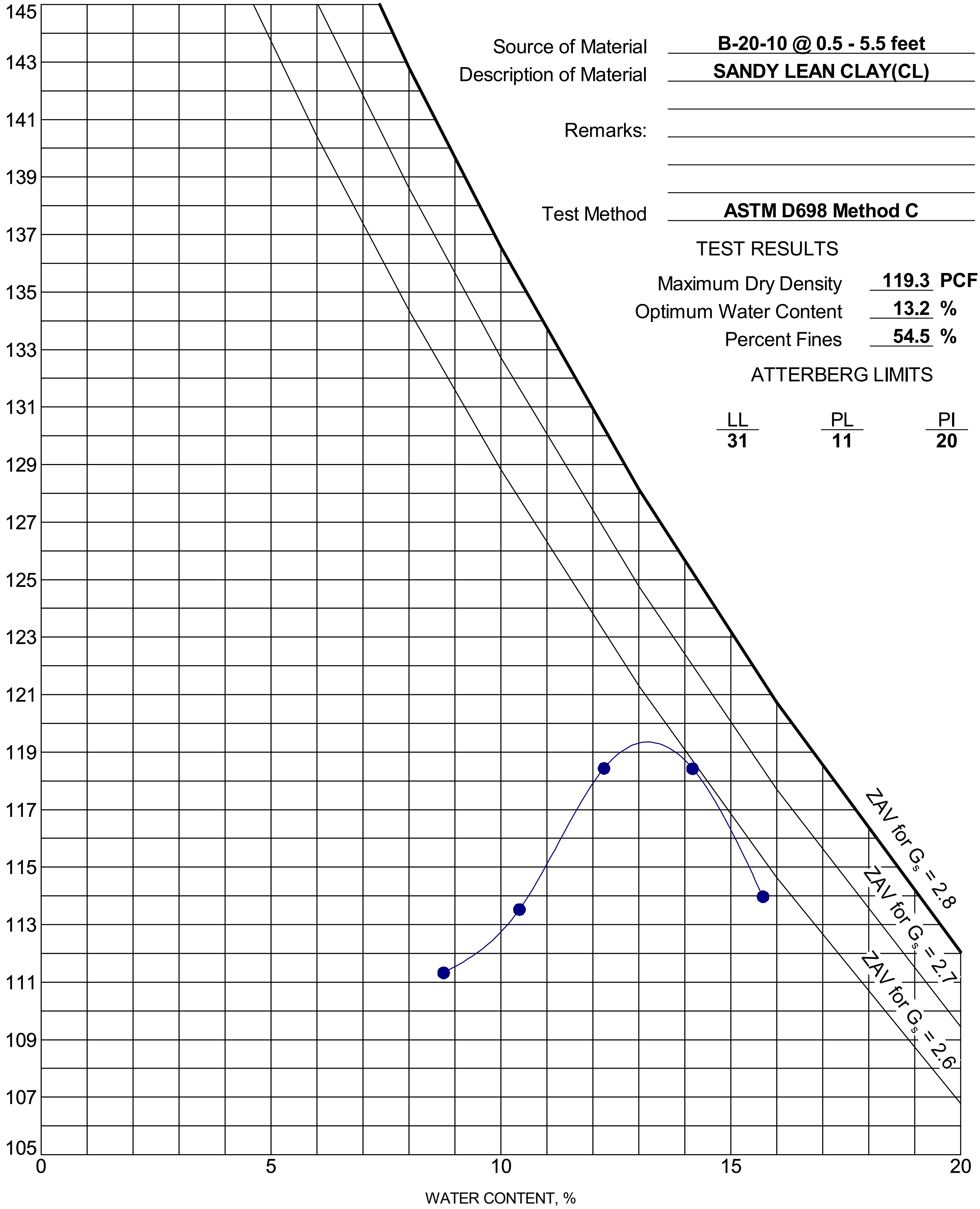
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**B-20-10 @ 0.5 - 5.5 feet**
Description of Material	**SANDY LEAN CLAY(CL)**
Remarks:	
Test Method	**ASTM D698 Method C**

TEST RESULTS

Maximum Dry Density	**119.3**	**PCF**
Optimum Water Content	**13.2**	**%**
Percent Fines	**54.5**	**%**

ATTERBERG LIMITS

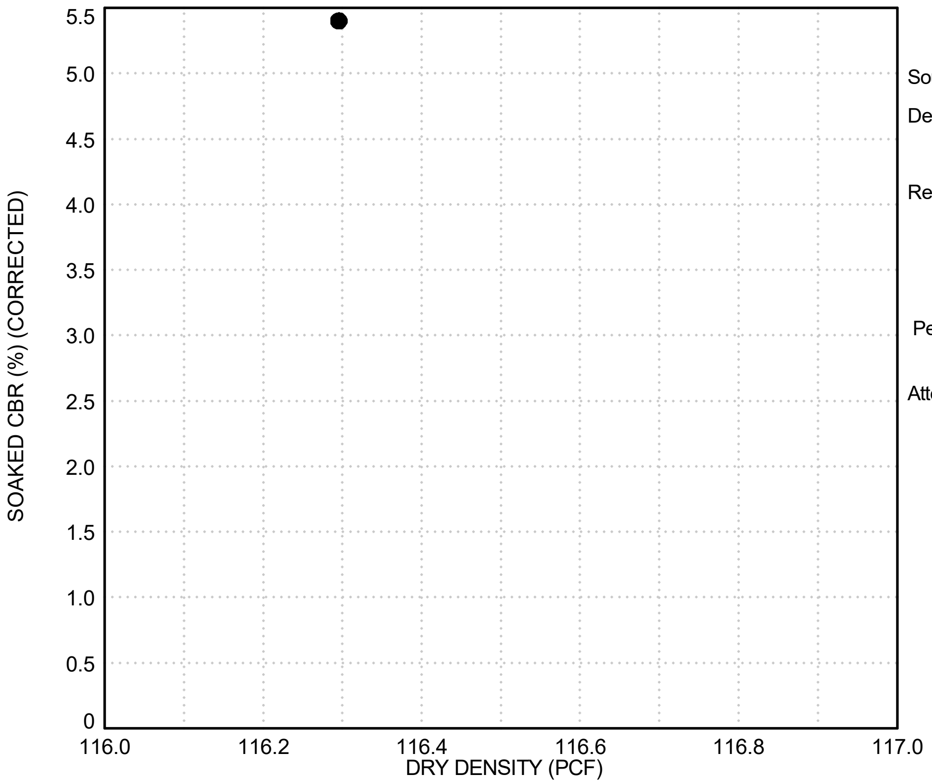
LL	PL	PI
31	**11**	**20**

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V1 N4205103 YELLOWOOD SOLAR -.GPJ TERRACON_DATATEMPLATE.GDT 8/10/20

PROJECT: Yellowood Solar Facility	Terracon 800 Morrison Rd Gahanna, OH	PROJECT NUMBER: N4205103
SITE: County Road 48 Lynchburg, OH		CLIENT: Invenergy LLC Chicago, IL

CALIFORNIA BEARING RATIO

ASTM D1883-07^{2}



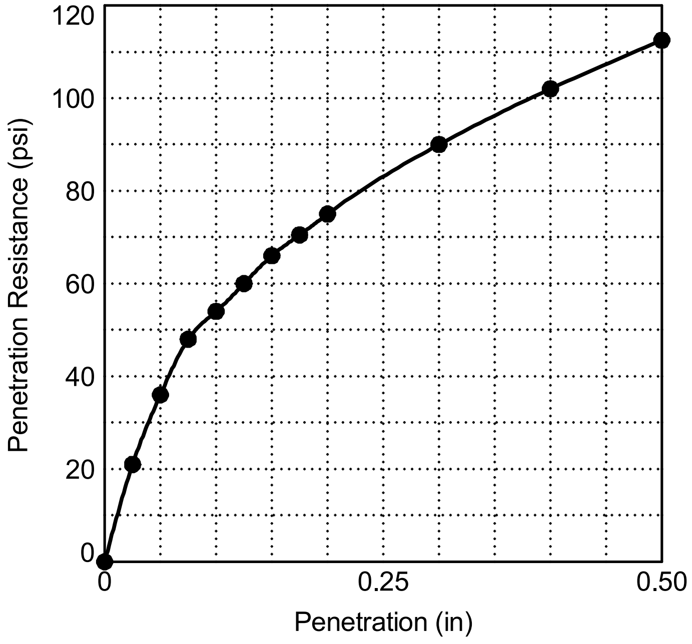
Source of Material **B-20-7B 0.5**

Description of Material **CLAYEY SAND(SC)**

Remarks:

Percent Fines **48.8 %**

Atterberg Limits	LL	PL	PI
	37	**12**	**25**



Sample No.	1
Sample Condition	Soaked
Compaction Method	ASTM 698C
Maximum Dry Density, (pcf)	117.3
Optimum Moisture Content, (%)	13.6
Dry Density before Soaking, (pcf)	116.30
Moisture Content, (%)	
After Compaction	13.8
Top 1" After Soaking	15.6
Surcharge,. (lbs)	20.00
Swell, (%)	0.83
Bearing Ratio, (%)	5.4

PROJECT: Yellowood Solar Facility

SITE: County Road 48
Lynchburg, OH

800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205103

CLIENT: Invenergy LLC
Chicago, IL

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CBR 1 PT REPORT N4205103 YELLOWOOD SOLAR -.GPJ TERRACON_DATATEMPLATE.GDT 8/10/20

Geotherm USA

21239 FM529 Rd., Bldg. F
Cypress, TX 77433
Tel: 281-985-9344
Fax: 832-427-1752
info@geothermusa.com
http://www.geothermusa.com

August 14, 2020

Terracon Consultants
800 Morrison Road
Columbus, Ohio 43230
Attn: Jamal N. Tahat, MSc.

Re: Thermal Analysis of Native Soil Samples
Yellowood Solar Project – Lynchburg, OH (PO# N4205103)

The following is the report of thermal dryout characterization tests conducted on three (3) bulk samples and three (3) tube samples of native soil from the referenced project received at our laboratory.

Thermal Resistivity Tests: The tube samples were tested 'as-is'. The bulk samples were tested at the 'optimum' moisture content and at 85% and 95% of the maximum dry density ***provided by Terracon.*** The tests were conducted in accordance with the **IEEE Standard 442-2017.** The results are tabulated below and the thermal dryout curves are presented in **Figures 1 to 3.**

Sample ID, Description, Thermal Resistivity, Moisture Content and Density

Sample ID	Depth (ft)	Compaction Effort (%)	Description (Terracon)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft^3)
				Wet	Dry		
B-20-1	0'-5'	85	Lean Clay	72	164	11	104
	0'-5'	95		64	129		117
	2'-4'	tube		74	243	23	96
B-20-5	0'-5'	85	Lean Clay	80	171	13	102
	0'-5'	95		73	142		114
	2'-4'	tube		79	243	26	92
B-20-10	0'-5'	85	Lean Clay	82	186	13	101
	0'-5'	95		68	147		113
	2'-4'	tube		88	226		95

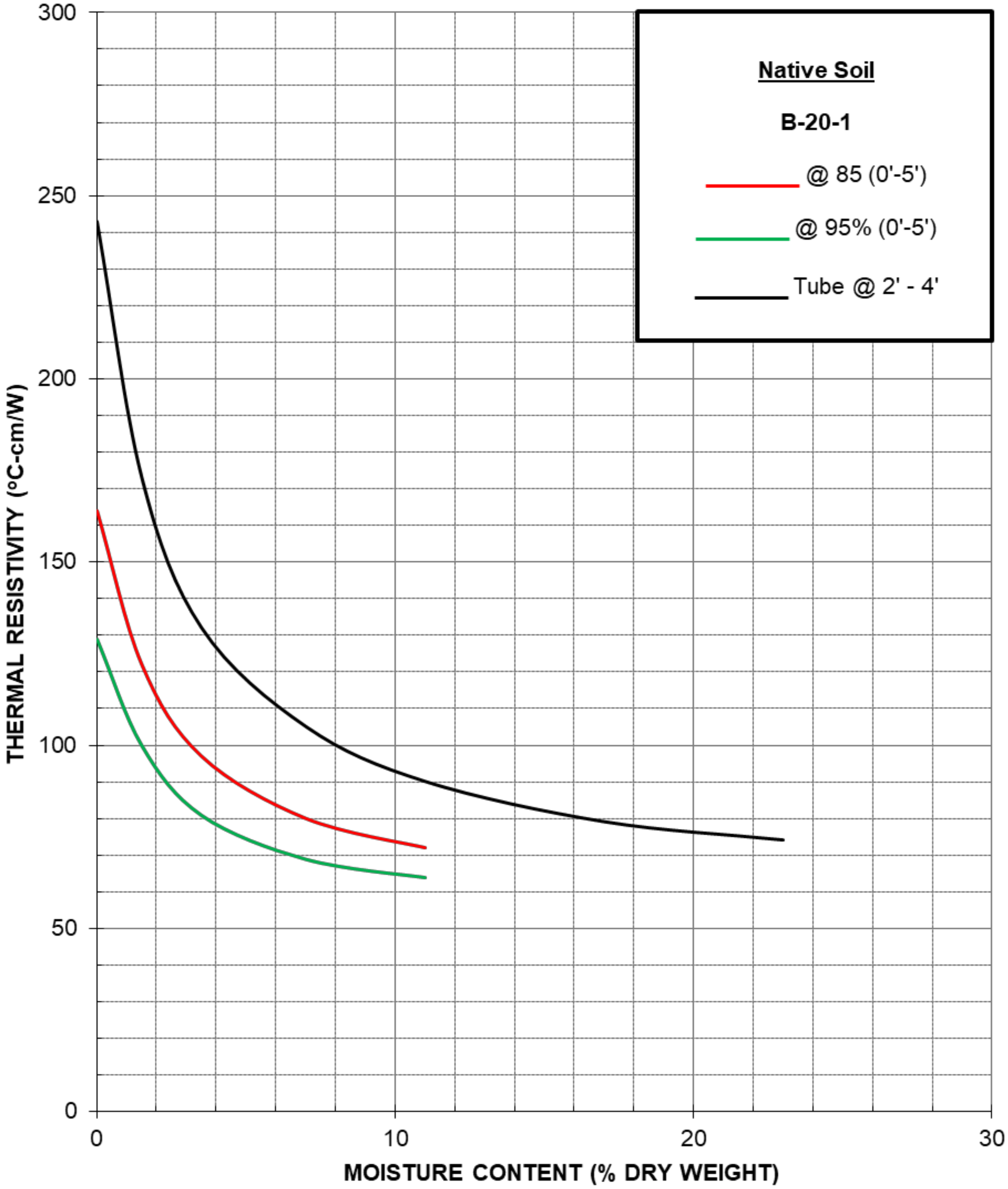
Comments: The thermal characteristic depicted in the dryout curves apply for the soil at the respective test dry density.

Please contact us if you have any questions or if we can be of further assistance.

Geotherm USA

Nimesh Patel

THERMAL DRYOUT CURVES



Terracon Consultants (PO No. N4205103)

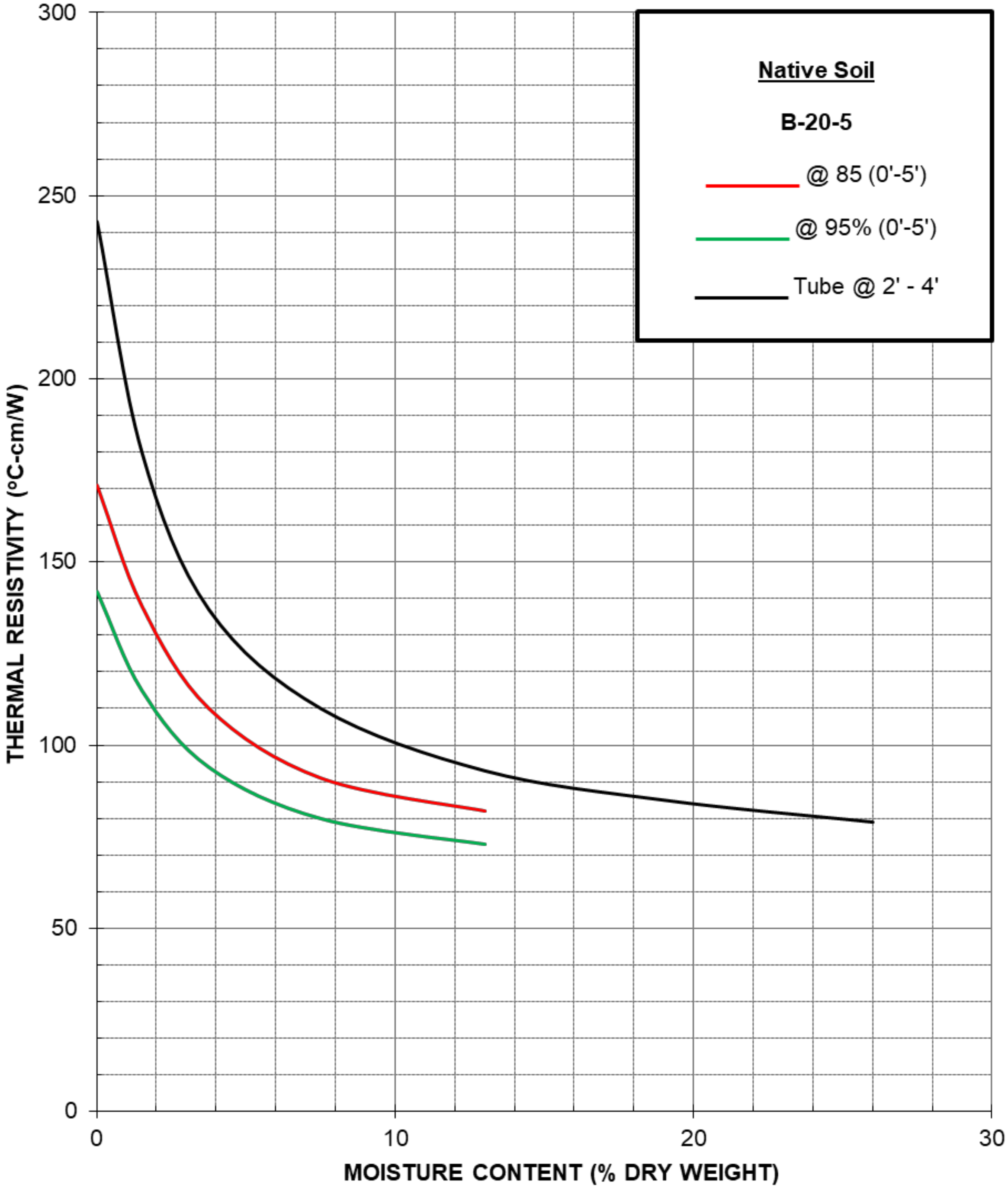
Thermal Analysis of Native Soil

Yellowood Solar Project – Lynchburg, OH

August 2020

Figure 1

THERMAL DRYOUT CURVES



Terracon Consultants (PO No. N4205103)

