Letter of Notification for the Nottingham Solar 138 kV Gen-Tie Transmission Line Project

OPSB Case No. 22-1030-EL-BLN

Submitted to:

The Ohio Power Siting Board

Pursuant to Ohio Administrative Code

Section 4906-6-05

Submitted by:

Nottingham Solar, LLC

November 9, 2022

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November 9, 2022

Via Electronic Filing

Ms. Tanowa Troupe
Administration/Docketing
Ohio Power Siting Board
180 East Broad Street, 11th Floor
Columbus, Ohio 43215-3793

Re: Nottingham Solar LLC 138 kV Gen-Tie Transmission Line Project
Case No. 22-1030-EL-BLN

Dear Ms. Troupe:

Enclosed for filing in the above-referenced case is a copy of Nottingham Solar LLC's Letter of Notification for a proposed 138 kV Gen-Tie Transmission Line Project ("Nottingham Gen-Tie") Athens Township, Harrison County, Ohio.

Name of Applicant: Nottingham Solar LLC
whose authorized representative is:
Lori Cuervo
Project Director
BQ Energy Development, LLC
400 Market Industrial Park, Suite 32
Wappingers Falls, NY 12590
Telephone: 412.680.1550
E-Mail: lori.cuervo@bqenergy.com

Name/Location of Proposed Facility: Nottingham Gen-Tie Project
Athens Township
Harrison County, Ohio

Authorized Representative:

Devin D. Parram
Bricker & Eckler LLP
100 South Third Street
Columbus, OH 43215
Telephone: (614) 227-8813
Facsimile: (614) 227-2390
E-Mail: dparram@bricker.com

Notarized Statement: *See* Attached Affidavit of Lori Cuervo, on behalf of Nottingham Solar LLC

Sincerely on behalf of
Nottingham Solar LLC

Devin D. Parram

Enclosure

BEFORE
THE OHIO POWER SITING BOARD

In the Matter of the Letter of Notification Nottingham Solar, LLC for the 138 kV Gen-Tie Transmission Line Project, Athens Township, Harrison County, Ohio	)))))	Case No. No 22-1030-EL-BLN

AFFIDAVIT OF LORI CUERVO
NOTTINGHAM SOLAR LLC

STATE OF PENNSYLVANIA :
: ss.
COUNTY OF WASHINGTON :

I, Lori Cuervo, being duly sworn and cautioned, state that I am over 18 years of age and competent to testify to the matters stated in this affidavit and further state the following based upon my personal knowledge:

1. I am a Director at BQ Energy Development, LLC ("BQ Energy"), which owns 100% of Nottingham Solar LLC ("Nottingham"). I am making this statement in my capacity as an Manager of Nottingham and not in my individual capacity

2. Nottingham's Letter of Notification to the Ohio Power Siting Board for a Certificate of Environmental Compatibility and Public Need to develop, and construct, a 138 kV Gen-Tie Transmission Line Project, Athens Township, Harrison County, Ohio was prepared and reviewed by BQ Energy employees or consultants that are the primary individuals in charge of the development of the Nottingham Application on whom I reasonably rely as subject matter experts.

3. To the best of my knowledge, information, and belief, the information and materials contained in the above-referenced Application are true and accurate.

4. To the best of my knowledge, information, and belief, the above-referenced Letter of Notification is complete.

Lori Cuervo

Lori Cuervo
Director at BQ Energy Development, LLC
NOTTINGHAM SOLAR LLC

Sworn to before and signed in my presence this 7th day of November 2022.

Alicia Scott

Notary Public
Alicia Scott
Notary Public State of New York
Ulster County
My commission expires: Nov/05/2026
01SC6383001
This Remote Notary act involved the use of communication technology.

[SEAL]

4906-6-05 Accelerated Application Requirements

Nottingham Solar LLC, a wholly owned subsidiary of BQ Energy Development LLC (BQ Energy), which in turn is a wholly owned subsidiary of Clean Capital LLC (the Applicant), provides the following information to the Ohio Power Siting Board (OPSB) in accordance with the accelerated application requirements of Ohio Administrative Code Section 4906-6-05.

4906-6-05(B) General Information

B(1) Project Description

The name of the project and applicant's reference number, names and reference number(s) of resulting circuits, a brief description of the project, and why the project meets the requirements for a Letter of Notification.

The Applicant, Nottingham Solar LLC, proposes to construct and operate the Project, a substation on-site of the proposed Nottingham Solar Facility, OPSB Case No. 21-0270-EL-BGN (Nottingham Solar Facility) and an approximately 0.8-mile overhead generation tie-line (gen-tie) that will deliver electricity to the existing American Electric Power (AEP) Nottingham 138 kV Substation that connects to the regional transmission grid. The location of the Project is shown on **Figures 1 and 2 in Appendix A**.

The Project meets the requirements for a Letter of Notification (LON) as defined by Item 1 (b) and Item 3 of Appendix A to Ohio Administrative Code Section 4906-1-01, *Application Requirement Matrix for Electric Power Transmission Lines*:

(1) New construction, extension, or relocation of single or multiple circuit electric power transmission line(s), or upgrading existing transmission or distribution line(s) for operation at a higher transmission voltage, as follows:

(b) Line(s) greater than 0.2 miles in length but not greater than two miles in length

And

(3) Constructing a new electric power transmission substation

The Project has been assigned Case No. 22-1030-EL-BLN.

B(2) Statement of Need

If the proposed Letter of Notification project is an electric power transmission line or gas or natural gas transmission line, a statement explaining the need for the proposed facility.

The Nottingham Solar Facility (Case No. 21-270-EL-BGN) received its Certificate of Environmental Compatibility and Public Need (CECPN) for a solar facility located in Harrison County, Ohio, on August 18, 2022. This Project is necessary to interconnect the solar project to its point of interconnection with the PJM electric grid. The Project will construct the gen tie line from Applicant's on-site substation to the delivery point at the existing AEP Nottingham Substation.

B(3) Project Location

The applicant shall provide the location of the project in relation to existing or proposed lines and substations shown on an area system map of sufficient scale and size to show existing and proposed transmission facilities in the Project area.

The location of the Project in relation to existing transmission lines and substations is shown on **Figure 1, Appendix A**. **Figure 2, Appendix A**, identifies the Project components on a 2020 aerial photograph.

B(4) Alternatives Considered

The applicant shall describe the alternatives considered and reasons why the proposed location or route is best suited for the proposed facility. The discussion shall include, but not be limited to, impacts associated with socioeconomic, ecological, construction, or engineering aspects of the project.

Due to the location of the proposed on-site substation facility, existing AEP Nottingham Substation, and the short length of the gen-tie line, no other alternatives were considered for the Project. Any other alternative would add additional length to the Project without any additional benefit. Therefore, this Project represents the most suitable and least impactful alternative. No other alternatives were considered. Socioeconomic, land use, and ecological information is presented in Section B(10).

B(5) Public Information Program

The applicant shall describe its public information program to inform affected property owners and tenants of the nature of the project and the proposed timeframe for project construction and restoration activities.

Nottingham Solar LLC will inform affected property owners and tenants about this Project through several different mediums. Within seven days of filing this LON, Nottingham Solar LLC will issue a public notice in a newspaper of general circulation in the Project area. The notice will comply with all requirements of OAC Section 4906-6-08(A)(1-6). Further, the Company has mailed (or will mail) a letter, via first class mail, to affected landowners, tenants, contiguous owners and any other landowner Nottingham Solar LLC may approach for an easement necessary for the construction, operation, or maintenance of the Project. The letter will comply with all requirements of OAC Section 4906-6-08(B). Nottingham Solar LLC maintains a website (www.nottinghamsolarproject.com) which hosts an electronic copy of this LON and the public notice of this LON. An electronic and paper copy of the LON will be served to the public library in each political subdivision affected by this Project.

B(6) Construction Schedule

The applicant shall provide an anticipated construction schedule and proposed in-service date of the project.

Construction of the Project is planned to begin in generally March 2023 with an anticipated in-service date of no later than December 2024.

B(7) Area Map

The applicant shall provide a map of at least 1:24,000 scale clearly depicting the facility with clearly marked streets, roads, and highways, and an aerial image.

Figure 1, Appendix A, identifies the location of the Project area on a United States Geological Survey 1:24,000 quadrangle map. **Appendix A**, **Figure 2** displays the Project components on a 2020 aerial photograph.

To visit the Project from downtown Columbus, Ohio, take I-70 E toward Wheeling for 80 miles. Take exit 180B to merge onto I-77 N for 3.8 miles. Take exit 47 to merge onto US 22 E/Cadiz Road toward Cadiz for 31 miles. Turn right onto OH-519 E/Stumptown Road and continue for 3 miles. The Project is located to the north and south of OH-519 E/Stumptown Road.

B(8) Property Agreements

The applicant shall provide a list of properties for which the applicant has obtained easements, options, and/or land use agreements necessary to construct and operate the

facility and a list of the additional properties for which such agreements have not been obtained.

A list of properties required for the Project are provided in the table below.

Property Parcel Number	Agreement Type	Easement or Option Obtained (Yes/No)
02-0000128.000	Lease Agreement	Yes
02-0000130.000	Lease Agreement	Yes
02-0000123.000	Easement	In Progress

B(9) Technical Features

The applicant shall describe the following information regarding the technical features of the project:

B(9)(a) Operating characteristics, estimated number and types of structures required, and right-of-way and/or land requirements.

The transmission line will include the following:

Gen-tie 138 kV Line

Voltage: 138 kV
Conductors: 795 kcmil 26/7 Strands DRAKE ACSR
Shield Wire: 2 DNO-11839 OPGW
Insulators: Polymer
ROW Width: 100 feet
Structure Type: Three (3) Single Circuit Wood Pole Guyed Terminal Dead End, Seven (7) Single Circuit Wood Pole Tangent (vertical configuration), Two (2) Single Circuit Wood Pole Guyed Running Angle

The substation is proposed to have a breaker and a half configuration, and include the following equipment:

- 1 – 138 kV Circuit Breaker
- 1 – 138 kV disconnect switch
- 1 – 138/34.5 kV Power Transformer
- 1 – Station Service Transformer

- 1 – 34.5 kV Circuit Breaker
- 1 – 34.5 kV disconnect switch
- 1 – Capacitor Bank
- 1 – Electrical Control Enclosure

Nottingham Solar LLC conducted a geotechnical investigation for the proposed Project substation. The findings of the geotechnical engineering study is provided in **Appendix B**. The geotechnical investigation consisted of four geotechnical test pits to evaluate the site is suitable for cost-effective development of the proposed on-site substation. High-level geotechnical considerations were evaluated based on the desktop review and detailed observations conducted during the test pit exploration program.

In general, the desktop review coupled with the test pit exploration program indicated the site has an extensive mining history and the vast majority of the site is underlain by mine spoil of various thicknesses. The assessment did not identify or encounter conditions that would prohibit development of this site for the proposed on-site substation. Additional detailed studies are recommended, and geotechnical general industry practices will need to be followed to support the more detailed stages of design.

Redevelopment of previously mined lands with thick layers of mine spoil presents technical challenges due to the heterogeneous nature of the mine spoil material and the variation of spoil thickness across the site. However, successful redevelopment of formerly mined land for a substation is feasible and common in this area of Ohio assuming proper site-specific geotechnical evaluations, designs, and controls are completed.

B(9)(b) Electric and Magnetic Fields

For electric power transmission lines that are within one hundred feet of an occupied residence or institution, the production of electric and magnetic fields during the operation of the proposed electric power transmission line.

B(9)(b)(i) Calculated Electric and Magnetic Field Strength Levels

i) Calculated Electric and Magnetic Field Levels

Not applicable. No occupied residences or institutions are located within 100 feet of the Project.

B(9)(b)(ii) Design Alternatives

A discussion of the applicant's consideration of design alternatives with respect to electric and magnetic fields and their strength levels, including alternate conductor configuration and phasing, tower height, corridor location, and right-of-way width.

Not applicable. No occupied residences or institutions are located within 100 feet of the Project.

B(9)(b)(ii)(c) Project Cost

The estimated capital cost of the project.

The capital costs estimate for the proposed Project, which is comprised of applicable tangible and capital costs, is approximately $930,000 +/- 20% using a Class 4 estimate. Pursuant to the PJM OATT, the costs for this Project will not be recovered in the Nottingham Solar LLC FERC formula rate.

B(10) Social and Economic Impacts

The applicant shall describe the social and ecological impacts of the project:

B(10)(a) Operating Characteristics

Provide a brief, general description of land use within the vicinity of the proposed project, including a list of municipalities, townships, and counties affected.

The Project is located in Athens Township, Harrison County, Ohio. The property class in the Project area is predominantly vacant agricultural land and residential vacant, as classified by the Harrison County Auditor. There are no residences located within 1,000 feet of the Project. There are no schools, parks, churches, cemeteries, wildlife management areas, or nature preserve lands within 1,000 feet of the centerline of the Project.

B(10)(b) Agricultural Land Information

Provide the acreage and a general description of all agricultural land, and separately all agricultural district land, existing at least sixty days prior to submission of the application within the potential disturbance area of the project.

No properties registered as agricultural district land are located in the Project area based on email coordination with the Harrison County Auditor's Office on October 10, 2022. The Project occupies 9.7 acres of that approximately 5.9 acres has been used for old field, and 3.6 acres is scrub/shrub, grassland, successional woodland, and developed.

B(10)(c) Archaeological and Cultural Resources Provide a description of the applicant's investigation concerning the presence or absence of significant archaeological or cultural resources that may be located within the potential disturbance area of the project, a statement of the findings of the investigation, and a copy of any document produced as a result of the investigation.

Nottingham Solar LLC's consultant completed a desktop analysis within a 10-mile radius of the Nottingham Solar facility (Case No. 20-270-EL-BGN) consisting of a visibility and viewshed analysis and data review of registered landmark of historic, archaeological, or other cultural significance. Based on this desktop analysis, Nottingham Solar LLC's consultant identified 249 archaeological resources and 673 architectural resources within a 10-mile-radius of the Nottingham Solar facility.

Upon review of past survey findings, Nottingham Solar LLC's consultant recommends that the Project will have no adverse effect on historic properties and no further cultural resource work would be necessary. Nottingham Solar LLC's consultant is currently submitting a literature review and recommendation with the State Historic Preservation Office ("SHPO") (Appendix C). Coordination with SHPO will be provided to OPSB once it has been received.

SHPO has determined that the information contained in Figures 4-2 and 4-4 of Nottingham's desktop review is confidential. Therefore, rather than filing Figures 4-2 and 4-4, this information will be marked confidential and provided directly to OPSB staff for review.

B(10)(d) Local, State, and Federal Agency Correspondence Provide a list of the local, state, and federal governmental agencies known to have requirements that must be met in connection with the construction of the project, and a list of documents that have been or are being filed with those agencies in connection with siting and constructing the project.

A glint/glare analysis was filed with the Federal Aviation Administration (FAA) for authorization of the proposed Nottingham Solar Facility (Case No. 21-270-EL-BGN) to minimize potential impacts to the Harrison County Airport (FAA ID #8G6). Nottingham Solar LCC will implement any design modifications to the facility if required by the FAA. A Notice of Intent ("NOI") will be filed with the Ohio Environmental Protection Agency for authorization of construction storm water discharges under General Permit OHC000005, and Nottingham Solar LCC will implement and maintain best management practices as outlined in the project-specific Storm Water Pollution Prevention Plan to minimize erosion and control sediment to protect surface water quality during storm events. The 14 proposed steel pole structures will not be installed in any streams or wetlands (see Appendix D). The Project will require approximately 1 acre of tree clearing; however no clearing is required within wetlands or streams. Consequently, the Project will not require a Clean Water Act Section 404 Permit from the U.S. Army Corps of Engineers or Pre-Construction Notification to the U.S. Army Corps of Engineers.

No structures or proposed access roads are located within the Federal Emergency Management Agency's ("FEMA") 100-year floodplain area. Therefore, no floodplain permitting is expected to be required for the Project. A local stormwater permit will be obtained from Harrison County prior to the start of construction.

There are no other known local, state or federal requirements that must be met prior to commencement of the Project.

B(10)(e) Threatened, Endangered, and Rare Species

Provide a description of the applicant's investigation concerning the presence or absence of federal and state designated species (including endangered species, threatened species, rare species, species proposed for listing, species under review for listing, and species of special interest) that may be located within the potential disturbance area of the project, a statement of the findings of the investigation, and a copy of any document produced as a result of the investigation.

On October 20, 2022, Nottingham Solar LLC's consultant submitted coordination letters to the United States Fish and Wildlife Service (USFWS) and the Ohio Department of Natural Resources (ODNR) Ohio Natural Heritage Program (ONHP) and Division of Wildlife (DOW), seeking an environmental review of the Project area for potential impacts to state and/or federally protected species. The USFWS provided a response on November 9, 2022 (Project Code: 2023-0003608). The ODNR response was not yet received at the time of the filing. Copies of the submitted consultation letters and response from USFWS are presented in **Appendix E**. The coordination response from ODNR will be provided to OPSB once it has been received.

The November 9, 2022 USFWS coordination letter indicated that the Project is within the range of the Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*) in Ohio. Typically, the USFWS recommends seasonal tree clearing (October 1 through March 31) if no caves or abandoned mines are present and trees ≥ 3 inches dbh cannot be avoided. If implementation of seasonal tree cutting is not feasible for the Project, the USFWS recommends a summer presence/absence survey be conducted between June 1 and August 15 in coordination with the Ohio Field Office. Approximately 1 acre of tree clearing is anticipated for the Project; however, a desktop assessment conducted prior to the field survey identified no potential hibernacula within a 0.5-mile radius of the Project. Nottingham Solar LLC will adhere to seasonal tree clearing restrictions between October 1 and March 31; therefore, impact to these species are not anticipated.

Based on the nature of the proposed Project activities and habitat characteristics of the surrounding vicinity, construction impacts to protected species are not anticipated. Nottingham Solar LLC will continue coordination with USFWS and ODNR to mitigate any potential impacts to state and/or federally protected species.

B(10)(f) Areas of Ecological Concern

Provide a description of the applicant's investigation concerning the presence or absence of areas of ecological concern (including national and state forests and parks, floodplains, wetlands, designated or proposed wilderness areas, national and state wild and scenic rivers, wildlife areas, wildlife refuges, wildlife management areas, and wildlife sanctuaries) that may be located within the potential disturbance area of the project, a statement of the findings of the investigation, and a copy of any document produced as a result of the investigation.

On September 20, 2021 and September 14, 2022, wetland and stream delineation surveys were completed by the Company's consultant for an approximately 14.4-acre Environmental Survey Area (ESA) (**Appendix D**). During the September 14, 2022 field survey, one palustrine emergent (PEM) wetland (Wetland NS-24) was identified within the ROW of the Project. No vegetation clearing within the wetland is anticipated. No other impacts to delineated features are anticipated and no other areas of ecological concern were identified within the Project area.

Based on a review of the Protected Areas Database of the United States as well as the Conservation Easement Database, there are no state or national parks, forests, wildlife areas or mapped conservation easements in the vicinity of the Project.

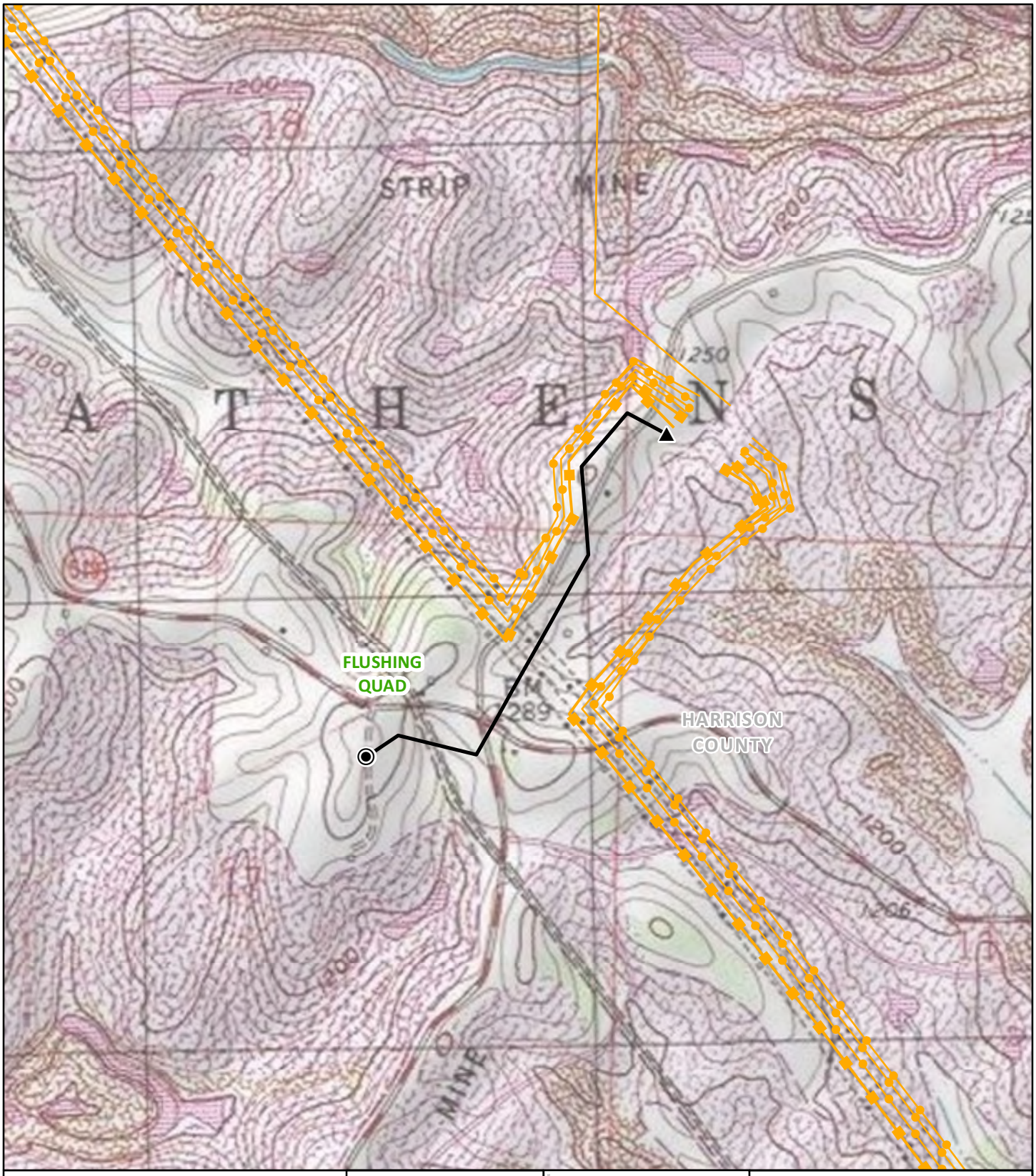
The FEMA Flood Insurance Rate Map was reviewed to identify floodplains/flood hazard areas within the Project area (specifically, map number 39067C3010D). Based on this mapping, no mapped FEMA floodplains are located in the Project area. Therefore, no floodplain permitting is expected required for the Project. There are no other local, state or federal requirements for construction of the Project.

B(10)(g) Unusual Conditions

Provide any known additional information that will describe any unusual conditions resulting in significant environmental, social, health, or safety impacts.

To the best of Nottingham Solar LLCs knowledge, no unusual conditions exist that would result in significant environmental, social, health, or safety impacts.

Appendix A Project Maps



- Existing AEP Substation
- Proposed BQ Energy Substation
- Proposed 138 kV Gen-Tie
- Existing 138 kV Transmission Line
- Existing 345 kV Transmission Line
- Existing 69 kV Transmission Line
- USGS 7.5' Topographic Quad Boundary
- County Boundary

Sources:
Topo Quads (USGS 2013)
Hydrography (USGS 2021)
Transportation (ODOT 2021)
Basemap (USGS 1994)

State Plane Ohio North
NAD 83

October 31, 2022

Figure 1
Project Area

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 500 1,000
Feet

Existing AEP Substation
Proposed BQ Energy Substation
Proposed 138 kV Gen-Tie
Existing 138 kV Transmission Line
Existing 345 kV Transmission Line
Existing 69 kV Transmission Line
Proposed Substation Fenceline
Stream or River
Lake or Pond
Parcel Boundary

Sources:
Imagery (OGRIP 2020)
Hydrography (USGS 2021)
Transportation (ODOT 2021)

State Plane Ohio North
NAD 83

October 31, 2022

Figure 2
Aerial Map

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 200 400
Feet

Appendix B Geotechnical Engineering Study

REPORT

Geotechnical Report - Nottingham Substation

Rev. 1

Submitted to:

Nottingham Solar, LLC
400 Market Industrial Park, Suite 32
Wappingers Falls, New York 12590

Submitted by:

Golder Associates Inc.
5500 Brooktree Road, Suite 102, Wexford, Pennsylvania, USA 15090

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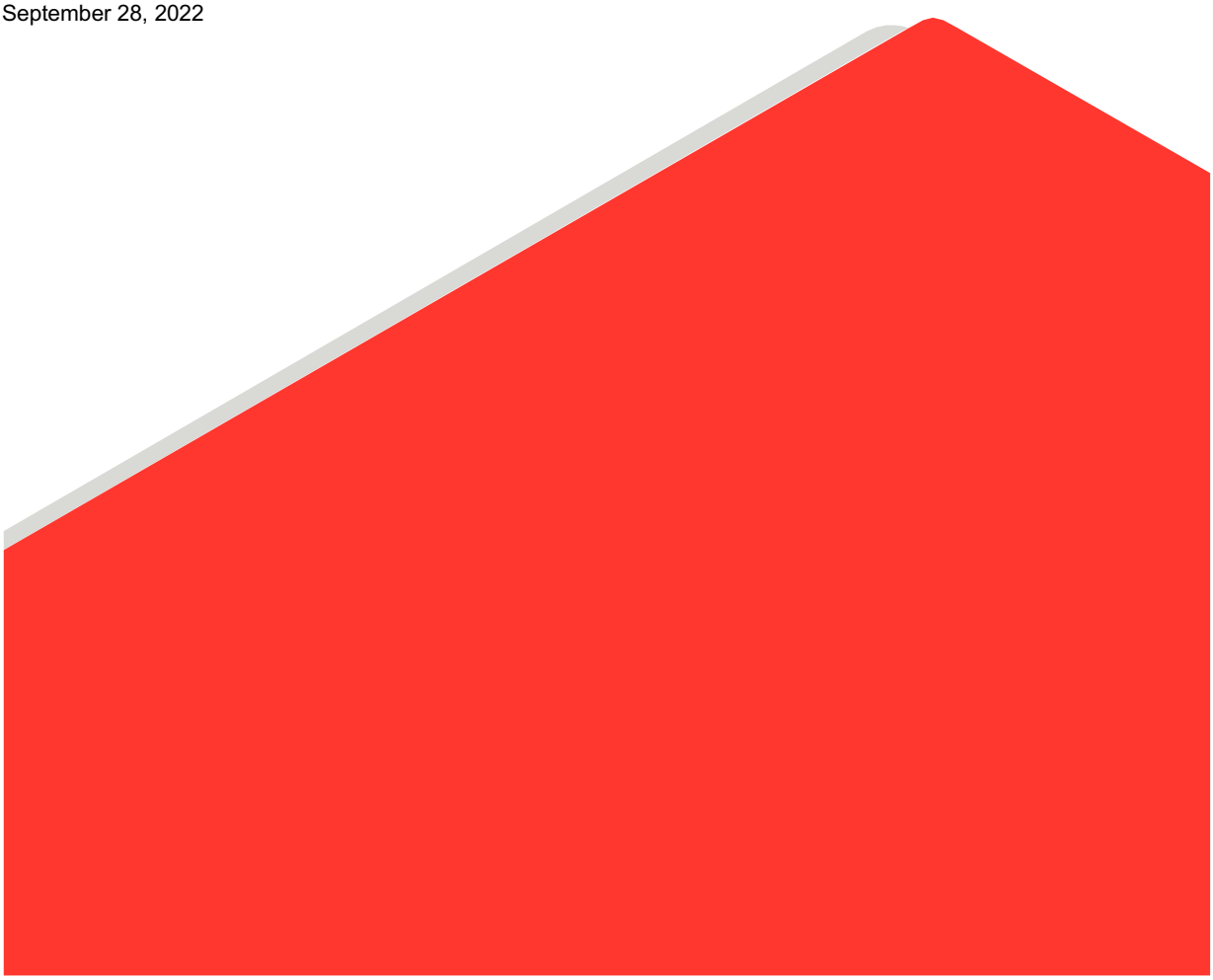
GLA21458932

September 28, 2022



Distribution List

Nottingham Solar, LLC

Golder Associates USA Inc.

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EXECUTIVE SUMMARY

Nottingham Solar LLC (Nottingham Solar) intends to develop a utility-scale 100 megawatt (MW) solar energy facility at the 400-acre Nottingham site located in Harrison County, Ohio. The proposed facility will include the installation of solar panel arrays, buried collection lines, various substations, as well as other ancillary structures. Golder Associates USA Inc. and member of WSP (Golder) previously completed preliminary and interim geotechnical studies to evaluate the geotechnical feasibility of the site for development as a solar facility.

Golder was further retained by Nottingham Solar to conduct a geotechnical investigation program for the proposed Nottingham Substation development, a component of the greater Nottingham Solar development project, located in Athens Township, Harrison County, Ohio. The proposed development includes construction of a new substation area covering about ½ acre of relatively flat terrain. The purpose of this Geotechnical Report is to provide the designer with expected subsurface conditions for the proposed substation development, as well as support their respective design.

This report summarizes the field geotechnical investigation program developed by Barr Engineering Co. (Barr) and conducted by Golder between April 26 and May 5, 2022. The investigation program included a desktop review of local geology and previous land uses, advancing geotechnical boreholes, performing field soil resistivity testing, and developing a geotechnical laboratory testing program including limited thermal conductivity and chemical testing (i.e., corrosivity and sulfates) to support the proposed development. Nine boreholes were advanced during the geotechnical investigation of which four were located in the vicinity of the proposed substation and are the subject of this report. In general, the subsurface conditions encountered in the borings within the substation area consisted of a thin layer of topsoil overlying successive layers of residual soils, weathered rock, and bedrock. Firm bedrock consisting of sandstone overlying shale was encountered at a depth of about 10 feet below the ground surface (feet bgs) within the proposed substation footprint. Bedrock consisting of limestone overlying sandstone was encountered at a depth of about 25 feet bgs in the boring advanced outside of the proposed substation footprint.

The proposed substation equipment can be supported on shallow foundations bearing on approved subgrade consisting of native residual soils or weathered rock. If the allowable bearing capacities or side resistance values are inadequate for shallow foundation support following the determination of final foundation load requirements, the proposed structures can alternatively be supported on deep foundations following the recommendations provided herein.

A preliminary grading plan showing the proposed layout and configuration of the proposed structures and ancillary site components was not available for review at the time of preparing this report. A complete summary of the investigation work, foundation design and site preparation recommendations are further detailed in this report.

1.0 INTRODUCTION

Golder Associates USA Inc. a member of WSP (Golder) is pleased to submit this Geotechnical Engineering Report to Nottingham Solar LLC, a wholly owned subsidiary of BQ Energy Development (Nottingham Solar), in connection with the geotechnical engineering design of the proposed Nottingham Substation facility in Athens Township, Harrison County, Ohio. This report focuses on a component of the greater Nottingham Solar development which includes a new substation comprising about ½ acre. A supplemental report will be provided describing the findings from the geotechnical exploration conducted for the proposed gen-tie (generation intertie) transmission line pole structures, which was completed concurrently with the geotechnical exploration for the substation area as described herein. See Figure 1 for the Site Location Map.

This report also supplements previous feasibility level and intermediate geotechnical studies completed by Golder for the greater Nottingham Solar development. The proposed development plans include a utility-scale 100 megawatt (MW) solar energy facility, which will include the installation of solar panel arrays, buried collection lines, various substations, as well as other ancillary structures.

Golder understands that Barr Engineering Co. (Barr) was contracted directly by Nottingham Solar, and serves as their primary (i.e., lead) design consultant for the subject project. Golder has coordinated and maintained project communications with Nottingham Solar and Barr during the design process on the subject project, as appropriate.

A preliminary grading plan showing the proposed layout and configuration of the proposed structures and ancillary site components was not available for review at the time of preparing this report. A complete summary of the investigation work, foundation design and site preparation recommendations are further detailed in this report. Golder's scope of work for this study generally included: performing a subsurface exploration program (drilling test borings and field soil resistivity testing); geotechnical laboratory testing of soil and rock samples; evaluating geotechnical data and performing geotechnical engineering analyses; and preparing this geotechnical report.

1.1 Background

The site (approximate coordinates 40.190131, -81.041042) is located near the center of Athens Township in Harrison County, Ohio, approximately 6.2 miles southwest of Cadiz and 2.4 miles west of New Athens, Ohio. The proposed Nottingham Substation footprint comprises approximately ½ acre located within a grassy field approximately 350 feet south of State Route 519 (Stumptown Road), bounded between two generally parallel pipeline right-of-way's (ROW's) owned and operated by Dominion Energy to the northeast and Energy Transfer to the southwest. Wooded vegetation is present northwest of the proposed substation location, between the two adjacent pipeline ROW's.

Harrison County and the New Athens, Ohio area have a long history of coal mining. Mining, including both underground and surface, has been occurring in this area for more than 100 years. Mine maps archived by the Ohio Department of Natural Resources (ODNR) indicate that the general site area has a history of various stages of surface mining (i.e., mountain top, contour mining, or area mining), auger mining, as well as underground mining. The Nottingham area was predominantly surface mined and has been partially reclaimed to form a flat to rolling terrace on the otherwise consistently sloping hillsides. Refer to the interim geotechnical report completed for the Nottingham Solar Facility (Golder 2022) for a detailed review of the mining history and reclamation in the general area of the site. The proposed substation footprint is located within an area without prior mining, though the location is near lands that were formerly surface mined for coal as further described herein.

1.2 Proposed Construction

Golder understands that the subject phase of the Nottingham development will include a new substation and multiple gen-tie transmission line pole structures connected through overhead cable tensioned conductors with 138 kV and 34.5 kV group operated switches. Golder understands the transmission line structures within the substation area will likely consist of a take-off mast consisting of an H-Frame or static masts consisting of mono poles supported on drilled shafts (i.e., piers). The proposed substation equipment will reportedly consist of various circuit breakers, pad mounted transformers, and other substation components supported on rolled steel structures, which are anticipated to consist of hollow structural sections. Golder understands the substation equipment will likely be supported on shallow foundations consisting of either concrete mats/slabs, isolated spread footings, or continuous strip footings.

2.0 GEOLOGY AND LAND USE

The region is marked by hilly terrain of a maturely dissected plateau having rounded uplands and moderate to steep valley slopes. The drainage system is widespread and distinctly dendritic. The site is located within the Appalachian Plateau in the sub-set Allegheny and Marietta Plateau physiographic province. Within the area local to the project site, the Appalachian Plateau is comprised of Permian-Pennsylvanian-age, Dunkard Group through Monongahela Group, flat-lying, fine grained rocks with minable coal. Local bedrock consists of non-marine cyclic sequences of sandstone, siltstone, shale, as well as limestone and the known Pittsburgh (No. 8) and Meigs Creek (No. 9) coal beds. Refer to the preliminary geotechnical report completed for the Nottingham Solar Facility (Golder 2021) for additional information on the geologic setting in the general area of the site.

2.1 Mining

Mining is prevalent within Harrison County and Athens Township, Ohio, with mining of the Pittsburgh (No. 8) and Meigs Creek (No. 9) coal seams commonly occurring. The ODNR database has records of surface and underground mining of these seams extending through much of the county and Athens Township.

A review of available information indicates that areas outside of the proposed substation footprint had been extensively surface and deep mined of the Pittsburgh (No. 8) and Meigs Creek (No. 9) coal beds over several intervals from the 1960s (or earlier for some areas of the property) to as recent as between 2006 and 2007. This includes surface area (strip)[1] mining in most directions surrounding the proposed substation, and highwall[2] mining at the base of highwalls in areas south of State Route 519. The area south and west of the proposed substation footprint is mapped as having been auger mined with buried highwalls which extended to the floor of the Meigs Creek (No. 9) coal bed elevation. An excerpt of the D-2100 mine map, which includes the boring locations overlain on the map, is shown below. The full permitted mine map for the area surrounding the site, including a legend identifying features shown on the mine map excerpt, is included as Figure 3.