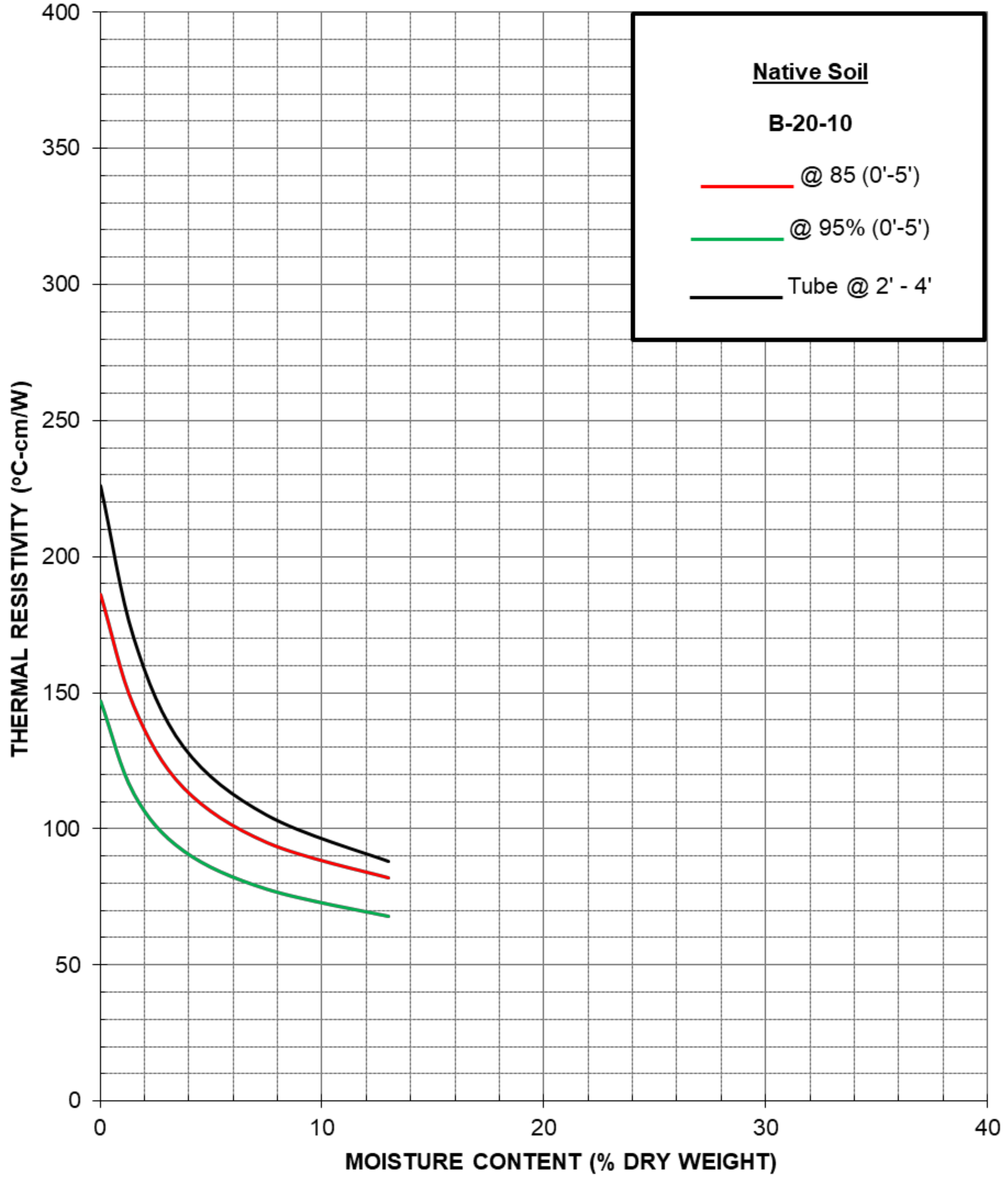
Thermal Analysis of Native Soil

Yellowood Solar Project – Lynchburg, OH

August 2020

Figure 2

THERMAL DRYOUT CURVES



Terracon Consultants (PO No. N4205103)

Thermal Analysis of Native Soil

Yellowood Solar Project – Lynchburg, OH

August 2020

Figure 3

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Terracon GeoReport

Client

Invenergy LLC
Chicago, IL

Project

Yellowood Solar

Sample Submitted By: Terracon (N4) **Date Received:** 7/30/2020 **Lab No.: 20-0856**

Results of Corrosion Analysis

Sample Number	--	--	--	--
Sample Location	B-20-1	B-20-2	B-20-3	B-20-4
Sample Depth (ft.)	0.0-5.0	0.0-5.0	0.0-5.0	0.0-5.0
pH Analysis, ASTM G 51	8.22	7.51	7.44	8.12
Water Soluble Sulfate (SO4), ASTM C 1580 (ppm)	198	182	141	122
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil	Nil	Nil
Chlorides, ASTM D 512, (ppm)	57	45	55	27
Red-Ox, ASTM G 200, (mV)	+691	+695	+694	+692
Total Salts, AWWA 2540, (mg/kg)	881	941	1021	1148
Resistivity (Saturated), ASTM G 187, (ohm-cm)	1809	1474	1206	1407

Analyzed By: Trisha Campo

Trisha Campo
Chemist

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Terracon GeoReport

Client

Invenergy LLC
Chicago, IL

Project

Yellowood Solar

Sample Submitted By: Terracon (N4) **Date Received:** 7/30/2020 **Lab No.: 20-0856**

Results of Corrosion Analysis

Sample Number	--	--	--	--
Sample Location	B-20-5	B-20-6	B-20-7	B-20-8
Sample Depth (ft.)	0.0-5.0	0.0-5.0	0.0-5.0	0.0-5.0
pH Analysis, ASTM G 51	8.10	8.14	8.25	8.30
Water Soluble Sulfate (SO4), ASTM C 1580 (ppm)	108	68	74	203
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil	Nil	Nil
Chlorides, ASTM D 512, (ppm)	85	55	75	40
Red-Ox, ASTM G 200, (mV)	+693	+683	+689	+692
Total Salts, AWWA 2540, (mg/kg)	1305	1663	1680	1506
Resistivity (Saturated), ASTM G 187, (ohm-cm)	1139	938	804	938

Analyzed By: Trisha Campo

Trisha Campo
Chemist

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

Invenergy LLC
Chicago, IL

Project

Yellowood Solar

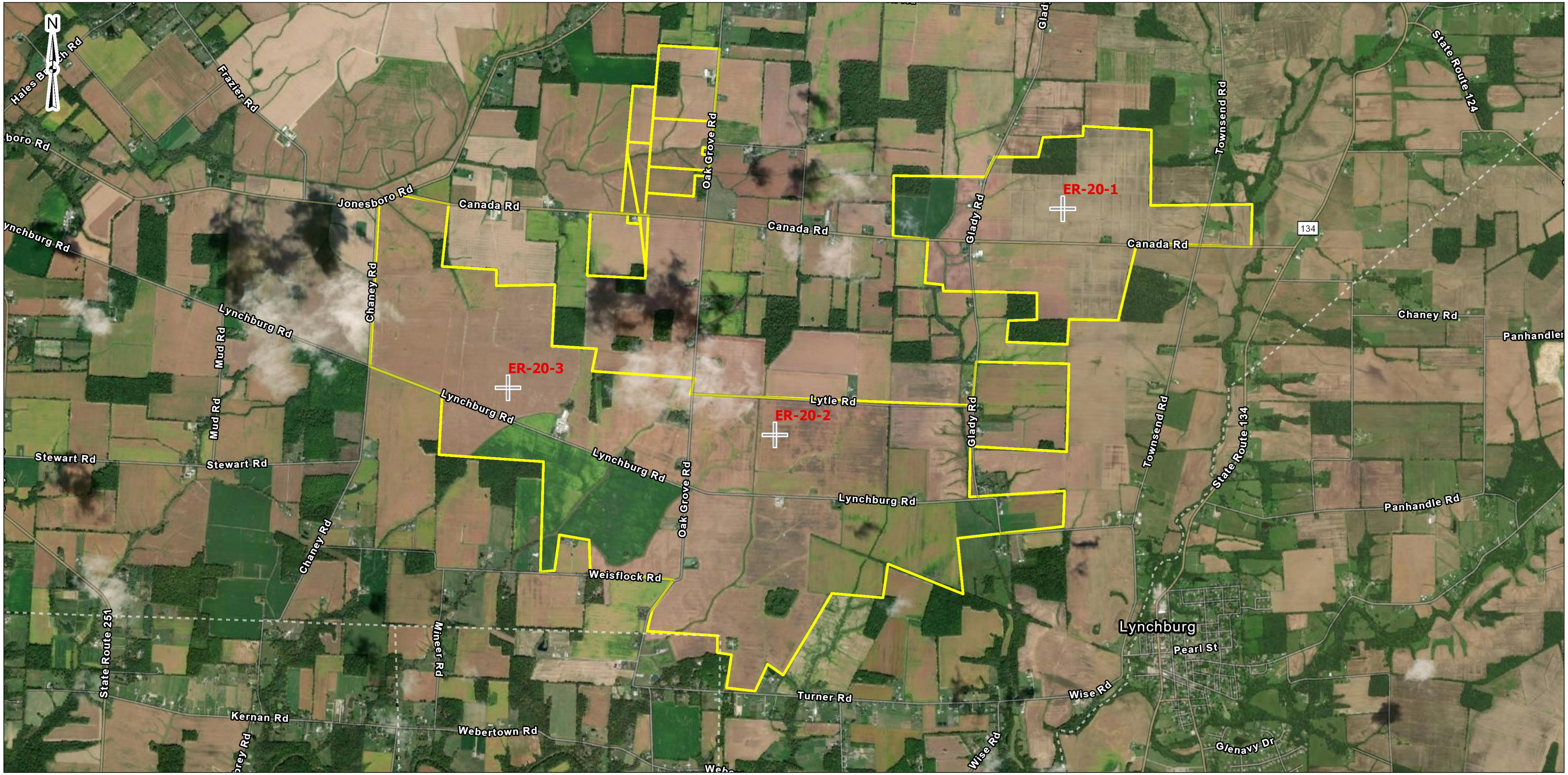
Sample Submitted By: Terracon (N4) **Date Received:** 7/30/2020 **Lab No.: 20-0856**

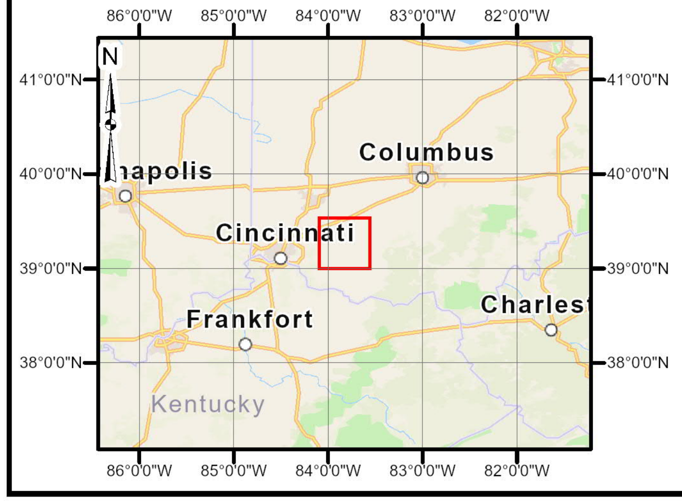
Results of Corrosion Analysis

Sample Number	--	--
Sample Location	B-20-9	B-20-10
Sample Depth (ft.)	0.0-5.0	0.0-5.0
pH Analysis, ASTM G 51	8.39	8.26
Water Soluble Sulfate (SO4), ASTM C 1580 (ppm)	124	224
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil
Chlorides, ASTM D 512, (ppm)	53	70
Red-Ox, ASTM G 200, (mV)	+692	+690
Total Salts, AWWA 2540, (mg/kg)	1557	1109
Resistivity (Saturated), ASTM G 187, (ohm-cm)	938	1474

Analyzed By: Trisha Campo

Trisha Campo
Chemist





┼ Field Electrical Resistivity Location

▭ Site_Boundary

DATA SOURCES:
ESRI WMS - World Topographic, Streets

Miles
0 0.3 0.6 1.2

Project No.:	N4205103
Date:	August, 2020
Drawn By:	JNT
Reviewed By:	YSR

Terracon
800 Morrison Road Gahanna , Ohio 43230
PH. (614) 328-5150 terracon.com

FIELD ELECTRICAL RESISTIVITY LOCATION PLAN

Yellowood Solar Facility

Invenergy Solar
One South Wacker Drive, Suite 1800
Chicago, IL 60606

ELECTRICAL EARTH RESISTIVITY TEST DATA

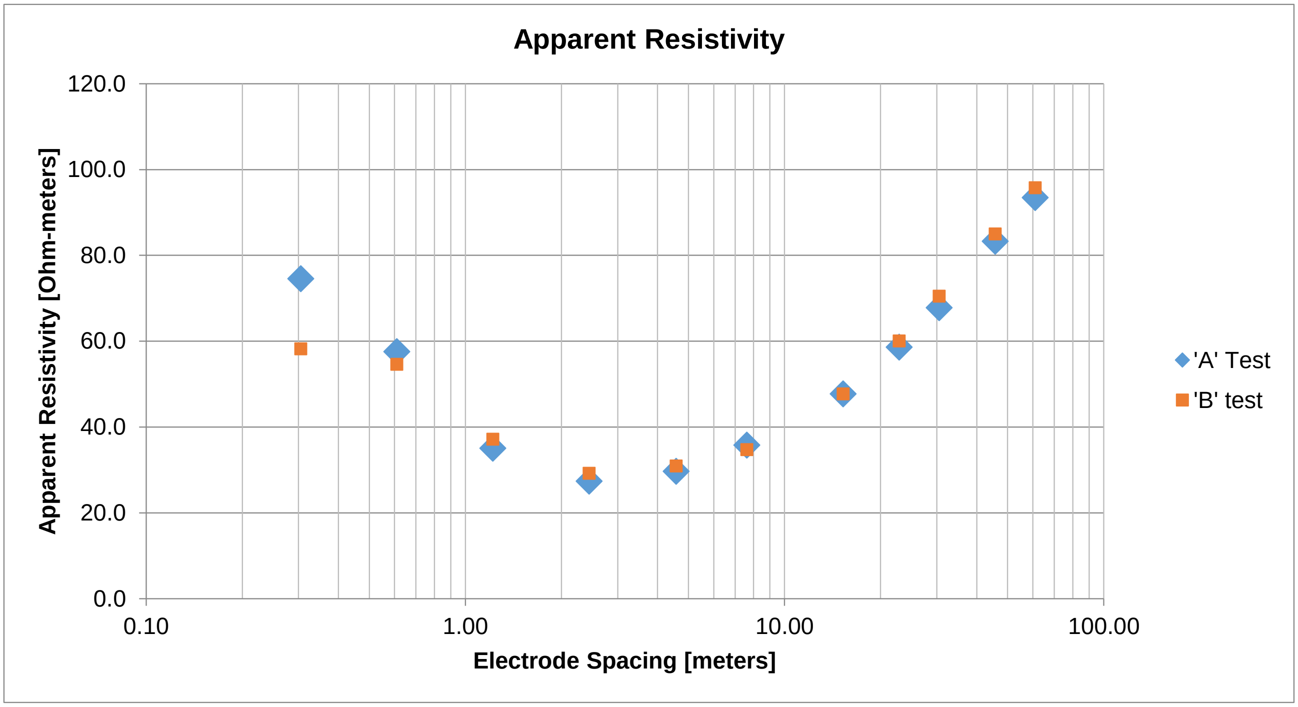
Test Line EER-20-1

Project Yellowood Solar Project
Location Martinsville, OH
Project # N4205103
Test Date July 21, 2020

Weather 78° and fair
Surface Soil Silty Clay
Instrument Megger DET2/2
Tested By I. McGougan, M. Bishop

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended N-S)**		**"B" Test (Extended E-W)**	
[feet]	[meters]	[feet]	[meters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-meters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-meters]
1	0.30	0.5	0.15	29.60	74.6	23.10	58.2
2	0.61	0.5	0.15	13.68	57.6	12.97	54.6
4	1.22	0.5	0.15	4.46	35.1	4.73	37.2
8	2.44	0.5	0.15	1.78	27.4	1.90	29.2
15	4.57	1	0.30	1.026	29.7	1.068	30.9
25	7.62	1	0.30	0.746	35.8	0.724	34.8
50	15.24	1	0.30	0.498	47.7	0.498	47.7
75	22.86	1	0.30	0.408	58.6	0.418	60.1
100	30.48	1	0.30	0.354	67.8	0.368	70.5
150	45.72	1	0.30	0.290	83.3	0.296	85.0
200	60.96	1	0.30	0.244	93.5	0.250	95.8

Apparent resistivity p is calculated as : $$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



ELECTRICAL EARTH RESISTIVITY TEST DATA

Test Line EER-20-2

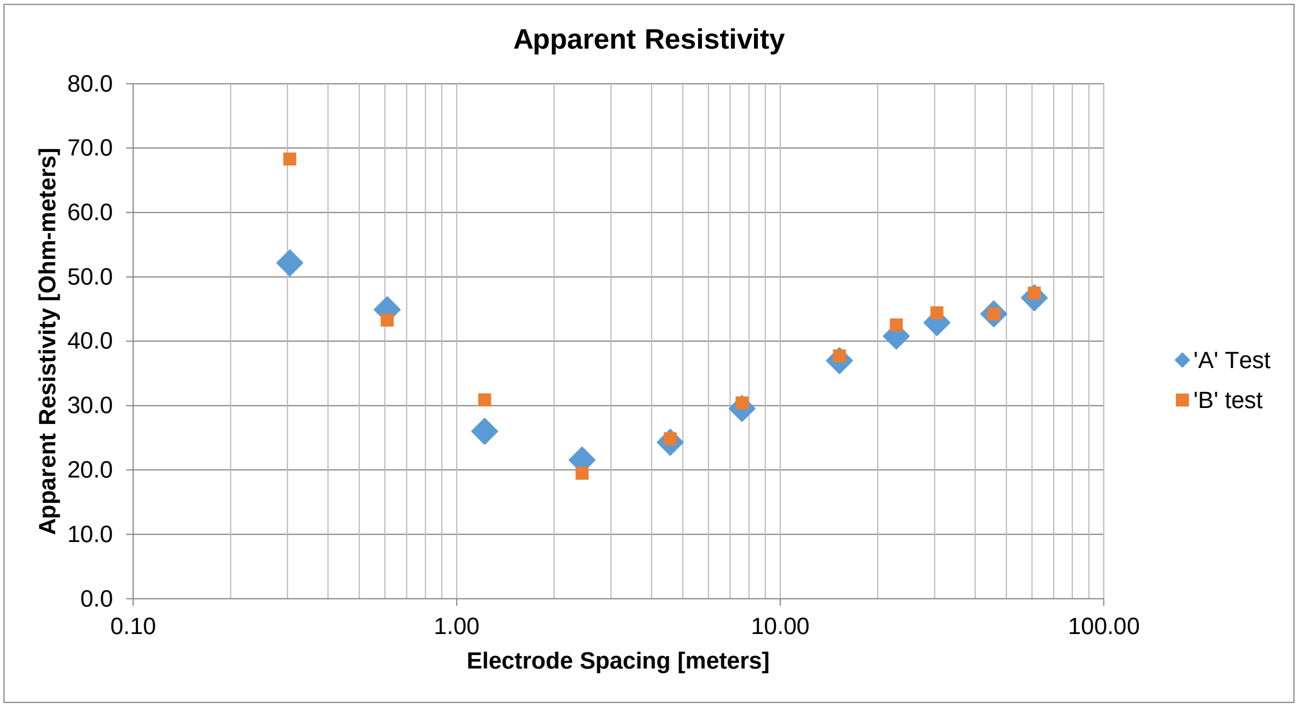
Project Yellowood Solar Project
Location Martinsville, OH
Project # N4205103
Test Date July 21, 2020

Weather 78° and fair
Surface Soil Silty clay
Instrument Megger DET2/2
Tested By I. McGougan, M. Bishop

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended N-S)**		**"B" Test (Extended E-W)**	
[feet]	[meters]	[feet]	[meters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-meters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-meters]
1	0.30	0.5	0.15	20.70	52.2	27.10	68.3
2	0.61	0.5	0.15	10.66	44.9	10.28	43.3
4	1.22	0.5	0.15	3.31	26.0	3.93	30.9
8	2.44	0.5	0.15	1.398	21.6	1.264	19.5
15	4.57	1	0.30	0.840	24.3	0.860	24.9
25	7.62	1	0.30	0.616	29.6	0.634	30.4
50	15.24	1	0.30	0.386	37.0	0.394	37.8
75	22.86	1	0.30	0.284	40.8	0.296	42.5
100	30.48	1	0.30	0.224	42.9	0.232	44.4
150	45.72	1	0.30	0.154	44.2	0.154	44.2
200	60.96	1	0.30	0.122	46.7	0.124	47.5

Apparent resistivity p is calculated as :

$$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$



ELECTRICAL EARTH RESISTIVITY TEST DATA

Test Line EER-20-3

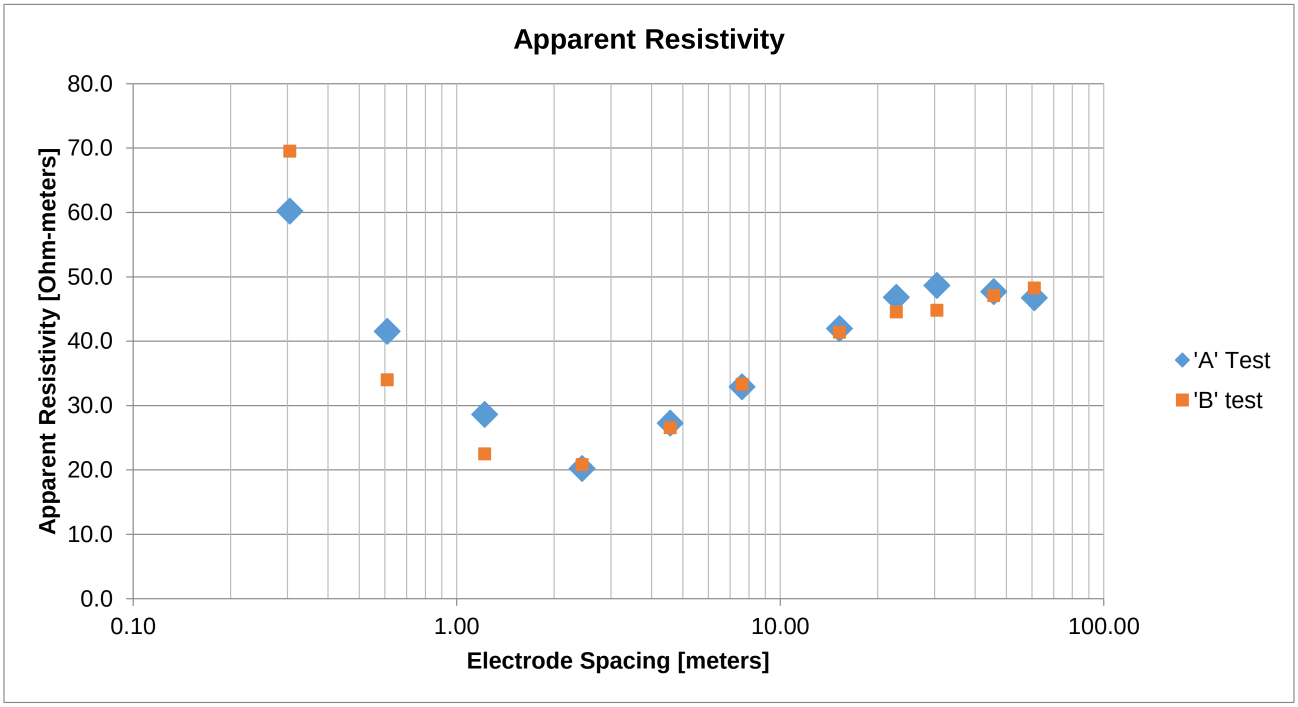
Project Yellowood Solar Project
Location Martinsville, OH
Project # N4205103
Test Date July 21, 2020

Weather 78° and Fair
Surface Soil Silty Clay
Instrument Megger DET2/2
Tested By I. McGougan, M. Bishop

Electrode Spacing "a"		**Electrode Depth "b"**		**"A" Test (Extended E-W)**		**"B" Test (Extended N-S)**	
[feet]	[meters]	[feet]	[meters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-meters]	Measured Resistance "R" [Ohms]	Apparent Resistivity "ρ" [Ohm-meters]
1	0.30	0.5	0.15	23.90	60.2	27.60	69.6
2	0.61	0.5	0.15	9.86	41.5	8.08	34.0
4	1.22	0.5	0.15	3.64	28.6	2.86	22.5
8	2.44	0.5	0.15	1.31	20.2	1.35	20.9
15	4.57	1	0.30	0.942	27.3	0.918	26.6
25	7.62	1	0.30	0.686	32.9	0.694	33.3
50	15.24	1	0.30	0.438	42.0	0.432	41.4
75	22.86	1	0.30	0.326	46.8	0.310	44.5
100	30.48	1	0.30	0.254	48.7	0.234	44.8
150	45.72	1	0.30	0.166	47.7	0.164	47.1
200	60.96	1	0.30	0.122	46.7	0.126	48.3

Apparent resistivity p is calculated as :

$$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$

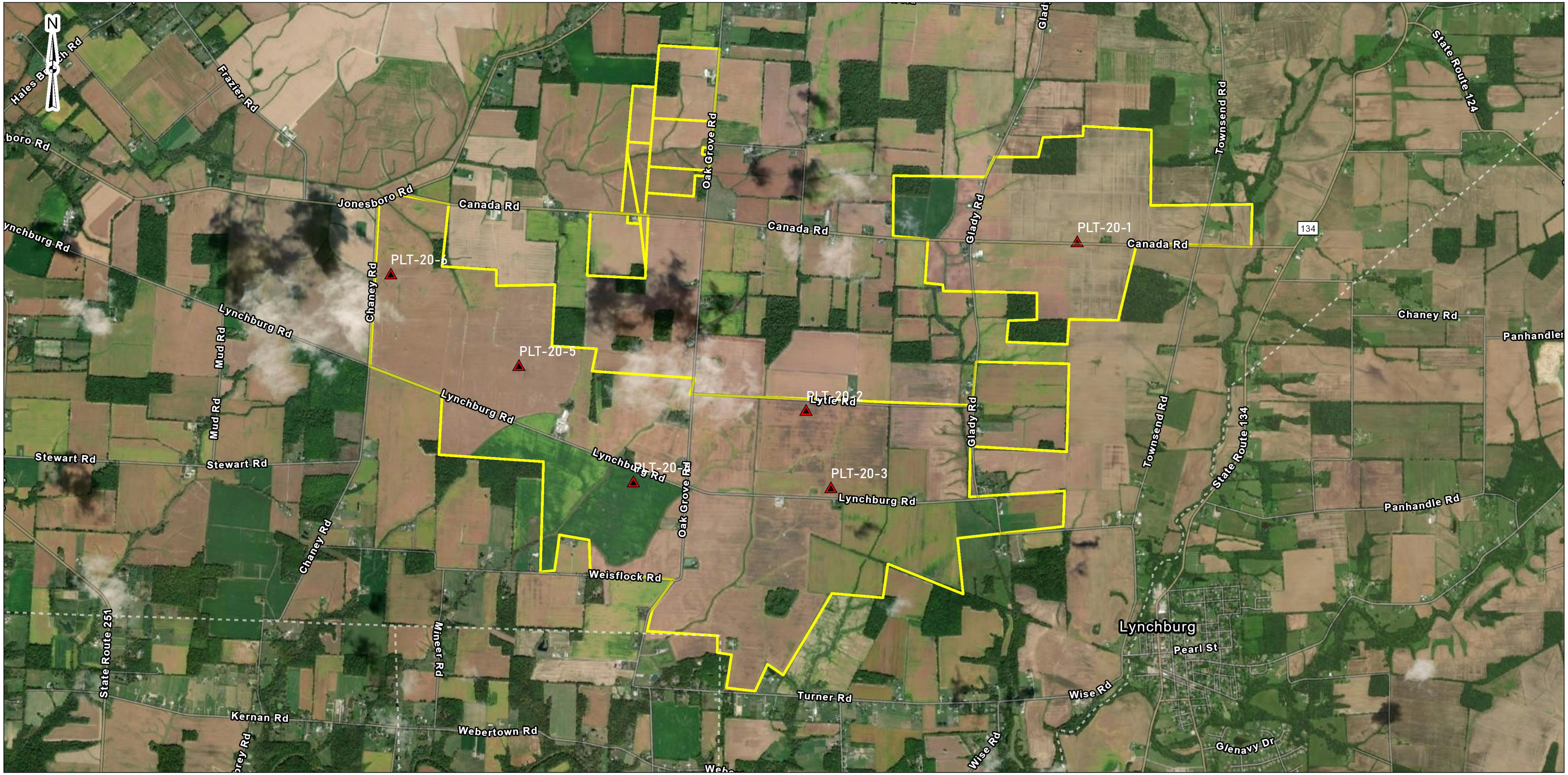


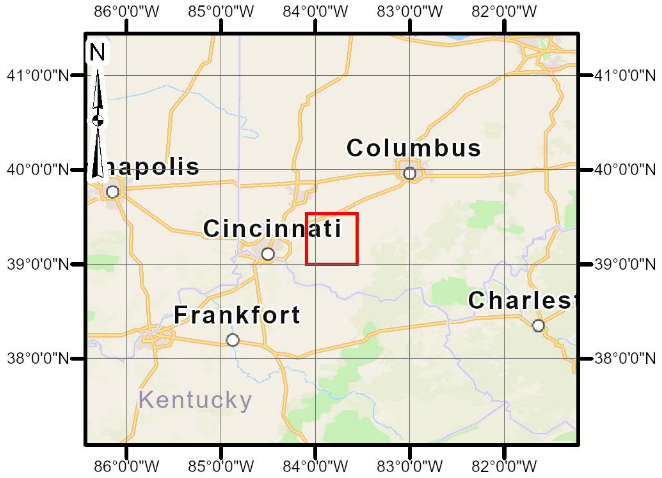
PILE DRIVING AND LOAD TESTING RESULTS

PILE LOAD TEST & ZONE PLANS

Contents:

Note: All attachments are one page unless noted above.





🟨 Site Boundary

▲ PILE TEST LOCATION

DATA SOURCES:
ESRI WMS - World Topographic, Streets

Miles
0 0.3 0.6 1.2

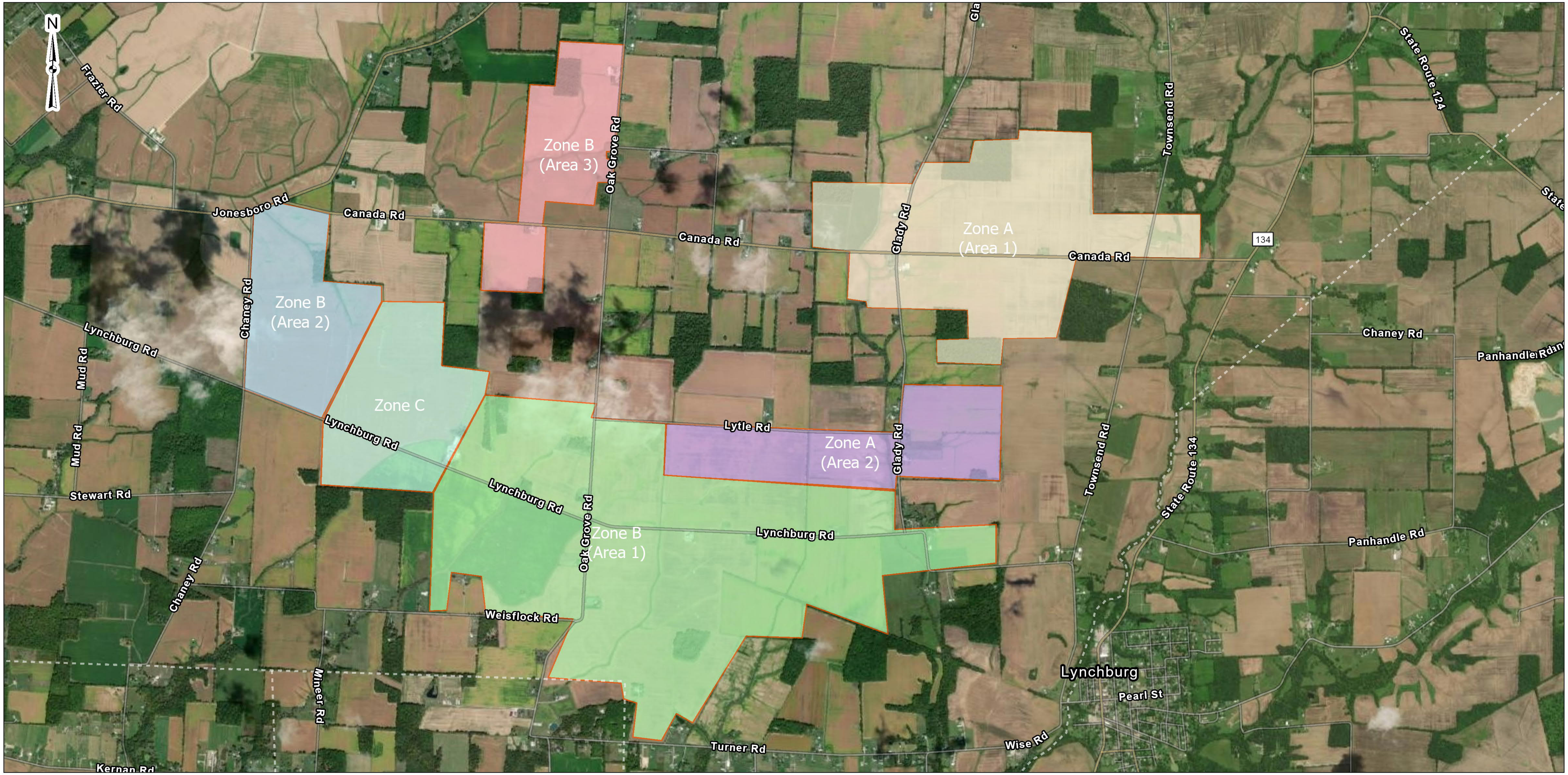
Project No.:	N4205103
Date:	August, 2020
Drawn By:	JNT
Reviewed By:	YSR

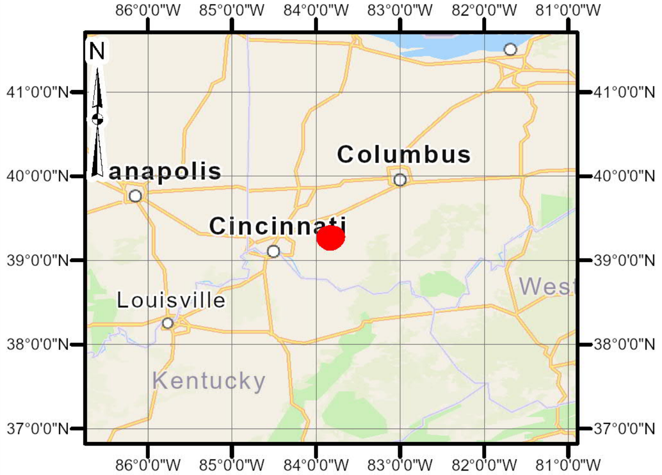
Terracon
800 Morrison Road Gahanna , Ohio 43230
PH. (614) 328-5150 terracon.com

PILE TEST LOCATION PLAN

Yellowood Solar Facility

Invenergy Solar
One South Wacker Drive, Suite 1800
Chicago, IL 60606





🟨 Zone A (Area 1)

🟪 Zone A (Area 2)

🟩 Zone B (Area 1)

🟦 Zone B (Area 2)

🟥 Zone B (Area 3)

🟩 Zone C

DATA SOURCES:
ESRI WMS - World Topographic, Streets

Miles
0 0.28 0.55 1.1

Project No.:	N4205103
Date:	August, 2020
Drawn By:	JNT
Reviewed By:	YSR

Terracon

800 Morrison Road Gahanna , Ohio 43230
PH. (614) 328-5150 terracon.com

PILE ZONE PLAN

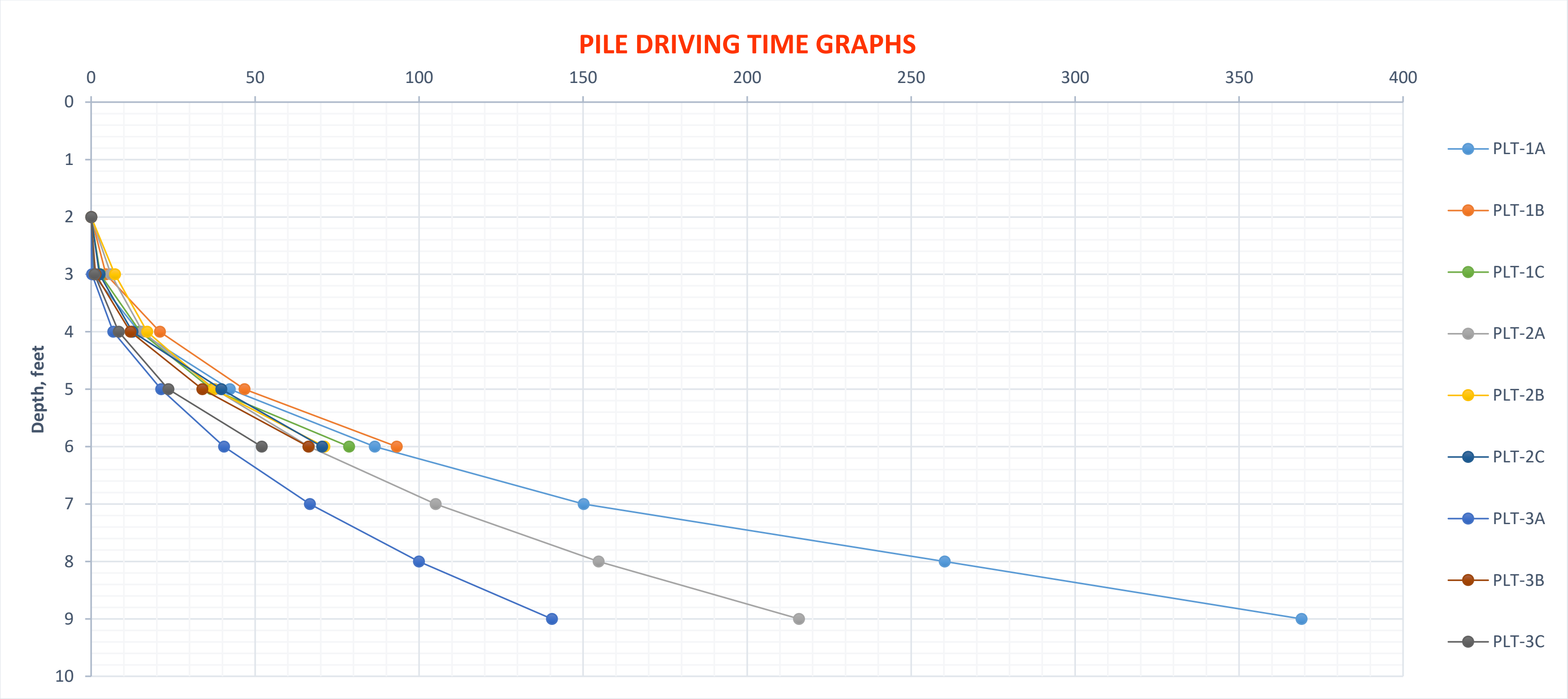
Yellowood Solar Facility

Invenergy Solar
One South Wacker Drive, Suite 1800
Chicago, IL 60606

PILE LOAD TESTING RESULTS

Contents:

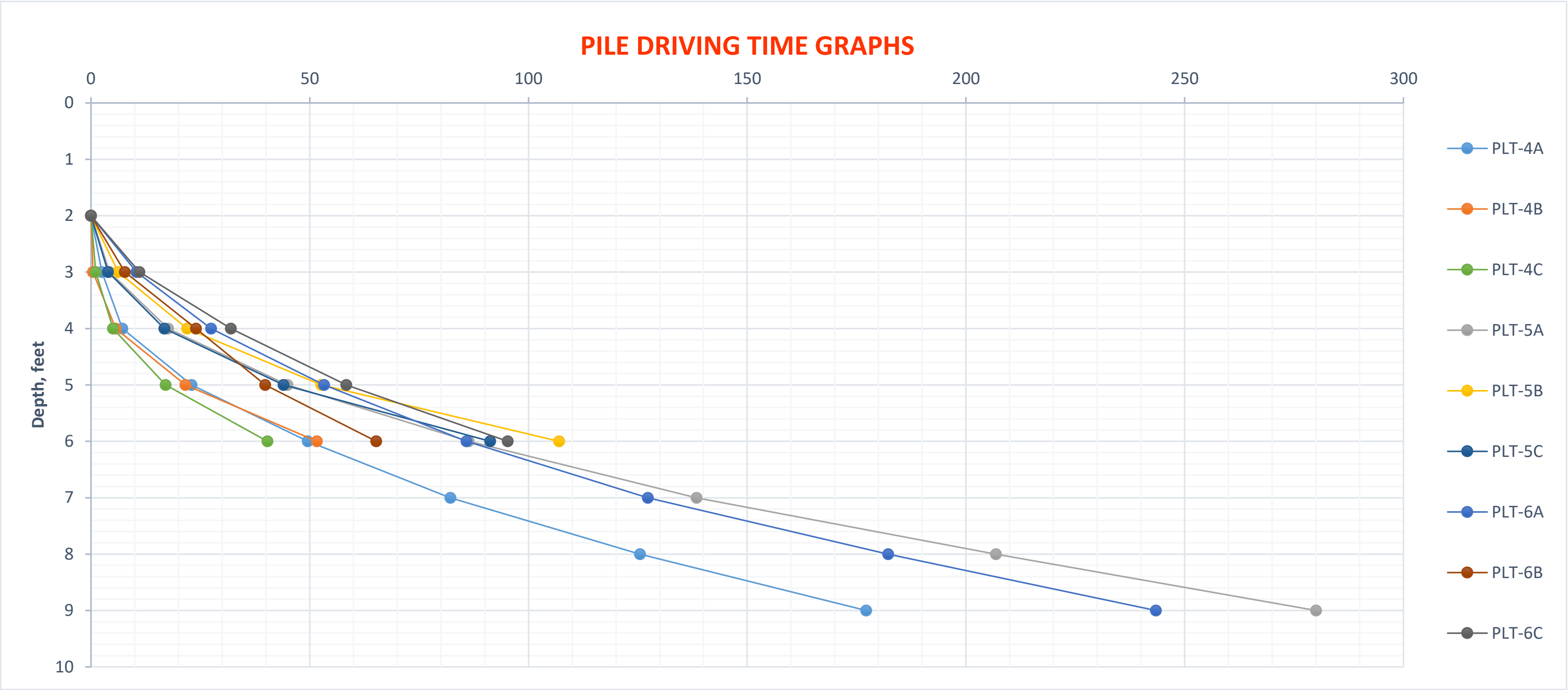
Note: All attachments are one page unless noted above.