[1] Practice of mining a seam of mineral, at this site coal, by first removing a long strip of overlying soil and rock (the overburden) to reach and extract the coal. Strip mining occurring where a hillside is excavated a from the slope face typically creates a highwall.

[2] A steep slope carved by mining operations into the hillside above the stripped area, largely through bedrock,

Boring Overlay – Permitted Mine Map (D-2100) Excerpt

3.0 SITE INVESTIGATION

Barr developed specifications (Barr 2022) and criteria for completing a geotechnical investigation at the project site. The specifications package included nine proposed boring locations of which four were located in the vicinity of the proposed Nottingham Substation and are the subject of this report. These four borings (NB-1 through NB-4) were subsequently relocated by Barr to alternate locations than indicated in the specification package due to minor layout adjustments to the proposed substation. Golder conducted the site-specific subsurface exploration program developed by Barr in general accordance with the criteria and specifications provided in the Barr specifications package. A boring location plan is included as Figure 2.

The primary objective of the site-specific subsurface exploration program was to evaluate soil, bedrock, and groundwater conditions for this phase, including classifying and testing soils to estimate engineering properties, establish the elevation at the top of bedrock, and observe the layering and rock types for a nominal depth below the expected bottom of potential foundation support options to be considered for the proposed structures.

3.1 Subsurface Exploration Program

Four (4) boreholes were advanced in the vicinity of the proposed substation area between April 26 and April 27, 2022, to explore, characterize, and describe the subsurface conditions. The boreholes were advanced to depths below the ground surface (bgs) ranging from about 20 feet to 35 feet. A minimum of 10 feet of bedrock was cored in each of the boreholes to verify overburden thickness and generalize subsurface profiles across the proposed substation area. The depths explored were considered adequate for the proposed structures after encountering and confirming the presence and depth of bedrock beneath the site. A boring location plan is

provided as Figure 2 and the borehole logs are provided as Appendix A. The approximate as-drilled borehole locations and depths for the substation area are summarized in the table below.

Table 1: General Borehole Information

Borehole ID	Latitude	Longitude	Ground Surface Elevation (ft)	Depth to Bedrock (ft)	Total Depth (ft)
NB-1	40.190051	-81.041070	1315	10.5	20.5
NB-2	40.189897	-81.041009	1318	10.2	20.7
NB-3	40.189965	-81.040876	1316	10.2	20.3
NB-4	40.190534	-81.039977	1302	25.1	35.1

The subsurface exploration program generally included the following:

- Located the borehole locations with a handheld GPS and cleared each location of buried utilities using geophysical methods including Ground Penetrating Radar (GPR) and Radiodetection.
- Geotechnical boreholes advanced by DLZ American Drilling, Inc. (DLZ) of Bridgeville, Pennsylvania using a CME 55 track-mounted drill rig and hollow stem auger (HSA) drilling techniques. Boreholes were advanced to auger refusal, at which point bedrock samples were extracted utilizing NQ diamond rock coring methods.
- Standard 2-inch diameter split-spoon soil samples were collected at 2.5-foot intervals until auger refusal was met. Representative disturbed soil samples were collected for classification, future inspection, and geotechnical laboratory testing.
- Standard Penetration Test (SPT) measurements were collected in accordance with ASTM D1586, and the corresponding N-values (i.e., blow counts) were recorded on the borehole logs. The SPT N-value is defined as the number of blows required to advance a 2-inch outer diameter (O.D.) split-spoon sampler 1 foot into the underlying soil using a 140-pound hammer free-falling 30 inches. The blow counts are recorded in 6-inch increments, and for the 24-inch-long split-spoon samplers used for this project, the initial and final 6-inch intervals are disregarded and the blow counts for the middle two 6-inch intervals are combined to form the N-value. These N-values provide a measure of the compactness of granular soils or the stiffness of cohesive soils.
- Collected disturbed soil samples were visually classified in the field, in accordance with Golder's Soil Description System, and appropriate soil descriptions were noted on the borehole logs (see Appendix A for borehole logs and classification summary).
- Continuous NQ diameter rock core samples were collected from auger refusal depths to boring termination. Rock core samples were preserved in wooden boxes for future inspection, classification, and rock strength testing.
- In each boring, a minimum of 10 feet of rock core was cut and examined for in-situ bedrock confirmation beneath the native site soils.
- Rock core samples were visually classified and logged in the field, and the core recovery and Rock Quality Designation (RQD) were measured in accordance with ASTM D6032.
- Where encountered, groundwater levels were noted during field operations.

- Upon completion of each boring, the boreholes were left open for delayed water level measurements. All borings were backfilled (infilled) with a mixture of grout and/or bentonite chips and the drill cuttings at the end of the drilling program.
- Collected representative photographs of the field activities and samples, as appropriate.

3.2 Soil Resistivity Testing

Golder collected soil resistivity testing at two test lines within the substation as directed by Barr. The proposed layout provided by Barr was modified in the field due to the proximity of the two natural gas pipeline ROWs encountered with the original proposed plan. Golder modified the distances based on communication with the Barr engineer. The results of the data are located on the field data sheets in Appendix C.

4.0 SUBSURFACE CONDITIONS

In general, the subsurface conditions encountered in the borings within the proposed substation area consisted of a thin layer of topsoil overlying successive layers of residual soils, weathered rock, and bedrock as further described in the following sections.

4.1 Surface Materials

Topsoil was encountered at the ground surface in each of the boreholes. The topsoil layer was generally found to be approximately 6 inches thick with localized thicker topsoil up to 12 inches thick within the wooded area in the vicinity of boring NB-4.

4.2 Residual Soils

Exploration into the ground beneath the planned substation area encountered in-situ residual soils beneath the topsoil. The residual soils encountered within the proposed substation footprint (NB-1 through NB-3) extended to depths ranging from about 2.5 to 10 feet bgs and consisted of predominantly silty sand (SM) with SPT N-values (excluding the upper 2 feet) ranging from 21 to 58 blows per foot, indicating a compact to very dense in-situ condition.

Residual soils encountered in the boring advanced outside of the proposed substation footprint (NB-4) extended to a depth of about 15 feet bgs and consisted of predominantly silty sand (SM) overlying sandy clay (CL) with SPT N-values ranging from 9 to 58 blows per foot, indicating a compact (coarse-grained) or stiff to hard (fine-grained) in-situ condition. These soils were generally found to be moist. A static groundwater level was not encountered in the borings explored beneath the proposed substation area (see Section 4.6).

4.3 Weathered Rock

Weathered rock, sampled as soil, was encountered beneath the residual soils in each of the borings. The weathered bedrock consisted of highly to slightly weathered sandstone, shale, and claystone and was found to be very dense or hard as indicated by successive intervals of split-spoon refusal (e.g., greater than 50 blows per 6-inch interval of penetration). A thin weathered coal seam was encountered in boring NB-4 at a depth of 15 feet bgs. Each boring was advanced through the weathered bedrock until auger refusal was met and rock coring was performed.

4.4 Bedrock

A minimum of 10 feet of bedrock was cored in each of the boreholes following auger refusal. Firm bedrock was encountered within the proposed substation footprint (NB-1 through NB-3) at a near uniform depth of about 10 to 10.5 feet bgs, corresponding to approximate Elevation (El.) 1305 feet to El. 1308 ft-amsl. Bedrock consisted of highly weathered to fresh sandstone overlying moderately weathered to fresh shale. Core recoveries ranged

from 30% to 100% and averaged about 88% while RQD values ranged from 0% to 73% and averaged about 34%.

Firm bedrock was encountered outside of the proposed substation footprint (NB-4) at a depth of about 25 feet bgs, corresponding to approximate El. 1277 ft-amsl. Bedrock consisted slightly weathered to fresh limestone overlying fresh sandstone. Core recoveries were 100% while RQD values ranged from 51% to 100%.

4.5 Groundwater

A static groundwater level was not encountered in the borings advanced in the vicinity of the proposed substation. Hydrologic data was collected from the site during and following drilling through water level measurements taken in open boreholes, general site observations, and observations of moisture content changes across samples during SPT sampling. Water level measurements taken after rock coring are mainly useful as indications of soil permeability, and fracture prevalence and should not be used in themselves as indications of in-situ groundwater, because water is introduced to the borehole during the coring process. While groundwater was not encountered prior to rock coring, water level measurements after rock coring were recorded at depths between approximately 3 to 5 feet bgs in each of these boreholes (NB-1 through NB-4), indicating a likely lower permeability of the native material.

Groundwater depths provided herein should only be considered to represent approximate measurements collected at the time of the drilling program. Groundwater conditions can vary substantially over time, due to seasonal variations in precipitation. Because the site investigation was completed in the late spring where seasonal rainfall and thus groundwater levels generally peak in the region, it is likely the groundwater conditions encountered in the borings represent a more conservative scenario of typical groundwater fluctuations beneath the site.

5.0 LABORATORY TESTING PROGRAM

Selected soil and rock core samples were transported to Geotechnics, Inc. geotechnical laboratory of East Pittsburgh, Pennsylvania, where the soil and rock core samples were further examined and tested to assist with classification and obtain selected engineering properties. Laboratory work was performed in accordance with applicable American Society for Testing Materials (ASTM) testing procedures, where applicable. The soil and rock test results are summarized in the tables below and provided in Appendix B.

Table 2: Soil Laboratory Index Test Results

Borehole ID	**Depth (feet bgs)**	Moisture Content (%)	Percent Passing No. 4	Percent Passing No. 200	Clay Fraction (%)
NB-1	2.0-10.0	14	99	43	-
NB-1	2.5-4.5	12	97	34	17
NB-2	5.0-6.2	9	96	30	-
NB-3	2.0-8.0	10	95	34	-
NB-3	2.5-4.5	9	81	22	-
NB-4	2.5-4.5	12	91	23	-
NB-4	7.5-9.5	13	97	64	25
NB-4	17.5-18.8	16	99	70	35

Table 3: Moisture-Density Relationship (Standard Proctor)

Borehole ID	Depth (feet bgs)	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)
NB-1	2.0-10.0	116.2	13.5

Table 4: Rock Core Laboratory Test Results

Borehole ID	Depth (feet bgs)	Unconfined Compressive Strength (lb/in^2)	Rock Type
NB-1	10.9-11.5	2,440	Sandstone
NB-4	26.0-26.6	3,540	Limestone

5.1 Corrosion Properties

Representative soil samples from the upper roughly 2 to 10 feet of sampled soil collected from two of the borings (NB-1 and NB-3) were evaluated for their corrosion potential, including pH, electrical resistivity, soluble chloride content, sulfate content, sulfide content, and oxidation reduction potential (see Table below for a summary of the laboratory test results). Following the "10-Point System" as outlined in the American Water Works Association C105-10 and ASTM A888 Table X.2 (ASTM International, 2020), the corrosion potential of the soils was evaluated. Although the "10-Point System" is specific to cast-iron pipe, the results are a useful indication of corrosion potential. Points are assigned for various soil parameters including soil resistivity, pH, oxidation reduction (redox) potential, sulfide content, and moisture condition. If the number of points exceed 10, the soil is considered corrosive to cast iron pipe. For the two soil samples tested, no points were given for soil resistivity, pH, or redox potential. Some sulfides were noted above the threshold, and the upper site soils were generally moist, so the total points for both representative soil samples were 4.5. This is below the value of 10 points; therefore, the site is not considered corrosive to iron pipe.

AASHTO (2020) considers site conditions to be corrosive when soil resistivity is less than 2,000 ohm-cm, pH is less than 5.5, pH is between 5.5 and 8.5 in soils with high organic content, sulfate concentrations greater than 1,000 ppm (1,000 mg/L), and if the chloride content is greater than 500 ppm in water. Based on the test results from representative soil samples, the site is non-corrosive following AASHTO guidance. No special recommendations are needed for the type of cement or admixtures that should be used for concrete in contact with the soil at the site based on the corrosion test results.

Table 5: Corrosion Suite Laboratory Test Results

Borehole ID	Depth (feet bgs)	Chloride Content (mg/L)	Soil pH	Minimum Resistivity (ohm-cm)	Sulfate Content (ppm)	Sulfide Content (mg/Kg)	Redox Potential (mV)
NB-1	2.0-10.0	14	6.7	8,100	29	24	250
NB-3	2.0-8.0	14	7.1	18,000	14	30	250

5.2 Thermal Conductivity

Thermal conductivity testing was completed in accordance with ASTM D5334 on two representative samples obtained from borings NB-1 and NB-3 at depths between 2.5 and 4.5 feet bgs. Golder understands that cables will likely be buried at a depth of approximately 4 feet bgs. The subsurface materials present at this depth across

the substation footprint consisted of predominantly silty sand (SM). The thermal conductivity of the soils was tested to be 0.387 and 0.136 Watts per meter degree Kelvin for borings NB-1 and NB-3, respectively. The laboratory test results are provided in Appendix B.

6.0 GEOTECHNICAL EVALUATIONS

6.1 Seismic Considerations

The International Building Code (IBC 2009) and the United States Geologic Survey (USGS) provide six Site Class definitions in Table 1613.5.2 that range from hard rock (A) to potentially unstable soil (F). Each site class definition is described by the average shear wave velocity, standard penetration resistance, or soil undrained shear strength in the top 100 feet of the site subsurface profile. A minimum of 10 feet of bedrock was cored in each of the boreholes; thus, bedrock was assumed to extend from the termination depths to 100 feet for the evaluation of seismic site class. Based on the subsurface borings completed for this exploration and the depth to bedrock encountered across the site, Golder recommends the proposed structures be designed using the following seismic parameters.

Table 6: Seismic Design Parameters

Seismic Design Parameters	Substation
Site Class	C
0.2 Second Spectral Response Acceleration, S_s	0.093g
1.0 Second Spectral Response Acceleration, S_1	0.049g
0.2 Second Seismic Coefficient, F_a	1.3
1.0 Second Seismic Coefficient, F_v	1.5

The above ground motions should be adjusted for site class effects using the provided seismic coefficients. Based on the nature and consistency of the subsurface materials and the relatively low potential for strong ground-motion (relatively low ground accelerations), liquefaction is considered unlikely, though has not been evaluated for this project.

6.2 Foundation Recommendations

6.2.1 Frost Depth

A review of the 2017 Ohio Building Code (OBC 2017) indicates in Section 1809.5 that the design frost depth is governed by the local jurisdiction. Within Harrison County, Ohio, the frost depth is mapped as approximately 36 inches below the ground surface. As such, Golder recommends a frost depth of 36 inches (3 feet) or deeper be used for structural foundation design for adequate protection against frost heave. Any structure that is susceptible to differential movement should be supported on a foundation placed on granular soils and designed with an appropriate embedment for frost penetration. In general, the higher the fines (<#200 sieve) content, the more susceptible the soil is to ice lenses and frost heave. If the foundation bearing elevation for a frost susceptible structure is founded within native residual soils (silty sand), we recommend over-excavation of the naturally deposited frost susceptible soils and replacement with non-frost susceptible granular fill.

6.2.1.1 Adfreeze Consideration

Considering the site location and subsurface conditions encountered in the borings, the potential for frost heave should be considered in the design of deep foundations. As discussed above, fine-grained soils or granular soils with a high fines content are susceptible to frost heave due to entrapped moisture being unable to infiltrate or evaporate prior to freezing. This consequently begins to create ice lenses that latch onto the embedded

structures, followed by ice-jacking due to frost heave. This is commonly referred to as adfreeze stress, which can be considered as an external, upward force applied to the foundation. The magnitude of the upward force is dependent on the thickness of the frost susceptible material, the interface bond stress between the foundation and the surrounding material, and the surface area of the structure in contact with the bond stress.

Golder recommends that an adfreeze (uplift) stress with an appropriate uplift resistance factor and appropriate for the soil types in contact with the embedded materials (e.g., buried wood, steel, or concrete) be considered in the design of deep foundations as final foundation loads, material types, and dimensions are established. Near surface soils encountered in the proposed substation area consisted of predominantly silty and clayey sands.

6.2.2 Shallow Foundations

Golder understands that electrical substation equipment and other components of the substation will likely be supported on concrete pads installed at grade and/or on shallow foundations, as suitable following the determination of final foundation loads for individual components. The proposed substation equipment can be supported on individual spread footings, continuous strip footings, or mat/slab foundations as appropriate for substation equipment size, configuration, and load distribution, bearing on native residual soils or weathered bedrock. Bearing capacity is typically governed by a limiting value of allowable settlement and serviceability of the structure being built. Net allowable bearing capacities were developed based on interpretation of the subsurface conditions encountered in the borings, evaluation of the laboratory test results, and the provisions provided in Table 1806.2 of the 2017 Ohio Building Code (OBC 2017). The soil parameters provided in the following table should be considered for design purposes within the substation area.

Table 7: Allowable Bearing Capacity and Soil Design Parameters

Depth (feet bgs)	Material	Total Unit Weight	Friction Angle	Cohesion	Allowable Bearing Capacity	Allowable Side Resistance
0-3	Topsoil & Clay (frost zone)	100 lb/ft^3	26°	0 lb/ft^2	N/A	N/A
3-8	Residual Soil (SM)	120 lb/ft^3	32°	0 lb/ft^2	2,000 lb/ft^2	150 lb/ft^2
8-10	Weathered Rock	130 lb/ft^3	36°	0 lb/ft^2	3,000 lb/ft^2	250 lb/ft^2

Footings should be a minimum of 18 inches wide for continuous strip footings and 24 inches wide for individual spread footings. If unsuitable soft or wet soils are present at the foundation bearing elevation, the material should be over-excavated and replaced with a granular structural fill such as ODOT Item # 703.05 or AASHTO #57 clean crushed stone. A geotextile fabric meeting the requirements of ODOT Table 712.09 (Type D) for subgrade separation should be used between the native material and structural fill. All footings constructed adjacent to utility trenches should bear below an imaginary 1H:1V plane projected upward from the bottom of the adjacent trench. Water control measures for foundation excavations are described in Section 7.5.

Lateral loads may be resisted by a combination of passive pressure on the vertical faces of the footings and friction between the bottoms of the foundations and the underlying bearing material. For mass concrete placed against newly placed fill or existing soils, a coefficient of sliding friction of 0.35 can be used for frictional resistance to lateral loads.

Uplift loads may be resisted by the weight of the foundation and overlying soil. The contribution of the soil resisting uplift can be estimated using the weight of a soil wedge above the footing within an angle of 20 degrees

from the vertical portion of the wedge. The weight of the footing plus the weight of the soil within the wedge can be used to resist uplift. A unit weight of 130 pounds per cubic foot (pcf) for granular structural fill should be used above the design groundwater level and a buoyant unit weight should be used below the design groundwater level (although not anticipated). If the weight of these is inadequate to provide the necessary uplift resistance, deep foundations such as drilled shafts may be used alternatively as further discussed herein.

Concrete pads and mat foundations should be designed for a modulus of subgrade reaction of 100 pounds per cubic inch (pci). Concrete pads planned to be supported at grade should be over-excavated and replaced with a minimum 24-inch-thick layer of granular structural fill or crushed stone placed over geotextile separator fabric and bearing on native residual soils or weathered rock. As further discussed above, any structure that is susceptible to differential movement should be supported on a foundation placed on granular soils, designed with an appropriate embedment for frost penetration.

6.2.3 Lateral Earth Pressures

Permanent below-grade walls and foundations should be designed to resist at-rest lateral earth pressures. Retaining walls that are free to deflect laterally may be designed for active earth pressure (soil unit weight times the active lateral earth load coefficient). Where excavations for walls are made by sloping the excavation sides at 1H:1V or flatter, the earth loads should be determined based on the backfill material properties, whereas for steeper or vertical excavations, the lateral earth loads should be based on the in-situ material properties as summarized in the following table.

Table 8: Lateral Earth Pressure Design Parameters

Material	Total Unit Weight	Friction Angle	K_o	K_a	K_p
Topsoil & Clay	100 lb/ft^3	26°	0.56	0.39	2.56
Residual Soil (SM)	120 lb/ft^3	32°	0.47	0.31	3.25
Weathered Rock	130 lb/ft^3	36°	0.41	0.26	3.85
Granular Structural Fill	130[3] lb/ft^3	34°	0.44	0.28	3.53

Backfill placed immediately behind below-grade walls should consist of free draining material with subsurface drains incorporated into the backfill to reduce the potential for hydrostatic pressures acting on the wall face. Surcharges due to dead loads (such as the foundations of adjacent structures) and live loads (such as vehicular traffic) should also be considered when estimating loads on permanent structures. Groundwater and surface water control measures for foundation excavations are further described in Section 7.5.

6.2.4 Deep Foundations

Structures with significant ground line shear forces and overturning moments may be supported on deep foundations. Golder understands through coordination with the project team that deep foundations are anticipated for transmission line structures within the substation area and will likely consist of masts supported on drilled shafts.

6.2.4.1 Drilled Shafts

The design load carrying capacity may be developed through a combination of side resistance along the perimeter of the shaft and through end bearing at the base of the shaft. Allowable side resistance parameters for bedrock units were also developed should additional load carrying capacity necessitate the use of rock

[3] If clean poorly graded aggregate is utilized (i.e., AASTHO No. 57), then a unit weight of 115 pcf should be utilized.

sockets. Minimum embedment depths for drilled shaft foundations should be at least 4B, where B is equal to the shaft diameter.

Design parameters were developed in accordance with the procedures detailed in the American Association of State Highway and Transportation Officials (AASHTO) Load-and-Resistance Factor (LRFD) Design Specifications for foundations (AASHTO 2020). The following table provides soil and rock parameters for use in drilled shaft design. The upper three (3) feet of overburden should be neglected for side resistance due to the high fines content near the surface and its proximity to the atmosphere.

Table 9: Drilled Shaft Design Parameters

Material	Max Allowable Side Resistance		Max Allowable Tip Bearing Pressure (ksf)
	Side Shear (psi)	Uplift (psi)	
Native Soil	3.1	2.5	8
Shale	33	24	9
Sandstone / Limestone	50	36	38

Temporary casing may be required to stabilize the shaft excavations through the overburden materials. The temporary casing would retain the sides of the shaft only long enough for concrete placement and then be removed once the concrete reaches a level sufficient to withstand ground and groundwater pressures. Permanent casing would require approval from the engineer due to the casings effect on the axial and lateral design parameters provided herein. All casings should be free of soil, lubricants, and other deleterious materials detrimental to the integrity of the drilled shafts. Depending on final shaft lengths and construction methods, casings should be sealed at the top of rock to allow dewatering, as necessary, prior to concrete placement.

Groundwater was not encountered in any of the borings advanced within the substation area and dewatering of shaft excavations is not anticipated to facilitate drilled shaft construction. Dewatering requirements would depend on the depth and groundwater conditions at the time and location of construction. Prior to steel reinforcement and concrete placement, water, debris, drill cuttings, and/or sloughed material should be removed from the bottom of the shafts. Concrete placement methods should be approved by the engineer and may require modification based on conditions encountered during shaft installation. Water entering the shaft excavation should be pumped such that less than 3 inches remains at the bottom of the shaft.

The shaft bottom should be cleaned of all debris and loose material prior to placement of reinforcing steel and concrete. The steel reinforcement and concrete mix should be designed in accordance with the 2015 International Building Code (IBC) allowable stress requirements presently adopted in the State of Ohio. Minimum concrete 28-day compressive strength should be 4,000 psi.

As appropriate and when possible, shafts should be installed with a center-to-center spacing of at least three diameters such that group effects can be neglected, and the total capacity of the shaft group can be taken as the sum of the capacities of individual shafts. When closer installation of the shafts is required, the lateral capacity of the group is not equivalent to the lateral capacity of an isolated individual shaft times the number of shafts in the group. Only those shafts that are unobstructed by the other shafts in the direction of the force develop full capacity. For shaft groups with a shaft spacing of three shaft diameters center-to-center, a multiplier of 0.8 should be used for the lead row of shafts, 0.4 for the second row, and 0.3 for the third and subsequent rows, as appropriate. The efficiency of the shaft group is dependent on the shaft layout in the group but would typically be on the order of 75 percent of a single shaft for a shaft spacing of three shaft diameters. The shaft group effect increases significantly for closer spacing, resulting in lower efficiency.

6.2.4.2 Lateral Resistance

Large-diameter drilled shafts should develop lateral resistance from the passive pressure acting on the upper portion of the shafts and their structural rigidity. The lateral capacity of the drilled shafts depends on the element stiffness, the strength of the surrounding soil, vertical load on the element, the allowable deflection at the top of the element, and the allowable moment capacity of the element. Recommended lateral resistance soil and rock parameters for use in the software program LPile to model the lateral response for the structure foundations are provided in Table 11, which is included as a separate attachment.

The upper three feet of overburden should be neglected for lateral and side resistance due to the high fines content near the surface and its proximity to the atmosphere. The geotechnical parameters were determined based on local engineering experience, evaluation of the laboratory test results, and through empirical correlation to the average of the N-values encountered in the borings for the different soil layers. As lateral loads are the driving force on the pole structures, a lateral load test should be considered for deep foundations to verify lateral resistance of the pile/shaft in accordance with ASTM D3966 for deep foundations under lateral load.

6.2.5 Settlement

The proposed substation footprint is underlain by approximately 10 feet of predominantly granular native soils overlying bedrock. The predominantly granular soils are generally not anticipated to experience significant long-term settlements following increased loading and most of the settlement is anticipated to occur during or shortly after construction. Golder understands that the equipment to be placed on concrete pads and/or shallow foundations will be relatively lightly to moderately loaded. If the recommended bearing pressures and subgrade preparation work described herein are used for design and verified during construction, Golder estimates that total settlements will be less than 1 inch and differential settlements of adjacent structural elements will be less than ¾ inch.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Site Preparation

The upper roughly six (6) inches of material contains, topsoil, roots, and other deleterious materials such as grass and plant matter. Topsoil should be stripped prior to earthwork and any fill placement for the proposed substation and other ancillary components. All clearing activities should be performed in strict accordance with the approved soil erosion and sediment control plan prepared for the project.

Clearing and grubbing of all trees (including the removal of any associated root networks) and vegetation designated for removal should be performed prior to earthwork and any fill placement. All trash/debris, trees, vegetation, organic matter, and other deleterious materials should be properly disposed off-site in accordance with applicable local regulations.

7.2 Subgrade Preparation

After rough grades have been achieved and before any fill is placed in fill areas, the exposed excavated surfaces should be visually observed and probed for the presence of fill, organic soils, carbonaceous shales, coal, extremely weak bedrock (i.e., claystones), and any other unsuitable, deleterious materials, which would require additional removal. Exposed excavated surfaces should also be visually observed for the presence of seeps and seep producing strata (e.g., carbonaceous shale and colluvium), which should be controlled as described herein.

Once the required site clearing activities have been completed, the exposed subgrade surface should be proof-rolled (i.e., compacted) with heavy rubber-tired vehicles, such as a 20-ton fully loaded tandem axle dump truck or equivalent, to identify the potential presence and extent of any additional soft, loose, or otherwise unsuitable

materials. The proofrolling should involve overlapping coverages in mutually perpendicular directions. If noticeable pumping, yielding, or rutting is observed, or pockets of unsuitable materials are identified, these materials should be removed and replaced with well-compacted structural fill.

All shallow foundation subgrade materials should be proofrolled and compacted to at least 98% of the maximum dry density (in accordance with ASTM D698) using a walk behind vibratory smooth drum roller or equivalent prior to placement of any structural fill or foundation concrete. Any fill materials placed should be carefully moisture conditioned to within 2 percent of the optimum moisture content to facilitate compaction. Any soft subgrade materials encountered during proofrolling or compaction should be removed and replaced with well-compacted structural fill in accordance with the recommendations provided herein.

A qualified geotechnical engineer or inspector should approve prepared subgrade prior to foundation construction or structural fill placement. The approved foundation subgrade should be protected from inclement weather, disturbance from construction equipment, and foot traffic prior to concrete placement. Proper care should be taken to avoid ponding of water or the accumulation of snow, ice, trash, or other debris within approved subgrade areas.

7.3 Excavation Methods

Excavations will be required to install buried conduits and construct shallow foundations for the proposed substation equipment. Excavations are anticipated to occur in native residual soils (silty sand) and weathered rock derived from sandstone, and conventional earth moving equipment should be capable of excavating the subsurface soils. These soils are primarily cohesionless, therefore some raveling of excavations should be anticipated as the soils become drier or are eroded by moisture fluctuations. Safe excavation slopes are the responsibility of the contractor and should be adjusted to suit the angle of repose displayed by the materials at field moisture levels at the time of construction. All excavations should comply with OSHA regulations for excavation safe work practices (29 CFR 1926.652).

All utility trenches created for buried conduits should be effectively sealed to restrict water intrusion and flow along the trenches. Golder recommends capping utility trenches with a minimum 12-inch-thick layer of clayey soil to construct an effective trench seal.

7.4 Fill Materials and Placement

The onsite soils are generally granular but occasionally contain a significant percentage (>20%) of fines (minus #200 sieve) and therefore can be susceptible to frost heave. Fill soils used beneath concrete pads or foundations should consist of a granular structural fill such as the gradation provided for ODOT Item # 703.05 for fine aggregate or AASHTO No. 57 clean crushed stone. A geotextile fabric meeting the requirements of ODOT Table 712.09 (Type D) for subgrade separation should be used between native material and imported structural fill. The onsite soils not meeting the gradation criteria would be considered acceptable for general fill placed outside the substation pad or foundation limits.

Maximum dry density and the optimum moisture content should be established for all materials to be placed as fill in accordance with ASTM D698 (Standard Proctor) for structural and general fill. All fill materials should be conditioned to within 2 percent of their optimum moisture content, placed in required horizontal lifts of uniform loose thickness and compacted in accordance with the following criteria:

Table 10: Fill Placement Criteria

Location	Fill Type	Maximum Loose Lift Thickness (inches)	Minimum Compaction Effort
Under Concrete Pads & Backfill Against Foundations	Structural	6	98% Standard Proctor
Outside Concrete Pad & Pavement Limits	General	12	92% Standard Proctor

Backfill placed within five feet of below grade walls or within areas of limited maneuverability should be compacted with handheld or walk behind compaction equipment to avoid imposing excessive lateral earth pressures onto the wall structures. No fill material should be placed on areas where free water is standing, on frozen subgrade areas, or on surfaces which have not been approved by a qualified geotechnical engineer or inspector. All newly placed fill should be tested for compliance with the project criteria for compaction using a nuclear densometer in accordance with ASTM D6938.

7.5 Groundwater and Surface Water Control

Effective drainage should be provided during construction and maintained throughout the life of the facility. Temporary drainage controls should be implemented, as necessary, by the contractor to intercept and direct surface water runoff away from all excavation and other critical areas. Infiltration of water into foundation excavations must be prevented during construction. Water permitted to pond next to the foundations can result in greater soil movements than those discussed in this report. All final grades should provide effective drainage away from the foundations. This includes controlling surface water runoff and protecting subgrade soils by maintaining proper slopes for drainage and preventing ponding of water. Erosion and sedimentation controls should be always provided and designed and installed following industry best practices and standards. All surface and subsurface water control outlets should discharge to a collection point away from the structures and fill slopes. Estimated movements described in this report are based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained.

Backfill against footings should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration. The ground surface should be sloped at a minimum of 10 percent grade away from foundations for at least 10 feet beyond their perimeter. Verification that effective drainage has been achieved is recommended following construction. Grades around the structures should also be periodically inspected for ponding and adjusted as necessary to eliminate ponding.

Although groundwater was not encountered during or upon completion of soil sampling in the substation area, ponding of surface water and infiltration of perched water may occur during excavation and construction of conduit trenches and shallow foundations. If groundwater is encountered, the excavation should be dewatered, and groundwater levels should be maintained at least 2 feet below the base of the excavation during foundation construction. Dewatering of collected stormwater runoff and seepage into excavations is expected to be handled by conventional sump pumping. Any groundwater dewatering activities should be completed prior to construction of the site structures.

7.6 Access Road Construction

Golder understands that an access road will be required to enter and exit the proposed substation; however, the final location and configuration of the access road are still being considered. The access road leading to the substation can be supported on approved proofrolled subgrade consisting of native residual soils or weathered rock. The proofrolling should consist of at least four overlapping coverages of a smooth drum or sheepsfoot roller for predominantly granular and fine-grained subgrade materials, respectively, having a minimum static

drum weight of 8 tons. Alternatively, a fully-loaded tandem axle dump truck weighing at least 20 tons can be used to proofroll the access road.

Subgrade areas should be inspected and approved by a qualified geotechnical engineer or inspector before constructing the access road. Any soft, loose, or unsuitable soils identified by the inspecting geotechnical engineer should be removed and replaced with approved compacted engineered fill. The proposed access road is expected to be unpaved and consist of crushed stone placed to accommodate occasional light vehicular traffic such as utility maintenance vehicles accessing the substation. A geotextile separation fabric should be installed before placing crushed stone for the access road. Positive site drainage should be considered during design of the access road and while preparing the finished subgrade.

Provided that the subgrade preparation procedures are followed as previously described, a California Bearing Ratio (CBR) value of 10 can be used for design of the access road as it is expected to generally represent the conditions of existing native soils after the recommended subgrade preparation as described herein. The recommended CBR value should only be utilized for soils along natural ground. Should an access road be required in areas with previous ground disturbance (e.g., mine spoil), the subgrade soils should not be considered suitable for road support and should be excavated to a minimum depth of 5 feet and replaced with compacted structural fill and/or provided with additional stabilization through chemical treatment options, including but not limited to, the introduction of lime or cement.

Any aggregate fill should be compacted to project specifications, after it has been graded smooth and before it is subjected to accumulated traffic. Inadequate compaction will result in surface rutting under wheel loads. The rutting will reduce the total effective thickness of the aggregate fill and increases stress imposed on the subgrade. Compaction equipment and methods should be appropriate for the type of aggregate fill being used, its total thickness, and the underlying subgrade conditions.

7.7 Slope Stability

A preliminary grading plan for the proposed construction was not available at the time of preparing this report. Golder anticipates that any site fills for the proposed substation will be minor and associated with access road or pad construction. Provided that new slopes in native material are constructed at 2.5H:1V slopes or flatter constructed of compacted structural fill with proper benching/keying and drainage[4], stability of slopes does not appear to be a concern at this site.

[4] These construction techniques are critical to the long term stability of earthen fill embankments and include benches/keys of sufficient width and depth to limit the ability for failure surfaces to form at the fill interface and installation of subsurface drains installed over observed seeps and water producing strata to maintain a drained embankment condition.

8.0 CLOSING AND LIMITATIONS

We appreciate the opportunity to provide our services and present the results of this geotechnical investigation. This Geotechnical Engineering Report was prepared in a manner consistent with that level of care and skill ordinarily exercised by engineering professionals currently practicing under similar conditions and subject to the same time limits and financial / physical constraints imposed on Golder.

This report was prepared for: a) Nottingham Solar's use (i.e., no third-party use of or reliance on this report without Golder's written authorization) in connection with the subject project; and b) specific applications on the subject project. Furthermore, the findings, conclusions, and confirmation-dependent recommendations contained herein were based on 1) Golder's understanding of the project, as described herein; and 2) relevant, associated project information, as provided by Nottingham Solar and Barr Engineering Co. In addition, Golder is not responsible for errors and omissions, by others, in the project information provided by Nottingham Solar or Barr Engineering Co.

This report provides no warranties expressed or implied. In addition, Golder is not responsible for claims, damages, or liability arising from interpretations or reuse of subsurface information collected by, provided to, or made by others.