Depth (feet)	Cumulative Driving Time, seconds								
	PLT-1A	**PLT-1B**	**PLT-1C**	**PLT-2A**	**PLT-2B**	**PLT-2C**	**PLT-3A**	**PLT-3B**	**PLT-3C**
2	0	0	0	0	0	0	0	0	0
3	0.55	4.47	2.76	6.02	7.28	2.51	0.25	1.31	1.02
4	14.62	20.92	14.9	15.69	17.08	12.54	6.68	11.99	8.35
5	42.25	46.73	36.71	37.66	37.28	39.69	21.3	33.86	23.56
6	86.46	93.15	78.64	66.41	71.11	70.36	40.51	66.24	51.98
7	150.11			105.04			66.68		
8	260.24			154.72			99.95		
9	368.99			215.8			140.43		
Embedment Depth, ft	9	6	6	9	6	6	9	6	6
Total Drive Time, sec	368.99	93.15	78.64	215.80	71.11	70.36	140.43	66.24	51.98
Average, sec/ft	52.71	23.29	19.66	30.83	17.78	17.59	20.06	16.56	13.00

NOTES:

Piles advanced with Vermeer PD-10 hydraulic ram. Installation depth started at 24 inches below ground surface



Depth (feet)	Cumulative Driving Time, seconds								
	PLT-4A	PLT-4B	PLT-4C	PLT-5A	PLT-5B	PLT-5C	PLT-6A	PLT-6B	PLT-6C
2	0	0	0	0	0	0	0	0	0
3	2.5	0.44	1.05	4.26	6.24	3.93	10.42	7.72	11.09
4	7.16	5.66	5.01	17.63	22	16.79	27.46	24	32
5	23.02	21.59	17.08	44.93	52.66	44.03	53.3	39.82	58.38
6	49.55	51.66	40.35	86.32	107.03	91.28	85.84	65.22	95.28
7	82.17			138.45			127.29		
8	125.51			206.87			182.24		
9	177.23			280.06			243.46		
Embedment Depth, ft	9	6	6	9	6	6	9	6	6
Total Drive Time, sec	177.23	51.66	40.35	280.06	107.03	91.28	243.46	65.22	95.28
Average, sec/ft	25.32	12.92	10.09	40.01	26.76	22.82	34.78	16.31	23.82

NOTES:

Piles advanced with Vermeer PD-10 hydraulic ram. Installation depth started at 24 inches below ground surface

Terracon

LATERAL LOAD TEST RESULT

Lateral Load Test Result for 1-A

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

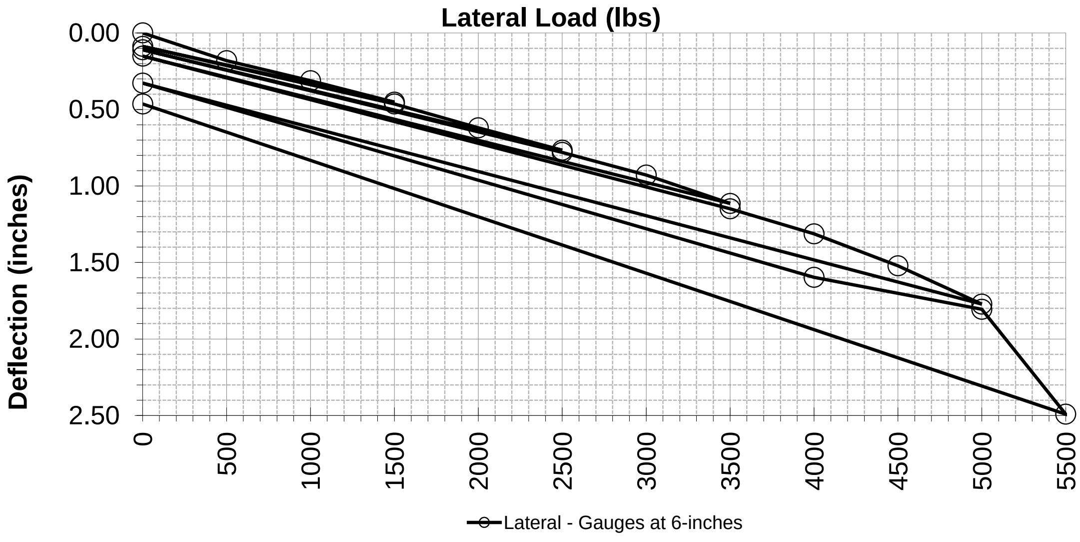
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	1-A
Latitude:	39.27433
Longitude:	-83.79880
Pile Type:	W6x9
Pile Embedment Depth [in]:	108
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	368.99

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.181	
14%	1000	0.313	
21%	1500	0.453	
0%	0	0.088	
21%	1500	0.464	
29%	2000	0.620	
36%	2500	0.767	
0%	0	0.109	
36%	2500	0.781	
43%	3000	0.929	
50%	3500	1.115	
0%	0	0.152	
50%	3500	1.149	
57%	4000	1.313	
64%	4500	1.522	
71%	5000	1.772	
0%	0	0.328	
57%	4000	1.597	
71%	5000	1.806	
79%	5500	2.492	
86%	6000		
93%	6500		
100%	7000		
0%	0	0.464	



Lateral Load Test Result for 1-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

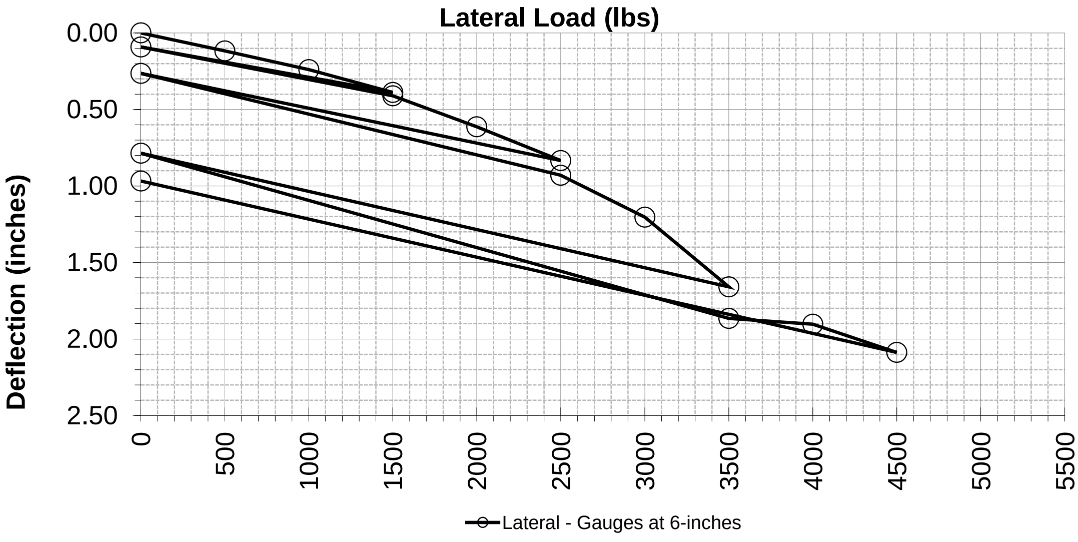
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	1-B
Latitude:	39.27433
Longitude:	-83.79880
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	93.15

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.117	
14%	1000	0.239	
21%	1500	0.389	
0%	0	0.092	
21%	1500	0.411	
29%	2000	0.613	
36%	2500	0.834	
0%	0	0.264	
36%	2500	0.930	
43%	3000	1.203	
50%	3500	1.660	
0%	0	0.786	
50%	3500	1.865	
57%	4000	1.903	
64%	4500	2.088	
71%	5000		
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	0.968	



Lateral Load Test Result for 2-A

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

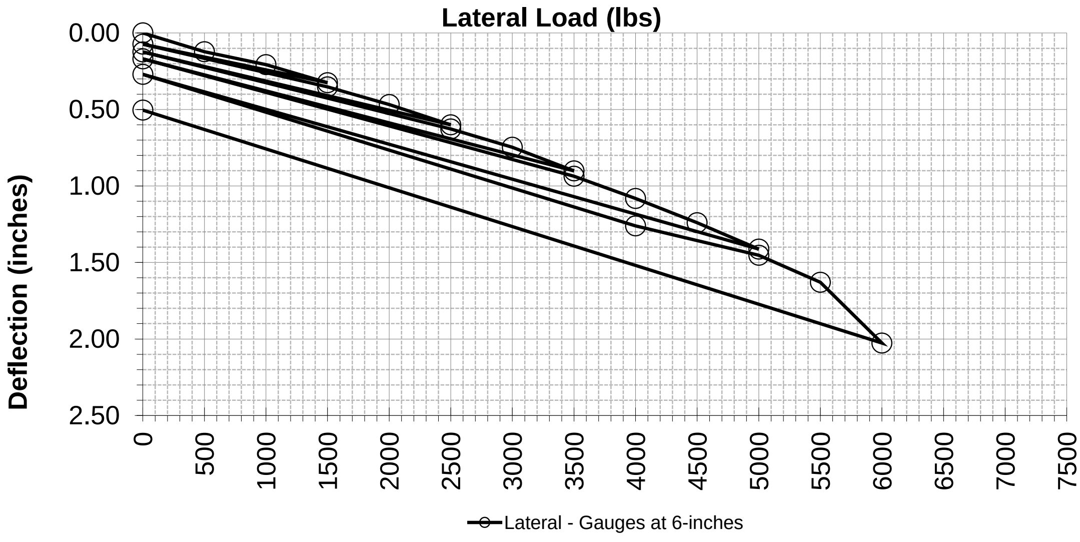
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	2-A
Latitude:	39.26245
Longitude:	-83.82550
Pile Type:	W6x9
Pile Embedment Depth [in]:	108
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	215.8

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.122	
14%	1000	0.207	
21%	1500	0.325	
0%	0	0.073	
21%	1500	0.353	
29%	2000	0.468	
36%	2500	0.600	
0%	0	0.124	
36%	2500	0.628	
43%	3000	0.747	
50%	3500	0.901	
0%	0	0.169	
50%	3500	0.937	
57%	4000	1.082	
64%	4500	1.241	
71%	5000	1.413	
0%	0	0.271	
57%	4000	1.260	
71%	5000	1.452	
79%	5500	1.629	
86%	6000	2.027	
93%	6500		
100%	7000		
0%	0	0.504	



Lateral Load Test Result for 2-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

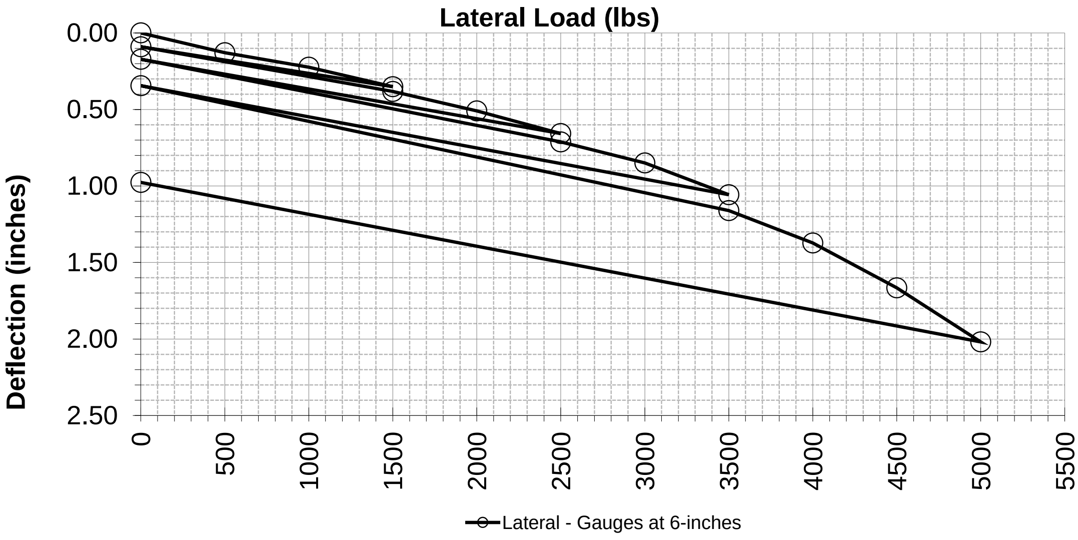
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	2-B
Latitude:	39.26245
Longitude:	-83.82550
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	71.11

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.130	
14%	1000	0.225	
21%	1500	0.351	
0%	0	0.090	
21%	1500	0.383	
29%	2000	0.509	
36%	2500	0.657	
0%	0	0.172	
36%	2500	0.712	
43%	3000	0.849	
50%	3500	1.057	
0%	0	0.345	
50%	3500	1.161	
57%	4000	1.373	
64%	4500	1.666	
71%	5000	2.019	
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	0.977	



Lateral Load Test Result for 3-A

Project Information

Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Lateral Load Test Set Up

Number of Top Gauges: 0
Number of Bottom Gauges: 2
Height of Top Gauges [in]: 6
Height of Bottom Gauges [in]: 6
Height of Applied Load [in]: 24
Load Cell: ED JR

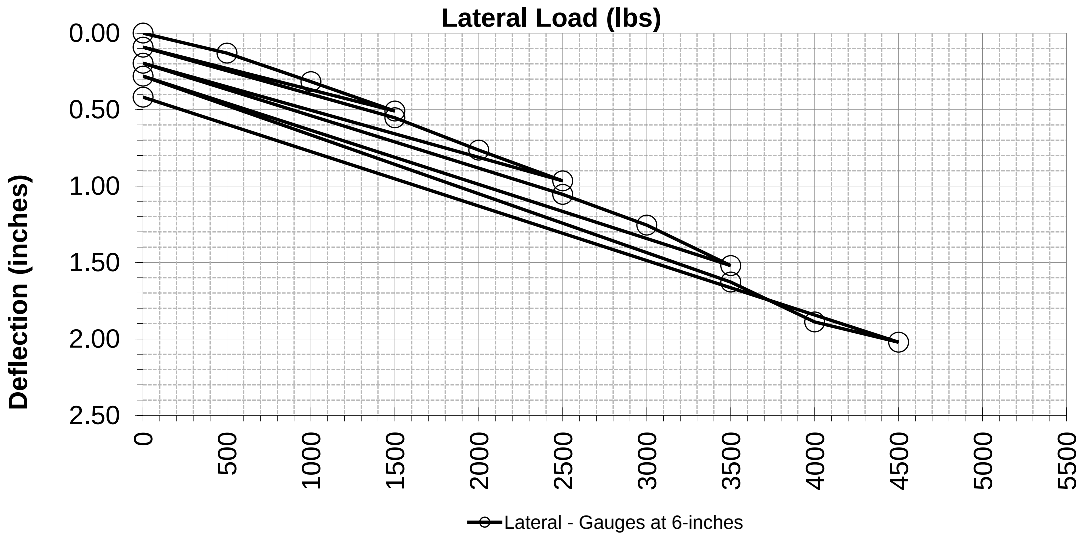
Test Date and Representative

Tested By Terracon Rep: J. Lombardi
Date Tested: 8/13/2020

Pile Information

Pile ID: 3-A
Latitude: 39.25659
Longitude: -83.82340
Pile Type: W6x9
Pile Embedment Depth [in]: 108
Pile Stick-Up [in]: 24
Lateral Design Load [lbs]: 7000
Drive Time [sec]: 140.43

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.131	
14%	1000	0.318	
21%	1500	0.510	
0%	0	0.092	
21%	1500	0.554	
29%	2000	0.765	
36%	2500	0.966	
0%	0	0.196	
36%	2500	1.054	
43%	3000	1.256	
50%	3500	1.520	
0%	0	0.282	
50%	3500	1.628	
57%	4000	1.890	
64%	4500	2.022	
71%	5000		
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	0.419	



Lateral Load Test Result for 3-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

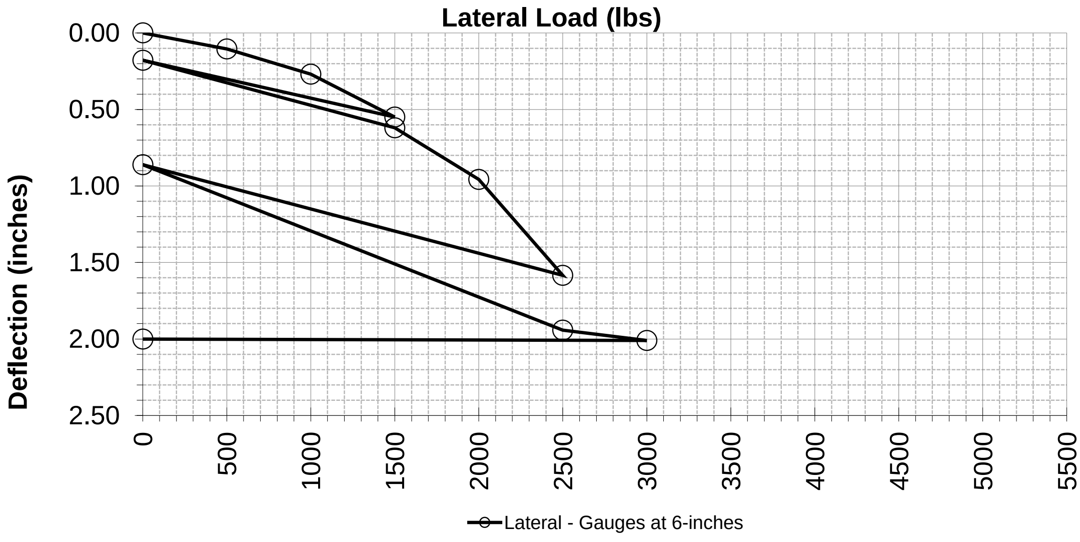
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	3-B
Latitude:	39.25659
Longitude:	-83.82340
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	66.24

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.104	
14%	1000	0.269	
21%	1500	0.549	
0%	0	0.178	
21%	1500	0.620	
29%	2000	0.957	
36%	2500	1.584	
0%	0	0.861	
36%	2500	1.942	
43%	3000	2.010	
50%	3500		
0%	0		
50%	3500		
57%	4000		
64%	4500		
71%	5000		
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	2.000	