Golder's intent with the proposed and executed geotechnical site investigation program was to provide a thorough summary of the likely encountered subsurface conditions in the proposed project areas under the provided scheduling and budget constraints. The investigation techniques utilized resulted in observations and data regarding discrete locations in the project area. Engineering and geologic interpretation of the discrete data should be used to provide an estimate of the subsurface conditions likely encountered between the discrete test locations during the execution of the project. However, sound judgment and caution should be utilized given the potential for existence of conditions varying from those encountered in the discrete investigation locations, especially given the surface mine history in the area surrounding the proposed development. Subsurface borehole data only indicate conditions at specific locations and to depths penetrated, and these boreholes do not reflect soils strata or groundwater conditions and/or variations elsewhere. The borehole locations were selected such that subsurface conditions could be explored within the planned footprint of the proposed structures to verify the feasibility of the proposed development. The subsurface information obtained from the boreholes may be considered representative of the subsurface conditions expected to be encountered at these discrete locations during construction. If changes to the layout or configuration of the proposed structures occurs or variations in subsurface conditions are found to exist from those described herein and/or observed during construction, Golder should be notified, and the confirmation-dependent recommendations presented herein should be re-evaluated by Golder.

The professional engineering services rendered by Golder, as described herein, were limited to only the foundation and geotechnical-related aspects of the subsurface conditions encountered at the subject site. That said, the presence or implications of possible surface and/or subsurface contamination, resulting from previous activities or uses of the subject site and/or from the introduction of materials from off-site sources, are outside the terms of reference for this report, have not been investigated, and have not been addressed herein.

9.0 REFERENCES

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Signature Page

Golder Associates Inc.

Nathan Richardson, PE
Consultant | *Geotechnical Engineer*

Dennis J. Fela, PE
Technical Principal | *Geotechnical Engineer*

NR/DF/ms

https://golderassociates.sharepoint.com/sites/143154/project files/6 deliverables/substation geotech report/final_rev1/gla21458932-r-nottingham substation geotechnical report_rev1.docx

Tables

Table 11: **Summary of Soil and Rock Properties for LPile Analysis (Substation)**
Nottingham Solar, LLC
New Athens, Harrison County, Ohio

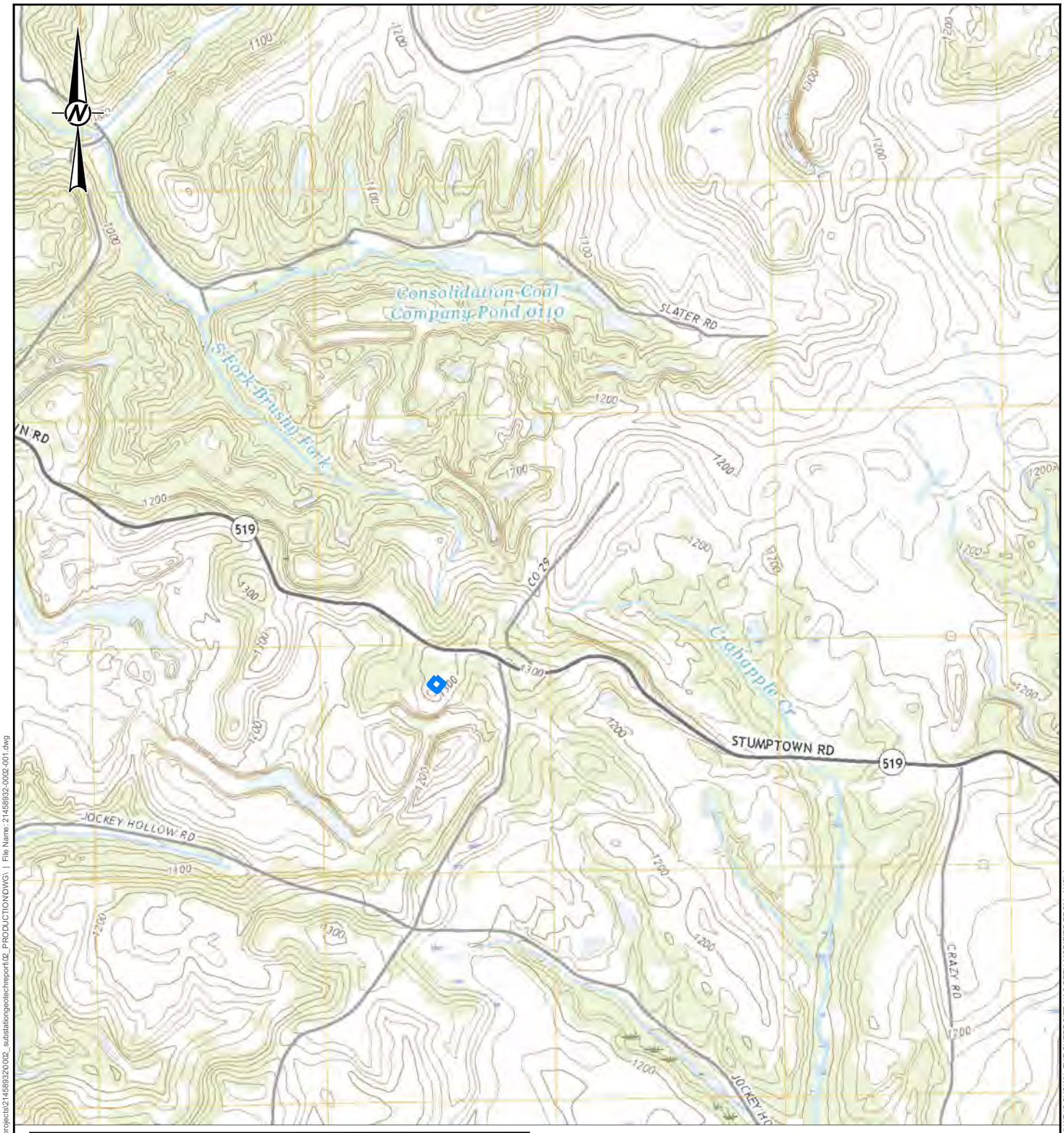
Design Depth to Groundwater: 10 feet

Substation Footprint - Borings NB-1, NB-2, and NB-3						Soil	Rock
Stratigraphy	Depth (ft)[1]	Layer Thickness (ft)	Lateral Model	Unit Weight (pcf)	Effective Unit Weight (pcf)[2]	Friction Angle (deg)[3]	Uniaxial Compressive Strength (psi)[4]
Residual Soils	0 8	8	Sand (Reese)	120	120	32	-
Weathered Rock	8 10	2	Sand (Reese)	130	130	36	-
Bedrock	10 20	10	Strong Rock (Vuggy Limestone)	150	87.6	-	2400

Notes:

1. Typical depths observed across the substation footprint.
2. Groundwater not encountered in the borings within the overburden material.
3. The default modulus of subgrade reaction value (k) should be used for the LPile analysis.
4. Laboratory test results for unconfined compressive strength of intact rock core.

Figures



LEGEND

PROPOSED SUBSTATION (APPROXIMATE)

REFERENCE(S)

1. USGS MAP: UNITED STATES GEOLOGICAL SURVEY OF FLUSHING, OHIO (2019)

0 1000 2000
1" = 2000' FEET

CLIENT
NOTTINGHAM SOLAR LLC

PROJECT
NOTTINGHAM SUBSTATION DEVELOPMENT

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-09-26
DESIGNED	NER
PREPARED	AM
REVIEWED	DJF
APPROVED	DJF

TITLE
SITE LOCATION MAP

PROJECT NO.	CONTROL	REV.	FIGURE
21458932	0002-001	1	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

1 in
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Last Edited By: amorales Date: 2022-09-14 Time:3:30:33 PM | Printed By: AMorales Date: 2022-09-26 Time:9:49:32 AM
Path: \\golder.gds\ComplexData\office\MtLaurel\Cadd\Projects\BQEnergy\oh-nottingham\99_projects\21458932\0002_substationgeotechreport\02_PRODUCTION\DWG\ | File Name: 21458932-0002-001.dwg

LEGEND

BORING LOCATION (APPROXIMATE)

REFERENCE(S)

1. AERIAL: MICROSOFT BING (2022)

0 100 200
1" = 200' FEET

CLIENT
NOTTINGHAM SOLAR LLC

CONSULTANT
wsp GOLDER

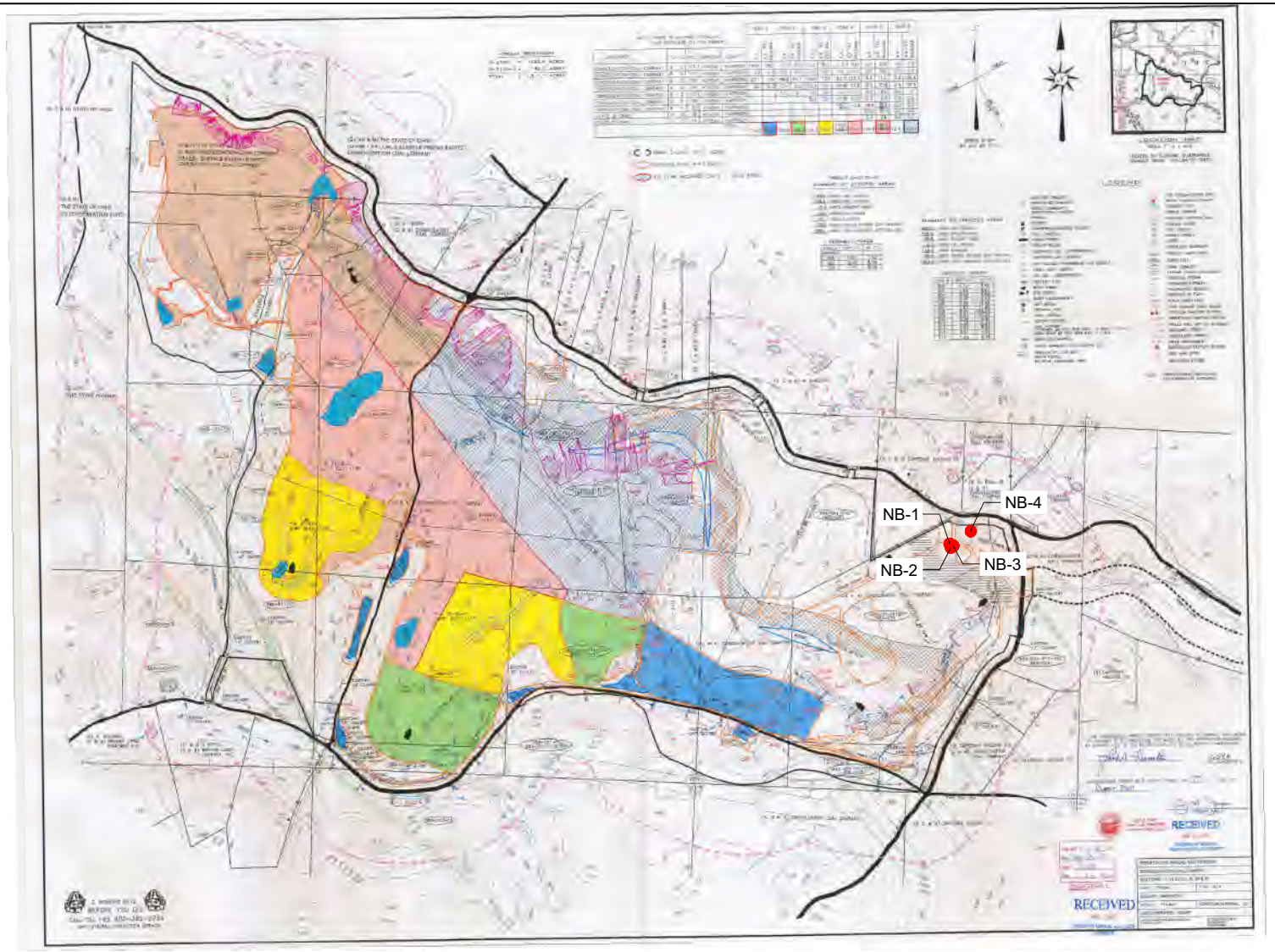
YYYY-MM-DD	2022-09-26
DESIGNED	NER
PREPARED	AM
REVIEWED	DJF
APPROVED	DJF

PROJECT
NOTTINGHAM SUBSTATION DEVELOPMENT

TITLE
BORING LOCATION PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
21458932	0002-001	1	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B



LEGEND

● BORING LOCATION (APPROXIMATE)

REFERENCE(S)

1. MAP: JACK A. HAMILTON & ASSOCIATES INC.

0 750 1500
1" = 1500' FEET

CLIENT
NOTTINGHAM SOLAR LLC

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-09-26
DESIGNED	NER
PREPARED	AM
REVIEWED	DJF
APPROVED	DJF

PROJECT
NOTTINGHAM SUBSTATION DEVELOPMENT

TITLE
PERMIT D-2100 ANNUAL MAP YEAR SIX

PROJECT NO.	CONTROL	REV.	FIGURE
21458932	0002-001	1	3

APPENDIX A

Boring Logs and Classification Summary

RECORD OF BOREHOLE: NB-1

CLIENT: Nottingham Solar, LLC
PROJECT: Nottingham Geotech
PROJECT NO: 21458932-01
LOCATION: New Athens Twp, Harrison County, Oh
DATE: April 26, 2022
INCLINATION: 90.0°
CONTRACTOR: DLZ

ELEVATION: 1315.0 ft (Ground)
COORDINATES: Lat: 40.190051° Long: -81.041070°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: NAVD88
HOLE LOC: Substation

DRILL RIG: CME 55 Track
DRILL METHOD: Hollow Stem Auger - 6-in Hole Dia.

DEPTH (ft)	DESCRIPTION	USCS	ELEV. DEPTH (ft)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
0	TOPSOIL.		0.0					
	(CL) SANDY LEAN CLAY, fine to coarse, and low to medium plasticity fines, trace gravel; gray to brown, RESIDUAL SOIL; w ~ PL, soft.	CL	1314.5 0.5	S-1	SS	100	0-1-1-6	2
	(SM) SILTY SAND, fine to coarse, non plastic fines, trace gravel; orangish brown to tan, RESIDUAL SOIL; sandstone; moist.	SM	1312.5 2.5	S-2	SS	100	7-12-15-25	27
				S-3	SS	100	6-10-14-13	24
				S-4	SS	100	9-9-12-27	21
	(SP-SM) SAND, fine to coarse, poorly graded, some gravel, some non plastic fines; orangish brown to tan, WEATHERED ROCK; sandstone; moist, very dense.	SP-SM	1305.0 10.0	S-5	SS	100	50-50/0"	
	Continued on Rock Log.		1304.5 10.5					
	End of hole at 20.50 ft.							

SPT N Value: PENETRATION RESISTANCE BLOWS/FT (20, 40, 60, 80)

GROUNDWATER OBSERVATIONS:
26Apr22 14:17
27Apr22 09:52

ADDITIONAL OBSERVATIONS:
4.50 ft: Groundwater encountered after rock coring. 4/26/2022 2:17:03 PM

Continued on Next Page

HAMMER TYPE: Automatic

REV:

LOGGED: Nathan Richardson DATE: Apr 26, 2022
CHECKED: Autumn Mohler DATE: Jun 13, 2022

RECORD OF BOREHOLE: NB-1

CLIENT: Nottingham Solar, LLC
PROJECT: Nottingham Geotech
PROJECT NO: 21458932-01
LOCATION: New Athens Twp, Harrison County, Oh

DATE: April 26, 2022
INCLINATION: 90.0°
CONTRACTOR: DLZ

ELEVATION: 1315.0 ft (Ground)
COORDINATES: Lat: 40.190051° Long: -81.041070°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: NAVD88
HOLE LOC: Substation

DRILL RIG: CME 55 Track
DRILL METHOD: Hollow Stem Auger - 6-in Hole Dia.

DEPTH (ft)	MATERIAL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. (ft)	RUN NO.	RECOVERY: TOTAL CORE %	RECOVERY: RQD %	INDICES: STRENGTH (R)	INDICES: WEATHERING (W) / ALTERATION (A)	FRACTURE INDEX (ft)	DISCONTINUITY: BETA ANGLE	DISCONTINUITY: ALPHA ANGLE	TYPE AND SURFACE DESCRIPTION	FAULT/BRECCIA/GOUGE	BROKEN CORE / LOST CORE / SHEAR ZONE	ADDITIONAL OBSERVATIONS
0	Continued on Soil Log.														
10			1304.5												
10.5	Highly weathered to fresh, tan to gray, fine grained to medium grained, very weak to medium strong, SANDSTONE, iron oxide staining, some clay infilling.														
12			1302.6												
12.4	Moderately weathered to fresh, gray, weak to medium strong, SHALE, interbedded with Sandstone.			R-1	100	30									
16				R-2	100	40									
20			1294.5												
20.5	End of hole at 20.50 ft.														

JN - Joint, FLT - Fault, SHR - Shear, B - Bedding, FO - Foliation
PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular
PO - Polished, SK - Slickensided, SM - Smooth, RO - Rough, VR - Rough
CA - Calcite, CI - Clay, CON - Contact, Fe - Iron, MI - Mica
Py - Pyrite, M - Silt, MN - Manganese, CR - Carbon, SH - Shale
CO - Coal, CN - Clean, SOL - Solutioning, W - Weathered, Mech - Poss. Mechanical

HAMMER TYPE: Automatic

REV:

LOGGED: Nathan Richardson DATE: Apr 26, 2022
CHECKED: Autumn Mohler DATE: Jun 13, 2022

RECORD OF BOREHOLE: NB-2

CLIENT:	Nottingham Solar, LLC	DATE:	April 26, 2022	ELEVATION:	1318.0 ft (Ground)
PROJECT:	Nottingham Geotech			COORDINATES:	Lat: 40.189897° Long: -81.041009°
PROJECT NO:	21458932-01	INCLINATION:	90.0°	COORD SYS:	Geographical Coordinates
LOCATION:	New Athens Twp, Harrison County, Oh	CONTRACTOR:	DLZ	HORZ DATUM:	NAD83 VERT DATUM: NAVD88
				HOLE LOC:	Substation

DRILL RIG: CME 55 Track

DRILL METHOD: Hollow Stem Auger - 6-in Hole Dia.

DEPTH (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLE NUMBER	SAMPLE TYPE	REC %	BLOWS	N-VALUE
0	TOPSOIL.		0.0					
0	(SC) CLAYEY SAND, low plasticity fines, some gravel; dark gray to brown, RESIDUAL SOIL; moist, loose.	SC	1317.5 / 0.5	S-1	SS	90	1-2-4-8	6
2	(SM) SILTY SAND, fine to coarse, non plastic fines; orangish brown to tan, WEATHERED ROCK; sandstone; moist, very dense.	SM	1315.5 / 2.5	S-2	SS	100	33-50/5"	
5				S-3	SS	100	34-49-50/2"	
8				S-4	SS	100	19-32-49-50/2"	81
10			1307.8	S-5	SS	100	50/2"	
10	Continued on Rock Log.		10.2					
20	End of hole at 20.70 ft.							

SPT N Value: PENETRATION RESISTANCE BLOWS/FT (20, 40, 60, 80)

GROUNDWATER OBSERVATIONS: 26Apr'22 13:08; 27Apr'22 09:53

ADDITIONAL OBSERVATIONS: 3.20 ft: Groundwater encountered after rock coring. 4/26/2022 1:08:27 PM

Continued on Next Page

HAMMER TYPE: Automatic

REV:

WSP GOLDER

LOGGED: Nathan Richardson DATE: Apr 26, 2022

CHECKED: Autumn Mohler DATE: Jun 13, 2022

RECORD OF BOREHOLE: NB-2

CLIENT: Nottingham Solar, LLC
PROJECT: Nottingham Geotech
PROJECT NO: 21458932-01
LOCATION: New Athens Twp, Harrison County, Oh

DATE: April 26, 2022
INCLINATION: 90.0°
CONTRACTOR: DLZ

ELEVATION: 1318.0 ft (Ground)
COORDINATES: Lat: 40.189897° Long: -81.041009°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: NAVD88
HOLE LOC: Substation

DRILL RIG: CME 55 Track
DRILL METHOD: Hollow Stem Auger - 6-in Hole Dia.

DEPTH (ft)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft)	RUN NO.
0	Continued on Soil Log.		1307.8	
10	Moderately weathered to fresh, orangish brown to gray, fine grained to medium grained, weak to medium strong, SANDSTONE, iron oxide staining, some clay infilling.		10.2	R-1, R-2
15			1302.4	
15	Slightly weathered to fresh, gray, weak to medium strong, SHALE.		15.6	R-3
20			1297.3	
20	End of hole at 20.70 ft.			

JN - Joint, FLT - Fault, SHR - Shear, B - Bedding, FO - Foliation
PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular
PO - Polished, SK - Slickensided, SM - Smooth, RO - Rough, VR - Rough
CA - Calcite, Cl - Clay, CON - Contact, Fe - Iron, MI - Mica
Py - Pyrite, M - Silt, MN - Manganese, CR - Carbon, SH - Shale
CO - Coal, CN - Clean, SOL - Solutioning, W - Weathered, Mech - Poss. Mechanical

RECOVERY: TOTAL CORE %; RQD %
INDICES: STRENGTH (R); WEATHERING (W); ALTERATION (A); FRACTURE INDEX (ft)
DISCONTINUITY: BETA ANGLE; ALPHA ANGLE; TYPE AND SURFACE DESCRIPTION

FAULT/BRECCIA/GOUGE
BROKEN CORE / LOST CORE
SHEAR ZONE

ADDITIONAL OBSERVATIONS

HAMMER TYPE: Automatic

REV:

LOGGED: Nathan Richardson DATE: Apr 26, 2022
CHECKED: Autumn Mohler DATE: Jun 13, 2022

RECORD OF BOREHOLE: NB-3

CLIENT: Nottingham Solar, LLC
PROJECT: Nottingham Geotech
PROJECT NO: 21458932-01
LOCATION: New Athens Twp, Harrison County, Oh
DATE: April 26, 2022
INCLINATION: 90.0°
CONTRACTOR: DLZ
ELEVATION: 1316.0 ft (Ground)
COORDINATES: Lat: 40.189965° Long: -81.040876°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: NAVD88
HOLE LOC: Substation

DRILL RIG: CME 55 Track
DRILL METHOD: Hollow Stem Auger - 6-in Hole Dia.

DEPTH (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
0	TOPSOIL.		1316.0 / 0.0					
0.5	(SM) SILTY SAND, fine to coarse, low plasticity fines, some gravel; orangish brown to tan, RESIDUAL SOIL; sandstone; moist, very dense.	SM	1315.5 / 0.5	S-1	SS	100	9-11-12	23
				S-2	SS	100	10-19-29	37
				S-3	SS	100	20-22-36-48	58
7.5	(SP-SM) gravelly SAND, fine to coarse, poorly graded, some non plastic fines; orangish brown to tan, WEATHERED ROCK; sandstone; moist, very dense.	SP-SM	1308.5 / 7.5	S-4	SS	100	38-50/1"	
				S-5	SS	100	50/1"	
10.1	Continued on Rock Log.		1305.9 / 10.1					
20.3	End of hole at 20.30 ft.							

SPT N Value: PENETRATION RESISTANCE BLOWS/FT (20, 40, 60, 80)

GROUNDWATER OBSERVATIONS:
26Apr22 11:52
27Apr22 09:51

ADDITIONAL OBSERVATIONS:
2.40 ft: Groundwater encountered after rock coring. 4/26/2022 11:52:57 AM

Continued on Next Page

HAMMER TYPE: Automatic

REV:

LOGGED: Nathan Richardson DATE: Apr 26, 2022
CHECKED: Autumn Mohler DATE: Jun 13, 2022

RECORD OF BOREHOLE: NB-3

CLIENT: Nottingham Solar, LLC
PROJECT: Nottingham Geotech
PROJECT NO: 21458932-01
LOCATION: New Athens Twp, Harrison County, Oh

DATE: April 26, 2022
INCLINATION: 90.0°
CONTRACTOR: DLZ

ELEVATION: 1316.0 ft (Ground)
COORDINATES: Lat: 40.189965° Long: -81.040876°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: NAVD88
HOLE LOC: Substation

DRILL RIG: CME 55 Track
DRILL METHOD: Hollow Stem Auger - 6-in Hole Dia.

DEPTH (ft)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft)	RUN NO.	RECOVERY TOTAL CORE %	RECOVERY RQD %	INDICES STRENGTH (R)	INDICES WEATHERING (W) / ALTERATION (A)	FRACTURE INDEX (ft)	DISCONTINUITY BETA ANGLE	DISCONTINUITY ALPHA ANGLE	TYPE AND SURFACE DESCRIPTION	FAULT/BRECCIA/GOUGE	BROKEN CORE / LOST CORE / SHEAR ZONE	ADDITIONAL OBSERVATIONS
0	Continued on Soil Log.														
10			1305.9												
10	Highly weathered to fresh, gray and brown, fine grained, very weak to medium strong, SANDSTONE, iron oxide staining, some clay infilling.		10.1	R-1	75										
14			1301.6	R-2	100	56									
14	Slightly weathered to fresh, gray, weak to medium strong, SHALE.		14.4												
20			1295.7	R-3	100	73									
20	End of hole at 20.30 ft.														

JN - Joint, FLT - Fault, SHR - Shear, B - Bedding, FO - Foliation
PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular
PO - Polished, SK - Slickensided, SM - Smooth, RO - Rough, VR - Rough
CA - Calcite, CI - Clay, CON - Contact, Fe - Iron, MI - Mica
Py - Pyrite, M - Silt, MN - Manganese, CR - Carbon, SH - Shale
CO - Coal, CN - Clean, SOL - Solutioning, W - Weathered, Mech - Poss. Mechanical

HAMMER TYPE: Automatic

REV:

LOGGED: Nathan Richardson DATE: Apr 26, 2022
CHECKED: Autumn Mohler DATE: Jun 13, 2022

RECORD OF BOREHOLE: NB-4

CLIENT: Nottingham Solar, LLC
PROJECT: Nottingham Geotech
PROJECT NO: 21458932-01
LOCATION: New Athens Twp, Harrison County, Oh
DATE: April 27, 2022
INCLINATION: 90.0°
CONTRACTOR: DLZ

ELEVATION: 1302.0 ft (Ground)
COORDINATES: Lat: 40.190534° Long: -81.039977°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: NAVD88
HOLE LOC: Transmission Tower

DRILL RIG: CME 55 Track
DRILL METHOD: Hollow Stem Auger - 6-in Hole Dia.

DEPTH (ft)	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	SPT N Value: PENETRATION RESISTANCE BLOWS/FT	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	TOPSOIL.			0.0 / 1301.0								
1	(SM) SILTY SAND, fine to coarse, non plastic fines, trace gravel; orangish brown to tan, RESIDUAL SOIL; sandstone; moist, loose.	SM		1.0	S-1	SS	65	2-2-3-5	5	▲		
2												
3					S-2	SS	100	9-12-11-13	23	▲		
4											27Apr22 12:13	4.10 ft: Groundwater encountered after rock coring. 4/27/2022 12:13:58 PM
5												
6					S-3	SS	100	12-14-13-9	27	▲		
7				1294.5								
8	(CL) SANDY LEAN CLAY, fine to medium, and low to medium plasticity fines, trace gravel; brown to reddish brown, RESIDUAL SOIL; decomposed claystone; w < PL, stiff to hard.	CL		7.5	S-4	SS	100	6-4-5-10	9	▲		
9												
10												
11					S-5	SS	100	14-21-37-43	58	▲		
12												
13					S-6	SS	100	16-24-28-20	52	▲		
14												
15				1287.0								
16	(SM) SILTY SAND, fine to coarse, non plastic fines, trace gravel; black; moist, very dense, weathered coal.	SM		15.0	S-7	SS	100	20-50/5"			▲	
17				1284.5								
18	(CL) SANDY LEAN CLAY, fine to medium, and low to medium plasticity fines, trace gravel; gray to brown, WEATHERED ROCK; claystone; iron oxide staining; w < PL, hard.	CL		17.5	S-8	SS	100	9-16-50/4"			▲	
19												
20					S-9	SS	100	39-50-50/4"			▲	
21												
22					S-10	SS	100	50/5"			▲	
23												
24												
25												

Continued on Next Page

HAMMER TYPE: Automatic

REV:

GOLDER

LOGGED: Nathan Richardson DATE: Apr 27, 2022
CHECKED: Autumn Mohler DATE: Jun 13, 2022

RECORD OF BOREHOLE: NB-4

CLIENT: Nottingham Solar, LLC
PROJECT: Nottingham Geotech
PROJECT NO: 21458932-01
LOCATION: New Athens Twp, Harrison County, Oh
DATE: April 27, 2022
INCLINATION: 90.0°
CONTRACTOR: DLZ

ELEVATION: 1302.0 ft (Ground)
COORDINATES: Lat: 40.190534° Long: -81.039977°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: NAVD88
HOLE LOC: Transmission Tower

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	SPT N Value: PENETRATION RESISTANCE BLOWS/FT	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
25	CME 55 Track	Hollow Stem Auger - 6-in Hole Dia.	(CL) SANDY LEAN CLAY, fine to medium, and low to medium plasticity fines, trace gravel; gray to brown, WEATHERED ROCK; claystone; iron oxide staining; w < PL, hard. Continued on Rock Log.			1276.9 / 25.1	S-11	SS	100	50/4"		20 40 60 80		
35			End of hole at 35.10 ft.											
50			Continued on Next Page											

HAMMER TYPE: Automatic

REV:

LOGGED: Nathan Richardson DATE: Apr 27, 2022
CHECKED: Autumn Mohler DATE: Jun 13, 2022

RECORD OF BOREHOLE: NB-4

CLIENT: Nottingham Solar, LLC
PROJECT: Nottingham Geotech
PROJECT NO: 21458932-01
LOCATION: New Athens Twp, Harrison County, Oh

DATE: April 27, 2022
INCLINATION: 90.0°
CONTRACTOR: DLZ

ELEVATION: 1302.0 ft (Ground)
COORDINATES: Lat: 40.190534° Long: -81.039977°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: NAVD88
HOLE LOC: Transmission Tower

DRILL RIG: CME 55 Track
DRILL METHOD: Hollow Stem Auger - 6-in Hole Dia.

DEPTH (ft)	MATERIAL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. (ft)	RUN NO.	RECOVERY: TOTAL CORE %	RECOVERY: RQD %	INDICES: STRENGTH (R)	INDICES: WEATHERING (W) / ALTERATION (A)	FRACTURE INDEX (ft)	DISCONTINUITY: BETA ANGLE	DISCONTINUITY: ALPHA ANGLE	TYPE AND SURFACE DESCRIPTION	FAULT/BRECCIA/GOUGE	BROKEN CORE / LOST CORE / SHEAR ZONE	ADDITIONAL OBSERVATIONS
25	Continued on Soil Log		1276.9												
	Slightly weathered to fresh, gray, medium strong to strong, LIMESTONE, iron oxide staining.		25.1	R-1	100	100									
26															
27															
28				R-2	100	58									
29															
30															
31															
32			1270.0												
	Fresh, gray, fine grained to medium grained, medium strong to strong, SANDSTONE, interbedded with Limestone.		32.0	R-3	100	61									
33															
34															
35			1266.9												
	End of hole at 35.10 ft.														
36															
37															
38															
39															
40															
41															
42															
43															
44															
45															
46															
47															
48															
49															
50															

JN - Joint, FLT - Fault, SHR - Shear, B - Bedding, FO - Foliation
PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular
PO - Polished, SK - Slickensided, SM - Smooth, RO - Rough, VR - Rough
CA - Calcite, Cl - Clay, CON - Contact, Fe - Iron, MI - Mica
Py - Pyrite, M - Silt, MN - Manganese, CR - Carbon, SH - Shale
CO - Coal, CN - Clean, SOL - Solutioning, W - Weathered, Mech - Poss. Mechanical

HAMMER TYPE: Automatic

REV:

GOLDER

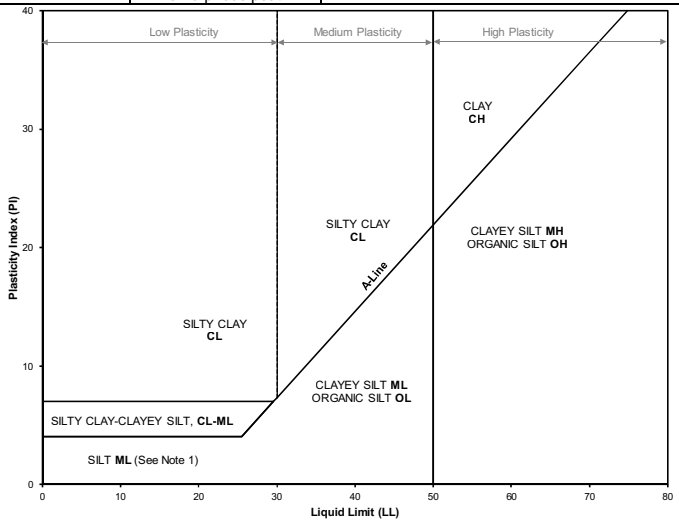
LOGGED: Nathan Richardson DATE: Apr 27, 2022
CHECKED: Autumn Mohler DATE: Jun 13, 2022

METHOD OF SOIL CLASSIFICATION

The Golder Associates USA Inc. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content <30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with <12% * fines (by mass)	Poorly Graded	<4	≤1 or ≥3	<30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (>50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with <12% * fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content <30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below*)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3 mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3 mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3 mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below*)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY
			Liquid Limit 30 to <50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CL	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous, or amorphous peat							75% to 100%		PEAT



Note 1 – Fine-grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are Non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics." For soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

* Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, and, CL-ML. For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel).
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see plasticity chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, GM/SM, CL/ML. A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

SYMBOLS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimeters	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	> 300	> 12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	< 0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY CLAYEY" as applicable
> 5 to 12	Some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Test (DCPT), N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SOIL TESTS

w	water content
PL , w_P	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996) and correspond to typical N_{60} values. Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the compactness term. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	Undrained Shear Strength (tsf)	SPT 'N'[1,2] (blows/foot)
Very Soft	<12	<0.12	0 to 2
Soft	12 to 25	0.12 to 0.25	2 to 4
Firm	25 to 50	0.25 to 0.5	4 to 8
Stiff	50 to 100	0.5 to 1	8 to 15
Very Stiff	100 to 200	1 to 2	15 to 30
Hard	>200	>2	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does not apply. Rely on direct measurement of undrained shear strength or other manual observation.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

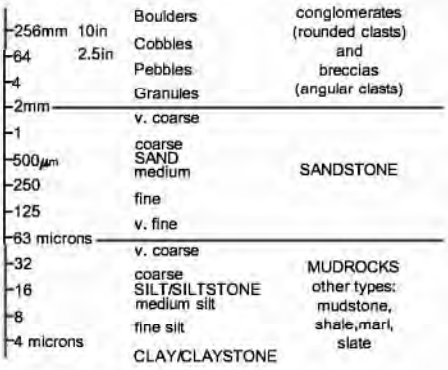
STRENGTH INDEX

Grade	Description	Field Identification	Approximate Range of Uniaxial Compressive Strength (MPa)	(psi)
S1	Very Soft Clay	Easily penetrated several inches by fist	<0.025	<4
S2	Soft Clay	Easily penetrated several inches by thumb	0.025 - 0.05	4 - 7
S3	Firm Clay	Can be penetrated several inches by thumb with moderate effort	0.05 - 0.10	7 - 15
S4	Stiff Clay	Readily indented by thumb but penetrated only with great effort	0.1 - 0.25	15 - 35
S5	Very Stiff Clay	Readily indented by thumbnail	0.25 - 0.5	35 - 70
S6	Hard Clay	Indented with difficulty by thumbnail	>0.5	>70
R0	Extremely Weak Rock	Indented with thumbnail	0.25 - 1.0	35 - 150
R1	Very Weak Rock	Crumbles under firm blows with point of geological hammer, can be peeled by pocket knife	1.0 - 5.0	150 - 725
R2	Weak Rock	Can be peeled by pocket knife with difficulty, shallow indententations made by a firm blow of geological hammer	5.0 - 25	725 - 3500
R3	Medium Strong Rock	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single blow of geological hammer	25 - 50	3500 - 7500
R4	Strong Rock	Specimen requires more than one blow of geological hammer to fracture it	50 - 100	7500 - 15,000
R5	Very Strong Rock	Specimen requires many blows of geological hammer to fracture it	100 - 250	15,000 - 35,000
R6	Extremely Strong Rock	Specimen can only be chipped with geological hammer	>250	>35,000

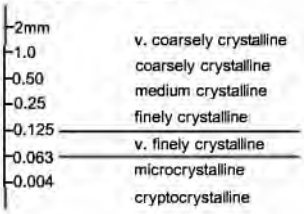
NOTE: Grades S1 to S6 apply to cohesive soils, for example, clays, silty clays and combinations of silts and clays with sand, generally slow draining. Some rounding of the strength values has been made when converting to S.I. units.

GRAIN SIZE CLASSIFICATION

Grain Size Classes & Siliciclastic Rock Types



Crystalline Rocks



WEATHERING INDEX

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

MODIFIED CORE RECOVERY (RQD) AS AN INDEX OF ROCK QUALITY

RQD (%)	Description
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

GROUNDWATER LEVELS

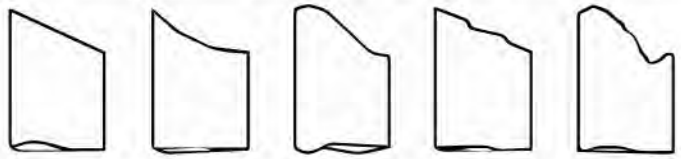
Water level at least 24 hours after drilling

Water level one hour or less after drilling

BEDDING THICKNESS

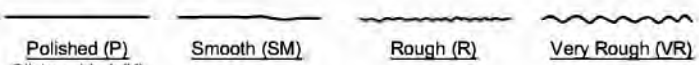
Term	Criterion
Very thickly bedded	Thicker than 1m
Thickly bedded	30 - 100cm
Medium bedded	10 - 30cm
Thinly bedded	3 - 10cm
Very thinly bedded	1 - 3cm
Thickly laminated	0.3 - 1cm
Thinly laminated	Thinner than 0.3cm

DISCONTINUITY SHAPE CLASSIFICATION



Planar (PL) Curved (C) Undulating (U) Stepped (ST) Irregular (I)

DISCONTINUITY ROUGHNESS CLASSIFICATION

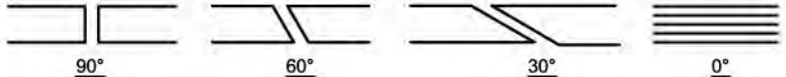


Polished (P) Slickensided (K) Smooth (SM) Rough (R) Very Rough (VR)

FRACTURE SPACING

Fracturing	Size Range of Pieces	Remarks
Crushed	less than 0.1 ft	Contains clay
Intensely fractured	1/16 in - 0.1 ft	Contains no clay
Closely fractured	0.1 ft - 0.5 ft	
Moderately fractured	0.5 ft - 1.0 ft	
Little fractured	1.0 ft - 3.0 ft	
Massive	3.0 ft and larger	

FRACTURE ORIENTATION WITH RESPECT TO CORE AXIS



90° 60° 30° 0°

WSP GOLDER

KEY TO ROCK CLASSIFICATION

G:\Field Forms\Soil-Rock Classification.dwg 3/13/2009 2:55 PM

APPENDIX B

Laboratory Test Results

MOISTURE CONTENT

ASTM D 2216-19

Client: WSP Golder
Client Reference: BQ Energy GLA21458932.006SUB.00
Project No.: 2022-292-001

Lab ID:	001	002	003	004	005
Boring No.:	NB-1	NB-3	NB-5	NB-9	NB-1
Depth (ft):	2.0-10.0'	2.0-8.0'	2.0-10.0'	2.0-15.0'	2.5-4.5'
Sample No.:	BS-1	BS-1	BS-1	BS-1	BS-2
Tare Number	3292	2998	2850	2952	3023
Wt. of Tare & Wet Sample (g)	164.01	185.16	200.41	276.85	180.43
Wt. of Tare & Dry Sample (g)	145.18	169.54	175.06	250.73	162.31
Weight of Tare (g)	8.02	8.06	8.01	8.06	8.01
Weight of Water (g)	18.83	15.62	25.35	26.12	18.12
Weight of Dry Sample (g)	137.16	161.48	167.05	242.67	154.30
Water Content (%)	**13.7**	**9.7**	**15.2**	**10.8**	**11.7**

Lab ID	006	007	008	009	010
Boring No.	NB-2	NB-3	NB-4	NB-4	NB-4
Depth (ft)	5.0-6.2'	2.5-4.5'	2.5-4.5'	7.5-9.5'	17.5-18.8'
Sample No.	S-3	S-2	S-2	S-4	S-8
Tare Number	3205	3240	4	11	5
Wt. of Tare & Wet Sample (g)	137.15	259.34	70.47	61.43	31.50
Wt. of Tare & Dry Sample (g)	126.69	238.32	63.83	55.17	28.39
Weight of Tare (g)	8.09	8.10	8.56	8.40	8.50
Weight of Water (g)	10.46	21.02	6.64	6.26	3.11
Weight of Dry Sample (g)	118.60	230.22	55.27	46.77	19.89
Water Content (%)	**8.8**	**9.1**	**12.0**	**13.4**	**15.6**

Notes :

Tested By SG *Date* 5/23/22 *Checked By* BRB *Date* 5/24/22

544 Braddock Avenue • East Pittsburgh, PA 15112 • Phone (412) 823-7600 • Fax (412) 823-8999 • www.geotechnics.net

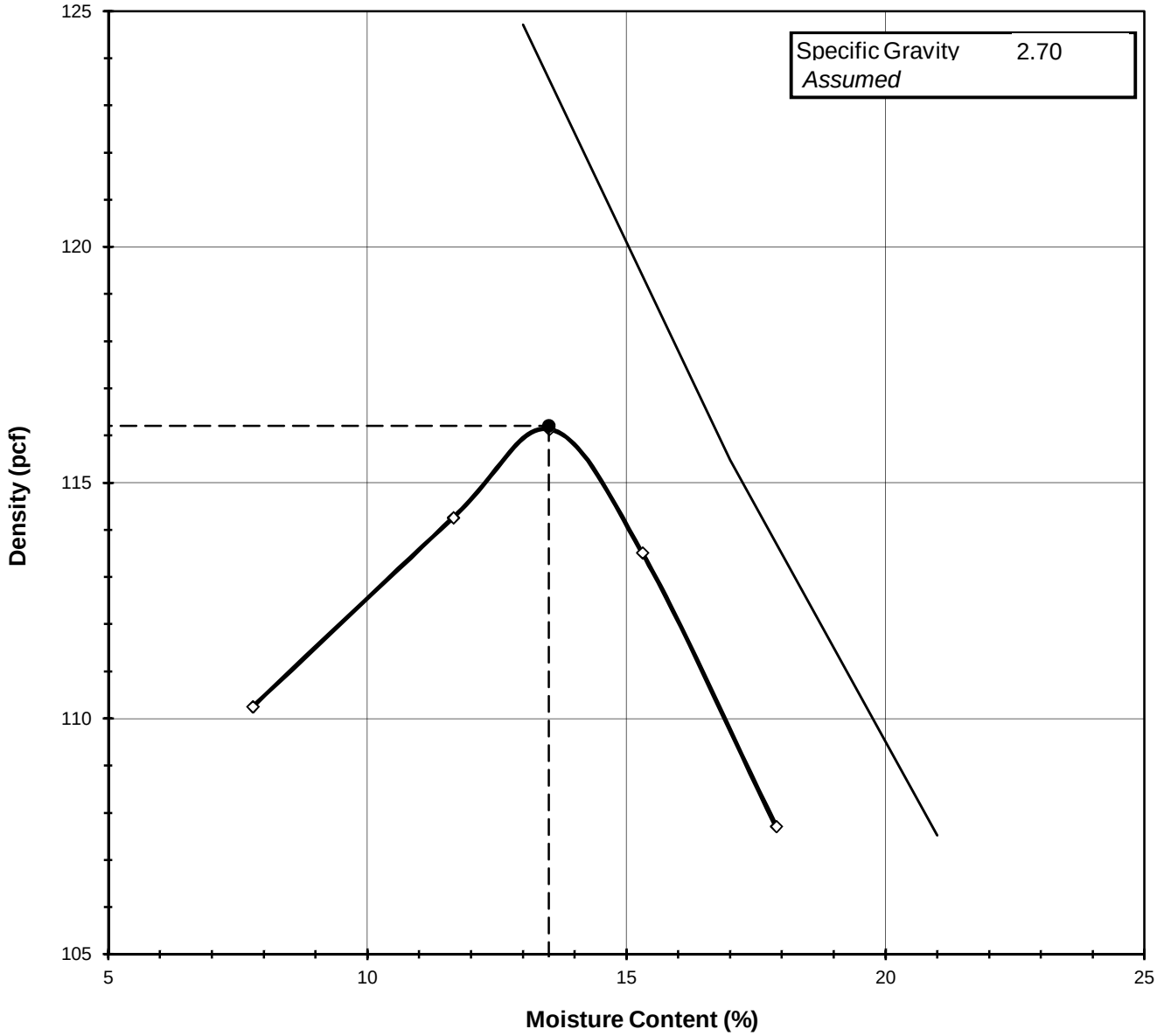
MOISTURE - DENSITY RELATIONSHIP

ASTM D698-12

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-10.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-001	Test Method	**STANDARD**

Visual Description: Brown Silty Clay

Optimum Moisture Content (%): 13.5
Maximum Dry Density (pcf): 116.2



Tested By MLF *Date* 5/23/22 *Checked By* JLK *Date* 5/25/22

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MOISTURE - DENSITY RELATIONSHIP

ASTM D698-12

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-10.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-001		

Visual Description: Brown Silty Clay

Total Weight of the Sample (g):	NA
As Received Water Content (%):	NA
Assumed Specific Gravity:	2.70
Percent Retained on 3/4":	NA
Percent Retained on 3/8":	NA
Percent Retained on #4:	NA
Oversize Material:	Not included
Procedure Used:	A

Test Type:	**STANDARD**
Rammer Weight (lb):	5.5
Rammer Drop (in):	12
Rammer Type:	MECHANICAL
Machine ID:	G441
Mold ID:	G1924
Mold diameter:	4"
Weight of the Mold (g):	4230
Volume of the Mold (cm^3):	942

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Weight of Mold & Wet Sample (g):	6024	6156	6220	6206	6147
Weight of Mold (g):	4230	4230	4230	4230	4230
Weight of Wet Sample (g):	1794	1926	1990	1976	1917
Mold Volume (cm^3):	942	942	942	942	942

Moisture Content / Density

Tare Number:	580	914	878	610	550
Weight of Tare & Wet Sample (g):	444.86	392.13	356.30	372.80	389.16
Weight of Tare & Dry Sample (g):	418.78	362.66	326.97	334.28	342.42
Weight of Tare (g):	83.94	109.91	109.90	82.67	81.20
Weight of Water (g):	26.08	29.47	29.33	38.52	46.74
Weight of Dry Sample (g):	334.84	252.75	217.07	251.61	261.22

Wet Density (g/cm^3):	1.90	2.04	2.11	2.10	2.04
Wet Density (pcf):	118.8	127.6	131.8	130.9	127.0
Moisture Content (%):	**7.8**	**11.7**	**13.5**	**15.3**	**17.9**
Dry Density (pcf):	**110.3**	**114.3**	**116.1**	**113.5**	**107.7**

Zero Air Voids

Moisture Content (%):	13.0	17.0	21.0
Dry Unit Weight (pcf):	124.7	115.5	107.5

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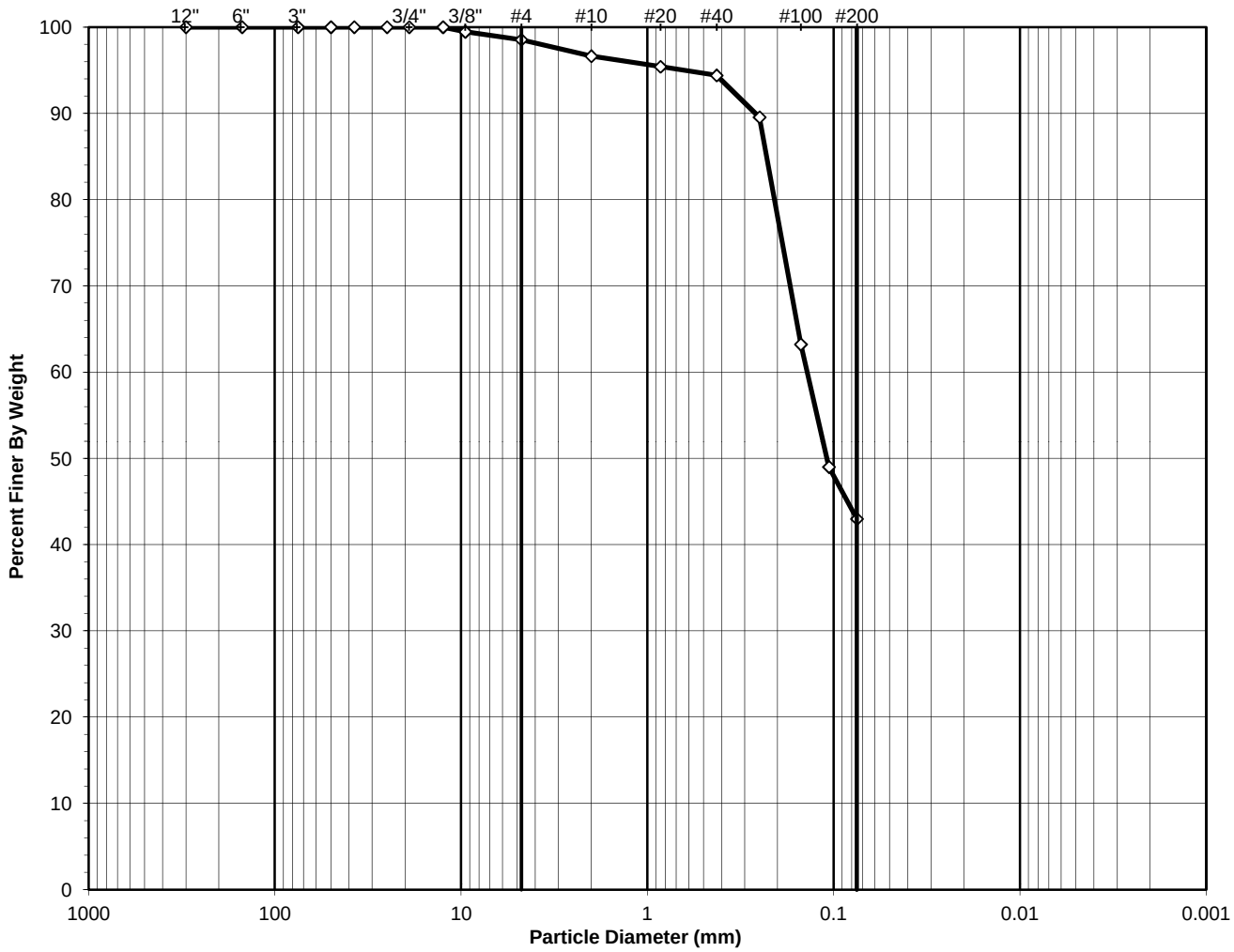
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-10.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-001	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
sc, ASSUMED

D50 = 0.11

USCS Classification:
CLAYEY SAND

Tested By CN Date 5/24/22 Checked By JLK Date 5/25/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-10.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-001	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	2013	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	658.22	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	595.21	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	144.02	Weight of Tare (g):	NA
Weight of Water (g):	63.01	Weight of Water (g):	NA
Weight of Dry Soil (g):	451.19	Weight of Dry Soil (g):	NA
Moisture Content (%):	**14.0**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	451.19
Tare No. (Sub-Specimen)	2013	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	658.22	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	144.02	Dry Weight of - 3/4" Sample (g):	451.19
Sub-Specimen Wet Weight (g):	514.20	Dry Weight -3/4" +3/8" Sample (g):	2.40
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	448.79
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	0.00		0.00	0.00	100.00	**100**
1/2"	12.5	0.00	(**)	0.00	0.00	100.00	**100**
3/8"	9.5	2.40		0.53	0.53	99.47	**99**
#4	4.75	4.19		0.93	1.46	98.54	**99**
#10	2	8.57		1.90	3.36	96.64	**97**
#20	0.85	5.54	(**)	1.23	4.59	95.41	**95**
#40	0.425	4.52		1.00	5.59	94.41	**94**
#60	0.25	21.92		4.86	10.45	89.55	**90**
#100	0.15	118.84		26.34	36.79	63.21	**63**
#140	0.106	64.12		14.21	51.00	49.00	**49**
#200	0.075	27.12		6.01	57.01	42.99	**43**
Pan	-	193.97		42.99	100.00	-	**-**

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

Tested By CN Date 5/24/22 Checked By JLK Date 5/25/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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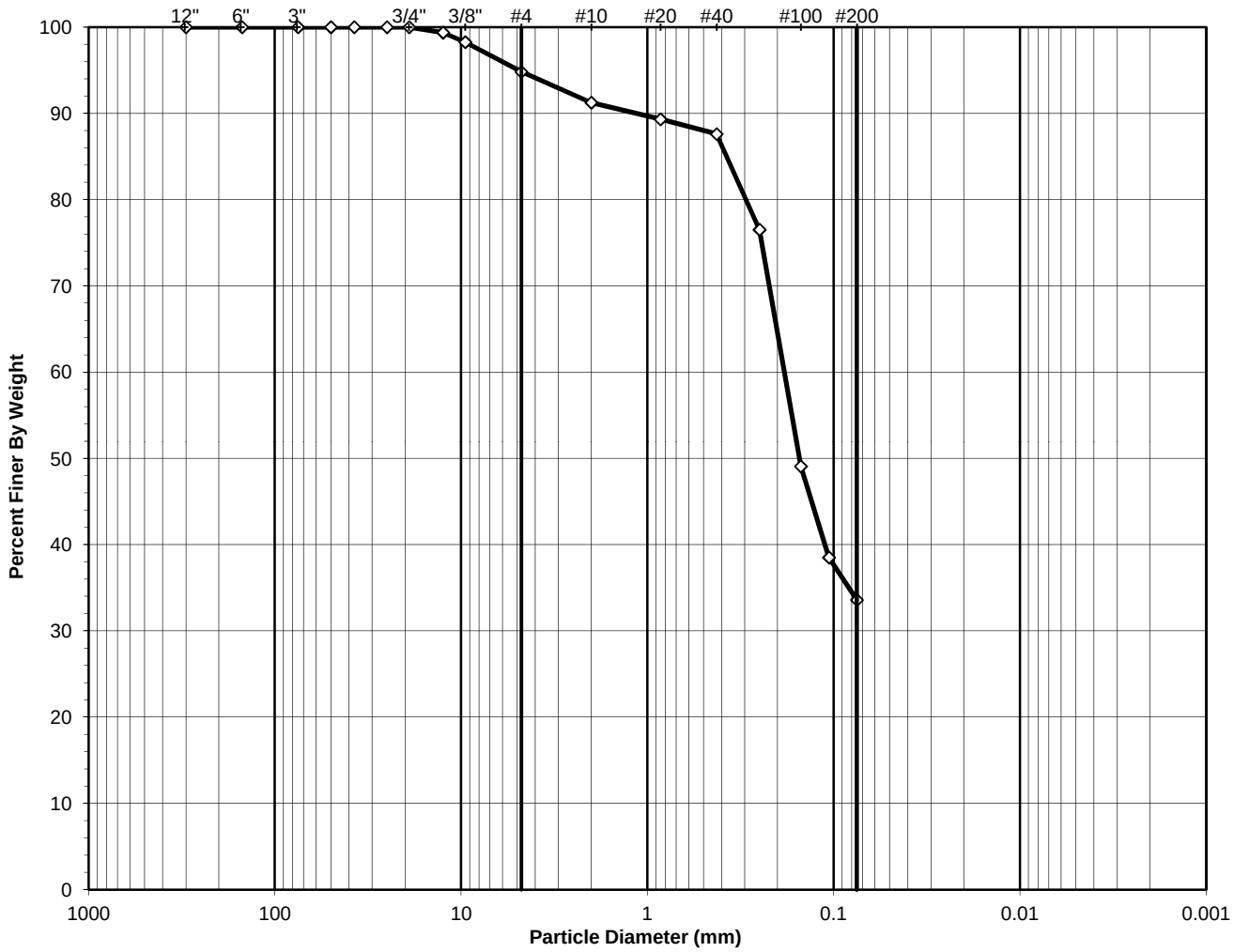
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	WSP Golder	Boring No.:	NB-3
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-8.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-002	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
sm, ASSUMED

D50 = 0.15

USCS Classification:
SILTY SAND

Tested By CN Date 5/24/22 Checked By JLK Date 5/25/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	WSP Golder	Boring No.:	NB-3
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-8.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-002	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	1478	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	713.66	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	663.18	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	147.00	Weight of Tare (g):	NA
Weight of Water (g):	50.48	Weight of Water (g):	NA
Weight of Dry Soil (g):	516.18	Weight of Dry Soil (g):	NA
Moisture Content (%):	**9.8**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	516.18
Tare No. (Sub-Specimen)	1478	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	713.66	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	147.00	Dry Weight of - 3/4" Sample (g):	516.18
Sub-Specimen Wet Weight (g):	566.66	Dry Weight -3/4" +3/8" Sample (g):	8.98
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	507.20
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	0.00		0.00	0.00	100.00	**100**
1/2"	12.5	3.24	(**)	0.63	0.63	99.37	**99**
3/8"	9.5	5.74		1.11	1.74	98.26	**98**
#4	4.75	17.75		3.44	5.18	94.82	**95**
#10	2	18.43		3.57	8.75	91.25	**91**
#20	0.85	9.97	(**)	1.93	10.68	89.32	**89**
#40	0.425	8.82		1.71	12.39	87.61	**88**
#60	0.25	57.27		11.09	23.48	76.52	**77**
#100	0.15	141.64		27.44	50.92	49.08	**49**
#140	0.106	54.52		10.56	61.49	38.51	**39**
#200	0.075	25.42		4.92	66.41	33.59	**34**
Pan	-	173.38		33.59	100.00	-	**-**

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

Tested By CN Date 5/24/22 Checked By JLK Date 5/25/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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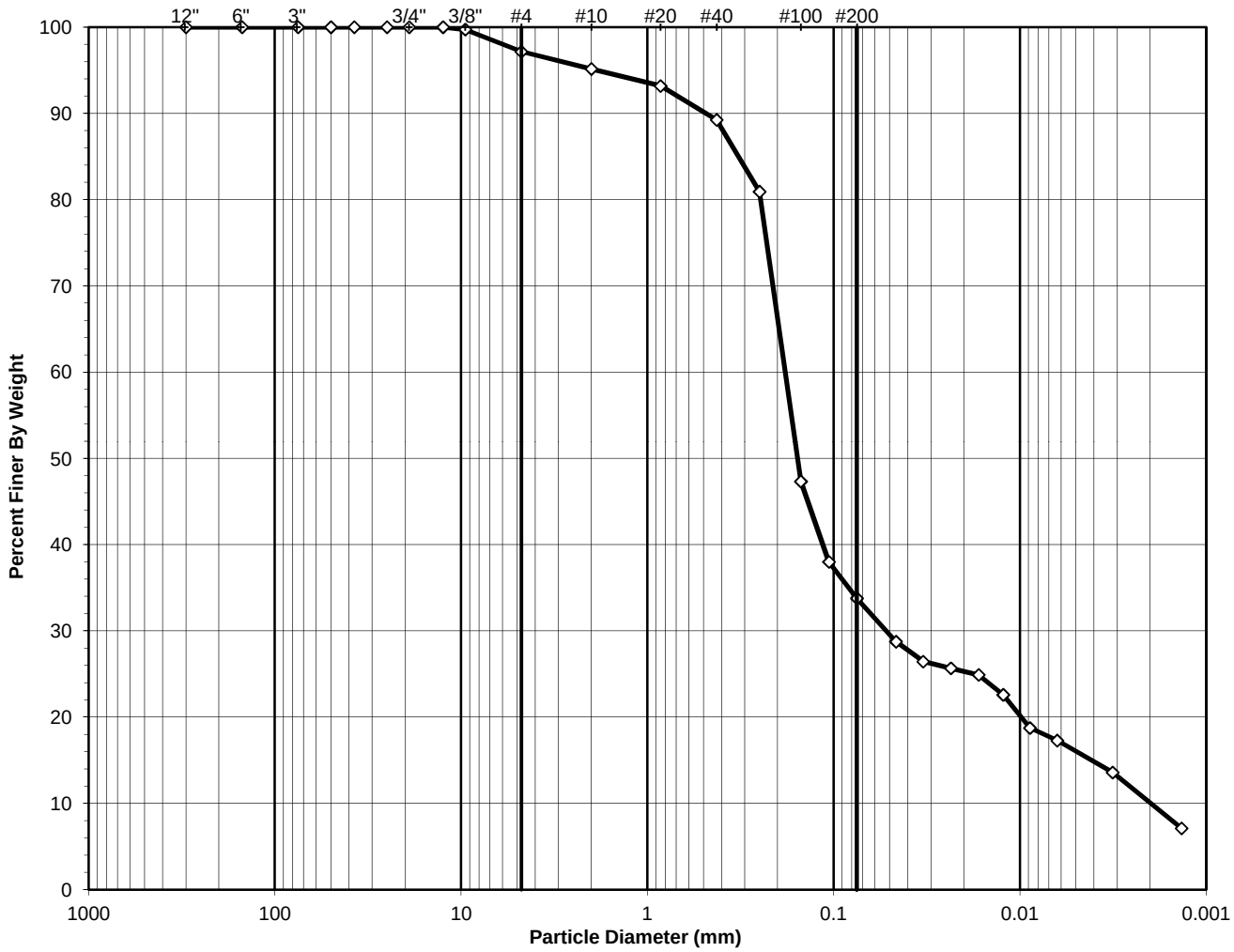
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-005	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
sm, ASSUMED

D50 = 0.16

USCS Classification:
SILTY SAND

Tested By CN Date 5/25/22 Checked By BRB Date 6/7/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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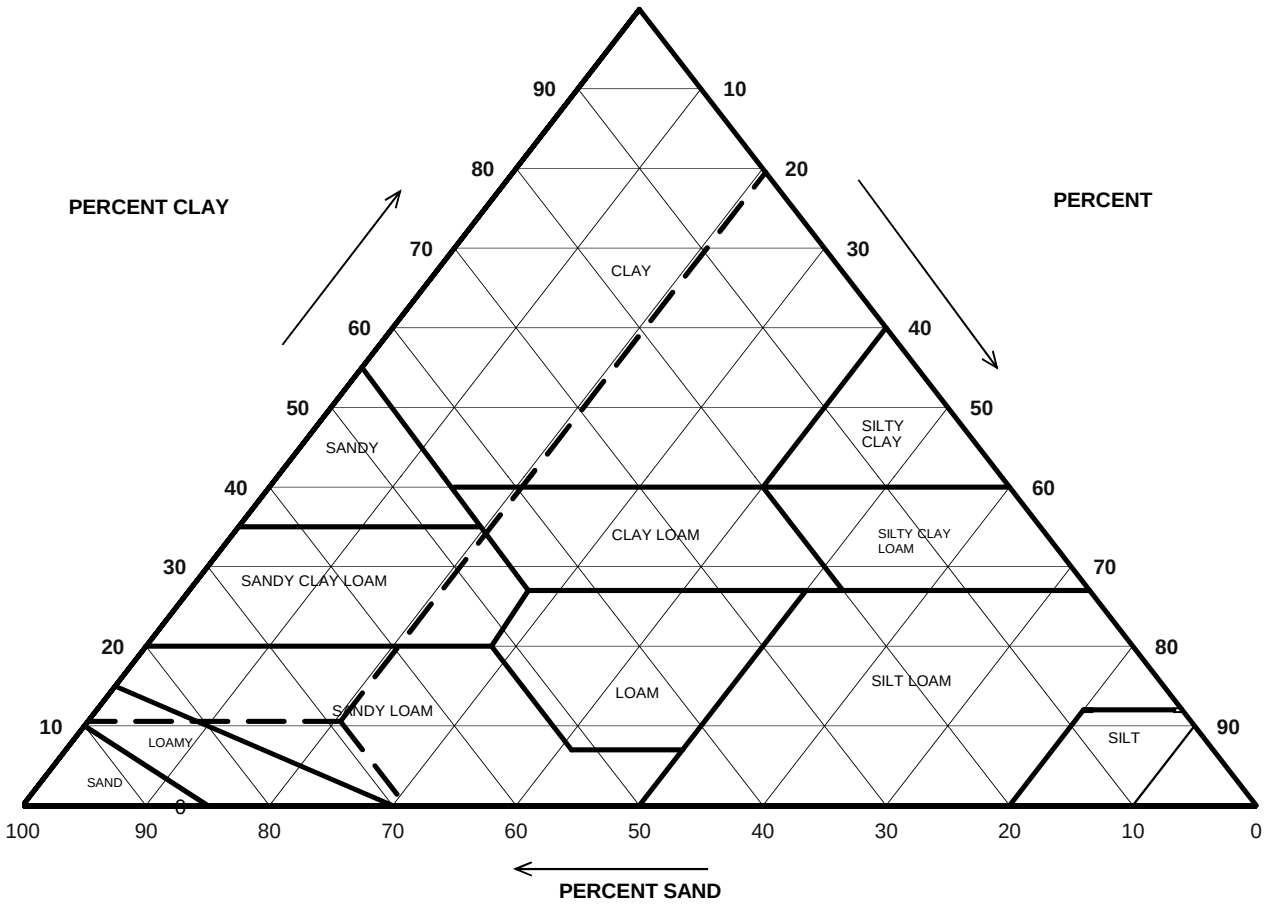
USDA CLASSIFICATION CHART

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-005	Soil Color:	Brown



USDA SUMMARY				
Particle Size (mm)	Percent Finer		Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	4.84	
2	95.16	Sand	65.60	68.94
0.05	29.55	Silt	19.49	20.48
0.002	10.06	Clay	10.06	10.57

USDA Classification: SANDY LOAM

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-005	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	39	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	758.27	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	697.47	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	199.46	Weight of Tare (g):	NA
Weight of Water (g):	60.80	Weight of Water (g):	NA
Weight of Dry Soil (g):	498.01	Weight of Dry Soil (g):	NA
Moisture Content (%):	**12.2**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	498.01
Tare No. (Sub-Specimen)	39	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	758.27	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	199.46	Dry Weight of - 3/4" Sample (g):	498.01
Sub-Specimen Wet Weight (g):	558.81	Dry Weight -3/4" +3/8" Sample (g):	1.36
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	496.65
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	0.00		0.00	0.00	100.00	**100**
1/2"	12.5	0.00	(**)	0.00	0.00	100.00	**100**
3/8"	9.5	1.36		0.27	0.27	99.73	**100**
#4	4.75	12.77		2.56	2.84	97.16	**97**
#10	2	9.99		2.01	4.84	95.16	**95**
#20	0.85	9.82	(**)	1.97	6.82	93.18	**93**
#40	0.425	19.58		3.93	10.75	89.25	**89**
#60	0.25	41.45		8.32	19.07	80.93	**81**
#100	0.15	167.35		33.60	52.67	47.33	**47**
#140	0.106	46.43		9.32	62.00	38.00	**38**
#200	0.075	21.06		4.23	66.23	33.77	**34**
Pan	-	168.20		33.77	100.00	-	**-**

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

Tested By CN Date 5/25/22 Checked By BRB Date 6/7/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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HYDROMETER ANALYSIS

ASTM D7928-17

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-005	Soil Color:	Brown

Elapsed Time (min)	Reading rm	Temp. (C^0)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	25.0	23.2	6.33	12.5	0.0463	85.1	28.8
2	23.5	23.2	6.33	12.8	0.0331	78.3	26.4
4	23.0	23.2	6.33	12.9	0.0235	76.0	25.7
8	22.5	23.2	6.33	13.0	0.0167	73.7	24.9
15	21.0	23.2	6.33	13.2	0.0123	66.9	22.6
30	18.5	23.2	6.33	13.7	0.0088	55.5	18.7
61	18.0	22.0	6.77	13.8	0.0063	51.2	17.3
240	15.0	23.6	6.17	14.3	0.0032	40.2	13.6
1440	11.5	21.7	6.88	15.0	0.0014	21.1	7.1

Soil Specimen Data

Tare No.:	960	Percent Finer than # 200:	33.77
Wt. of Tare & Dry Material (g):	118.50		
Weight of Tare (g):	91.81	Specific Gravity:	2.70 Assumed
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	21.69		

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

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

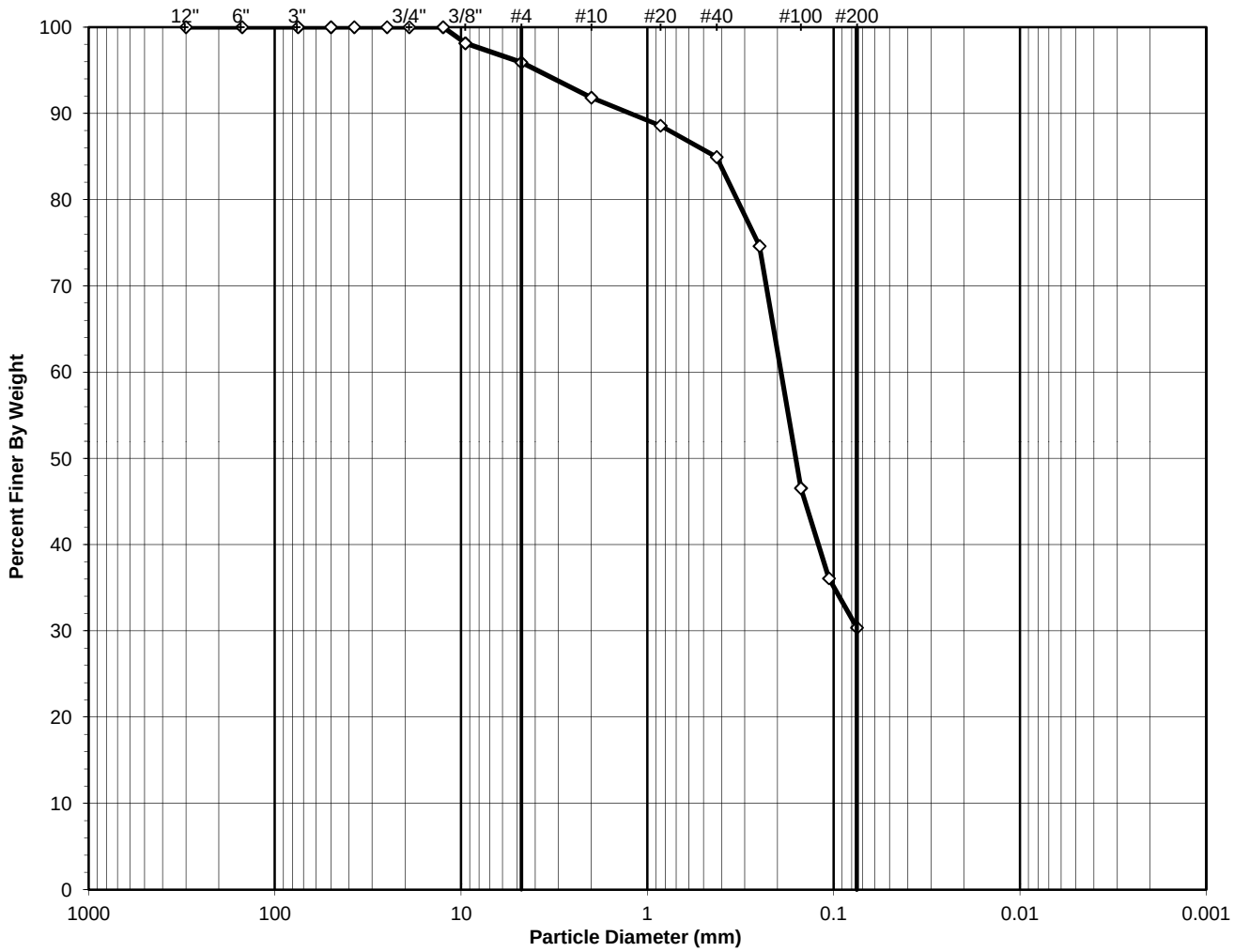
Tested By TO Date 6/2/22 Checked By BRB Date 6/7/22

SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	WSP Golder	Boring No.:	NB-2
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	5.0-6.2'
Project No.:	2022-292-001	Sample No.:	S-3
Lab ID:	2022-292-001-006	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
sm, ASSUMED

D50 = 0.16

USCS Classification:
SILTY SAND

Tested By CN Date 5/25/22 Checked By BRB Date 5/26/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	WSP Golder	Boring No.:	NB-2
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	5.0-6.2'
Project No.:	2022-292-001	Sample No.:	S-3
Lab ID:	2022-292-001-006	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	2014	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	507.16	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	478.32	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	144.81	Weight of Tare (g):	NA
Weight of Water (g):	28.84	Weight of Water (g):	NA
Weight of Dry Soil (g):	333.51	Weight of Dry Soil (g):	NA
Moisture Content (%):	**8.6**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	333.51
Tare No. (Sub-Specimen)	2014	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	507.16	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	144.81	Dry Weight of - 3/4" Sample (g):	333.51
Sub-Specimen Wet Weight (g):	362.35	Dry Weight -3/4" +3/8" Sample (g):	6.20
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	327.31
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	0.00		0.00	0.00	100.00	**100**
1/2"	12.5	0.00	(**)	0.00	0.00	100.00	**100**
3/8"	9.5	6.20		1.86	1.86	98.14	**98**
#4	4.75	7.44		2.23	4.09	95.91	**96**
#10	2	13.59		4.07	8.16	91.84	**92**
#20	0.85	10.85	(**)	3.25	11.42	88.58	**89**
#40	0.425	12.14		3.64	15.06	84.94	**85**
#60	0.25	34.41		10.32	25.38	74.62	**75**
#100	0.15	93.62		28.07	53.45	46.55	**47**
#140	0.106	34.89		10.46	63.91	36.09	**36**
#200	0.075	19.02		5.70	69.61	30.39	**30**
Pan	-	101.35		30.39	100.00	-	**-**

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

Tested By CN Date 5/25/22 Checked By BRB Date 5/26/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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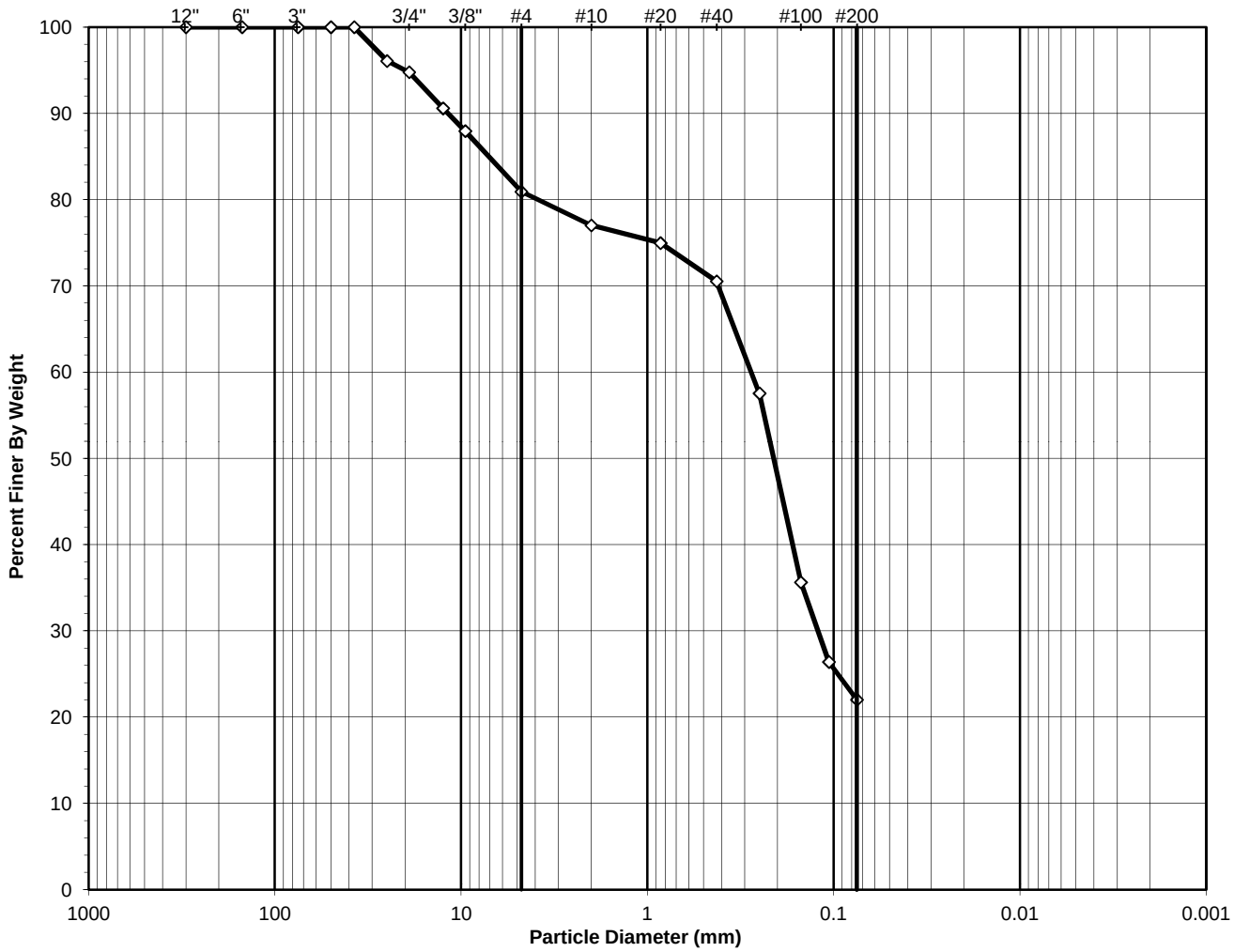
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	WSP Golder	Boring No.:	NB-3
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-007	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
sm, ASSUMED

D50 = 0.21

USCS Classification:
SILTY SAND WITH GRAVEL

Tested By CN Date 5/25/22 Checked By BRB Date 5/26/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	WSP Golder	Boring No.:	NB-3
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-007	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	1514	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	972.68	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	904.74	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	146.08	Weight of Tare (g):	NA
Weight of Water (g):	67.94	Weight of Water (g):	NA
Weight of Dry Soil (g):	758.66	Weight of Dry Soil (g):	NA
Moisture Content (%):	**9.0**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	758.66
Tare No. (Sub-Specimen)	1514	Wet Weight of +3/4" Sample (g):	43.17
Wt. of Tare & Wet Sub-Specimen (g):	972.68	Dry Weight of + 3/4" Sample (g):	39.62
Weight of Tare (g):	146.08	Dry Weight of - 3/4" Sample (g):	719.04
Sub-Specimen Wet Weight (g):	826.60	Dry Weight -3/4" +3/8" Sample (g):	51.80
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	667.24
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	29.76		3.92	3.92	96.08	**96**
3/4"	19	9.86		1.30	5.22	94.78	**95**
1/2"	12.5	31.76	(**)	4.19	9.41	90.59	**91**
3/8"	9.5	20.04		2.64	12.05	87.95	**88**
#4	4.75	53.28		7.02	19.07	80.93	**81**
#10	2	29.63		3.91	22.98	77.02	**77**
#20	0.85	15.58	(**)	2.05	25.03	74.97	**75**
#40	0.425	33.58		4.43	29.46	70.54	**71**
#60	0.25	98.66		13.00	42.46	57.54	**58**
#100	0.15	166.14		21.90	64.36	35.64	**36**
#140	0.106	70.09		9.24	73.60	26.40	**26**
#200	0.075	33.18		4.37	77.97	22.03	**22**
Pan	-	167.10		22.03	100.00	-	**-**

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

Tested By CN Date 5/25/22 Checked By BRB Date 5/26/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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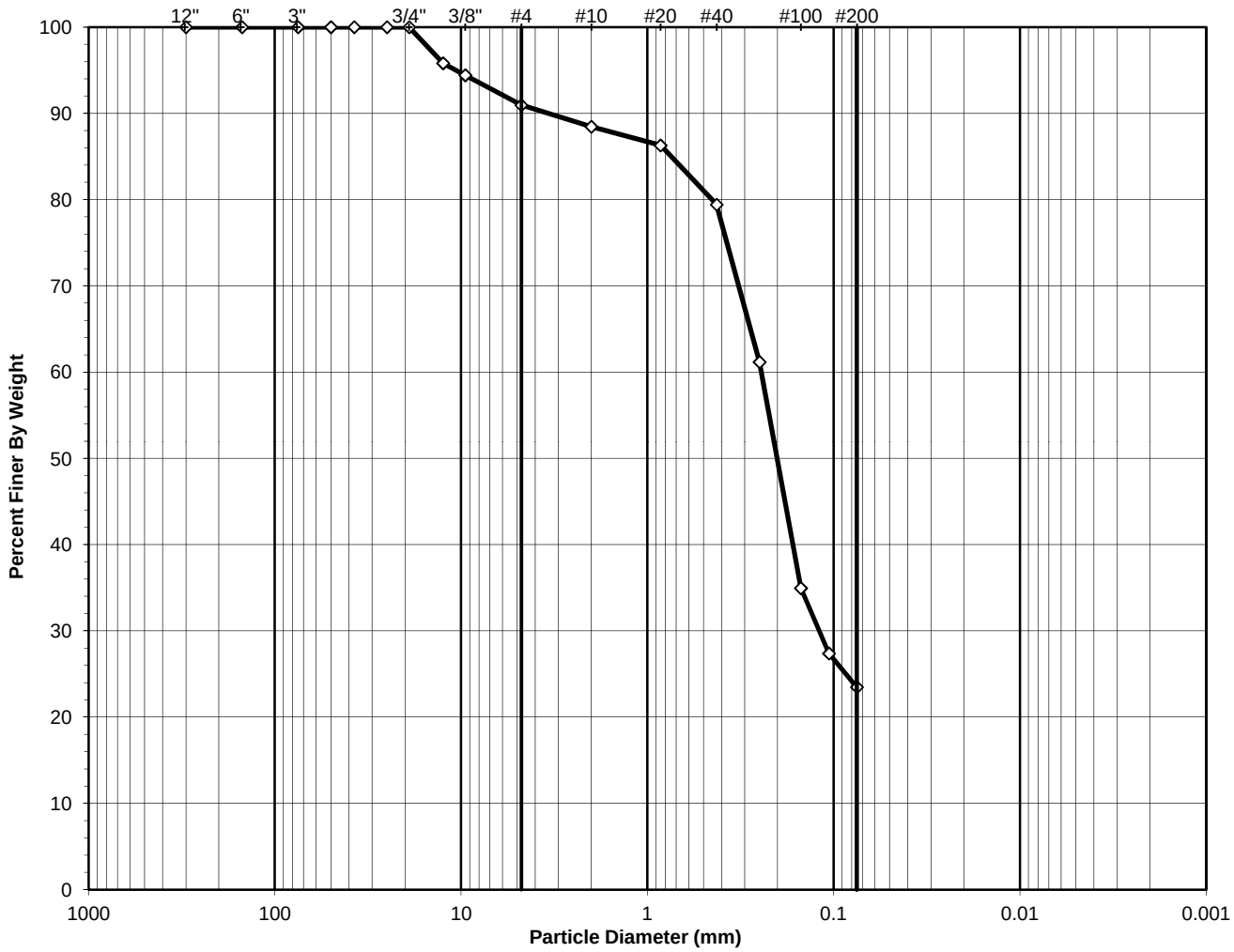
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-008	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
sm, ASSUMED

D50 = 0.20

USCS Classification:
SILTY SAND

Tested By NR Date 5/26/22 Checked By BRB Date 5/27/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-008	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	2045	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	825.77	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	752.67	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	144.30	Weight of Tare (g):	NA
Weight of Water (g):	73.10	Weight of Water (g):	NA
Weight of Dry Soil (g):	608.37	Weight of Dry Soil (g):	NA
Moisture Content (%):	**12.0**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	608.37
Tare No. (Sub-Specimen)	2045	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	825.77	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	144.30	Dry Weight of - 3/4" Sample (g):	608.37
Sub-Specimen Wet Weight (g):	681.47	Dry Weight -3/4" +3/8" Sample (g):	33.92
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	574.45
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	0.00		0.00	0.00	100.00	**100**
1/2"	12.5	25.44	(**)	4.18	4.18	95.82	**96**
3/8"	9.5	8.48		1.39	5.58	94.42	**94**
#4	4.75	21.08		3.46	9.04	90.96	**91**
#10	2	15.22		2.50	11.54	88.46	**88**
#20	0.85	13.19	(**)	2.17	13.71	86.29	**86**
#40	0.425	41.78		6.87	20.58	79.42	**79**
#60	0.25	111.01		18.25	38.83	61.17	**61**
#100	0.15	159.50		26.22	65.04	34.96	**35**
#140	0.106	46.06		7.57	72.61	27.39	**27**
#200	0.075	23.78		3.91	76.52	23.48	**23**
Pan	-	142.83		23.48	100.00	-	**-**

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

Tested By NR Date 5/26/22 Checked By BRB Date 5/27/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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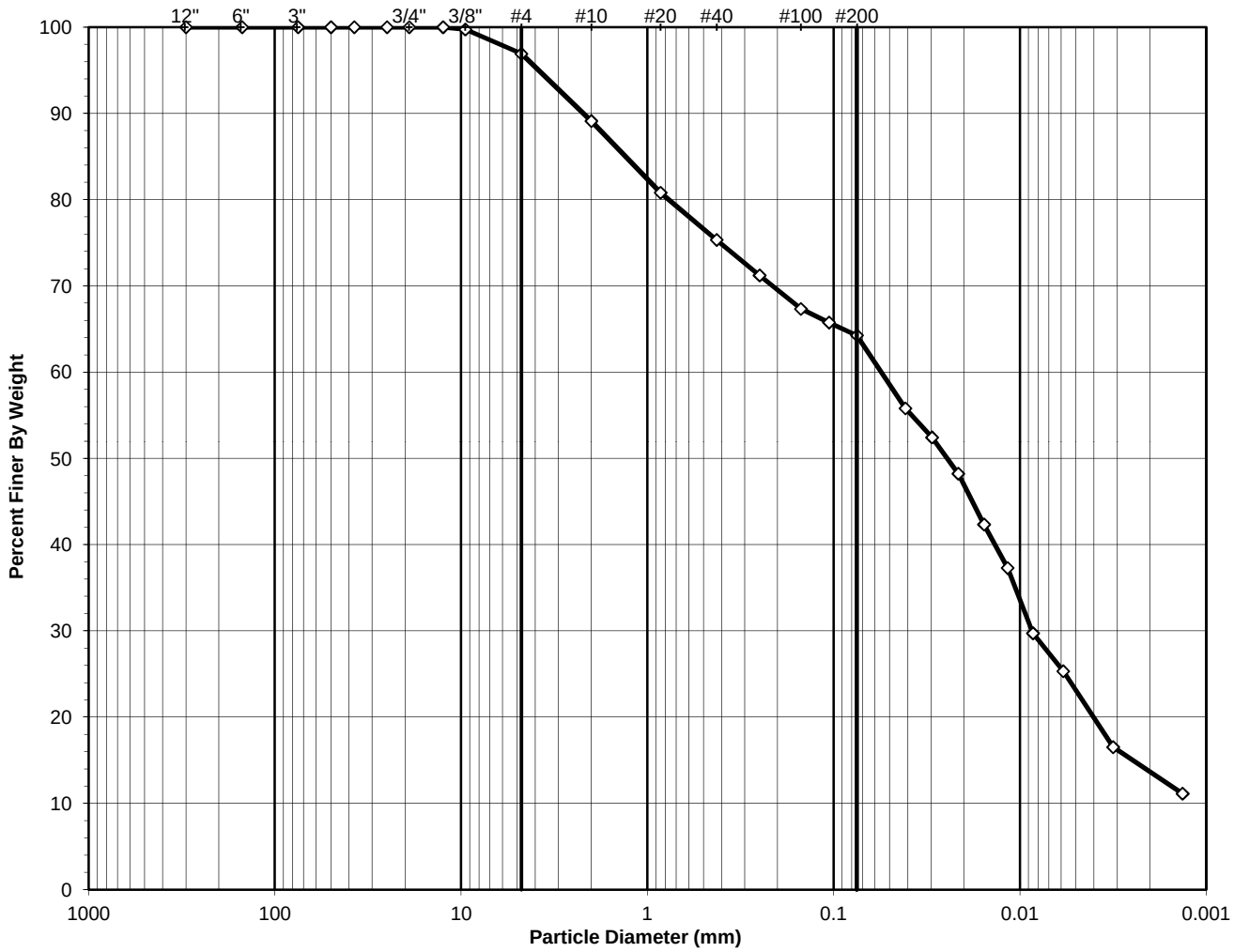
SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	7.5-9.5'
Project No.:	2022-292-001	Sample No.:	S-4
Lab ID:	2022-292-001-009	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
ml, ASSUMED

USCS Classification:
SANDY SILT

Tested By WT Date 5/26/22 Checked By BRB Date 6/7/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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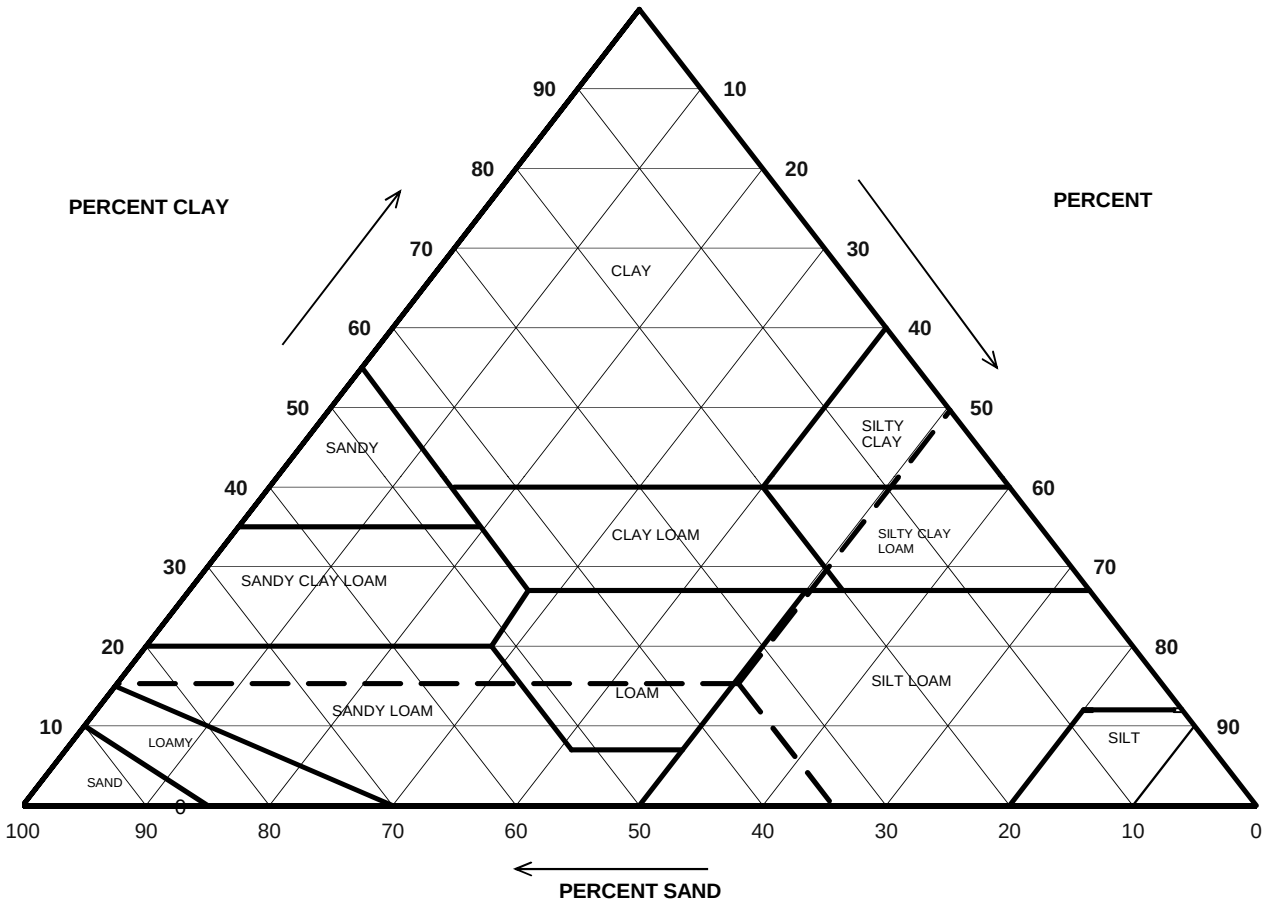
USDA CLASSIFICATION CHART

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	7.5-9.5'
Project No.:	2022-292-001	Sample No.:	S-4
Lab ID:	2022-292-001-009	Soil Color:	Brown



USDA SUMMARY				
Particle Size (mm)	Percent Finer		Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	10.88	
2	89.12	Sand	30.58	34.31
0.05	58.54	Silt	44.89	50.37
0.002	13.65	Clay	13.65	15.32

USDA Classification: SILT LOAM

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	7.5-9.5'
Project No.:	2022-292-001	Sample No.:	S-4
Lab ID:	2022-292-001-009	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	1414	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	660.63	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	597.03	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	144.96	Weight of Tare (g):	NA
Weight of Water (g):	63.60	Weight of Water (g):	NA
Weight of Dry Soil (g):	452.07	Weight of Dry Soil (g):	NA
Moisture Content (%):	**14.1**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	452.07
Tare No. (Sub-Specimen)	1414	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	660.63	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	144.96	Dry Weight of - 3/4" Sample (g):	452.07
Sub-Specimen Wet Weight (g):	515.67	Dry Weight -3/4" +3/8" Sample (g):	1.22
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	450.85
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100**
6"	150	0.00		0.00	0.00	100.00	**100**
3"	75	0.00		0.00	0.00	100.00	**100**
2"	50	0.00	(*)	0.00	0.00	100.00	**100**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100**
1"	25	0.00		0.00	0.00	100.00	**100**
3/4"	19	0.00		0.00	0.00	100.00	**100**
1/2"	12.5	0.00	(**)	0.00	0.00	100.00	**100**
3/8"	9.5	1.22		0.27	0.27	99.73	**100**
#4	4.75	12.74		2.82	3.09	96.91	**97**
#10	2	35.24		7.80	10.88	89.12	**89**
#20	0.85	37.54	(**)	8.30	19.19	80.81	**81**
#40	0.425	24.74		5.47	24.66	75.34	**75**
#60	0.25	18.62		4.12	28.78	71.22	**71**
#100	0.15	17.57		3.89	32.67	67.33	**67**
#140	0.106	7.13		1.58	34.24	65.76	**66**
#200	0.075	6.74		1.49	35.73	64.27	**64**
Pan	-	290.53		64.27	100.00	-	**-**

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

Tested By WT Date 5/26/22 Checked By BRB Date 6/7/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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HYDROMETER ANALYSIS

ASTM D7928-17

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	7.5-9.5'
Project No.:	2022-292-001	Sample No.:	S-4
Lab ID:	2022-292-001-009	Soil Color:	Brown

Elapsed Time (min)	Reading rm	Temp. (C^0)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	39.5	23.2	6.33	9.9	0.0412	86.8	55.8
2	37.5	23.2	6.33	10.3	0.0297	81.6	52.4
4	35.0	23.2	6.33	10.7	0.0214	75.0	48.2
8	31.5	23.2	6.33	11.4	0.0156	65.9	42.3
15	28.5	23.2	6.33	11.9	0.0117	58.0	37.3
30	24.0	23.2	6.33	12.7	0.0085	46.3	29.7
66	21.5	22.9	6.44	13.2	0.0059	39.4	25.3
240	16.0	23.6	6.17	14.1	0.0032	25.7	16.5
1440	13.5	21.7	6.88	14.6	0.0013	17.3	11.1

Soil Specimen Data

Tare No.:	950	Percent Finer than # 200:	64.27
Wt. of Tare & Dry Material (g):	140.12		
Weight of Tare (g):	97.34	Specific Gravity:	2.70 Assumed
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	37.78		

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

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

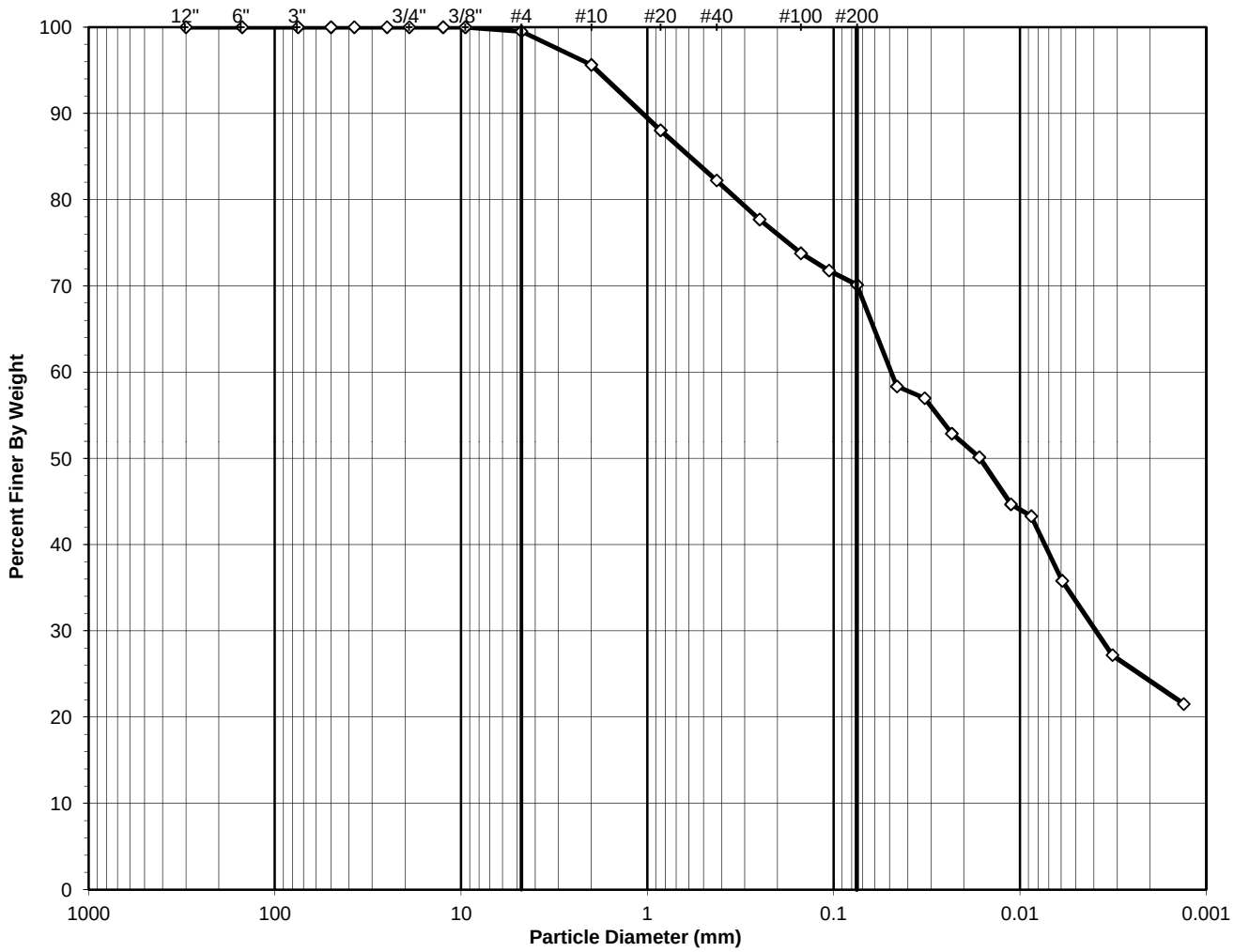
Tested By TO Date 6/2/22 Checked By BRB Date 6/7/22

SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	17.5-18.8'
Project No.:	2022-292-001	Sample No.:	S-8
Lab ID:	2022-292-001-010	Soil Color:	Gray

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol:
cl, ASSUMED

USCS Classification:
LEAN CLAY WITH SAND

Tested By CN Date 5/25/22 Checked By BRB Date 5/27/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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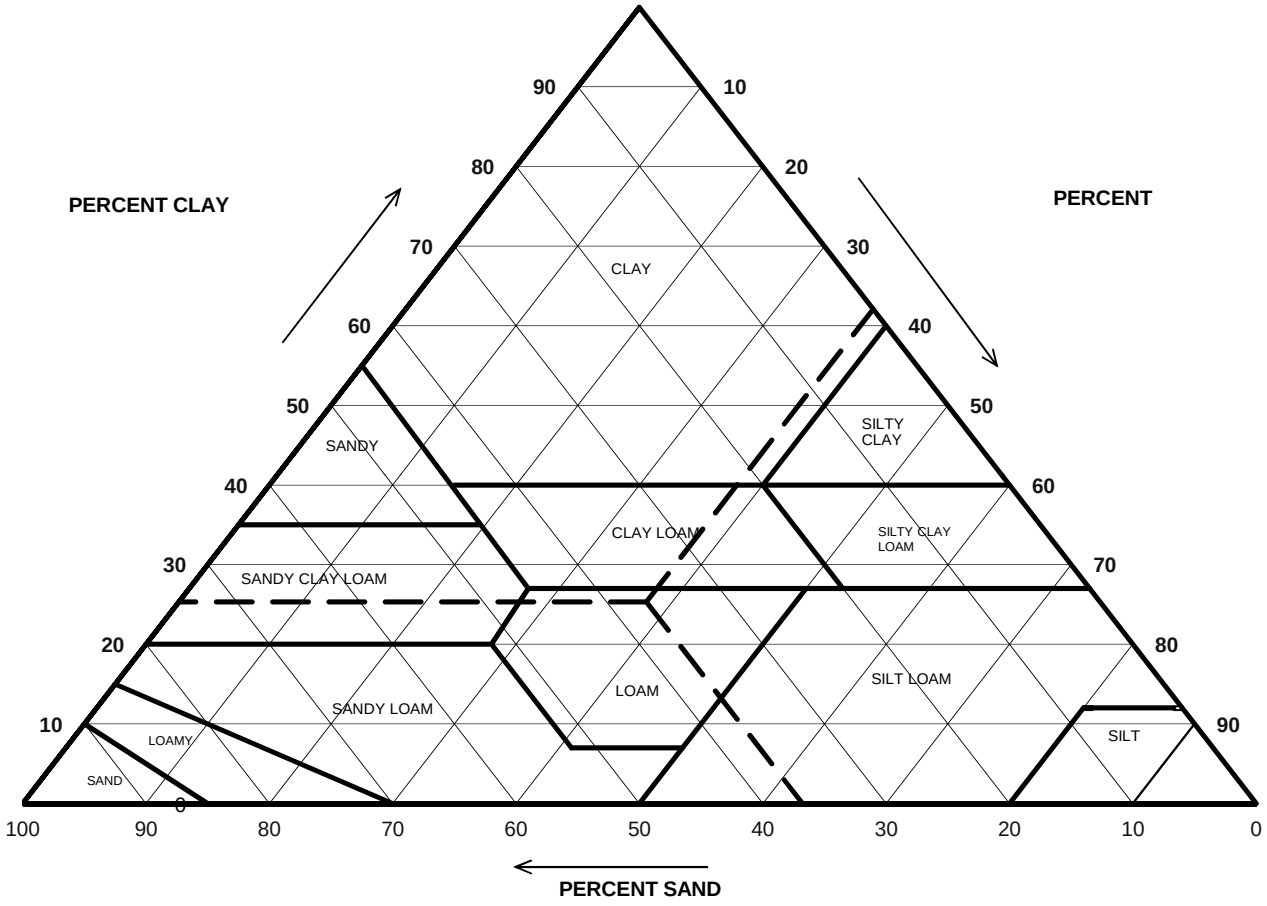
USDA CLASSIFICATION CHART

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	17.5-18.8'
Project No.:	2022-292-001	Sample No.:	S-8
Lab ID:	2022-292-001-010	Soil Color:	Gray



USDA SUMMARY				
Particle Size (mm)	Percent Finer		Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	4.37	
2	95.63	Sand	35.17	36.77
0.05	60.47	Silt	36.26	37.92
0.002	24.20	Clay	24.20	25.31

USDA Classification: LOAM

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WASH SIEVE ANALYSIS

ASTM D6913-17

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	17.5-18.8'
Project No.:	2022-292-001	Sample No.:	S-8
Lab ID:	2022-292-001-010	Soil Color:	Gray

Moisture Content of Passing 3/4" Material		Moisture Content of Retained 3/4" Material	
Tare No.:	1448	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	381.23	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	343.60	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	137.34	Weight of Tare (g):	NA
Weight of Water (g):	37.63	Weight of Water (g):	NA
Weight of Dry Soil (g):	206.26	Weight of Dry Soil (g):	NA
Moisture Content (%):	**18.2**	**Moisture Content (%):**	**0.0**

Dry Weight of Sample (g):	NA	Total Dry Weight of Sample (g):	206.26
Tare No. (Sub-Specimen)	1448	Wet Weight of +3/4" Sample (g):	0.00
Wt. of Tare & Wet Sub-Specimen (g):	381.23	Dry Weight of + 3/4" Sample (g):	0.00
Weight of Tare (g):	137.34	Dry Weight of - 3/4" Sample (g):	206.26
Sub-Specimen Wet Weight (g):	243.89	Dry Weight -3/4" +3/8" Sample (g):	0.00
Tare No. (-3/8" Sub-Specimen):	NA	Dry Weight of -3/8" Sample (g):	206.26
Wt. of Tare & Wet -3/8" Sub-Specimen (g):	NA	J - Factor (% Finer than 3/4"):	NA
Weight of Tare (g):	NA	J - Factor (% Finer than 3/8"):	NA
Sub-Specimen -3/8" Wet Weight (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)		Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00		0.00	0.00	100.00	**100.0**
6"	150	0.00		0.00	0.00	100.00	**100.0**
3"	75	0.00		0.00	0.00	100.00	**100.0**
2"	50	0.00	(*)	0.00	0.00	100.00	**100.0**
1 1/2"	37.5	0.00		0.00	0.00	100.00	**100.0**
1"	25	0.00		0.00	0.00	100.00	**100.0**
3/4"	19	0.00		0.00	0.00	100.00	**100.0**
1/2"	12.5	0.00	(**)	0.00	0.00	100.00	**100.0**
3/8"	9.5	0.00		0.00	0.00	100.00	**100.0**
#4	4.75	1.00		0.48	0.48	99.52	**99.5**
#10	2	8.01		3.88	4.37	95.63	**95.6**
#20	0.85	15.65	(**)	7.59	11.96	88.04	**88.0**
#40	0.425	11.97		5.80	17.76	82.24	**82.2**
#60	0.25	9.35		4.53	22.29	77.71	**77.7**
#100	0.15	8.09		3.92	26.21	73.79	**73.8**
#140	0.106	4.12		2.00	28.21	71.79	**71.8**
#200	0.075	3.40		1.65	29.86	70.14	**70.1**
Pan	-	144.67		70.14	100.00	-	**-**

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

Tested By CN Date 5/25/22 Checked By BRB Date 5/27/22

DCN: CT-S73T, DATE 2/25/22, REV. 1

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HYDROMETER ANALYSIS

ASTM D7928-17

Client:	WSP Golder	Boring No.:	NB-4
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	17.5-18.8'
Project No.:	2022-292-001	Sample No.:	S-8
Lab ID:	2022-292-001-010	Soil Color:	Gray