Lateral Load Test Result for 4-A

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

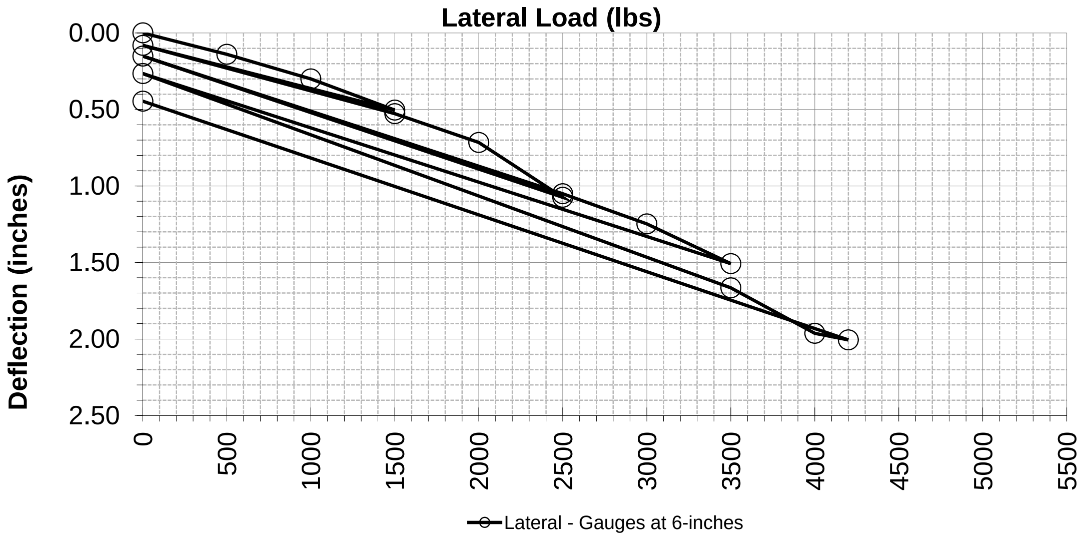
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	4-A
Latitude:	39.25756
Longitude:	-83.84240
Pile Type:	W6x9
Pile Embedment Depth [in]:	108
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	177.23

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.140	
14%	1000	0.300	
21%	1500	0.504	
0%	0	0.082	
21%	1500	0.528	
29%	2000	0.715	
36%	2500	1.074	
0%	0	0.151	
36%	2500	1.051	
43%	3000	1.249	
50%	3500	1.507	
0%	0	0.266	
50%	3500	1.666	
57%	4000	1.963	
60%	4200	2.006	
71%	5000		
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	0.446	



Lateral Load Test Result for 4-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

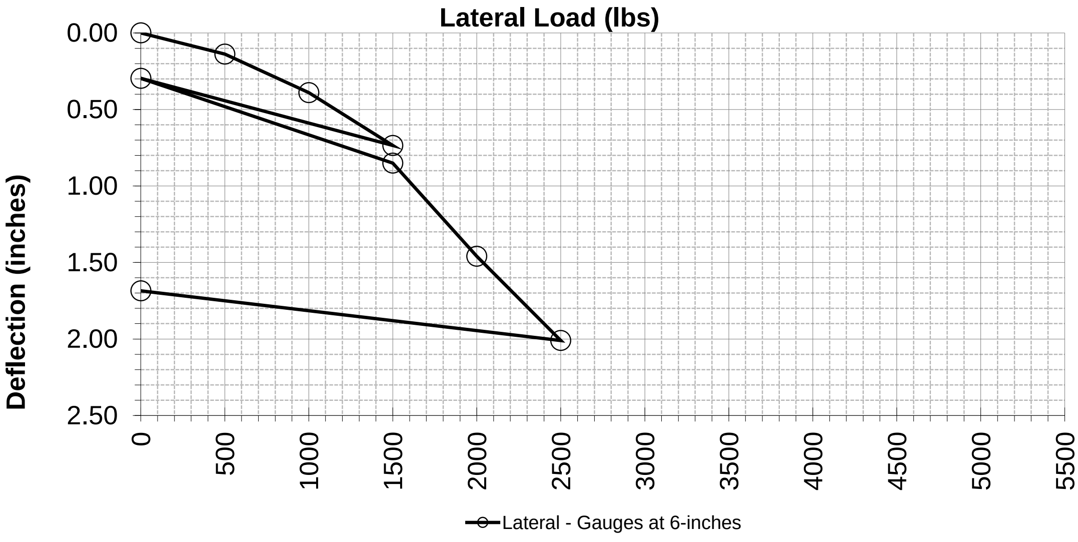
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	4-B
Latitude:	39.25756
Longitude:	-83.84240
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	51.66

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.138	
14%	1000	0.390	
21%	1500	0.736	
0%	0	0.297	
21%	1500	0.850	
29%	2000	1.460	
36%	2500	2.010	
0%	0	1.685	
36%	2500		
43%	3000		
50%	3500		
0%	0		
50%	3500		
57%	4000		
64%	4500		
71%	5000		
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0		



Lateral Load Test Result for 5-A

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

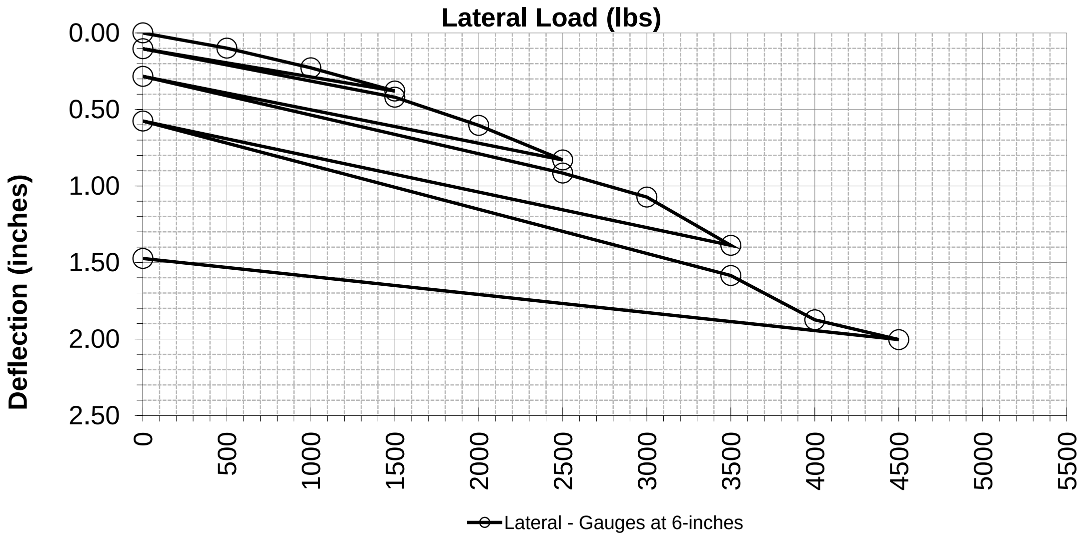
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	5-A
Latitude:	39.26657
Longitude:	-83.85300
Pile Type:	W6x9
Pile Embedment Depth [in]:	108
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	280.06

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.099	
14%	1000	0.227	
21%	1500	0.380	
0%	0	0.104	
21%	1500	0.420	
29%	2000	0.605	
36%	2500	0.831	
0%	0	0.283	
36%	2500	0.916	
43%	3000	1.072	
50%	3500	1.388	
0%	0	0.576	
50%	3500	1.585	
57%	4000	1.875	
64%	4500	2.004	
71%	5000		
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	1.474	



Lateral Load Test Result for 5-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

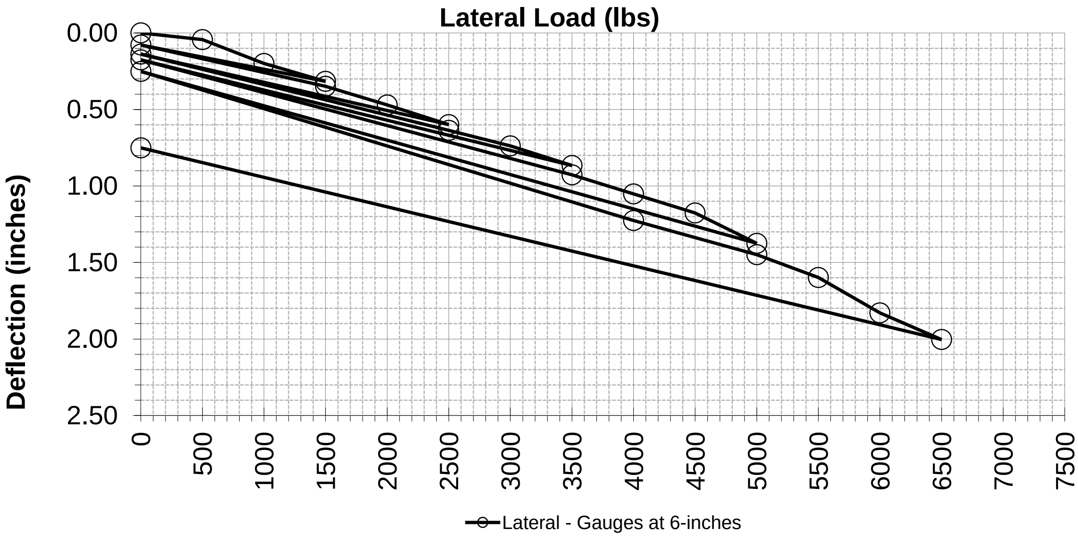
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	5-B
Latitude:	39.26657
Longitude:	-83.85300
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	107.03

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.044	
14%	1000	0.199	
21%	1500	0.316	
0%	0	0.079	
21%	1500	0.348	
29%	2000	0.470	
36%	2500	0.599	
0%	0	0.138	
36%	2500	0.637	
43%	3000	0.737	
50%	3500	0.866	
0%	0	0.175	
50%	3500	0.928	
57%	4000	1.051	
64%	4500	1.177	
71%	5000	1.374	
0%	0	0.252	
57%	4000	1.226	
71%	5000	1.449	
79%	5500	1.598	
86%	6000	1.829	
93%	6500	2.004	
100%	7000		
0%	0	0.751	



Lateral Load Test Result for 6-A

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

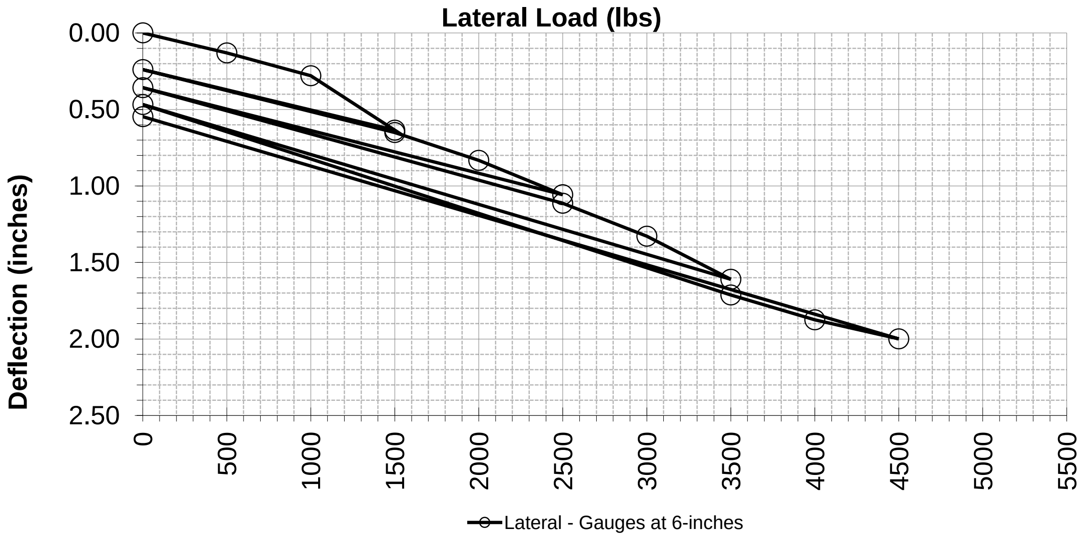
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/14/2020

Pile Information

Pile ID:	6-A
Latitude:	39.27376
Longitude:	-83.86500
Pile Type:	W6x9
Pile Embedment Depth [in]:	108
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	243.46

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.131	
14%	1000	0.279	
21%	1500	0.635	
0%	0	0.239	
21%	1500	0.651	
29%	2000	0.833	
36%	2500	1.057	
0%	0	0.357	
36%	2500	1.114	
43%	3000	1.329	
50%	3500	1.610	
0%	0	0.468	
50%	3500	1.713	
57%	4000	1.875	
64%	4500	1.999	
71%	5000		
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	0.547	



Lateral Load Test Result for 6-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	24
Load Cell:	ED JR

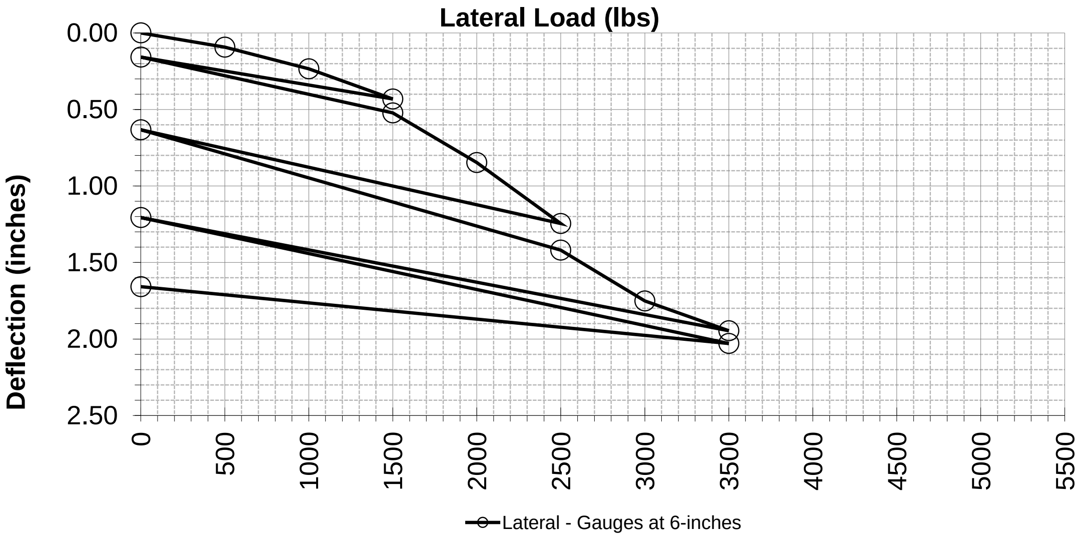
Test Date and Representative

Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/14/2020

Pile Information

Pile ID:	6-B
Latitude:	39.27376
Longitude:	-83.86500
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Stick-Up [in]:	24
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	65.22

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.093	
14%	1000	0.235	
21%	1500	0.432	
0%	0	0.158	
21%	1500	0.522	
29%	2000	0.847	
36%	2500	1.245	
0%	0	0.632	
36%	2500	1.420	
43%	3000	1.751	
50%	3500	1.946	
0%	0	1.206	
50%	3500	2.029	
57%	4000		
64%	4500		
71%	5000		
0%	0		
57%	4000		
71%	5000		
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	1.659	



AXIAL TENSION LOAD TEST RESULT

Tension Load Test Result for 1-A

Project Information

Project Name: Yellowwood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: Dillon ED Junior

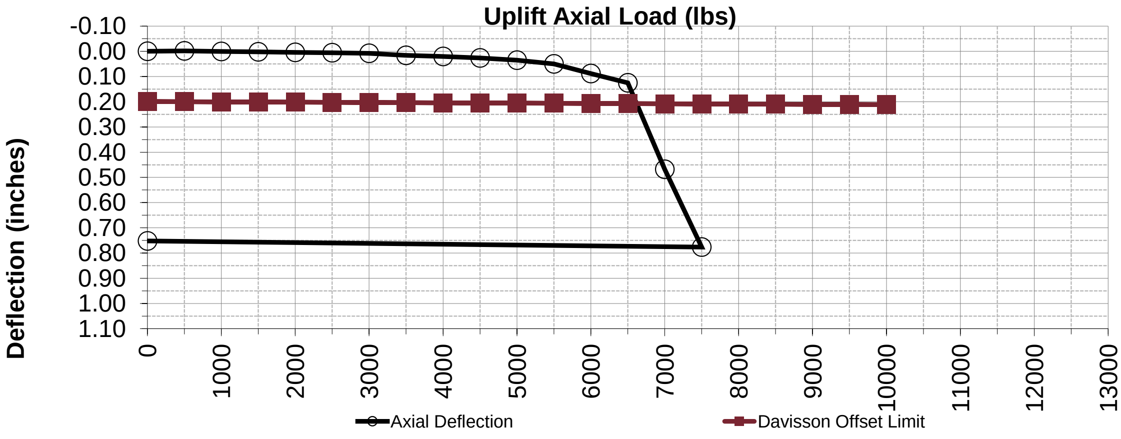
Test Date and Representative

Tested By Terracon Rep: J. Lombaridi
Date Tested: 8/13/2020

Pile Information

Pile ID: 1-A
Latitude: 39.27433
Longitude: -83.79885
Pile Type: W6X9
Pile Embedment Depth [in]: 108
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 0
Axial Design Load [lbs]: 10000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 368.99

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	-0.002	0.001	0.200	
10%	1000	0.001	0.001	0.200	
15%	1500	0.002	0.002	0.201	
20%	2000	0.004	0.003	0.202	
25%	2500	0.006	0.003	0.202	
30%	3000	0.008	0.004	0.203	
35%	3500	0.016	0.004	0.204	
40%	4000	0.021	0.005	0.204	
45%	4500	0.026	0.006	0.205	
50%	5000	0.035	0.006	0.205	
55%	5500	0.050	0.007	0.206	
60%	6000	0.088	0.008	0.207	
65%	6500	0.125	0.008	0.207	
70%	7000	0.468	0.009	0.208	
75%	7500	0.777	0.009	0.209	
80%	8000		0.010	0.209	
85%	8500		0.011	0.210	
90%	9000		0.011	0.210	
95%	9500		0.012	0.211	
100%	10000		0.013	0.212	
0%	0	0.752	0.000	0.199	



Tension Load Test Result for 1-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED Junior

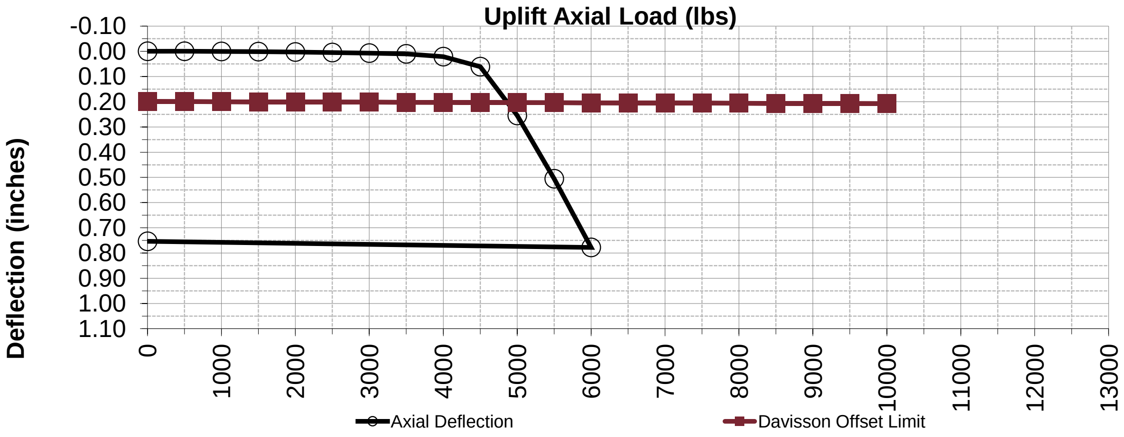
Test Date and Representative

Tested By Terracon Rep:	J. Lombaridi
Date Tested:	8/13/2020

Pile Information

Pile ID:	1-B
Latitude:	39.27433
Longitude:	-83.79885
Pile Type:	W6X9
Pile Embedment Depth [in]:	72
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	0
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.96
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	93.15