Elapsed Time (min)	Reading rm	Temp. (C^0)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	28.0	22.3	6.66	12.0	0.0458	83.2	58.4
2	27.5	22.3	6.66	12.1	0.0325	81.2	57.0
4	26.0	22.3	6.66	12.3	0.0232	75.4	52.9
8	25.0	22.3	6.66	12.5	0.0165	71.5	50.1
18	23.0	22.3	6.66	12.9	0.0112	63.7	44.7
30	22.5	22.3	6.66	13.0	0.0087	61.8	43.3
66	19.5	23.0	6.40	13.5	0.0059	51.1	35.8
240	16.5	22.6	6.55	14.1	0.0032	38.8	27.2
1440	14.5	22.4	6.63	14.4	0.0013	30.7	21.5

Soil Specimen Data

Tare No.:	664	Percent Finer than # 200:	70.14
Wt. of Tare & Dry Material (g):	123.45		
Weight of Tare (g):	93.09	Specific Gravity:	2.70 Assumed
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	25.36		

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

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

Tested By TO Date 5/25/22 Checked By BRB Date 5/27/22

UNCONFINED COMPRESSION STRENGTH of INTACT ROCK CORE SPECIMENS

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

Client:	WSP Golder	Boring No.:	NB-1
Client Project:	BQ Energy GLA 21458932.006SUB.00	Depth (ft):	10.9-11.5
Project No.:	2022-292-001	Sample ID:	R-1
Lab ID No.:	2022-292-001-026	Moisture Condition:	As Received-Preserved

Specimen Weight (g): 426.63

SPECIMEN LENGTH (in)		SPECIMEN DIAMETER (in):	
Reading 1:	4.01	Reading 1:	1.98
Reading 2:	4.01	Reading 2:	1.98
Reading 3:	4.01	Average:	**1.98**
Average:	**4.01**	Area (in^2):	3.07
		L/D:	2.03

MOISTURE CONTENT			
Tare Number:	3250	Total Load (lb):	7,490
Wt. of Tare & Wet Sample (g):	431.22	**Uniaxial Compressive Strength (psi):**	**2,440**
Wt. of Tare & Dry Sample (g):	417.48		
Weight of Tare (g):	8.07	Fracture Type:	**Cone & Split**
Weight of Wet Sample (g):	423.15		
Sample Volume (cm^3):	202.23	Rate of Loading (lb/sec):	82
Moisture Content (%):	3.36	Time to Break (min:sec):	1:31.28
Unit Wet Weight (g/cm^3):	2.110	Deviation From Straightness[3]:	
Unit Wet Weight (pcf):	131.6		
Unit Dry Weight (g/cm^3):	2.041	AXIAL: *Pass*	TOP: *Pass* BOTTOM: *Pass*
Unit Dry Weight (pcf):	127.4		

Physical Description: Rock Core

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

Tested By: JAC Date: 5/17/22 *Checked By:* NJM *Date:* 5/18/22

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UNCONFINED COMPRESSION STRENGTH of INTACT ROCK CORE SPECIMENS

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

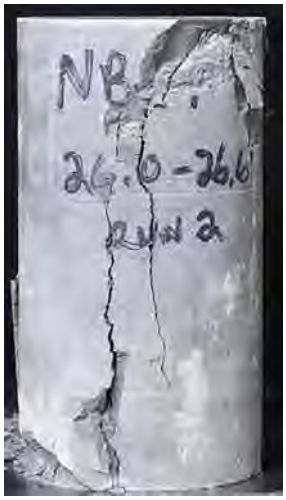
Client:	WSP Golder	Boring No.:	NB-4
Client Project:	BQ Energy GLA 21458932.006SUB.00	Depth (ft):	26.0-26.6
Project No.:	2022-292-001	Sample ID:	R-2
Lab ID No.:	2022-292-001-027	Moisture Condition:	As Received-Preserved

Specimen Weight (g): 511.57

SPECIMEN LENGTH (in)		SPECIMEN DIAMETER (in):	
Reading 1:	4.03	Reading 1:	1.97
Reading 2:	4.03	Reading 2:	1.97
Reading 3:	4.03	Average:	**1.97**
Average:	**4.03**	Area (in^2):	3.05
		L/D:	2.04

MOISTURE CONTENT			
Tare Number:	3105	Total Load (lb):	10,810
Wt. of Tare & Wet Sample (g):	514.37	**Uniaxial Compressive Strength (psi):**	**3,540**
Wt. of Tare & Dry Sample (g):	492.98		
Weight of Tare (g):	8.05	Fracture Type:	**Cone & Split**
Weight of Wet Sample (g):	506.32		
Sample Volume (cm^3):	201.68	Rate of Loading (lb/sec):	85
Moisture Content (%):	4.41	Time to Break (min:sec):	2:07.75
Unit Wet Weight (g/cm^3):	2.537	Deviation From Straightness[3]:	
Unit Wet Weight (pcf):	158.3		
Unit Dry Weight (g/cm^3):	2.429	AXIAL: *Pass*	TOP: *Pass* BOTTOM: *Pass*
Unit Dry Weight (pcf):	151.6		

Physical Description: Rock Core



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

Tested By: JAC Date: 5/17/22 *Checked By:* NJM *Date:* 5/18/22

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THERMAL CONDUCTIVITY OF SOILS

ASTM D5334-14

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-005		

Visual Description: Brown Silty Clay (Remolded)

Mold / Specimen

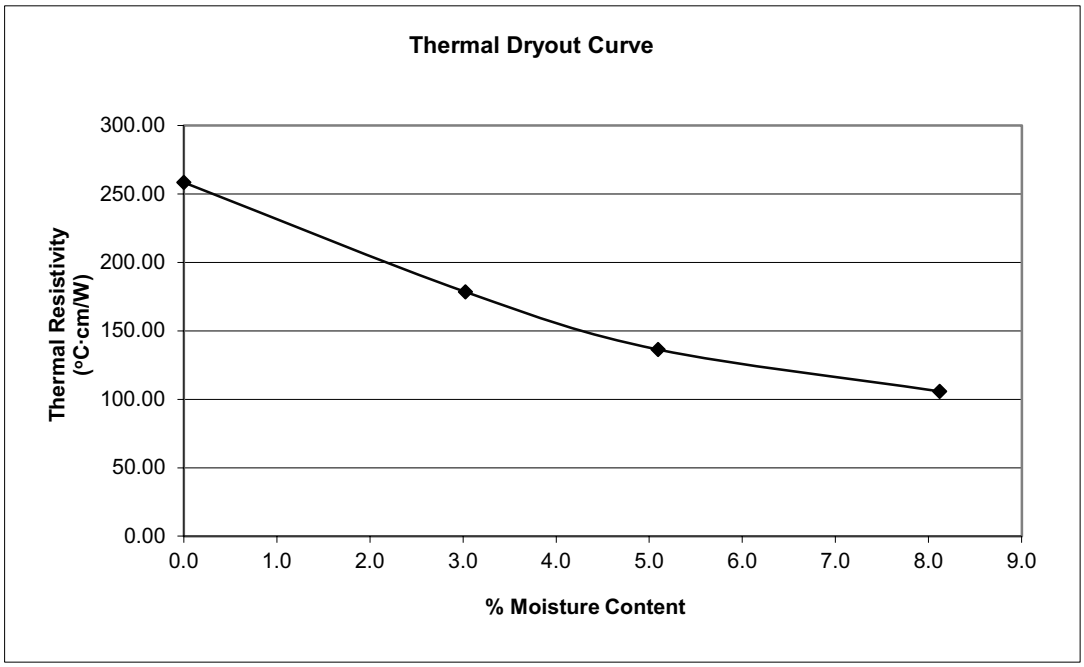
Point No.	**1**	**2**	**3**	**4**
Mold ID:	M	M	M	M
Weight of Sample and Mold (g):	2537	2496	2468	2427
Weight of Mold (g):	1072	1072	1072	1072
Sample Volume (cm^3):	856	856	856	856

Moisture Content / Density

Weight of Water (g):	110.00	69.00	41.00	0.00
Weight of Dry Sample (g):	1354.71	1354.71	1354.71	1354.71

Wet Density (g/cm^3):	1.71	1.66	1.63	1.58
Wet Density (pcf):	106.8	103.8	101.8	98.8
Moisture Content (%):	**8.1**	**5.1**	**3.0**	**0.0**
Dry Density (pcf):	**98.8**	**98.8**	**98.8**	**98.8**

Thermal Conductivity (W/(m·K))	0.945	0.733	0.560	0.387
Thermal Resistivity (°C·cm/W)	105.78	136.45	178.52	258.45



Tested By JAC *Date* 6/14/22 *Checked By* NJM *Date* 6/20/22

DCN: CT-S69, DATE: 4/20/18, REVISION: 1

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THERMAL CONDUCTIVITY OF SOILS

ASTM D5334-14

Client:	WSP Golder	Boring No.:	NB-3
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.5-4.5'
Project No.:	2022-292-001	Sample No.:	S-2
Lab ID:	2022-292-001-007		

Visual Description: Brown Silty Sand (Remolded)

Mold / Specimen

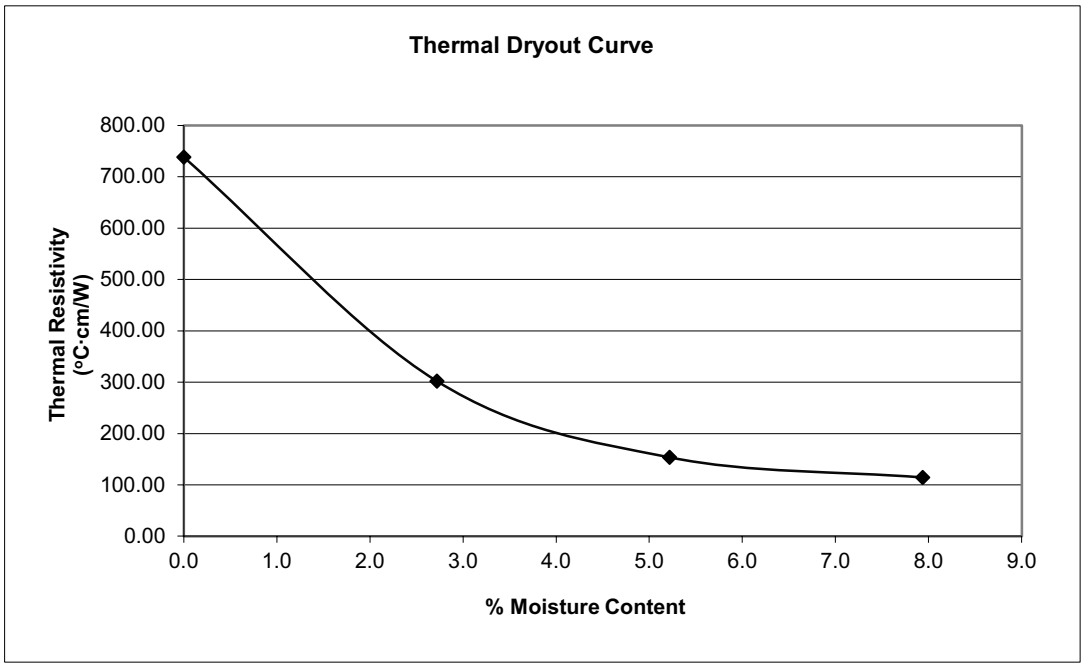
Point No.	**1**	**2**	**3**	**4**
Mold ID:	O	O	O	O
Weight of Sample and Mold (g):	2339	2302	2268	2231
Weight of Mold (g):	871	871	871	871
Sample Volume (cm^3):	860	860	860	860

Moisture Content / Density

Weight of Water (g):	108.00	71.00	37.00	0.00
Weight of Dry Sample (g):	1360.32	1360.32	1360.32	1360.32

Wet Density (g/cm^3):	1.71	1.67	1.63	1.58
Wet Density (pcf):	106.6	103.9	101.4	98.8
Moisture Content (%):	**7.9**	**5.2**	**2.7**	**0.0**
Dry Density (pcf):	**98.8**	**98.8**	**98.8**	**98.8**

Thermal Conductivity (W/(m·K))	0.875	0.652	0.331	0.136
Thermal Resistivity (°C·cm/W)	114.27	153.32	301.82	738.18



Tested By JAC *Date* 6/14/22 *Checked By* NJM *Date* 6/20/22

DCN: CT-S69, DATE: 4/20/18, REVISION: 1

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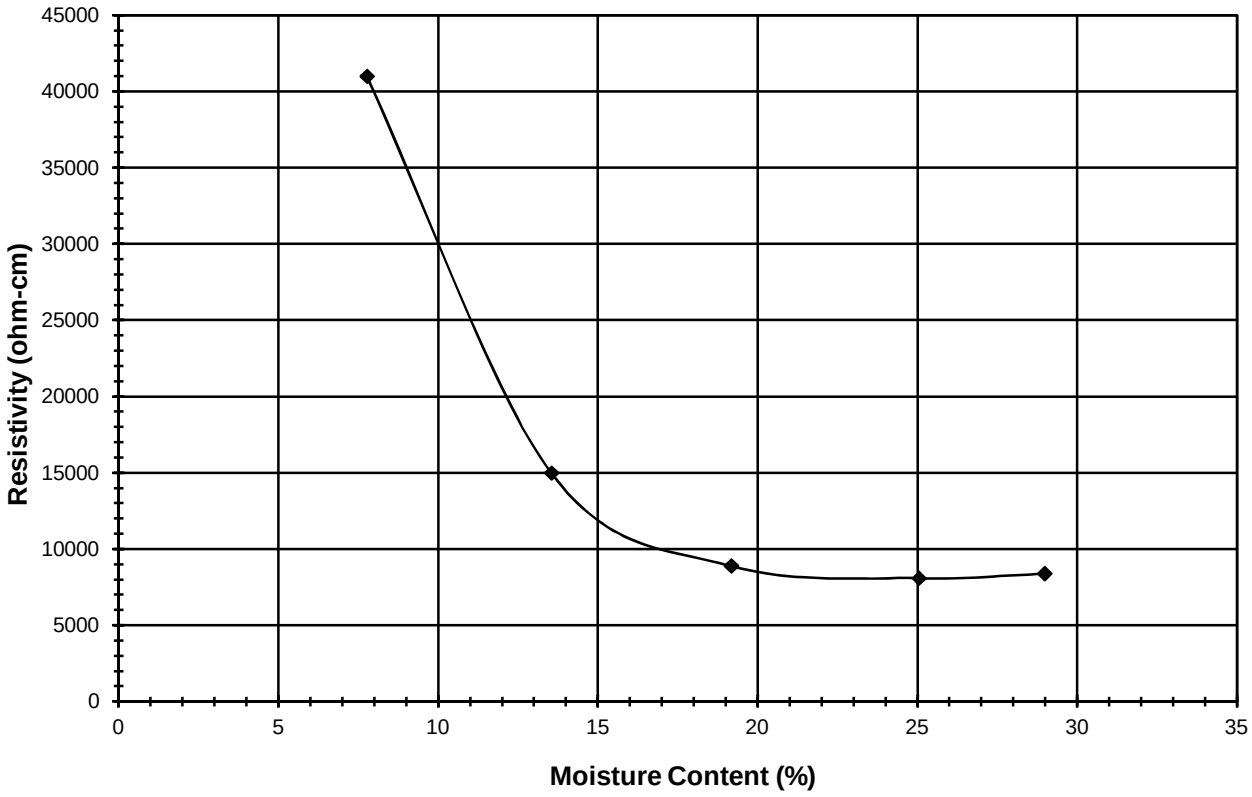
Minimum Resistivity

AASHTO T288-12

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-10.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-001	Visual Description:	Brown Silty Clay
		(- #10 Sieve material)	

Tare No.:	256	254	326	334	150
Tare & Wet Specimen (g):	37.62	40.17	35.19	39.48	43.53
Tare & Dry Specimen (g):	36.67	38.19	32.60	35.45	38.19
Tare Weight (g):	24.44	23.57	19.09	19.36	19.76
Moisture Content (%):	**7.8**	**13.5**	**19.2**	**25.0**	**29.0**
Resistance (ohm):	**41000**	**15000**	**8900**	**8100**	**8400**
Resistivity (ohm-cm):	**41000**	**15000**	**8900**	**8100**	**8400**

Note: The ratio of Miller Box area versus distance between electrodes is equal to 1.



Soil Class	*Corrosion Resistance*	*Specific Resistivity (ohm-cm)*
1	Excellent	10,000 - 6,000
2	Good	6,000 - 4,500
3	Fair	4,500 - 2,000
4	Bad	2,000 - 0

Tested By JAM *Date* 5/25/22 *Checked By* BRB *Date* 5/26/22

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pH OF SOILS

AASHTO T 289-91 (2013)

Client:	WSP Golder
Client Reference:	BQ Energy GLA21458932.006SUB.00
Project No.:	2022-292-001

Lab ID:	001
Boring No.:	NB-1
Depth (ft):	2.0-10.0'
Sample No.:	BS-1
Drying Tare No.:	2024
Testing Tare No.:	N
Temperature (^{o}C):	21.9
pH of Sample:	**6.74**

Meter Calibration
(as used each day)

Buffer pH	Meter Reading	Meter Model
4.00	4.00	ORION 720A
7.00	7.03	
10.00	10.03	

Tested By JAM Date 6/3/22 Checked By BRB Date 6/10/22

 DCN: CT-S36B DATE 6/5/14 REVISION: 1

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CHLORIDE ION CONTENT IN SOILS

AASHTO T 291 - 94 (2004) (*Method B*)

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-10.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-001	Description:	Brown Silty Clay

(- # 10 Sieve material)

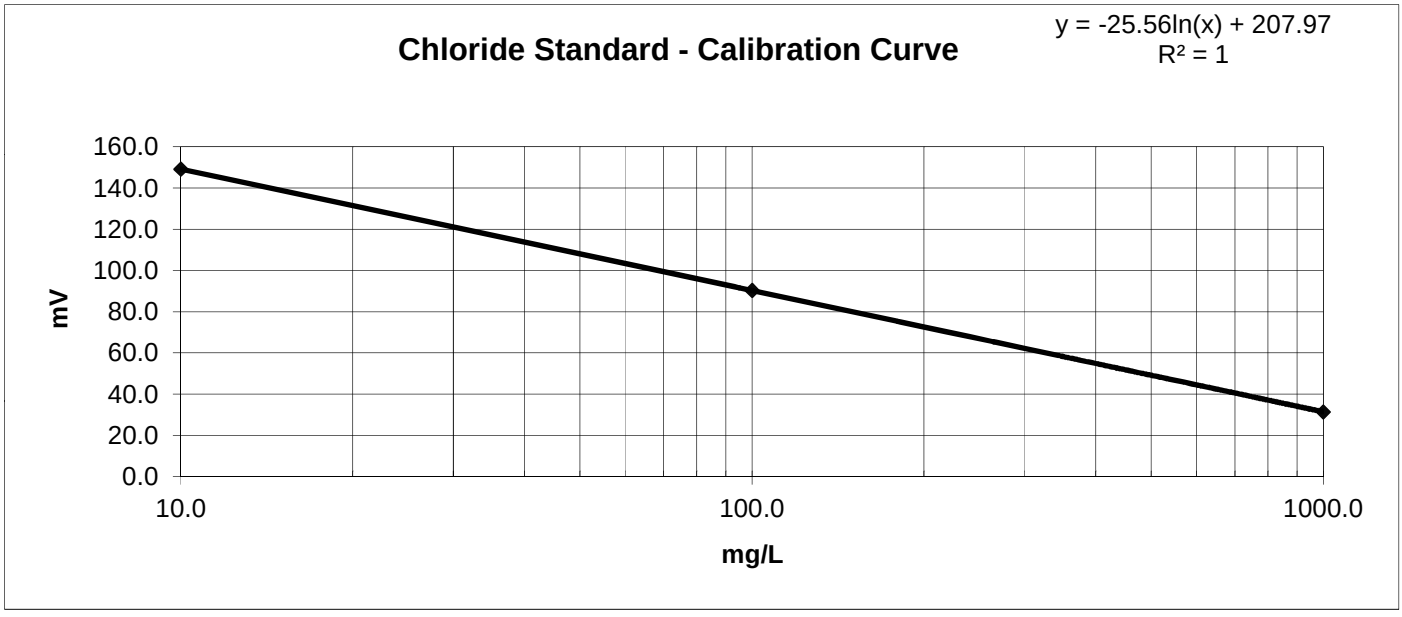
CHLORIDE STANDARD: CALIBRATION CURVE

STANDARD		MILLIVOLTS (mV)
10.0	mg/L	149.1
100.0	mg/L	90.3
1000.0	mg/L	31.4

MEASUREMENT OF CHLORIDES

		CONCENTRATION (mg/L)	CONCENTRATION (mg/kg)
Sample Weight (g):	100.0		
Water added to Sample (ml):	100.0		
Size of Sample Aliquot (ml):	25.0		
Sample Reading (mV):	141.3	13.58	13.58

Notes: 1) Samples and standards were buffered by the addition of an equal volume of the 0.2 M KNO_3 solution (1:1 volume).
2) Samples were dried for a minimum of 12 hours at 110 $^{+}/_{-}$ 5^{o}C.



Notes:

Tested By	JAM	Date	6/6/22	Checked By	BRB	Date	6/9/22

DCN: CT-S63A DATE: 6/2/14 REVISION: 1

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Water-Soluble Sulfate Ion Content in Soil

AASHTO T 290-95 (2020)

Client:	WSP Golder	Boring No.:	NB-1
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-10.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-001	Soil Description:	Brown Clay

Sulfate Standard - Calibration Curve Spectrophotometer Readings

Sulfate Ion Concentrations (mg/L)

0.0	4.0	10.0	20.0	30.0	40.0	60.0	80.0	100.0

Spectrophotometer Readings (FAU)

Underrange	Underrange	6	22	47	68	129	179	241

Measurement of Barium Chloride Turbidity

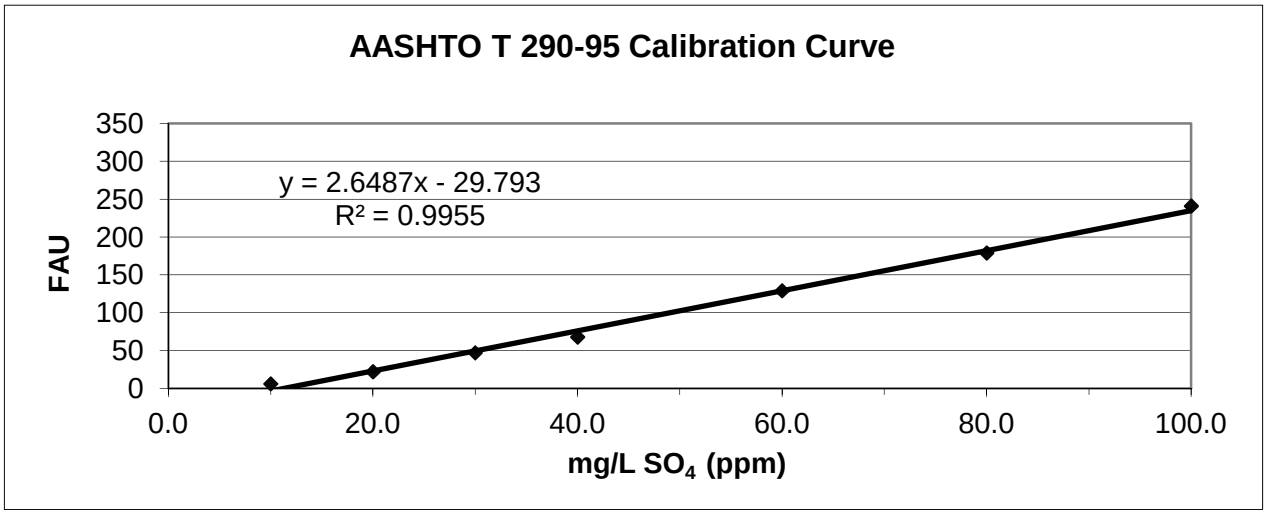
(Sample contains 5.0 mL NaCl solution and 0.3 g $BaCl_2 \cdot 2H_2O$)

Sample Weight (g):	100.0
Water added to Sample (mL):	300.0
Size of Sample Aliquot (mL):	50.0
Sample Reading (FAU):	47
Sample Diluted:	No
Sulfate Solution Added (ml):	0

Sample Moisture Content

Tare Number:	ZY
Weight of Tare & Wet Sample (g):	194.00
Weight of Tare & Dry Sample (g):	193.10
Weight of Tare (g):	83.10
Weight of Water (g):	0.90
Weight of Dry Sample (g):	110.00
Moisture Content (%):	0.82

Sample Sulfate Ion Concentration:	28.99	**mg/L SO_4 (ppm)**
Sample Sulfate Ion Content:	87.0	**mg/Kg SO_4 (not corrected for moisture)**
Sample Sulfate Ion Content:	87.7	**mg/Kg SO4 (corrected for moisture)**



Tested by: JAM Date: 6/3/22 Checked by: BRB Date: 6/9/22

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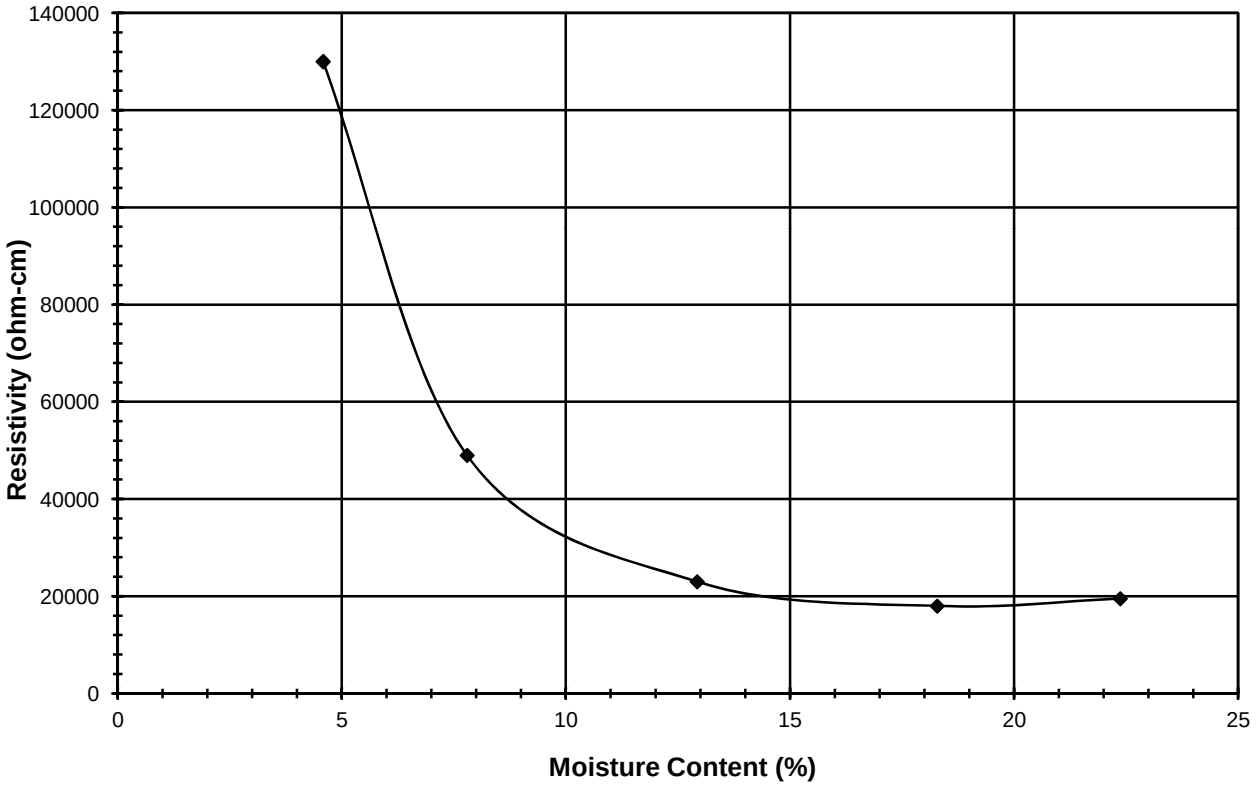
Minimum Resistivity

AASHTO T288-12

Client:	WSP Golder	Boring No.:	NB-3
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-8.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-002	Visual Description:	Brown Silt
		(- #10 Sieve material)	

Tare No.:	313	262	511	241	507
Tare & Wet Specimen (g):	38.22	27.22	34.18	37.94	40.05
Tare & Dry Specimen (g):	37.44	26.03	32.48	34.94	36.27
Tare Weight (g):	20.43	10.76	19.33	18.53	19.37
Moisture Content (%):	**4.6**	**7.8**	**12.9**	**18.3**	**22.4**
Resistance (ohm):	**130000**	**49000**	**23000**	**18000**	**19500**
Resistivity (ohm-cm):	**130000**	**49000**	**23000**	**18000**	**19500**

Note: The ratio of Miller Box area versus distance between electrodes is equal to 1.



Soil Class	*Corrosion Resistance*	*Specific Resistivity (ohm-cm)*
1	Excellent	10,000 - 6,000
2	Good	6,000 - 4,500
3	Fair	4,500 - 2,000
4	Bad	2,000 - 0

Tested By JAM *Date* 5/25/22 *Checked By* BRB *Date* 5/26/22

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pH OF SOILS

AASHTO T 289-91 (2013)

Client:	WSP Golder
Client Reference:	BQ Energy GLA21458932.006SUB.00
Project No.:	2022-292-001

Lab ID:	002
Boring No.:	NB-3
Depth (ft):	2.0-8.0'
Sample No.:	BS-1
Drying Tare No.:	1547
Testing Tare No.:	G
Temperature (^{o}C):	21.9
pH of Sample:	**7.11**

Meter Calibration
(as used each day)

Buffer pH	Meter Reading	Meter Model
4.00	4.00	ORION 720A
7.00	7.03	
10.00	10.03	

Tested By JAM Date 6/3/22 Checked By BRB Date 6/10/22

 DCN: CT-S36B DATE 6/5/14 REVISION: 1

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CHLORIDE ION CONTENT IN SOILS

AASHTO T 291 - 94 (2004) (*Method B*)

Client:	WSP Golder	Boring No.:	NB-3
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-8.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-002	Description:	Brown Silt

(- # 10 Sieve material)

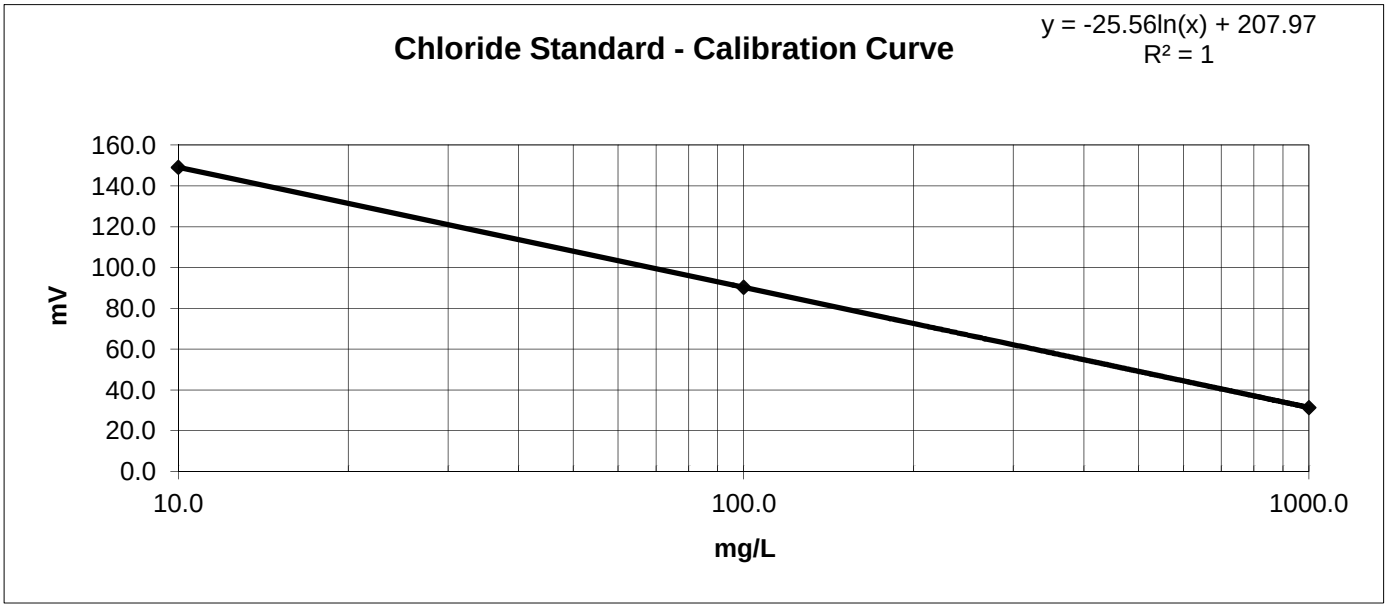
CHLORIDE STANDARD: CALIBRATION CURVE

STANDARD		MILLIVOLTS (mV)
10.0	mg/L	149.1
100.0	mg/L	90.3
1000.0	mg/L	31.4

MEASUREMENT OF CHLORIDES

		CONCENTRATION (mg/L)	CONCENTRATION (mg/kg)
Sample Weight (g):	100.0		
Water added to Sample (ml):	100.0		
Size of Sample Aliquot (ml):	25.0		
Sample Reading (mV):	140.5	14.01	14.01

Notes: 1) Samples and standards were buffered by the addition of an equal volume of the 0.2 M KNO_3 solution (1:1 volume).
2) Samples were dried for a minimum of 12 hours at 110 $^{+}/_{-}$ 5^{o}C.



Notes:

Tested By	JAM	Date	6/6/22	Checked By	BRB	Date	6/9/22

DCN: CT-S63A DATE: 6/2/14 REVISION: 1

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Water-Soluble Sulfate Ion Content in Soil

AASHTO T 290-95 (2020)

Client:	WSP Golder	Boring No.:	NB-3
Client Reference:	BQ Energy GLA21458932.006SUB.00	Depth (ft):	2.0-8.0'
Project No.:	2022-292-001	Sample No.:	BS-1
Lab ID:	2022-292-001-002	Soil Description:	Brown Silt

Sulfate Standard - Calibration Curve Spectrophotometer Readings

Sulfate Ion Concentrations (mg/L)

0.0	4.0	10.0	20.0	30.0	40.0	60.0	80.0	100.0

Spectrophotometer Readings (FAU)

Underrange	Underrange	6	22	47	68	129	179	241

Measurement of Barium Chloride Turbidity

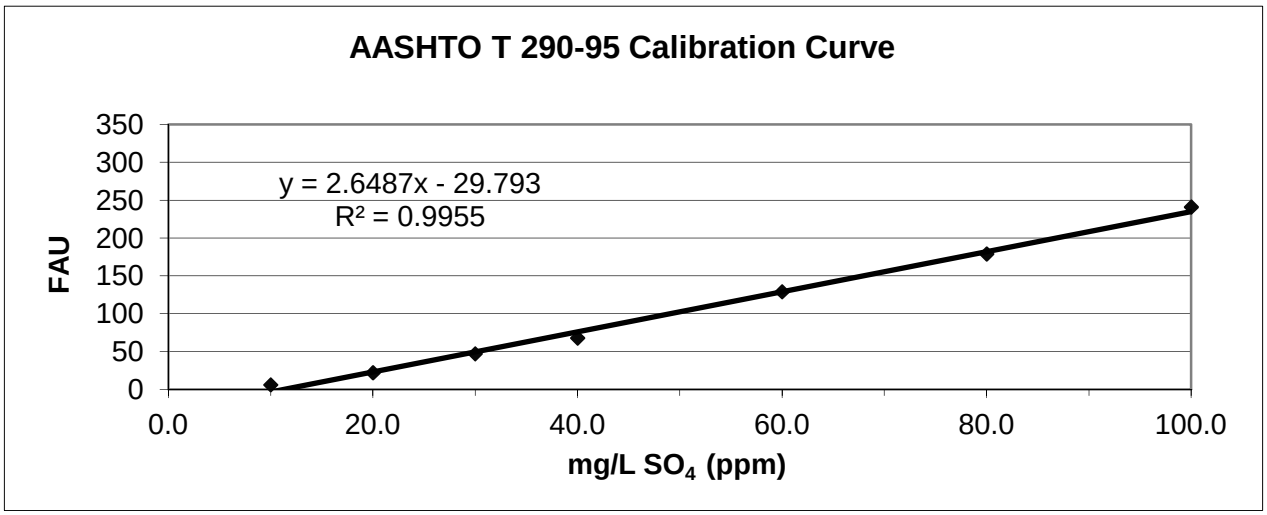
(Sample contains 5.0 mL NaCl solution and 0.3 g $BaCl_2 \cdot 2H_2O$)

Sample Weight (g):	100.0
Water added to Sample (mL):	300.0
Size of Sample Aliquot (mL):	50.0
Sample Reading (FAU):	8
Sample Diluted:	No
Sulfate Solution Added (ml):	0

Sample Moisture Content

Tare Number:	594
Weight of Tare & Wet Sample (g):	189.76
Weight of Tare & Dry Sample (g):	189.20
Weight of Tare (g):	80.39
Weight of Water (g):	0.56
Weight of Dry Sample (g):	108.81
Moisture Content (%):	0.51

Sample Sulfate Ion Concentration:	14.27	**mg/L SO_4 (ppm)**
Sample Sulfate Ion Content:	42.8	**mg/Kg SO_4 (not corrected for moisture)**
Sample Sulfate Ion Content:	43.0	**mg/Kg SO4 (corrected for moisture)**



Tested by: JAM Date: 6/7/22 Checked by: BRB Date: 6/9/22

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ANALYTICAL REPORT

Eurofins Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238
Tel: (412)963-7058

Laboratory Job ID: 180-138501-1
Client Project/Site: Geotechnics, WSP Golder

For:
Geotechnics Inc.
544 Braddock Ave
East Pittsburgh, Pennsylvania 15112

Attn: Caleb Kyper

Authorized for release by:
5/31/2022 7:44:35 PM

David Dunlap, Senior Project Manager
(412)963-2432
David.Dunlap@et.eurofinsus.com

PA Lab ID: 02-00416

Table of Contents

Case Narrative

Client: Geotechnics Inc.
Project/Site: Geotechnics, WSP Golder

Job ID: 180-138501-1

Job ID: 180-138501-1

Laboratory: Eurofins Pittsburgh

Narrative

Job Narrative
180-138501-1

Comments
The samples were received past the holding time for the sulfide analysis. At the direction of the client, the analysis was to be completed.

Receipt
The samples were received on 5/23/2022 4:06 PM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 21.1° C.

General Chemistry
Method 9034: The matrix spike/matrix spike duplicate (MS/MSD) of sample 2022-292-001-001 (180-138501-1) had the recoveries of sulfide below the control limits. The RPD between the spikes and the recovery of the laboratory control sample were within the control limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Definitions/Glossary

Client: Geotechnics Inc.
Job ID: 180-138501-1
Project/Site: Geotechnics, WSP Golder

Qualifiers

General Chemistry

Qualifier	Qualifier Description
!	Laboratory is not accredited for this parameter.
B	Analyte was found in the blank.
FL	MS and/or MSD recovery below control limits.
H	Sample was prepped or analyzed beyond the specified holding time
H3	Sample was received and analyzed past holding time.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Accreditation/Certification Summary

Client: Geotechnics Inc. Job ID: 180-138501-1
Project/Site: Geotechnics, WSP Golder

Laboratory: Eurofins Pittsburgh

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Pennsylvania	NELAP	02-00416	05-29-22

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
SM 2580B		Solid	Oxidation Reduction Potential

Sample Summary

Client: Geotechnics Inc.
Job ID: 180-138501-1
Project/Site: Geotechnics, WSP Golder

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
180-138501-1	2022-292-001-001	Solid	05/11/22 00:00	05/23/22 16:06
180-138501-2	2022-292-001-002	Solid	05/11/22 00:00	05/23/22 16:06
180-138501-3	2022-292-001-003	Solid	05/11/22 00:00	05/23/22 16:06
180-138501-4	2022-292-001-004	Solid	05/11/22 00:00	05/23/22 16:06

Method Summary

Client: Geotechnics Inc.
Project/Site: Geotechnics, WSP Golder

Job ID: 180-138501-1

Method	Method Description	Protocol	Laboratory
2540G	SM 2540G	SM22	TAL PIT
EPA 9034	Sulfide, Acid soluble and Insoluble (Titrimetric)	SW846	TAL PIT
SM 2580B	Reduction-Oxidation (REDOX) Potential	SM	TAL PIT
9030B	Sulfide, Distillation (Acid Soluble and Insoluble)	SW846	TAL PIT
DI Leach	Deionized Water Leaching Procedure	ASTM	TAL PIT

Protocol References:

ASTM = ASTM International

SM = "Standard Methods For The Examination Of Water And Wastewater"

SM22 = Standard Methods For The Examination Of Water And Wastewater, 22nd Edition

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL PIT = Eurofins Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Lab Chronicle

Client: Geotechnics Inc.
Project/Site: Geotechnics, WSP Golder

Job ID: 180-138501-1

Client Sample ID: 2022-292-001-001
Date Collected: 05/11/22 00:00
Date Received: 05/23/22 16:06

Lab Sample ID: 180-138501-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			399829	05/24/22 16:31	BAC	TAL PIT
	Instrument ID: NOEQUIP									
Soluble	Leach	DI Leach			19.99 g	20 mL	400191	05/27/22 12:27	ELS	TAL PIT
Soluble	Analysis	SM 2580B		1			400192	05/27/22 14:46	ELS	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: 2022-292-001-001
Date Collected: 05/11/22 00:00
Date Received: 05/23/22 16:06

Lab Sample ID: 180-138501-1
Matrix: Solid
Percent Solids: 88.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9030B			5.00 mL	50 mL	399766	05/24/22 10:30	HEK	TAL PIT
Total/NA	Analysis	EPA 9034		1			399783	05/24/22 12:25	HEK	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: 2022-292-001-002
Date Collected: 05/11/22 00:00
Date Received: 05/23/22 16:06

Lab Sample ID: 180-138501-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			399829	05/24/22 16:31	BAC	TAL PIT
	Instrument ID: NOEQUIP									
Soluble	Leach	DI Leach			19.74 g	20 mL	400191	05/27/22 12:27	ELS	TAL PIT
Soluble	Analysis	SM 2580B		1			400192	05/27/22 14:49	ELS	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: 2022-292-001-002
Date Collected: 05/11/22 00:00
Date Received: 05/23/22 16:06

Lab Sample ID: 180-138501-2
Matrix: Solid
Percent Solids: 91.3

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9030B			5.01 mL	50 mL	399766	05/24/22 10:30	HEK	TAL PIT
Total/NA	Analysis	EPA 9034		1			399783	05/24/22 12:44	HEK	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: 2022-292-001-003
Date Collected: 05/11/22 00:00
Date Received: 05/23/22 16:06

Lab Sample ID: 180-138501-3
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			399829	05/24/22 16:31	BAC	TAL PIT
	Instrument ID: NOEQUIP									
Soluble	Leach	DI Leach			20.15 g	20 mL	400191	05/27/22 12:27	ELS	TAL PIT
Soluble	Analysis	SM 2580B		1			400192	05/27/22 14:53	ELS	TAL PIT
	Instrument ID: NOEQUIP									

Lab Chronicle

Client: Geotechnics Inc.
Project/Site: Geotechnics, WSP Golder

Job ID: 180-138501-1

Client Sample ID: 2022-292-001-003
Date Collected: 05/11/22 00:00
Date Received: 05/23/22 16:06

Lab Sample ID: 180-138501-3
Matrix: Solid
Percent Solids: 86.8

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9030B			5.02 mL	50 mL	399766	05/24/22 10:30	HEK	TAL PIT
Total/NA	Analysis	EPA 9034		1			399783	05/24/22 12:51	HEK	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: 2022-292-001-004
Date Collected: 05/11/22 00:00
Date Received: 05/23/22 16:06

Lab Sample ID: 180-138501-4
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			399829	05/24/22 16:31	BAC	TAL PIT
	Instrument ID: NOEQUIP									
Soluble	Leach	DI Leach			20.26 g	20 mL	400191	05/27/22 12:27	ELS	TAL PIT
Soluble	Analysis	SM 2580B		1			400192	05/27/22 14:56	ELS	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: 2022-292-001-004
Date Collected: 05/11/22 00:00
Date Received: 05/23/22 16:06

Lab Sample ID: 180-138501-4
Matrix: Solid
Percent Solids: 89.9

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	9030B			5.04 mL	50 mL	399766	05/24/22 10:30	HEK	TAL PIT
Total/NA	Analysis	EPA 9034		1			399783	05/24/22 12:57	HEK	TAL PIT
	Instrument ID: NOEQUIP									

Laboratory References:

TAL PIT = Eurofins Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Analyst References:

Lab: TAL PIT

Batch Type: Leach

ELS = Edwin Shireman

Batch Type: Prep

HEK = Hope Kiesling

Batch Type: Analysis

BAC = Blase Cindric

ELS = Edwin Shireman

HEK = Hope Kiesling

Client Sample ID: 2022-292-001-001 — Lab Sample ID: 180-138501-1

Date Collected: 05/11/22 00:00 — **Matrix: Solid**
Date Received: 05/23/22 16:06

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	12.0		0.1	0.1	%			05/24/22 16:31	1
Percent Solids	88.0		0.1	0.1	%			05/24/22 16:31	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation Reduction Potential	250	!	10	10	millivolts			05/27/22 14:46	1

Client Sample ID: 2022-292-001-001 — Lab Sample ID: 180-138501-1

Date Collected: 05/11/22 00:00 — **Matrix: Solid**
Date Received: 05/23/22 16:06 — **Percent Solids: 88.0**

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	24	J H H3 B FL	34	11	mg/Kg	☼	05/24/22 10:30	05/24/22 12:25	1

Client Sample ID: 2022-292-001-002 — Lab Sample ID: 180-138501-2

Date Collected: 05/11/22 00:00 — **Matrix: Solid**
Date Received: 05/23/22 16:06

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	8.7		0.1	0.1	%			05/24/22 16:31	1
Percent Solids	91.3		0.1	0.1	%			05/24/22 16:31	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation Reduction Potential	250	!	10	10	millivolts			05/27/22 14:49	1

Client Sample ID: 2022-292-001-002 — Lab Sample ID: 180-138501-2

Date Collected: 05/11/22 00:00 — **Matrix: Solid**
Date Received: 05/23/22 16:06 — **Percent Solids: 91.3**

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	30	J H H3 B	33	11	mg/Kg	☼	05/24/22 10:30	05/24/22 12:44	1

Client Sample ID: 2022-292-001-003 — Lab Sample ID: 180-138501-3

Date Collected: 05/11/22 00:00 — **Matrix: Solid**
Date Received: 05/23/22 16:06

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	13.2		0.1	0.1	%			05/24/22 16:31	1
Percent Solids	86.8		0.1	0.1	%			05/24/22 16:31	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation Reduction Potential	260	!	9.9	9.9	millivolts			05/27/22 14:53	1

Client Sample ID: 2022-292-001-003 — Lab Sample ID: 180-138501-3

Date Collected: 05/11/22 00:00 — **Matrix: Solid**
Date Received: 05/23/22 16:06 — **Percent Solids: 86.8**

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	30	J H H3 B	34	11	mg/Kg	☼	05/24/22 10:30	05/24/22 12:51	1

Client Sample ID: 2022-292-001-004 — Lab Sample ID: 180-138501-4

Date Collected: 05/11/22 00:00 — **Matrix: Solid**
Date Received: 05/23/22 16:06

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	10.1		0.1	0.1	%			05/24/22 16:31	1
Percent Solids	89.9		0.1	0.1	%			05/24/22 16:31	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation Reduction Potential	280	!	9.9	9.9	millivolts			05/27/22 14:56	1

Client Sample ID: 2022-292-001-004 — Lab Sample ID: 180-138501-4

Date Collected: 05/11/22 00:00 — **Matrix: Solid**
Date Received: 05/23/22 16:06 — **Percent Solids: 89.9**

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	25	J H H3 B	33	11	mg/Kg	☼	05/24/22 10:30	05/24/22 12:57	1

Method: 2540G - SM 2540G

Lab Sample ID: 180-138501-3 DU
Matrix: Solid
Analysis Batch: 399829

Client Sample ID: 2022-292-001-003
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Percent Moisture	13.2			12.9		%				2	10
Percent Solids	86.8			87.1		%				0.3	10

Method: EPA 9034 - Sulfide, Acid soluble and Insoluble (Titrimetric)

Lab Sample ID: MB 180-399766/1-A
Matrix: Solid
Analysis Batch: 399783

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 399766

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	14.0	J B	30	10	mg/Kg		05/24/22 10:30	05/24/22 12:12	1

Lab Sample ID: LCS 180-399766/2-A
Matrix: Solid
Analysis Batch: 399783

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 399766

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Sulfide			190	194		mg/Kg		102	85 - 115		

Lab Sample ID: 180-138501-1 MS
Matrix: Solid
Analysis Batch: 399783

Client Sample ID: 2022-292-001-001
Prep Type: Total/NA
Prep Batch: 399766

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Sulfide	24	J H H3 B FL	216	153	FL	mg/Kg	☼	60	75 - 125		

Lab Sample ID: 180-138501-1 MSD
Matrix: Solid
Analysis Batch: 399783

Client Sample ID: 2022-292-001-001
Prep Type: Total/NA
Prep Batch: 399766

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Sulfide	24	J H H3 B FL	216	161	FL	mg/Kg	☼	63	75 - 125	5	20

Method: SM 2580B - Reduction-Oxidation (REDOX) Potential

Lab Sample ID: LCS 180-400192/1
Matrix: Solid
Analysis Batch: 400192

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Oxidation Reduction Potential			475	468		millivolts		99	90 - 110		

General Chemistry

Prep Batch: 399766

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-138501-1	2022-292-001-001	Total/NA	Solid	9030B	
180-138501-2	2022-292-001-002	Total/NA	Solid	9030B	
180-138501-3	2022-292-001-003	Total/NA	Solid	9030B	
180-138501-4	2022-292-001-004	Total/NA	Solid	9030B	
MB 180-399766/1-A	Method Blank	Total/NA	Solid	9030B	
LCS 180-399766/2-A	Lab Control Sample	Total/NA	Solid	9030B	
180-138501-1 MS	2022-292-001-001	Total/NA	Solid	9030B	
180-138501-1 MSD	2022-292-001-001	Total/NA	Solid	9030B	

Analysis Batch: 399783

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-138501-1	2022-292-001-001	Total/NA	Solid	EPA 9034	399766
180-138501-2	2022-292-001-002	Total/NA	Solid	EPA 9034	399766
180-138501-3	2022-292-001-003	Total/NA	Solid	EPA 9034	399766
180-138501-4	2022-292-001-004	Total/NA	Solid	EPA 9034	399766
MB 180-399766/1-A	Method Blank	Total/NA	Solid	EPA 9034	399766
LCS 180-399766/2-A	Lab Control Sample	Total/NA	Solid	EPA 9034	399766
180-138501-1 MS	2022-292-001-001	Total/NA	Solid	EPA 9034	399766
180-138501-1 MSD	2022-292-001-001	Total/NA	Solid	EPA 9034	399766

Analysis Batch: 399829

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-138501-1	2022-292-001-001	Total/NA	Solid	2540G	
180-138501-2	2022-292-001-002	Total/NA	Solid	2540G	
180-138501-3	2022-292-001-003	Total/NA	Solid	2540G	
180-138501-4	2022-292-001-004	Total/NA	Solid	2540G	
180-138501-3 DU	2022-292-001-003	Total/NA	Solid	2540G	

Leach Batch: 400191

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-138501-1	2022-292-001-001	Soluble	Solid	DI Leach	
180-138501-2	2022-292-001-002	Soluble	Solid	DI Leach	
180-138501-3	2022-292-001-003	Soluble	Solid	DI Leach	
180-138501-4	2022-292-001-004	Soluble	Solid	DI Leach	

Analysis Batch: 400192

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-138501-1	2022-292-001-001	Soluble	Solid	SM 2580B	400191
180-138501-2	2022-292-001-002	Soluble	Solid	SM 2580B	400191
180-138501-3	2022-292-001-003	Soluble	Solid	SM 2580B	400191
180-138501-4	2022-292-001-004	Soluble	Solid	SM 2580B	400191
LCS 180-400192/1	Lab Control Sample	Total/NA	Solid	SM 2580B	

Login Sample Receipt Checklist

Client: Geotechnics Inc.

Job Number: 180-138501-1

Login Number: 138501
List Number: 1
Creator: Kovitch, Christina M

List Source: Eurofins Pittsburgh

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	False	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	False	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX C

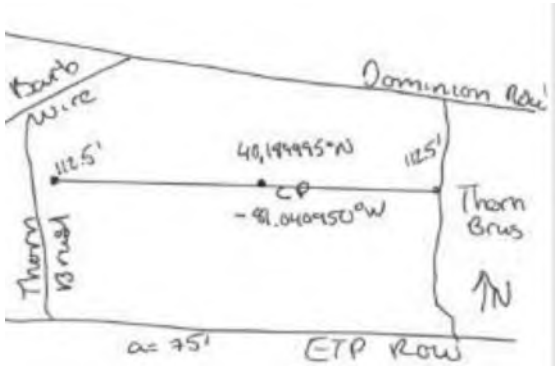
Soil Resistivity Test Results

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	BQ Nottingham Substation
WSP Project No.:	GLA21458932.000
Supplier Name & Operator	WSP - Matthew Oberg
Project Location:	Athens Township, Ohio
Date:	6/3/2022
Measurement No. & Orientation:	6032022 West (AM) to East (NB)
Description of Terrain & Probe Insertion:	moist, numerous cobbles
Weather (Present and Recent):	Sunny, light rain within 24 hours
Meter Model Type:	Supersting R8
Serial No. & Calibration Date:	SS2101144 - 05/09/2022



Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration A (ft)	M (ft)	0	N (ft)	B (ft)	Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-ft)
1	1	1	1.5	0.5		0.5	1.5	12	863	37.44	0	23.040	144.8
2	2	2	3	1		1	3	12	537	39.68	0	13.530	170.0
3	4	4	4.5	1.5		1.5	4.5	12	742	53.75	0	13.800	261.8
6	6	6	9	3		3	9	12	633	51.85	0	12.200	459.9
10	6	6	15	5		5	15	12	327	36.8	0	8.880	557.9
20	12	10	30	10		10	30	12	3134	407.5	0	7.690	966.9
25	12	10	37.5	12.5		12.5	37.5	12	1591	251.7	0	6.320	993.8
30	12	10	45	15		15	45	12	1211	250.7	0	4.830	910.1
45	12	10	67.5	22.5		22.5	67.5	12	824	401.8	0	2.050	579.9
60	12	10	90	30		30	90	12	482	385.7	0	1.249	471.0
75	12	10	112.5	37.5		37.5	112.5	12	327	333.9	0	0.979	461.4

Probe — Indicates probe pin ID at Ft marker in standing water

[1] Not required if using AGI meters.

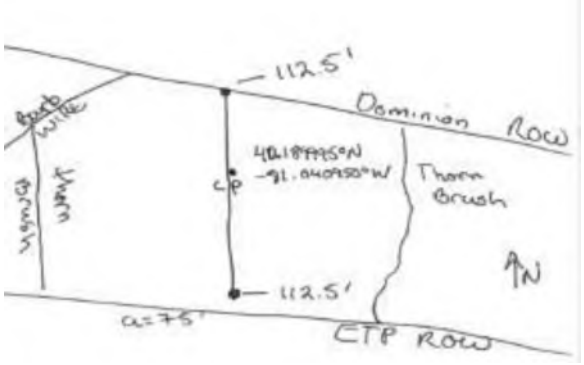
Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	BQ Nottingham Substation
WSP Project No.:	GLA21458932.000
Supplier Name & Operator	WSP - Matthew Oberg
Project Location:	Athens Township, Ohio
Date:	6/3/2022
Measurement No. & Orientation:	6032022 South (AM) to North (NB)
Description of Terrain & Probe Insertion:	moist, numerous cobbles
Weather (Present and Recent):	Sunny, light rain within 24 hours
Meter Model Type:	Supersting R8
Serial No. & Calibration Date:	SS2101144 - 05/09/2022



Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration A (ft)	M (ft)	0	N (ft)	B (ft)	Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-ft)
1	1	1	1.5	0.5		0.5	1.5	12	993	37.07	0	26.800	168.4
2	2	2	3	1		1	3	12	493	37.17	0	13.260	166.6
3	4	4	4.5	1.5		1.5	4.5	12	730	54.07	0	13.510	254.6
6	6	6	9	3		3	9	12	920	55.45	0	16.590	625.3
10	6	6	15	5		5	15	12	473	53.75	0	8.803	552.1
20	12	10	30	10		10	30	12	2612	481.6	0	5.423	681.5
25	12	10	37.5	12.5		12.5	37.5	12	2175	475.8	0	4.572	718.2
30	12	10	45	15		15	45	12	2284	578.3	0	3.950	744.6
45	12	10	67.5	22.5		22.5	67.5	12	1405	492.4	0	2.853	806.6
60	12	10	90	30		30	90	12	1009	461.9	0	2.184	823.4
75	12	10	112.5	37.5		37.5	112.5	12	684	452.1	0	1.514	713.5

Probe Indicates probe pin ID at Ft marker in standing water

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

golder.com

Appendix C Archaeological and Cultural Resources

November 3, 2022

Ms. Lori Cuervo
Director
BQ Energy Development LLC
400 Market Industrial Park, Suite 32
Wappinger Falls, NY 12590

Desktop Analysis for the Nottingham 138kV Gen-Tie Transmission Line, Harrison County, Ohio

Dear Ms. Cuervo:

WSP USA Inc. (WSP) conducted an architectural desktop analysis for the Nottingham 138kV Gen-Tie Transmission Line (Project), which will connect an on-site substation at the Nottingham Solar Site to the AEP Nottingham Substation, located on Stumptown Road in Harrison County, Ohio. The desktop analysis was completed to understand what architectural resources may be potentially affected by the Project. The 0.8-mile-long gen-tie line will have a 100-foot wide right-of-way (ROW) (Project Area). The project area is located in Section 11 of Township 9 North, Range 5 West (New Athens Township). A desktop review regarding archaeological resources will be presented in a separate report.

This work is being conducted in compliance with the Ohio Power Siting Board, Ohio Administrative Code 4906-4-08, Health and safety, land use and ecological information.

Project Description

Nottingham Solar LLC proposes to construct and operate a substation on-site of the proposed Nottingham Solar Project (Case No. 21-0270-EL-BGN) and an approximately 0.8-mile overhead generation tie-line (gen-tie) that will deliver electricity to the existing American Electric Power (AEP) Nottingham 138kV Substation that connects to the regional transmission grid (Figure 1).

Methodology

WSP's desktop analysis consisted of a records check/database review to determine the presence of any known architectural resources in the area within a 3.2-kilometer (2-mile) radius extending from each side of the Project Area boundaries (Study Area)(Figure 2). The OPSB regulations require an evaluation of cultural resources within a 10-mile radius of the project area, which will be completed for the purposes of the application to OPSB; however, the study area for this review has been defined as a 2-mile radius given the relatively short height of the transmission line and intervening vegetation.

Architectural review examined only the portion of the study area within the viewshed of the proposed transmission line, which was assumed to be generally 95 feet in height (see Figure 2). The resulting viewshed for the transmission line extends approximately 0.50 miles north and east of the study area for the adjacent Nottingham Solar Site (2021-HAS-51991).

The review identified resources listed in the National Register of Historic Places (NRHP) or the Ohio State Historic Preservation Office (OHPO) Online Mapping System for historic and

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archaeological sites (Ohio History Connection [OHC] 2021), and known cemeteries shown on United States Geological Survey (USGS) topographic maps and within the OHPO Online Mapping System. The review also included examination of historical maps and aerial imagery. Figure 3 shows the project area, the study area and viewshed, and the locations of known architectural resources.

In addition, WSP conducted a reconnaissance survey of architectural resources located within the northeastern areas of the Study Area that were not included in previous investigations for the Nottingham Solar Project. Results of the survey are provided in the section below.

Known Architectural Resources

Cemeteries
Only one previously recorded OGS cemetery was identified within the Nottingham study area: the Malcolm Cemetery that is extinct with all markers and remains destroyed (see Figure 3; Table 1)(OGS 2021).

TABLE 1: KNOWN OGS CEMETERIES IN THE NOTTINGHAM STUDY AREA

OGSID	RESOURCE	NRHP STATUS	CONDITION	WITHIN VIEWSHED (Y/N)	DISTANCE TO PROJECT AREA (MILES)
4951	Malcolm	Not Evaluated	Extinct	N	1.48

Source: OHC 2021

Historic-Period Structures
In the Ohio Mapping system, five historic structures were identified in the Nottingham Gen-Tie study area (see Figure 3; Table 1). All five resources—three houses and two farmsteads—are unevaluated. No NRHP-listed properties were identified in the study area. All but the Rev. John Walker House are within the viewshed of the Nottingham Gen-Tie Project Area (see Figure 3). In December 2021, Civil and Environmental Consultants (CEC) completed an historic property report for the BQ Nottingham Solar Site (2021-HAS-51991; CEC 2021). CEC evaluated one resource within the current study area, a dilapidated barn (CEC001), as not eligible for listing in the NRHP. CEC completed a reconnaissance-level history/architectural survey and identified thirty-three additional properties within the current study area (Attachment A). None of the properties would have their viewsheds affected by the proposed solar project; so no further work was recommended (CEC 2021:10). None of these properties are within the viewshed of the Substation.

TABLE 1: KNOWN HISTORIC STRUCTURES IN THE NOTTINGHAM GEN-TIE STUDY AREA

OHIO INVENTORY NO.	RESOURCE	CONDITION-INTEGRITY/ NRHP STATUS	LOCATION	WITHIN VIEWSHED (Y/N)	DISTANCE TO PROJECT AREA (MILES)
HAS0041514	McLaughlin House	Not Evaluated	SR 9 N of New Athens	Y	1.74
HAS0002814	Rev John Walker House	Non-Extant	SR 519 W of New Athens	Y	1.45
HAS0062414	Barricklow Farm	Not Evaluated	1450 NE of Jct Bus	N	1.72
HAS0064014	Applegarth House	Vinyl siding, replacement windows/Not Evaluated	SR 519 W of New Athens	Y	1.51

OHIO INVENTORY NO.	RESOURCE	CONDITION-INTEGRITY/ NRHP STATUS	LOCATION	WITHIN VIEWSHED (Y/N)	DISTANCE TO PROJECT AREA (MILES)
HAS0062614	Farmstead	Partially collapsed house and shed remain/Not Evaluated	Webb Rd	Y	1.26

Source: OHC 2021

Most of the study area for this project coincides with the study area for the Nottingham Solar Site (2021-HAS-51991). Since there were only a few unsurveyed properties to the northwest and west of New Athens in the study area, WSP conducted a reconnaissance architectural survey to identify any potential historic properties in the study area (Table 4). All of the unsurveyed properties are not located within the viewshed of the Project (see Figure 3). WSP also surveyed the McLaughlin House, which is located within the viewshed of the project, to gather information on its integrity.

TABLE 4. PROPERTIES OVER 45 YEARS IN AGE, NOT WITHIN PROPOSED PROJECT'S VIEWSHED

MAP ID NO.	RESOURCE	ADDRESS	STYLE/ CONSTRUCTION DATE	CONDITION-INTEGRITY/ NRHP RECOMMENDATIONS	PHOTOGRAPH
WSP-1	Concession Stand, Bramble Park	SR 519, New Athens	No style/ ca. 1970	Good/Does not warrant further investigation for NRHP consideration at this time.	
WSP-2	Water Tower	SR 9, New Athens	No style/ca. 1970	Good/Does not warrant further investigation for NRHP consideration at this time.	
WSP-3	Lackman House	76080 SR 9, New Athens	Ranch/1964	Fair (cladding and window replacements)/ Not a noteworthy example of style/Does not warrant further investigation for NRHP consideration at this time.	
WSP-4	Township Maintenance Shed	SR 9, New Athens	No style/ca. 1960	Good/Does not warrant further investigation for NRHP consideration at this time.	
WSP-5	Denoon Farm	76155 Cadiz-New Athens Road	Ranch/1957	Fair/Not a noteworthy example of style/Does not warrant further investigation for NRHP consideration at this time.	

McLaughlin House (HAS0041514)
The McLaughlin House is located at 76300 Cadiz-New Athens Road, approximately 1.73 miles from the Project Area. Situated on the top of a hill, the property consists of an Italianate style house with a large, gabled extension added to the rear elevation of the house between 2017 and 2020 (Figure 4) Google Earth Historical Imagery 2017, 2020). The only outbuilding on the property is a ca. 2017 gazebo, which was constructed on the site of a gabled outbuilding that appears to have been a small barn or machine shed (Figure 5) Google Earth Historical Imagery 2015). A gabled barn, located in the southern end of the parcel was demolished in April 2021 (Google Earth Historical Imagery 2021).

It appears that the McLaughlin house was renovated at the same time as the extension was constructed ca. 2018 (Figures 6 and 7). The house is clad with vinyl siding, has new one-over-one vinyl windows and has cladding in the deep eaves. The hipped roof has also been recently clad with asphalt shingles. However, the pedimented window surrounds appear to be original. The gable addition also has vinyl siding and windows with modern pedimented window surrounds. The addition is connected to the original house with a gabled hyphen.

Summary

WSP conducted an architectural desktop analysis for the Nottingham 138kV Gen-Tie Transmission Line project to determine the presence of any known architectural resources in the study area, defined as the area within a 3.2-kilometer (2-mile) radius extending from each side of the Project Area boundaries. The previously recorded OGS cemetery (Malcolm) is located in the study area; but it is an extinct cemetery and is not within the viewshed of the project area. The previously surveyed McLaughlin House (HAS0041514) is also located within the viewshed of the project area but is 1.73 miles away. While the Project may be visible from the house, the house's viewshed has already been diminished with the AEP Nottingham Substation and several transmission lines in the area of the Project.

WSP presents this information for review and comment by the Ohio State Historic Preservation Office in compliance with the Ohio Power Siting Board, Ohio Administrative Code 4906-4-08, Health and safety, land use and ecological information.

Kind regards,

Camilla R. McDonald

Camilla McDonald
Manager, Historic Preservation

CM
Encl.
File: EE1009829.0002

References

Civil & Environmental Consultants, Inc. (CEC)
2021 Historic Property Report for Nottingham Solar, Athens Township, Harrison County, Ohio. [Reference No. 2021-HAS-51991]. Prepared for Nottingham Solar LLC.

Google Earth
2015-2020 Orthoimagery of the Project Area. Google Earth Imagery dates: 2015, 2017, 2020. Accessed October 21, 2022, http://www.google.com/earth.

Ohio Genealogical Society [OGS]
2021 Cemetery Search. Online Database, Ohio Genealogical Society, Bellville. Accessed March 2, 2021, https://www.ogs.org/ohio-cemetery-search/.

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2021 Online Mapping System, GIS web application. Ohio History Connection, Ohio History Center, Columbus. Accessed March 2, 2021, https://www.ohiohistory.org/preserve/state-historic-preservation-office/mapping.

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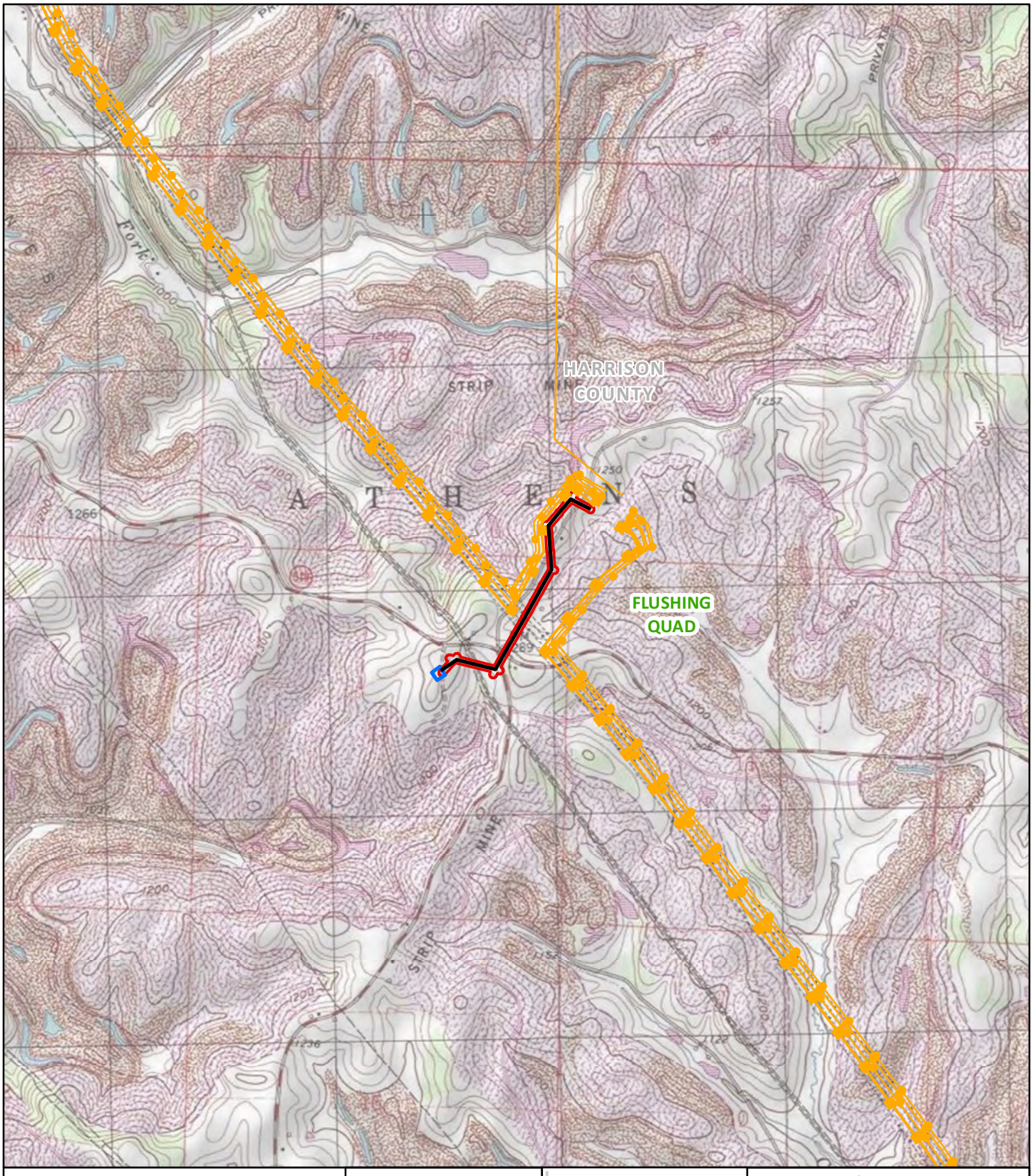
1953 *Canton Quadrangle*. Map scale 1:25,000. United States Geological Survey, Reston, Virginia.

1961 *Flushing Quadrangle*. (HTMC, 1978 ed.). Map scale 1:24,000. United States Geological Survey, Reston, Virginia.

1976 *Coshocton Quadrangle*. Map scale 1:100,000. United States Geological Survey, Reston, Virginia.

2010 *Flushing Quadrangle*. Map scale 1:24,000. United States Geological Survey, Reston, Virginia.

2019 *Flushing, OH*. 7.5-Minute Series Topographic Quadrangle. United States Geological Survey, Reston, Virginia, https://nationalmap.gov/ustopo/.