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offset Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.000	0.000	0.200	
10%	1000	0.000	0.001	0.200	
15%	1500	0.001	0.001	0.200	
20%	2000	0.002	0.002	0.201	
25%	2500	0.005	0.002	0.201	
30%	3000	0.007	0.003	0.202	
35%	3500	0.010	0.003	0.202	
40%	4000	0.021	0.003	0.203	
45%	4500	0.061	0.004	0.203	
50%	5000	0.254	0.004	0.203	
55%	5500	0.506	0.005	0.204	
60%	6000	0.778	0.005	0.204	
65%	6500		0.005	0.205	
70%	7000		0.006	0.205	
75%	7500		0.006	0.205	
80%	8000		0.007	0.206	
85%	8500		0.007	0.206	
90%	9000		0.008	0.207	
95%	9500		0.008	0.207	
100%	10000		0.008	0.208	
0%	0	0.754	0.000	0.199	



Tension Load Test Result for 2-A

Project Information

Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: Dillon ED Junior

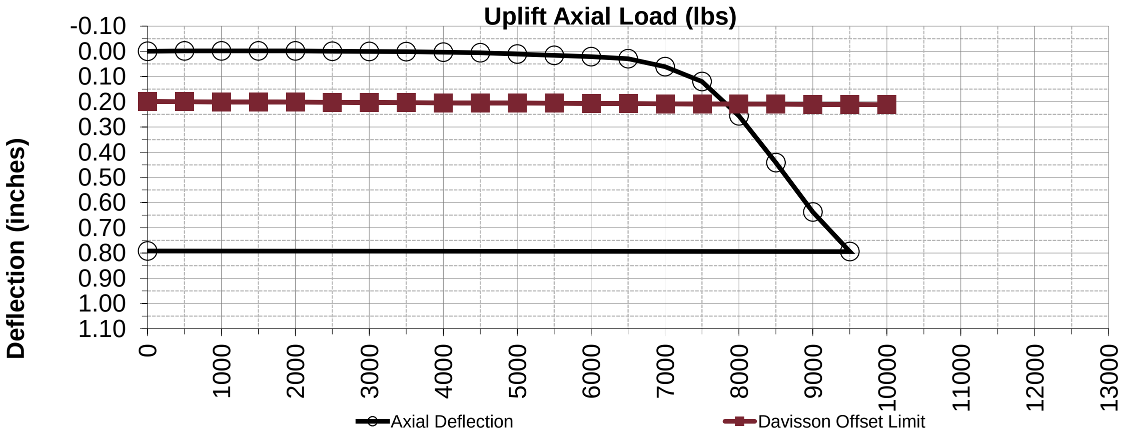
Test Date and Representative

Tested By Terracon Rep: J. Lombaridi
Date Tested: 8/13/2020

Pile Information

Pile ID: 2-A
Latitude: 39.26245
Longitude: -83.82553
Pile Type: W6X9
Pile Embedment Depth [in]: 108
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 0
Axial Design Load [lbs]: 10000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 215.8

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	-0.002	0.001	0.200	
10%	1000	-0.002	0.001	0.200	
15%	1500	-0.002	0.002	0.201	
20%	2000	-0.001	0.003	0.202	
25%	2500	0.000	0.003	0.202	
30%	3000	0.001	0.004	0.203	
35%	3500	0.002	0.004	0.204	
40%	4000	0.003	0.005	0.204	
45%	4500	0.005	0.006	0.205	
50%	5000	0.010	0.006	0.205	
55%	5500	0.016	0.007	0.206	
60%	6000	0.021	0.008	0.207	
65%	6500	0.029	0.008	0.207	
70%	7000	0.061	0.009	0.208	
75%	7500	0.120	0.009	0.209	
80%	8000	0.256	0.010	0.209	
85%	8500	0.442	0.011	0.210	
90%	9000	0.638	0.011	0.210	
95%	9500	0.794	0.012	0.211	
100%	10000		0.013	0.212	
0%	0	0.792	0.000	0.199	



Tension Load Test Result for 2-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED Junior

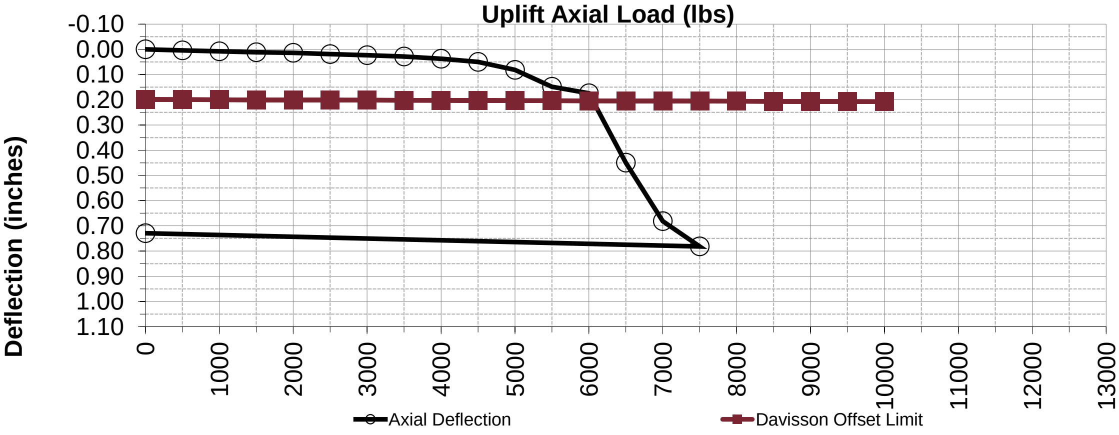
Test Date and Representative

Tested By Terracon Rep:	J. Lombaridi
Date Tested:	8/13/2020

Pile Information

Pile ID:	2-B
Latitude:	39.26245
Longitude:	-83.82553
Pile Type:	W6X9
Pile Embedment Depth [in]:	72
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	0
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.96
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	71.11

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.005	0.000	0.200	
10%	1000	0.008	0.001	0.200	
15%	1500	0.011	0.001	0.200	
20%	2000	0.014	0.002	0.201	
25%	2500	0.019	0.002	0.201	
30%	3000	0.023	0.003	0.202	
35%	3500	0.029	0.003	0.202	
40%	4000	0.037	0.003	0.203	
45%	4500	0.050	0.004	0.203	
50%	5000	0.081	0.004	0.203	
55%	5500	0.149	0.005	0.204	
60%	6000	0.175	0.005	0.204	
65%	6500	0.449	0.005	0.205	
70%	7000	0.682	0.006	0.205	
75%	7500	0.782	0.006	0.205	
80%	8000		0.007	0.206	
85%	8500		0.007	0.206	
90%	9000		0.008	0.207	
95%	9500		0.008	0.207	
100%	10000		0.008	0.208	
0%	0	0.729	0.000	0.199	



Tension Load Test Result for 3-A

Project Information

Project Name: Yellowwood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: Dillon ED Junior

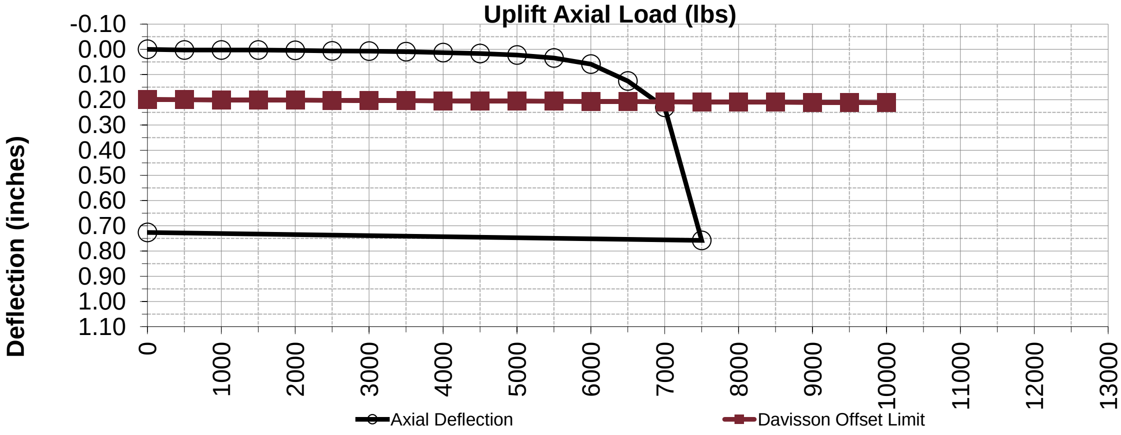
Test Date and Representative

Tested By Terracon Rep: J. Lombaridi
Date Tested: 8/13/2020

Pile Information

Pile ID: 3-A
Latitude: 39.25659
Longitude: -83.82340
Pile Type: W6X9
Pile Embedment Depth [in]: 108
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 0
Axial Design Load [lbs]: 10000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 140.43

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.003	0.001	0.200	
10%	1000	0.003	0.001	0.200	
15%	1500	0.003	0.002	0.201	
20%	2000	0.004	0.003	0.202	
25%	2500	0.007	0.003	0.202	
30%	3000	0.007	0.004	0.203	
35%	3500	0.010	0.004	0.204	
40%	4000	0.013	0.005	0.204	
45%	4500	0.017	0.006	0.205	
50%	5000	0.023	0.006	0.205	
55%	5500	0.034	0.007	0.206	
60%	6000	0.059	0.008	0.207	
65%	6500	0.126	0.008	0.207	
70%	7000	0.231	0.009	0.208	
75%	7500	0.758	0.009	0.209	
80%	8000		0.010	0.209	
85%	8500		0.011	0.210	
90%	9000		0.011	0.210	
95%	9500		0.012	0.211	
100%	10000		0.013	0.212	
0%	0	0.727	0.000	0.199	



Tension Load Test Result for 3-B

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED Junior

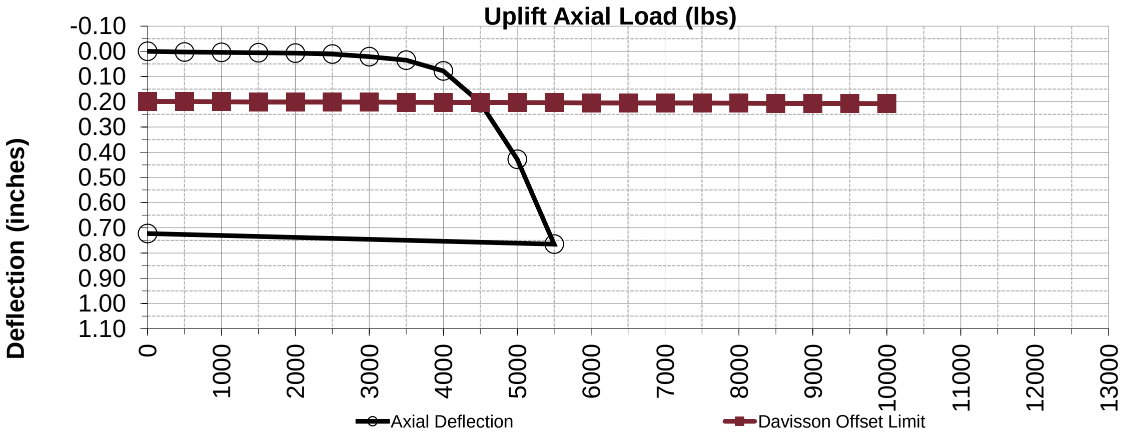
Test Date and Representative

Tested By Terracon Rep:	J. Lombaridi
Date Tested:	8/13/2020

Pile Information

Pile ID:	3-B
Latitude:	39.25659
Longitude:	-83.82340
Pile Type:	W6X9
Pile Embedment Depth [in]:	72
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	0
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.96
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	66.24

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offset Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.003	0.000	0.200	
10%	1000	0.004	0.001	0.200	
15%	1500	0.006	0.001	0.200	
20%	2000	0.007	0.002	0.201	
25%	2500	0.011	0.002	0.201	
30%	3000	0.021	0.003	0.202	
35%	3500	0.035	0.003	0.202	
40%	4000	0.078	0.003	0.203	
45%	4500	0.204	0.004	0.203	
50%	5000	0.428	0.004	0.203	
55%	5500	0.765	0.005	0.204	
60%	6000		0.005	0.204	
65%	6500		0.005	0.205	
70%	7000		0.006	0.205	
75%	7500		0.006	0.205	
80%	8000		0.007	0.206	
85%	8500		0.007	0.206	
90%	9000		0.008	0.207	
95%	9500		0.008	0.207	
100%	10000		0.008	0.208	
0%	0	0.723	0.000	0.199	



Tension Load Test Result for 4-A

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED Junior

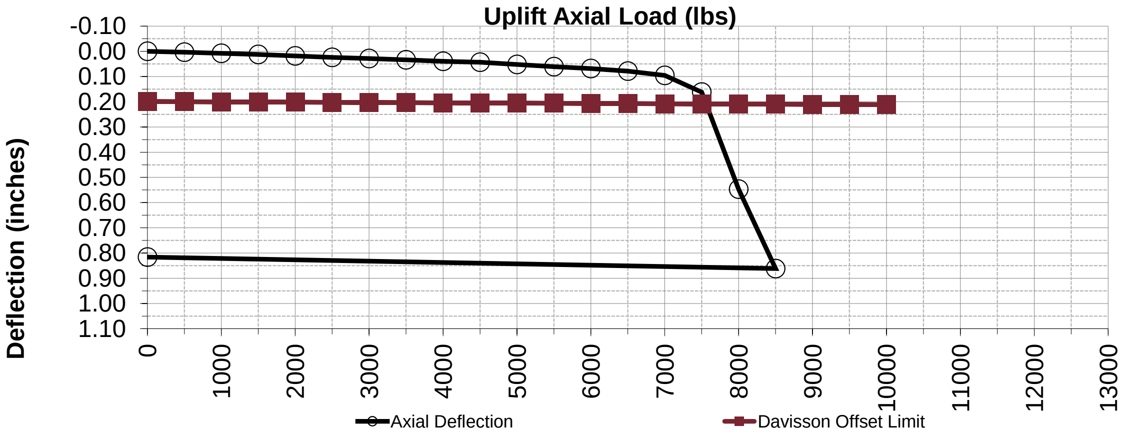
Test Date and Representative

Tested By Terracon Rep:	J. Lombaridi
Date Tested:	8/14/2020

Pile Information

Pile ID:	4-A
Latitude:	39.25756
Longitude:	-83.84239
Pile Type:	W6X9
Pile Embedment Depth [in]:	108
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	0
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.96
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	177.23

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.004	0.001	0.200	
10%	1000	0.008	0.001	0.200	
15%	1500	0.013	0.002	0.201	
20%	2000	0.018	0.003	0.202	
25%	2500	0.024	0.003	0.202	
30%	3000	0.029	0.004	0.203	
35%	3500	0.034	0.004	0.204	
40%	4000	0.039	0.005	0.204	
45%	4500	0.043	0.006	0.205	
50%	5000	0.052	0.006	0.205	
55%	5500	0.061	0.007	0.206	
60%	6000	0.068	0.008	0.207	
65%	6500	0.079	0.008	0.207	
70%	7000	0.096	0.009	0.208	
75%	7500	0.162	0.009	0.209	
80%	8000	0.547	0.010	0.209	
85%	8500	0.862	0.011	0.210	
90%	9000		0.011	0.210	
95%	9500		0.012	0.211	
100%	10000		0.013	0.212	
0%	0	0.816	0.000	0.199	



Tension Load Test Result for 4-B

Project Information

Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: Dillon ED Junior

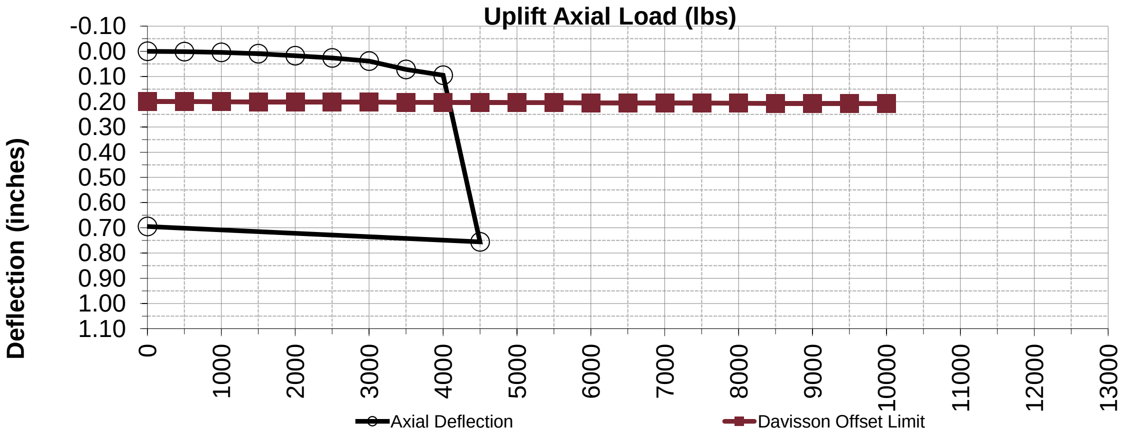
Test Date and Representative

Tested By Terracon Rep: J. Lombaridi
Date Tested: 8/14/2020

Pile Information

Pile ID: 4-B
Latitude: 39.25756
Longitude: -83.84239
Pile Type: W6X9
Pile Embedment Depth [in]: 72
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 0
Axial Design Load [lbs]: 10000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 51.66

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.001	0.000	0.200	
10%	1000	0.004	0.001	0.200	
15%	1500	0.009	0.001	0.200	
20%	2000	0.017	0.002	0.201	
25%	2500	0.026	0.002	0.201	
30%	3000	0.039	0.003	0.202	
35%	3500	0.072	0.003	0.202	
40%	4000	0.095	0.003	0.203	
45%	4500	0.756	0.004	0.203	
50%	5000		0.004	0.203	
55%	5500		0.005	0.204	
60%	6000		0.005	0.204	
65%	6500		0.005	0.205	
70%	7000		0.006	0.205	
75%	7500		0.006	0.205	
80%	8000		0.007	0.206	
85%	8500		0.007	0.206	
90%	9000		0.008	0.207	
95%	9500		0.008	0.207	
100%	10000		0.008	0.208	
0%	0	0.695	0.000	0.199	



Tension Load Test Result for 5-A

Project Information

Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: Dillon ED Junior

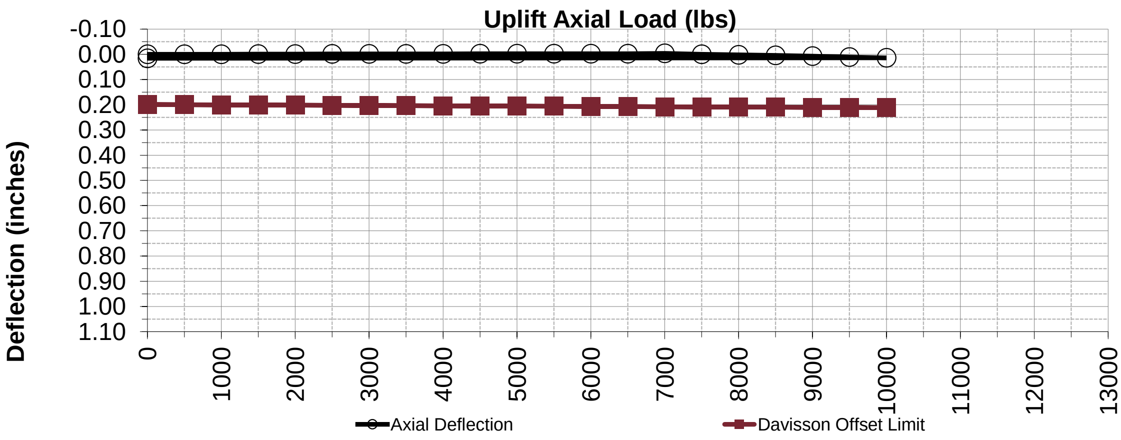
Test Date and Representative

Tested By Terracon Rep: J. Lombaridi
Date Tested: 8/14/2020

Pile Information

Pile ID: 5-A
Latitude: 39.26657
Longitude: -83.85300
Pile Type: W6X9
Pile Embedment Depth [in]: 108
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 0
Axial Design Load [lbs]: 10000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 280.06

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	**Axial Load [lbs]**	**Deflection Δ (in.) Gauges #1 & #2**	**Elastic Data (in) (PL/AE)**	**Davisson Offest Limit (in) (0.15+D/120+(PL/AE))**	**Comments**
0%	0	0.000	0.000	0.199	
5%	500	-0.001	0.001	0.200	
10%	1000	-0.001	0.001	0.200	
15%	1500	-0.001	0.002	0.201	
20%	2000	-0.001	0.003	0.202	
25%	2500	-0.002	0.003	0.202	
30%	3000	-0.002	0.004	0.203	
35%	3500	-0.002	0.004	0.204	
40%	4000	-0.002	0.005	0.204	
45%	4500	-0.003	0.006	0.205	
50%	5000	-0.003	0.006	0.205	
55%	5500	-0.003	0.007	0.206	
60%	6000	-0.003	0.008	0.207	
65%	6500	-0.003	0.008	0.207	
70%	7000	-0.004	0.009	0.208	
75%	7500	0.000	0.009	0.209	
80%	8000	0.002	0.010	0.209	
85%	8500	0.004	0.011	0.210	
90%	9000	0.007	0.011	0.210	
95%	9500	0.011	0.012	0.211	
100%	10000	0.014	0.013	0.212	
0%	0	0.016	0.000	0.199	



Tension Load Test Result for 5-B

Project Information

Project Name: Yellowwood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: Dillon ED Junior

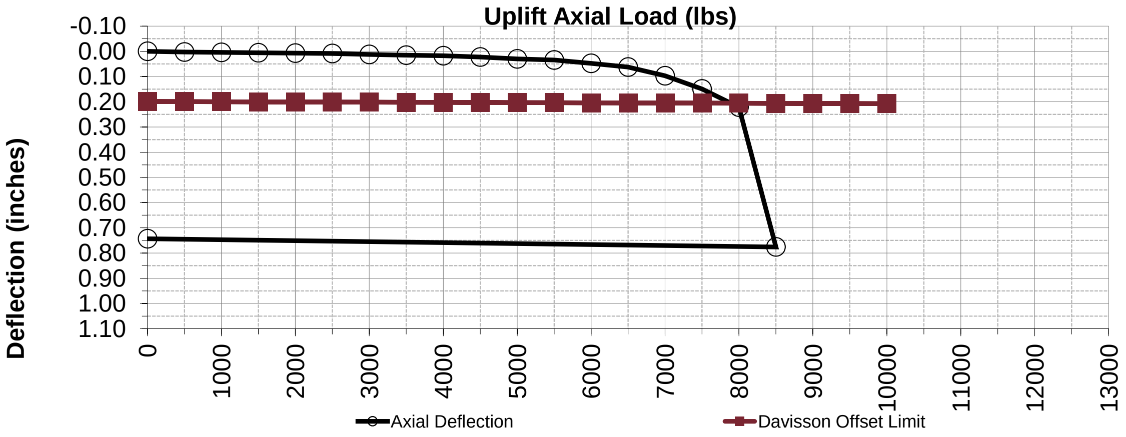
Test Date and Representative

Tested By Terracon Rep: J. Lombaridi
Date Tested: 8/14/2020

Pile Information

Pile ID: 5-B
Latitude: 39.26657
Longitude: -83.85300
Pile Type: W6X9
Pile Embedment Depth [in]: 72
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 0
Axial Design Load [lbs]: 10000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 107.03

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.003	0.000	0.200	
10%	1000	0.004	0.001	0.200	
15%	1500	0.006	0.001	0.200	
20%	2000	0.007	0.002	0.201	
25%	2500	0.009	0.002	0.201	
30%	3000	0.012	0.003	0.202	
35%	3500	0.015	0.003	0.202	
40%	4000	0.018	0.003	0.203	
45%	4500	0.022	0.004	0.203	
50%	5000	0.030	0.004	0.203	
55%	5500	0.035	0.005	0.204	
60%	6000	0.048	0.005	0.204	
65%	6500	0.062	0.005	0.205	
70%	7000	0.097	0.006	0.205	
75%	7500	0.149	0.006	0.205	
80%	8000	0.221	0.007	0.206	
85%	8500	0.776	0.007	0.206	
90%	9000		0.008	0.207	
95%	9500		0.008	0.207	
100%	10000		0.008	0.208	
0%	0	0.743	0.000	0.199	



Tension Load Test Result for 6-A

Project Information

Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: Dillon ED Junior

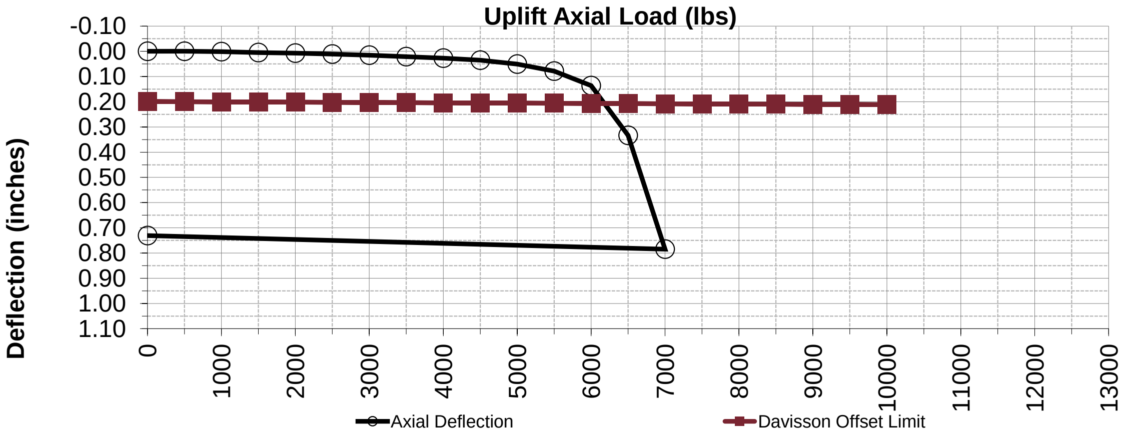
Test Date and Representative

Tested By Terracon Rep: J. Lombaridi
Date Tested: 8/14/2020

Pile Information

Pile ID: 6-A
Latitude: 39.27376
Longitude: -83.86502
Pile Type: W6X9
Pile Embedment Depth [in]: 108
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 0
Axial Design Load [lbs]: 10000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 243.46

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	-0.001	0.001	0.200	
10%	1000	0.001	0.001	0.200	
15%	1500	0.005	0.002	0.201	
20%	2000	0.007	0.003	0.202	
25%	2500	0.011	0.003	0.202	
30%	3000	0.015	0.004	0.203	
35%	3500	0.021	0.004	0.204	
40%	4000	0.027	0.005	0.204	
45%	4500	0.035	0.006	0.205	
50%	5000	0.051	0.006	0.205	
55%	5500	0.079	0.007	0.206	
60%	6000	0.136	0.008	0.207	
65%	6500	0.333	0.008	0.207	
70%	7000	0.785	0.009	0.208	
75%	7500		0.009	0.209	
80%	8000		0.010	0.209	
85%	8500		0.011	0.210	
90%	9000		0.011	0.210	
95%	9500		0.012	0.211	
100%	10000		0.013	0.212	
0%	0	0.731	0.000	0.199	



Tension Load Test Result for 6-B

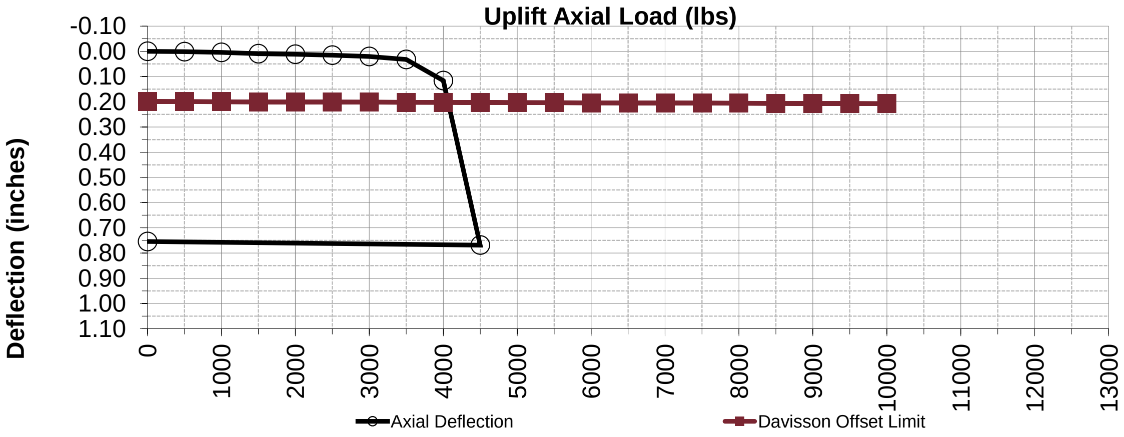
Project Information
Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up
Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: Dillon ED Junior

Test Date and Representative
Tested By Terracon Rep: J. Lombaridi
Date Tested: 8/14/2020

Pile Information
Pile ID: 6-B
Latitude: 39.27376
Longitude: -83.86502
Pile Type: W6X9
Pile Embedment Depth [in]: 72
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 0
Axial Design Load [lbs]: 10000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 65.22

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.001	0.000	0.200	
10%	1000	0.004	0.001	0.200	
15%	1500	0.009	0.001	0.200	
20%	2000	0.012	0.002	0.201	
25%	2500	0.016	0.002	0.201	
30%	3000	0.020	0.003	0.202	
35%	3500	0.033	0.003	0.202	
40%	4000	0.116	0.003	0.203	
45%	4500	0.769	0.004	0.203	
50%	5000		0.004	0.203	
55%	5500		0.005	0.204	
60%	6000		0.005	0.204	
65%	6500		0.005	0.205	
70%	7000		0.006	0.205	
75%	7500		0.006	0.205	
80%	8000		0.007	0.206	
85%	8500		0.007	0.206	
90%	9000		0.008	0.207	
95%	9500		0.008	0.207	
100%	10000		0.008	0.208	
0%	0	0.754	0.000	0.199	



AXIAL COMPRESSION LOAD TEST RESULT

Compression Load Test Result for 1-C

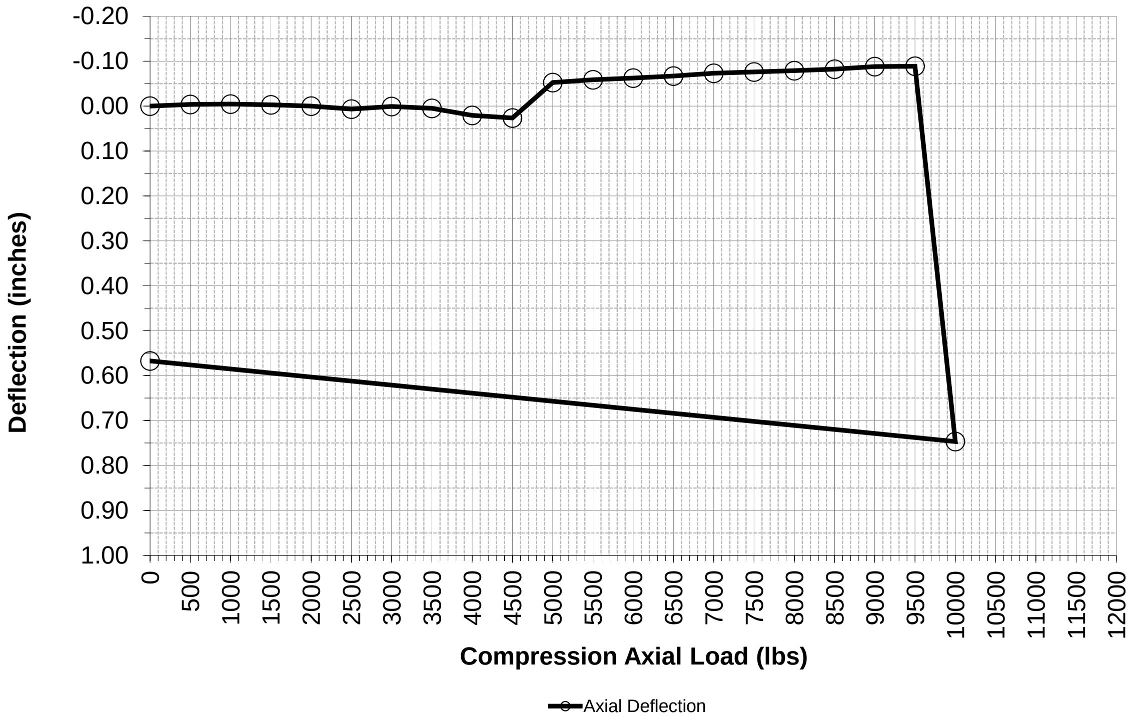
Project Information
Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up
Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: IQ+390-DC

Test Date and Representative
Tested By Terracon Rep: J. Lombardi
Date Tested: 8/13/2020

Pile Information
Pile ID: 1-C
Latitude: 39.27433
Longitude: -83.79885
Pile Type: W6x9
Pile Embedment Depth [in]: 72
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 24
Axial Design Load [lbs]: 13000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 78.64

Compression Test Results			
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	-0.004	
8%	1000	-0.004	
12%	1500	-0.003	
15%	2000	0.000	
19%	2500	0.007	
23%	3000	0.001	
27%	3500	0.005	
31%	4000	0.021	
35%	4500	0.027	
38%	5000	-0.052	
42%	5500	-0.059	
46%	6000	-0.062	
50%	6500	-0.067	
54%	7000	-0.073	
58%	7500	-0.076	
62%	8000	-0.079	
65%	8500	-0.082	
69%	9000	-0.088	
73%	9500	-0.089	
77%	10000	0.747	
81%	10500		
85%	11000		
88%	11500		
92%	12000		



Compression Load Test Result for 2-C

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	IQ+390-DC

Test Date and Representative

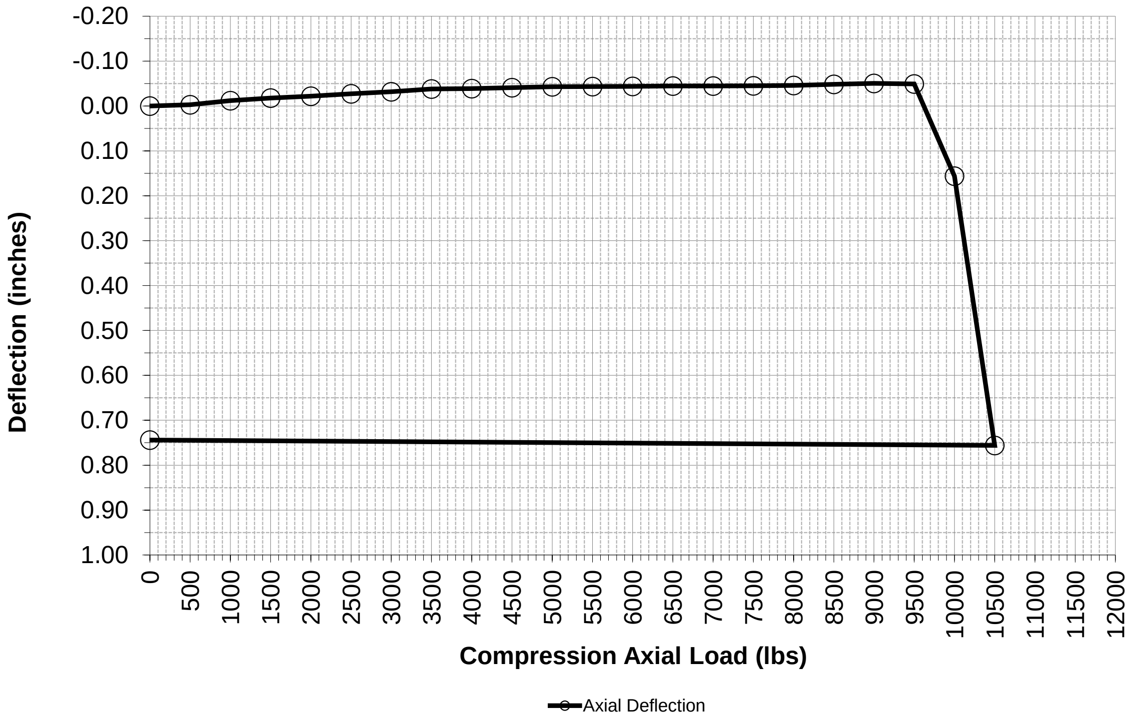
Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/13/2020

Pile Information

Pile ID:	2-C
Latitude:	39.26245
Longitude:	-83.82553
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	24
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.96
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	70.36

Compression Test Results

% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	-0.003	
8%	1000	-0.012	
12%	1500	-0.018	
15%	2000	-0.022	
19%	2500	-0.027	
23%	3000	-0.032	
27%	3500	-0.038	
31%	4000	-0.039	
35%	4500	-0.041	
38%	5000	-0.043	
42%	5500	-0.043	
46%	6000	-0.044	
50%	6500	-0.044	
54%	7000	-0.045	
58%	7500	-0.045	
62%	8000	-0.046	
65%	8500	-0.048	
69%	9000	-0.050	
73%	9500	-0.049	
77%	10000	0.156	
81%	10500	0.756	
85%	11000		
88%	11500		
92%	12000		



Compression Load Test Result for 3-C

Project Information

Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: IQ+390-DC

Test Date and Representative

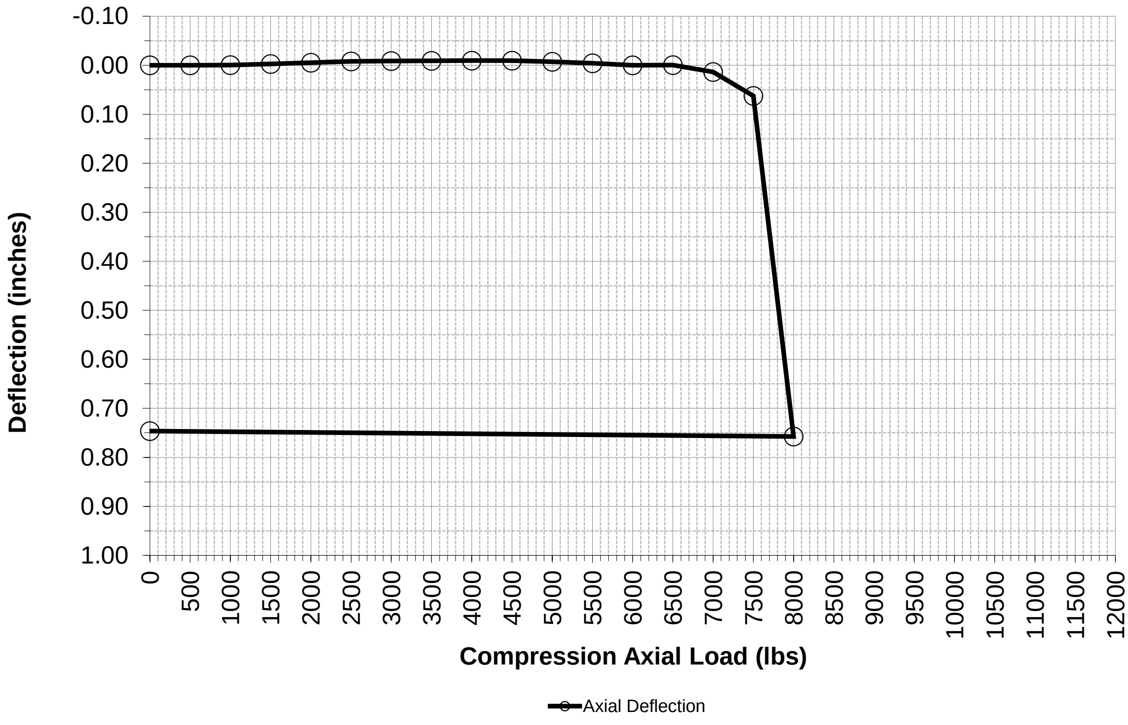
Tested By Terracon Rep: J. Lombardi
Date Tested: 8/13/2020

Pile Information

Pile ID: 3-C
Latitude: 39.25659
Longitude: -83.82340
Pile Type: W6x9
Pile Embedment Depth [in]: 72
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 24
Axial Design Load [lbs]: 13000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 51.98

Compression Test Results

% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.000	
8%	1000	0.000	
12%	1500	-0.003	
15%	2000	-0.005	
19%	2500	-0.008	
23%	3000	-0.009	
27%	3500	-0.009	
31%	4000	-0.010	
35%	4500	-0.009	
38%	5000	-0.007	
42%	5500	-0.004	
46%	6000	0.000	
50%	6500	0.000	
54%	7000	0.014	
58%	7500	0.063	
62%	8000	0.757	
65%	8500		
69%	9000		
73%	9500		
77%	10000		
81%	10500		
85%	11000		
88%	11500		
92%	12000		



Compression Load Test Result for 4-C

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	IQ+390-DC

Test Date and Representative

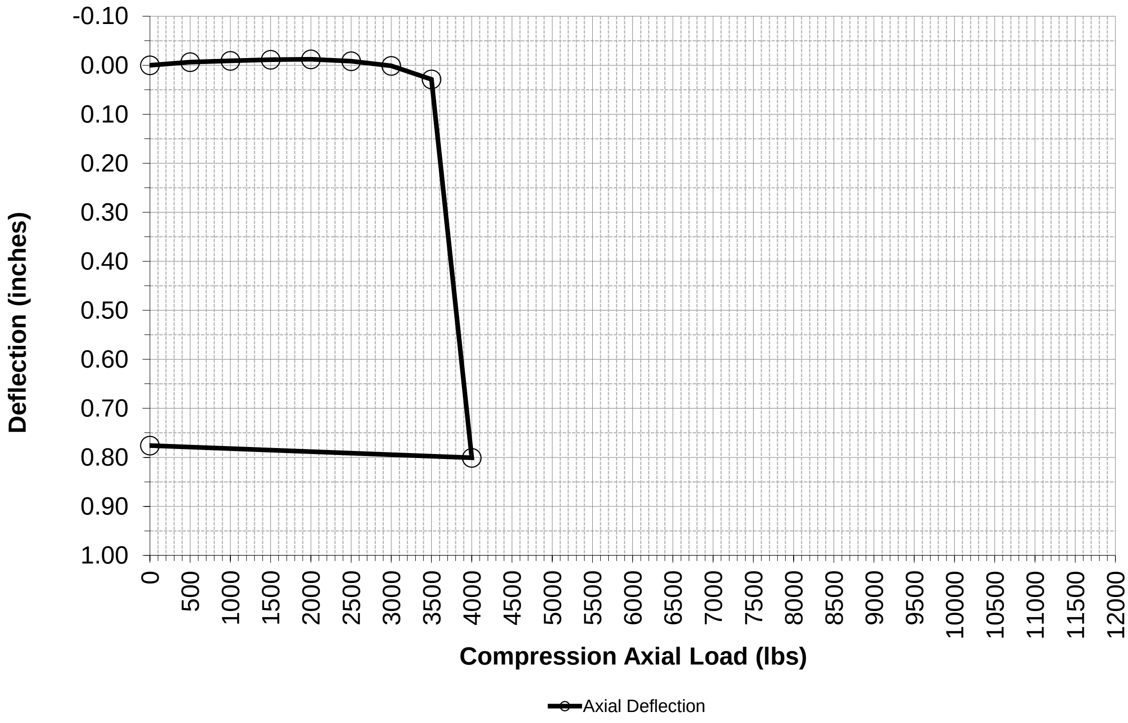
Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/14/2020

Pile Information

Pile ID:	4-C
Latitude:	39.25756
Longitude:	-83.84239
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	24
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.96
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	40.35

Compression Test Results

% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	-0.007	
8%	1000	-0.009	
12%	1500	-0.011	
15%	2000	-0.012	
19%	2500	-0.008	
23%	3000	0.001	
27%	3500	0.029	
31%	4000	0.801	
35%	4500		
38%	5000		
42%	5500		
46%	6000		
50%	6500		
54%	7000		
58%	7500		
62%	8000		
65%	8500		
69%	9000		
73%	9500		
77%	10000		
81%	10500		
85%	11000		
88%	11500		
92%	12000		



Compression Load Test Result for 5-C

Project Information

Project Name:	Yellowood Solar
Project Location:	Clinton, Ohio
Project Number:	N4205103

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	IQ+390-DC

Test Date and Representative

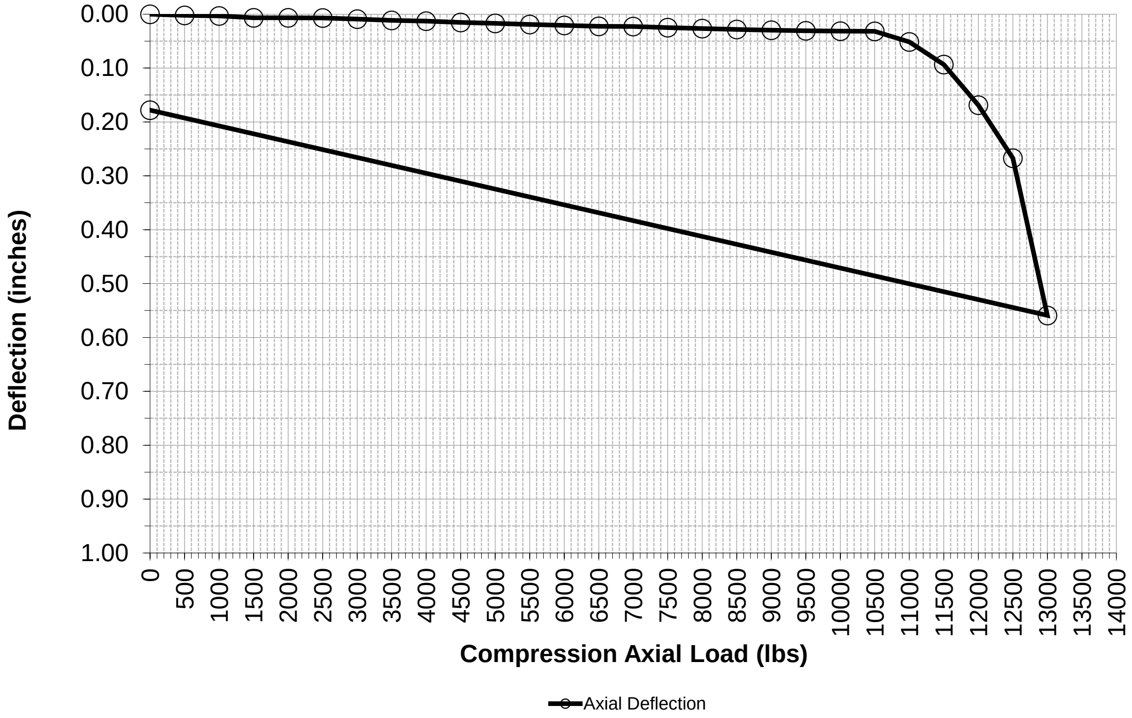
Tested By Terracon Rep:	J. Lombardi
Date Tested:	8/14/2020

Pile Information

Pile ID:	5-C
Latitude:	39.26657
Longitude:	-83.85300
Pile Type:	W6x9
Pile Embedment Depth [in]:	72
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	24
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.96
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	91.28

Compression Test Results

% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.002	
8%	1000	0.003	
12%	1500	0.007	
15%	2000	0.007	
19%	2500	0.007	
23%	3000	0.009	
27%	3500	0.012	
31%	4000	0.013	
35%	4500	0.015	
38%	5000	0.017	
42%	5500	0.019	
46%	6000	0.021	
50%	6500	0.022	
54%	7000	0.023	
58%	7500	0.025	
62%	8000	0.027	
65%	8500	0.028	
69%	9000	0.030	
73%	9500	0.031	
77%	10000	0.032	
81%	10500	0.032	
85%	11000	0.051	
88%	11500	0.093	
92%	12000	0.169	



Compression Load Test Result for 6-C

Project Information

Project Name: Yellowood Solar
Project Location: Clinton, Ohio
Project Number: N4205103

Axial Load Test Set Up

Number of Gauges: 2
Height of Gauges [in]: 6
Load Cell: IQ+390-DC

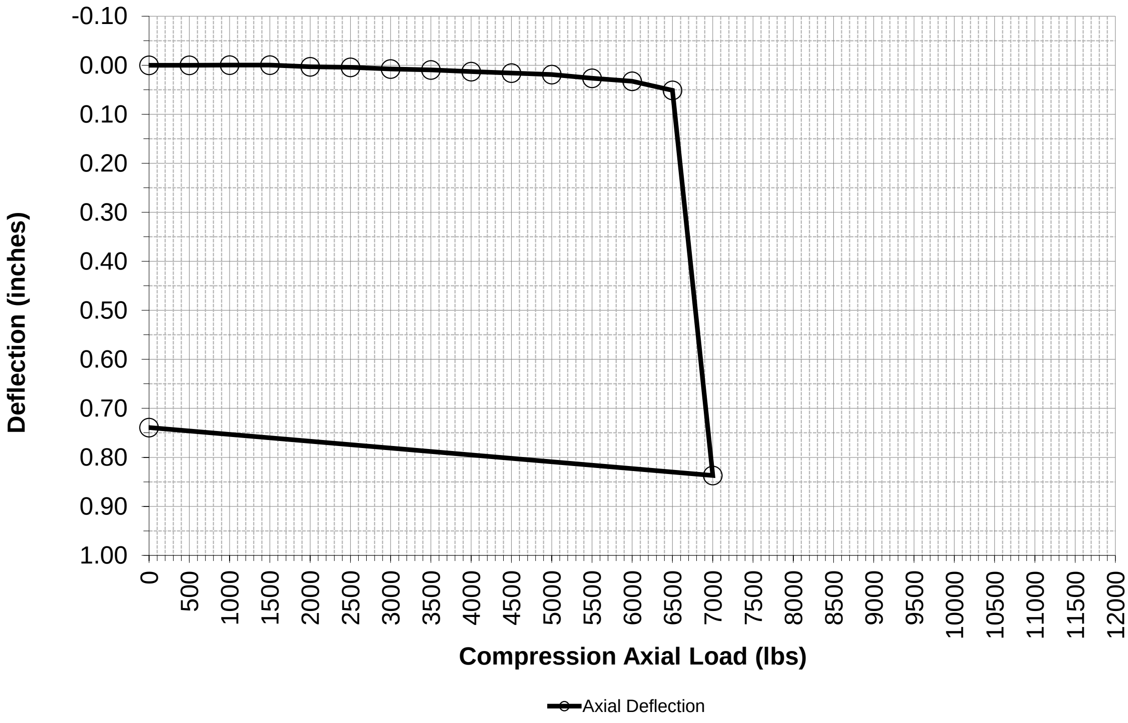
Test Date and Representative

Tested By Terracon Rep: J. Lombardi
Date Tested: 8/14/2020

Pile Information

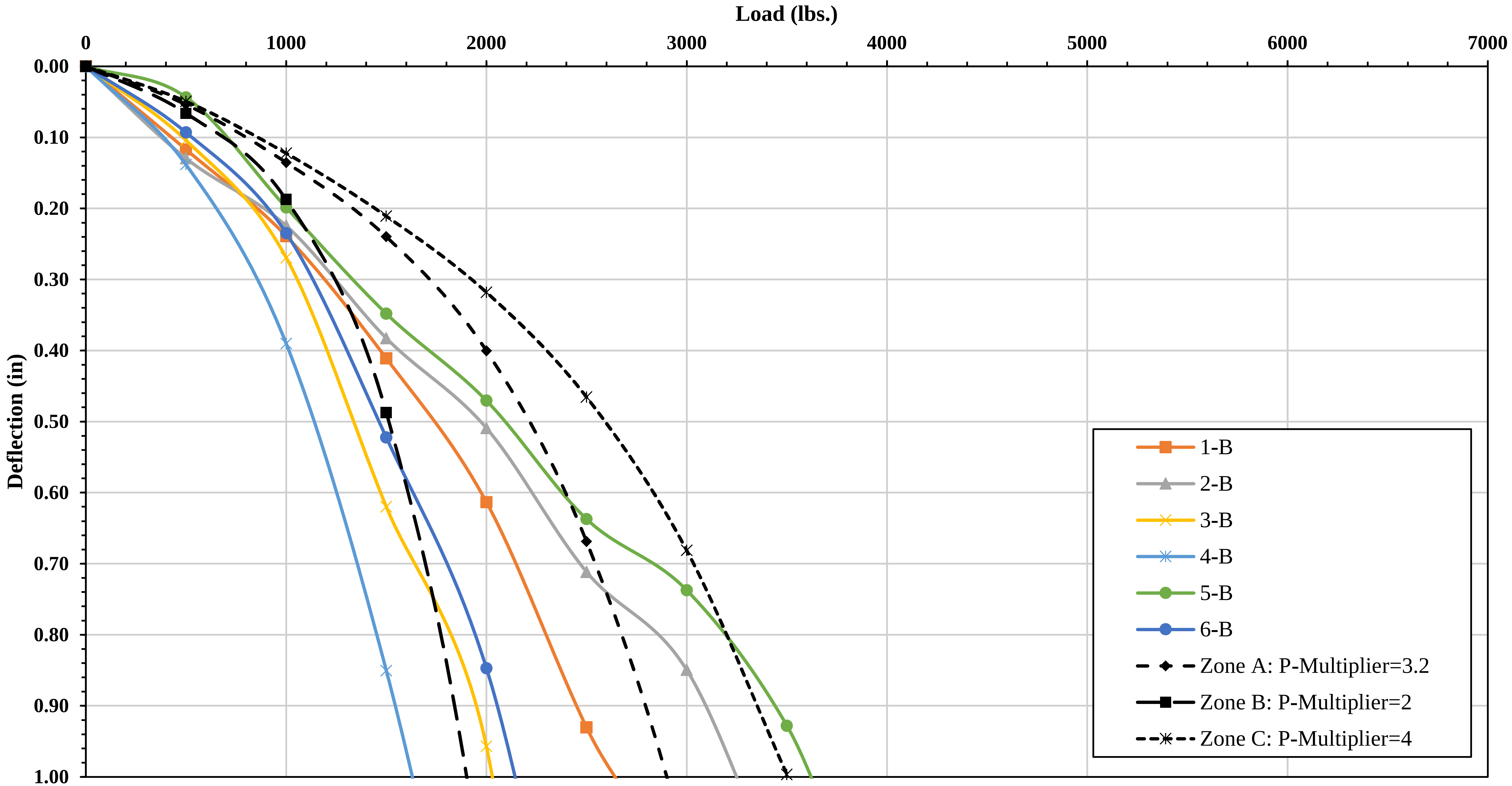
Pile ID: 6-C
Latitude: 39.27376
Longitude: -83.86502
Pile Type: W6x9
Pile Embedment Depth [in]: 72
Pile Diameter [in]: 5.9
Pile Stick-Up [in]: 24
Axial Design Load [lbs]: 13000
Pile Area [sq. in]: 2.96
Elastic Modulus [ksi]: 29,000
Drive Time [sec]: 95.28

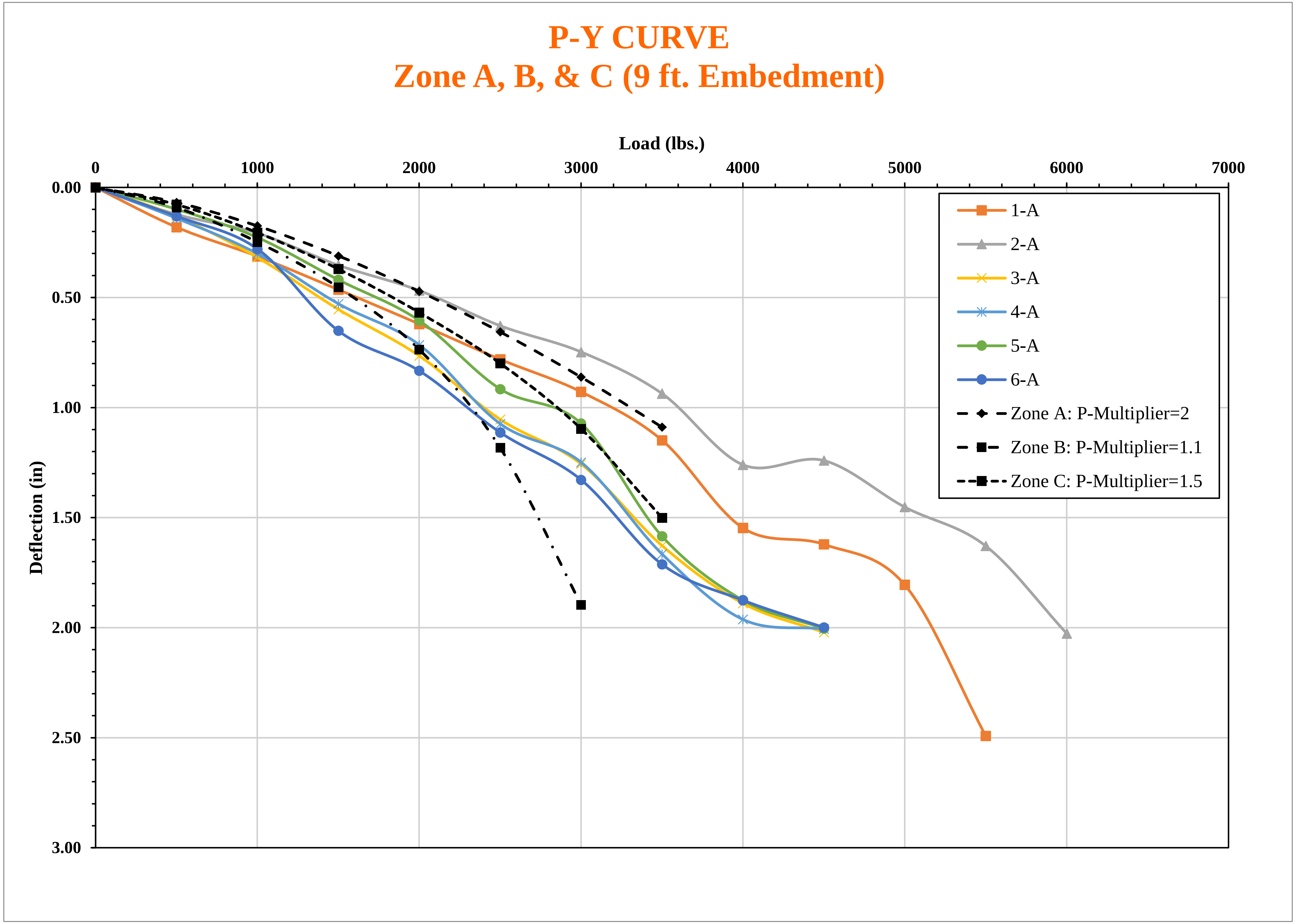
Compression Test Results			
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.000	
8%	1000	0.000	
12%	1500	0.000	
15%	2000	0.003	
19%	2500	0.004	
23%	3000	0.008	
27%	3500	0.010	
31%	4000	0.013	
35%	4500	0.016	
38%	5000	0.019	
42%	5500	0.027	
46%	6000	0.033	
50%	6500	0.051	
54%	7000	0.837	
58%	7500		
62%	8000		
65%	8500		
69%	9000		
73%	9500		
77%	10000		
81%	10500		
85%	11000		
88%	11500		
92%	12000		



P-Y CURVES

P-Y CURVE
Zone A , B , & C (6 ft. Embedment)




P-Y CURVE
Zone A, B, & C (9 ft. Embedment)
Load (lbs.)
0
1000
2000
3000
4000
5000
6000
7000
Deflection (in)
0.00
0.50
1.00
1.50
2.00
2.50
3.00
1-A
2-A
3-A
4-A
5-A
6-A
Zone A: P-Multiplier=2
Zone B: P-Multiplier=1.1
Zone C: P-Multiplier=1.5