Proposed 138 kV Gen-Tie
Existing 138 kV Transmission Line
Existing 345 kV Transmission Line
Existing 69 kV Transmission Line
Proposed Substation Fenceline
Project Area
USGS 7.5' Topographic Quad Boundary
County Boundary

Sources:
Topo Quads (USGS 2013)
Transportation (ODOT 2021)
Basemap (USGS 1994)

State Plane Ohio North
NAD 83

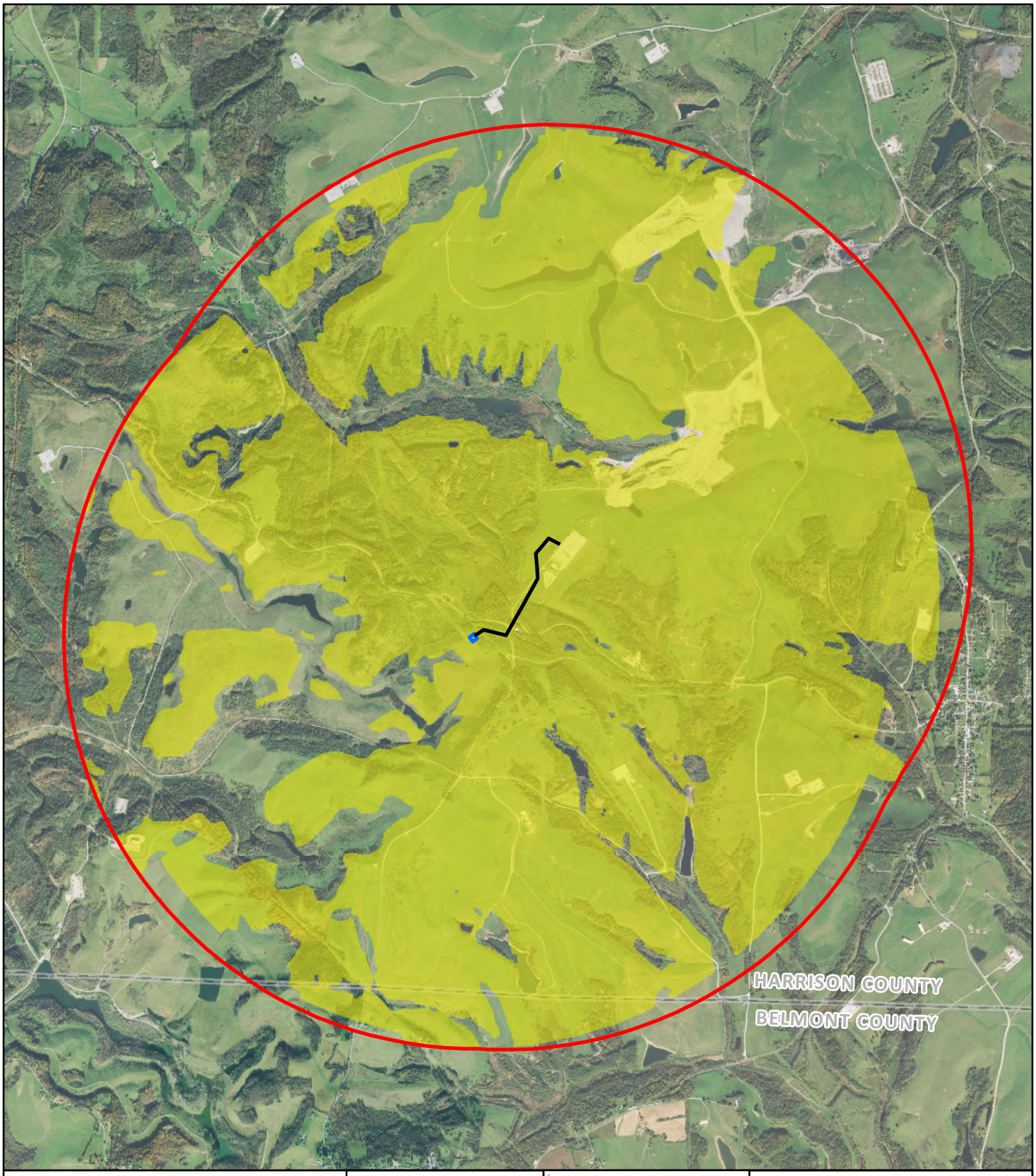
November 3, 2022

Figure 1
Proposed Nottingham Gen-Tie Transmission Line Project in Harrison County, Ohio

BQ Energy, llc.
Dedicated to the Development of Clean Energy Facilities

Nottingham Solar Project
138 kV Gen-Tie Line

0 1,000 2,000
Feet



Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Viewshed
Study Area
County Boundary

Sources:
Imagery (OGRIP 2020)
Hydrography (USGS 2021)
Transportation (ODOT 2021)

State Plane Ohio North
NAD 83

November 2, 2022

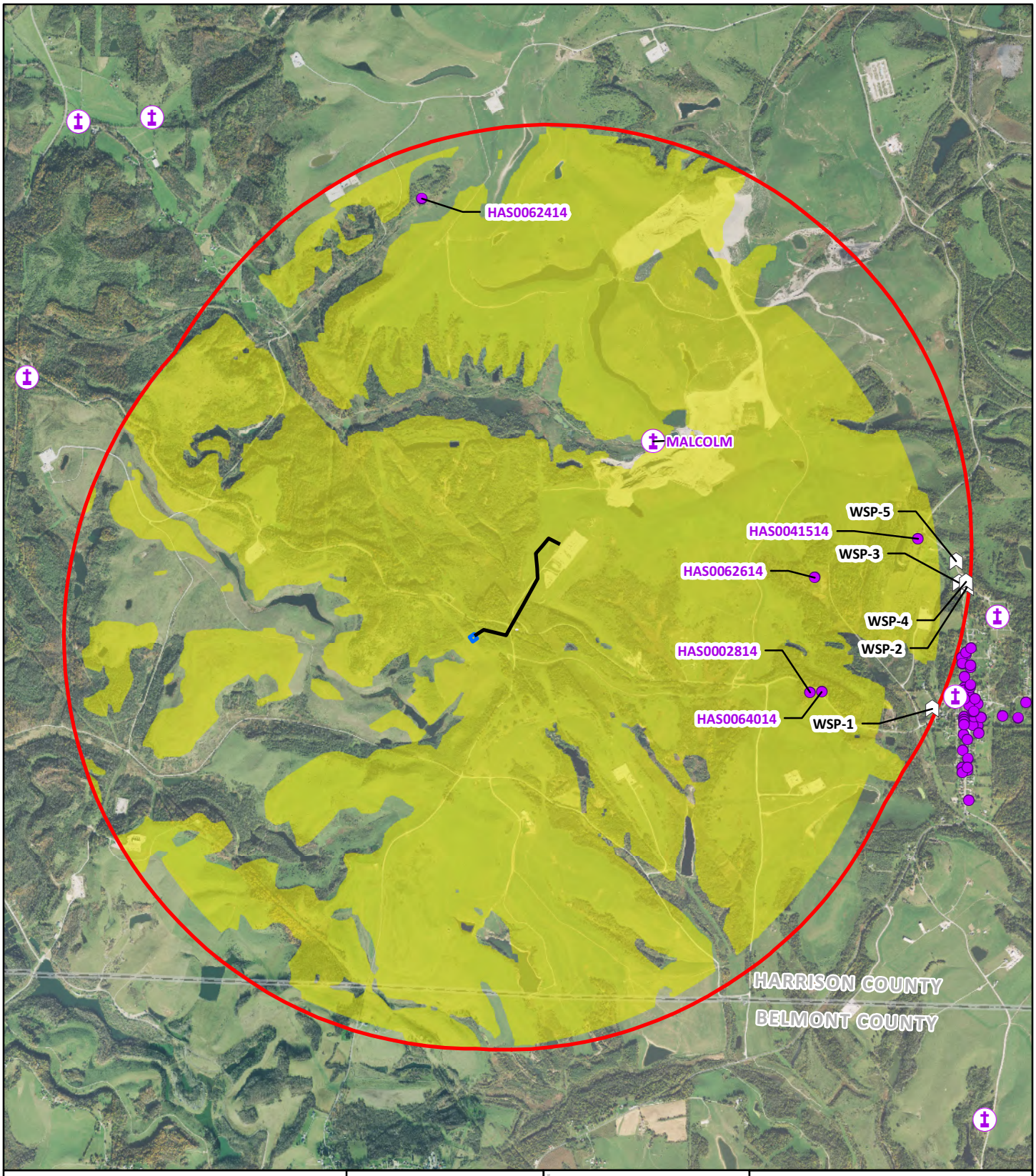
Figure 2

Proposed Nottingham Project
Study Area and Viewshed

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 0.4 0.8
Miles



Properties over 45 Years in Age
OGS Cemetery
Historic Structure
Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Viewshed
Study Area
County Boundary

Sources:
Cultural Data (SHPO 2021)
Imagery (OGRIP 2020)
Transportation (ODOT 2021)

State Plane Ohio North
NAD 83

November 2, 2022

Figure 3

Location of Known Architectural Resources in the Study Area

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 0.4 0.8
Miles

2017 2020

Figure 4: 2017 and 2020 Aerial Photographs of McLaughlin House (Google Historical Imagery 2017/2020)

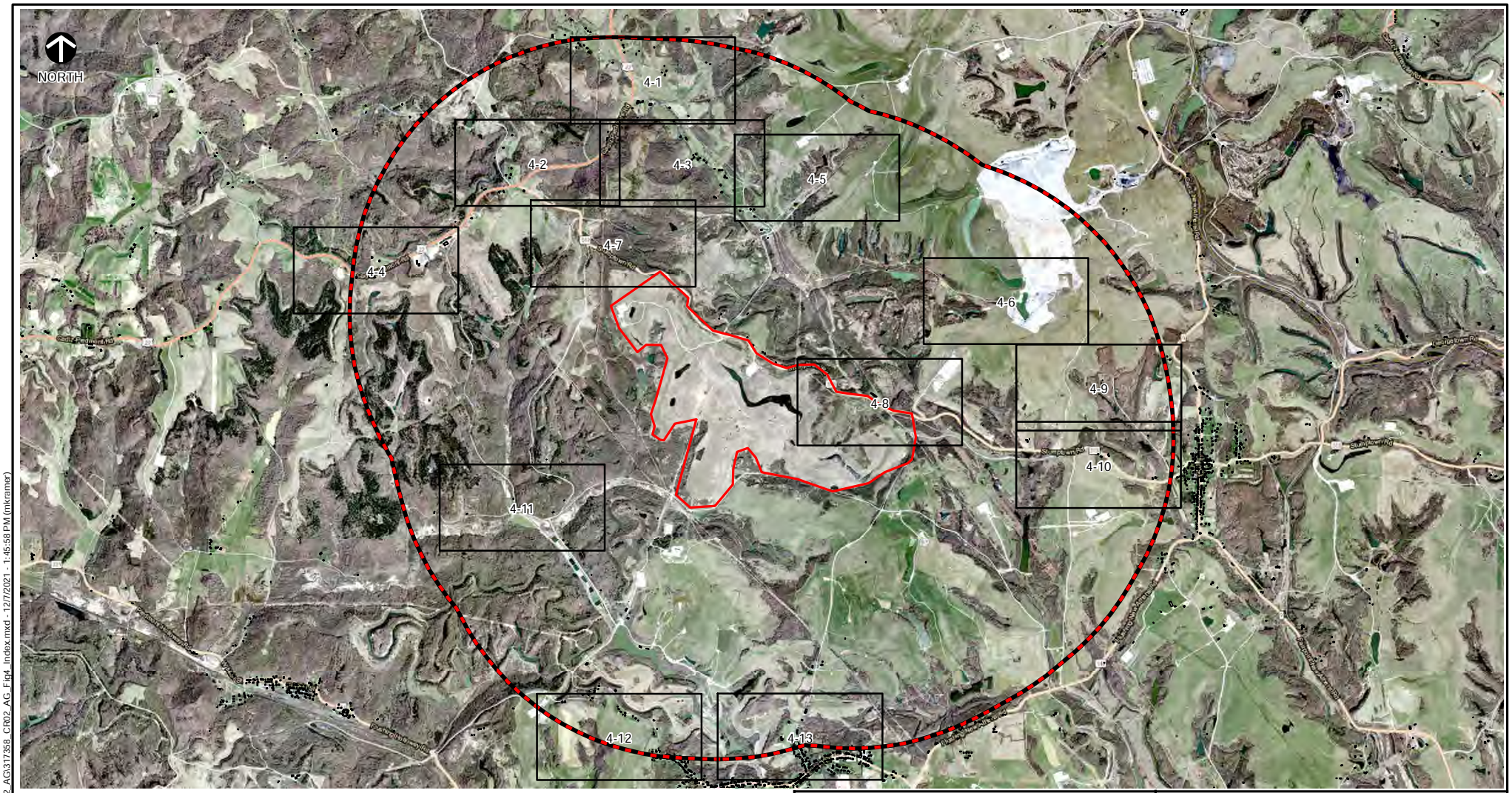
Figure 5: Aerial Photograph of McLaughlin House (Google Historical Imagery 2015)

Figure 6: Overview of McLaughlin House Looking WNW

Figure 7: Detail View of McLaughlin House Looking WNW

Attachment A:

Reconnaissance-level History/Architectural Survey Maps from CEC 2021 Survey



LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- PAGE EXTENT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

450 0 450 900 Meters

SOURCE:
1) OHIO STATEWIDE IMAGERY PROGRAM, VERSION III (OSIP III), RESOLUTION 6-INCH, IMAGERY DATED 2020, LAST ACCESSED: 12/7/2021.

Civil & Environmental Consultants, Inc.
530 East Ohio Street - Suite G - Indianapolis, IN 46204
317-655-7777 - 877-746-0749
www.cecinc.com

NOTTINGHAM SOLAR PROJECT
ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-INDEX
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 450 m	PROJECT NO:	317-358		

Signature on File *

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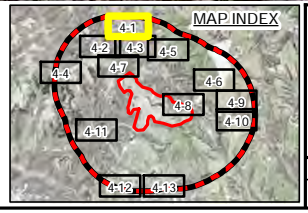
LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

SOURCE:
1) OHIO STATEWIDE IMAGERY PROGRAM, VERSION III (OSIP III), RESOLUTION 6-INCH, IMAGERY DATED 2020, LAST ACCESSED: 12/7/2021.

MAP INDEX



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NOTTINGHAM SOLAR PROJECT
ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-1
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

Signature on File *

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CONFIDENTIAL

LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

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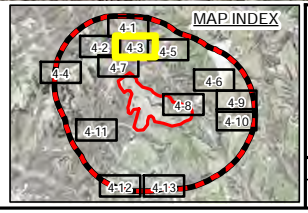

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NOTTINGHAM SOLAR PROJECT
ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-3
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

Signature on File *

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CONFIDENTIAL

LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

SOURCE:
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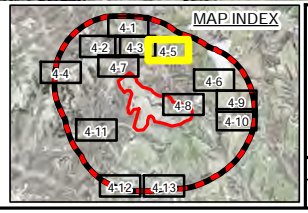

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NOTTINGHAM SOLAR PROJECT
ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-5
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

Signature on File *

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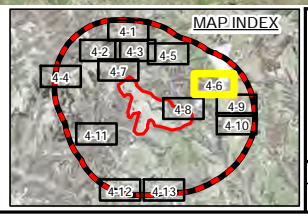
LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

SOURCE:
1) OHIO STATEWIDE IMAGERY PROGRAM, VERSION III (OSIP III), RESOLUTION 6-INCH, IMAGERY DATED 2020, LAST ACCESSED: 12/7/2021.



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ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-6
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

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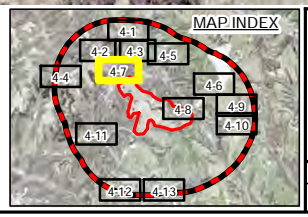
LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

SOURCE:
1) OHIO STATEWIDE IMAGERY PROGRAM, VERSION III (OSIP III), RESOLUTION 6-INCH, IMAGERY DATED 2020, LAST ACCESSED: 12/7/2021.



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ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-7
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

Signature on File *

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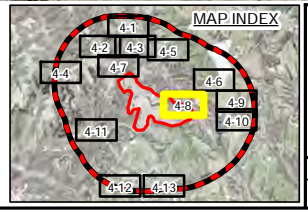
LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

SOURCE:
1) OHIO STATEWIDE IMAGERY PROGRAM, VERSION III (OSIP III), RESOLUTION 6-INCH, IMAGERY DATED 2020, LAST ACCESSED: 12/7/2021.



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ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-8
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

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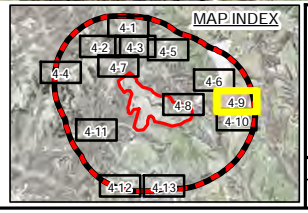
LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

SOURCE:
1) OHIO STATEWIDE IMAGERY PROGRAM, VERSION III (OSIP III), RESOLUTION 6-INCH, IMAGERY DATED 2020, LAST ACCESSED: 12/7/2021.

MAP INDEX



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NOTTINGHAM SOLAR PROJECT
ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-9
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

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LEGEND

- SURVEY AREA
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- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

SOURCE:
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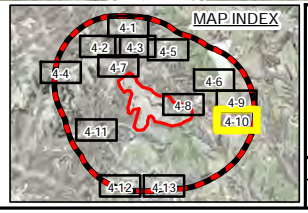

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ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-10
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

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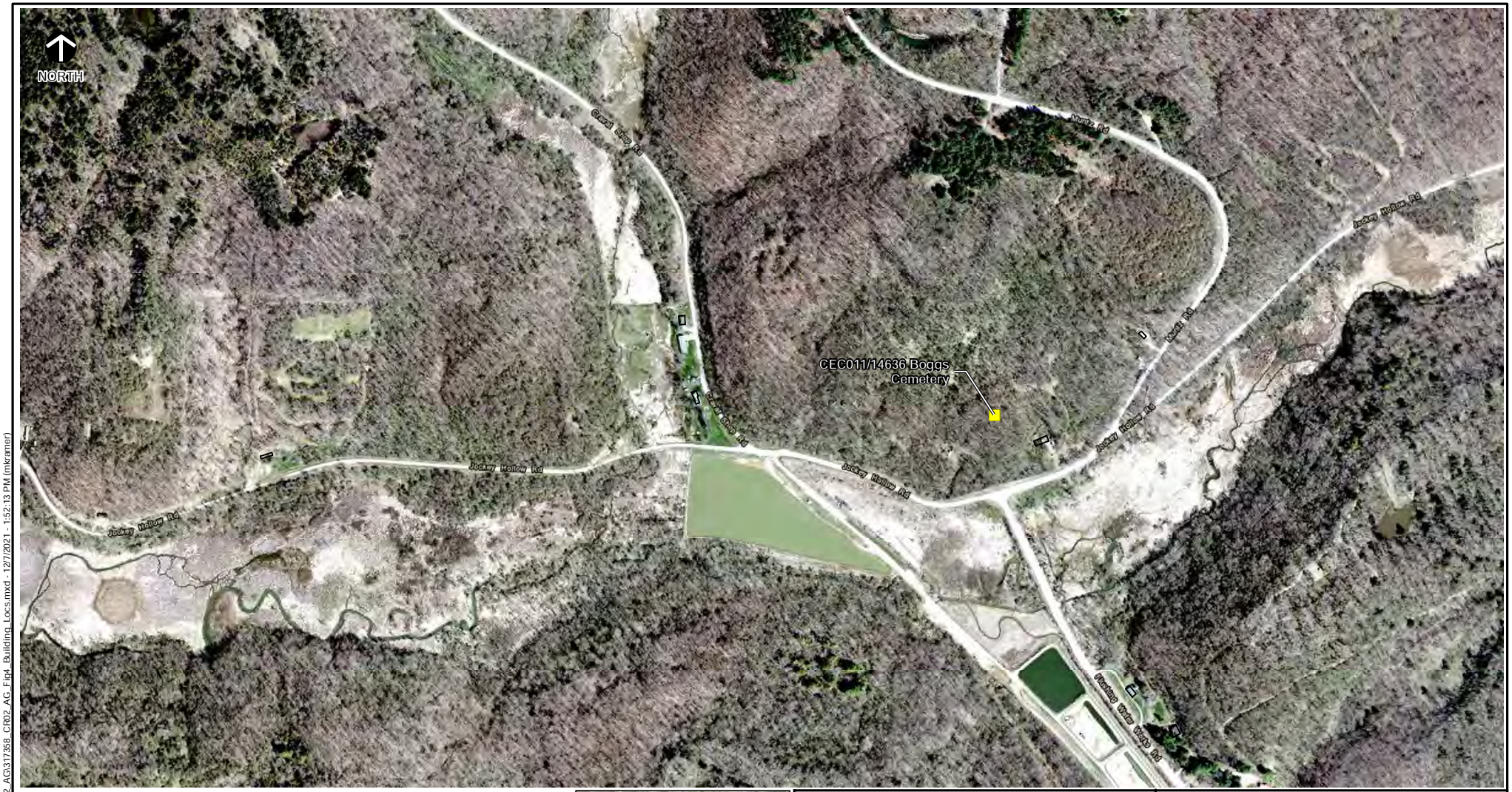

LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

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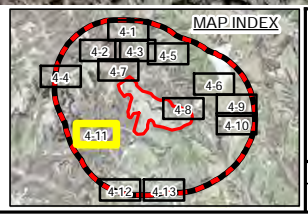

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ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-11
DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

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LEGEND

- SURVEY AREA
- NOTTINGHAM SOLAR PROJECT
- BUILDING FOOTPRINT
- HISTORIC STRUCTURE
- HISTORIC CEMETERY

50 0 50 100 Meters

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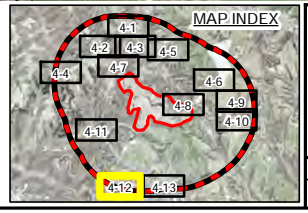

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BUILDING LOCATIONS WITHIN SURVEY AREA

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DATE:	DECEMBER 07, 2021	DWG SCALE:	1 cm = 50 m	PROJECT NO:	317-358		

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LEGEND

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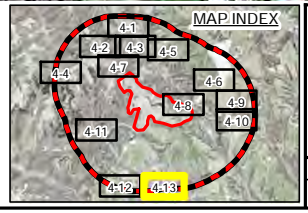
MAP INDEX



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NOTTINGHAM SOLAR PROJECT
ATHENS TOWNSHIP, HARRISON COUNTY, OHIO

BUILDING LOCATIONS WITHIN SURVEY AREA

DRAWN BY:	CBL/MHS	CHECKED BY:	KMHF	APPROVED BY:	JAS*	FIGURE NO:	4-13
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November 3, 2022

Ms. Lori Cuervo
Director
BQ Energy Development LLC
400 Market Industrial Park, Suite 32
Wappinger Falls, NY 12590

Desktop Analysis for the Nottingham 138kV Gen-Tie Transmission Line, Harrison County, Ohio

Dear Ms. Cuervo:

WSP USA Inc. (WSP) conducted a desktop analysis for the Nottingham 138kV Gen-Tie Transmission Line (Project), which will connect to an on-site substation at the Nottingham Solar Site to the American Electric Power (AEP) Nottingham Substation, located on Stumptown Road in Harrison County, Ohio. Located in Section 11 of Township 9 North, Range 5 West (New Athens Township), the 0.8-mile-long gen-tie line will have a 100-foot wide right-of-way (ROW) (Project Area). The desktop analysis was completed to understand what archaeological resources may be present in the project area. A desktop review regarding architectural resources will be presented in a separate report.

This work is being conducted in compliance with the Ohio Power Siting Board, Ohio Administrative Code 4906-4-08, Health and safety, land use and ecological information.

Project Description

Nottingham Solar LLC proposes to construct and operate a substation on-site of the proposed Nottingham Solar Project (Case No. 21-0270-EL-BGN) and an approximately 0.8-mile overhead generation tie-line (gen-tie) that will deliver electricity to the existing AEP Nottingham 138kV Substation that connects to the regional transmission grid (Figure 1). The new gen-tie line will have a 100-foot-wide right-of-way (ROW) (Project Area).

Methodology

WSP's desktop analysis consisted of a records check/database review to determine the presence of known cultural resources in the study area, defined as the area within a 1.6-kilometer (1-mile) radius extending from each side of the Project Area boundaries. The OPSB regulations require an evaluation of cultural resources within a 10-mile radius of the project area, which will be completed for the purposes of the application to OPSB; however, the study area for this review has been defined as a 1-mile radius given the relatively short height of the transmission line and intervening vegetation. The purpose of this desktop analysis is to understand the potential direct effects on resources within the project footprint rather than the potential for visual and/or auditory effects on resources.

The review identified resources listed in the National Register of Historic Places (NRHP) and the Ohio State Historic Preservation Office (OHPO) Online Mapping System for historic and archaeological sites (Ohio History Connection [OHC] 2021), and known cemeteries shown on United States Geological Survey (USGS) topographic maps and within the OHPO Online

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Mapping System. The review also included examination of historical maps and aerial imagery. Figure 2 shows the project area, the study area, and the locations of known archaeological resources.

Background Research

Five previous archaeological investigations have been conducted in the project area (Table 1; Figure 3). No additional archaeological investigations are located within the study area. Three of the investigations, conducted for the Nottingham Solar Site (2021-HAS-51991), intersect the southern end of the proposed Project.

In 2001, Smith conducted a Phase I archaeological survey for a proposed surface mine (Smith 2001). Using both pedestrian survey and shovel testing methods, the Smith survey investigated archaeologically sensitive areas identified by Dr. Jeffery Reichwein, Archaeologist for the Ohio Department of Natural Resources, Division of Mines and Reclamation (Smith 2001). In October 2021, WSP conducted an archaeological assessment for the Nottingham Solar Site using desktop analysis of disturbance from previous mining activities as well as limited shovel testing on one intact landform (WSP 2021). The assessment also provided information on previously identified Ohio Archaeological Inventory (OAI) sites 33HN0107 and 33HN0108 confirming that both sites were disturbed by mining and reclamation activities. In December 2021, Civil and Environmental Consultants (CEC) conducted shovel testing on an intact landform on the solar site (Kimsey 2021). Both the WSP and CEC reports were submitted by Nottingham Solar LLC to SHPO in December 2021 and SHPO concluded that no additional archaeological investigation was needed for the Nottingham Solar Site (SHPO 2021).

Two additional archaeological investigations have been conducted in the project area. These were Phase I and Phase II archaeological surveys for a mining tract (Beamer 1988) and the Nottingham Station S138kV Switch project and associated Nottingham-Freebyrd 138kV transmission line (Weller 2014), the southern 0.77 miles of which coincides with the current project area. Weller conducted subsurface testing along the entire length of the current project area, finding disturbed contexts approximately 300 feet north of Stumptown Road and in the remaining project area north of that point. Subsurface testing near Stumptown Road revealed intact soils but the tests were negative for archaeological deposits. Weller did not test the remaining project area as it was moderately sloped and had low potential for archaeological deposits (Weller 2014: Figure 4). Weller also visually inspected the area outside the construction limits extending to the gated access drive to the west and noted grading activity.

TABLE 1: PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS IN PROJECT AREA

NADB/ SURVEY NO.	CITATION	PROJECT TYPE	SURVEY TYPE	SURVEY YEAR	WITHIN PROJECT AREA (Y/N)
14542	Smith 2001	Mining tract	Phase I	2001	Y
13075	Beamer 1988	Mining tract	Phase I, Phase II	1988	Y
19779	Weller 2014	Transmission line	Phase I	2014	Y
N/A	WSP 2021	Solar facility	Archaeological Assessment	2021	Y
Pending	CEC 2021	Solar facility	Phase I	2021	Y

Source: OHC 2021

A total of 13 archaeological sites have been documented in the study area, consisting of seven historic sites and six prehistoric sites (Table 2). None of the sites has been evaluated for the NRHP.

TABLE 2: KNOWN ARCHAEOLOGICAL RESOURCES IN STUDY AREA

SITE NO.	SITE TYPE	NRHP STATUS	IN PROJECT AREA (Y/N)
33-HN-0107	Historic	Unevaluated, Disturbed	N
33-HN-0108	Historic	Unevaluated, Disturbed	N
33-HN-0051	Historic	Unevaluated	N
33-HN-0052	Prehistoric	Unevaluated	N
33-HN-0135	Historic	Unevaluated	N
33-HN-0136	Historic	Unevaluated	N
33-HN-0137	Historic	Unevaluated	N
33-HN-0138	Prehistoric	Unevaluated	N
33-HN-0139	Prehistoric	Unevaluated	N
33-HN-0140	Prehistoric	Unevaluated	N
33-HN-0141	Prehistoric	Unevaluated	N
33-HN-0235	Historic	Unevaluated	Y
33-HN-0241	Prehistoric	Unevaluated	N

Source: OHC 2021

The Weller investigation identified one previously unrecorded archaeological site (33-HN-235) within the project area, details of which are discussed below.

One previously recorded resource, Site 33-HN-235, was located in the project area by Weller in 2014 (see Figure 1). Site 33-HN-235 is a historic period occupation site associated with the late nineteenth- to early twentieth-century farmstead of James Lee, depicted on the 1875 map of the area (Weller 2014:17; Caldwell 1875; Figure 5). Weller (2014:19) reported that the site lacked sufficient integrity to be considered significant as it contained a mostly disturbed context and those areas that were intact had shallow soils with no apparent artifact patterning. Weller (2014:17) recommended Site 33-HN-235 as not eligible for the NRHP. Weller noted that the site extended to the west and to a gated access road, which is within the current project area; but that "the surface of this area that to the west of the construction limits and within the property boundary is heavily churned from grading/bulldozing" (Weller 2014:17).

No additional sites or surveys were found within the project area.

Historical Use of Project Area

WSP reviewed historical maps and aerial imagery of the project area. The county atlas for Harrison County from 1881 shows the project area owned by John Johnson but no dwellings were depicted on the map (Harrison County Map Office 1881, Figure 6). The map also depicts a county road that is currently the gated access road. The USGS (1903) Flushing quadrangle depicts a dwelling near the corner of Stumptown Road and the current gated access road. By 1919, the parcel was still owned by the Johnson family (H.V. Johnson); but no dwellings were included in the township map (Harrison County Map Office 1919, Figure 7). By 1961, the house was no longer present in the USGS (1961) quadrangle map of the project area; and a township map of the same year shows the parcel as owned by the Consolidation Coal Company (Grove 1961, Figure 8). The current transmission line running in a southeast-northwest direction through the project area is also shown on the 1961 USGS quadrangle.

Historical aerial imagery of the project area, which dates to 1960, shows a complex of buildings in the center of the parcel and a wooded area along Stumptown Road in the vicinity of the Johnson

dwelling depicted on the 1903 USGS quadrangle (Earth Explorer 1960; Figure 9). By 1982, the complex in the center of the parcel was gone and the project area had been extensively graded (Earth Explorer 1982; Figure 10). There was little change to the project area until 2015, when grading for the current access road and substation is visible (Nationwide Environmental Title Research LLC [NETR] 2015).

Summary

WSP conducted a desktop analysis and records check/database review of the proposed Nottingham 138kV Gen-Tie Transmission Line project area and a study area encompassing a 1-mile buffer around the project area. Historical maps and aerial imagery showed a county road and several building complexes in the project area as early as 1903. By 1961, these buildings were no longer extant and the parcel was owned by a coal mining company. Aerial imagery showed the project area had been extensively graded around 1982.

All but a small portion of the project area has been surveyed for archaeological resources, and one archaeological site (Site 33-HN-235) has been identified in the project area (see Figure 3). An additional 12 archaeological sites have been documented in the study area. None of the previously documented archaeological sites has been evaluated for the NRHP. Site 33-HN-235 was recommended by Weller in 2014 as not eligible for inclusion in the NRHP. Based on work completed by Weller (2014), WSP also recommends Site 33-HN-235 as not eligible for the NRHP owing to the lack of physical and contextual integrity necessary to address research questions about the rural Appalachian cultural landscape and history.

WSP presents this information for review and comment by the Ohio State Historic Preservation Office in compliance with the Ohio Power Siting Board, Ohio Administrative Code 4906-4-08, Health and safety, land use and ecological information.

Kind regards,

Camilla McDonald
Manager, Historic Preservation

Marlis M. Muschal
Archaeologist

CRM
Encl.
File: EE1009829.0002

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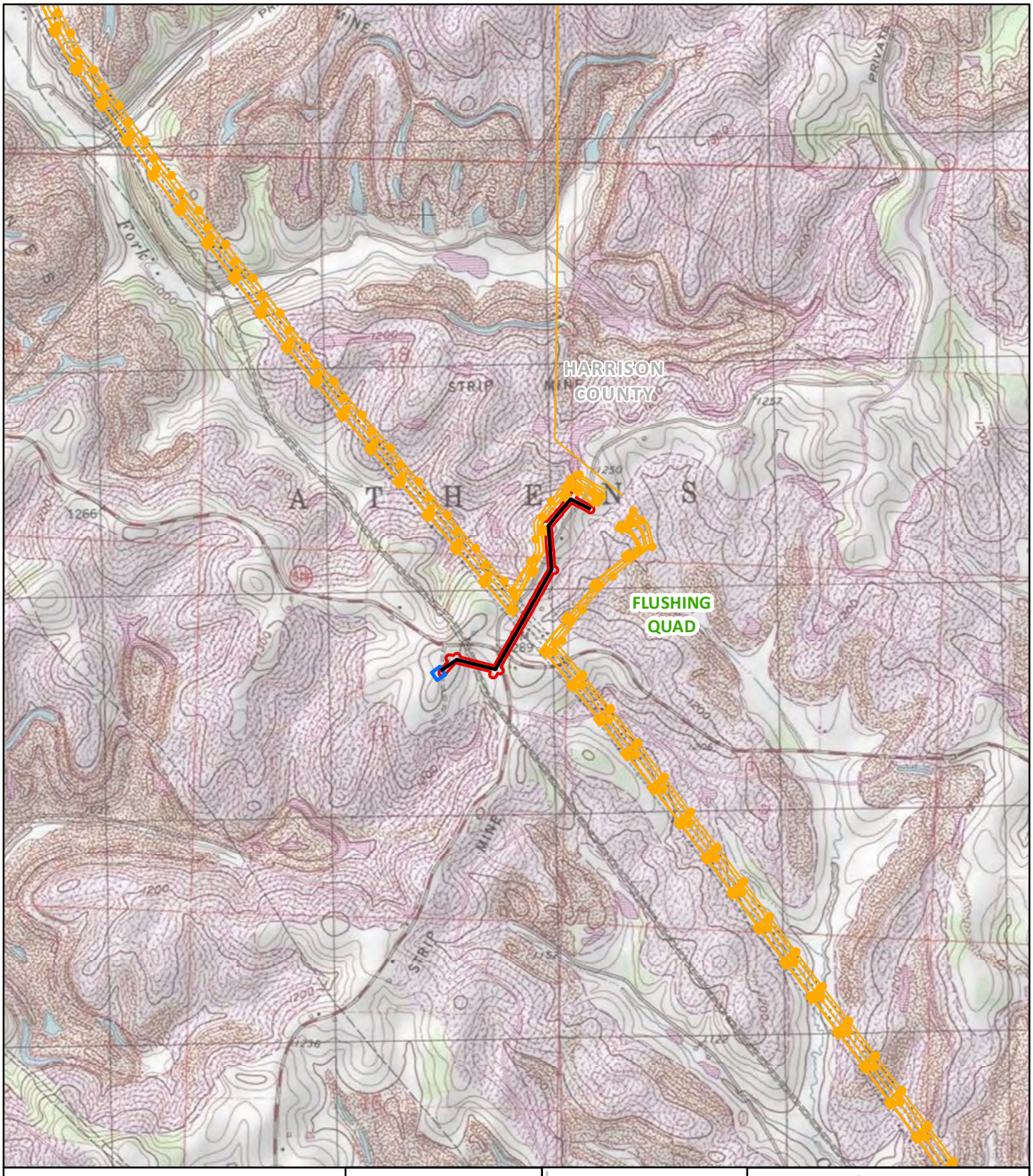


Proposed 138 kV Gen-Tie
Existing 138 kV Transmission Line
Existing 345 kV Transmission Line
Existing 69 kV Transmission Line
Proposed Substation Fenceline
Project Area
USGS 7.5' Topographic Quad Boundary
County Boundary

Sources:
Topo Quads (USGS 2013)
Transportation (ODOT 2021)
Basemap (USGS 1994)

State Plane Ohio North
NAD 83

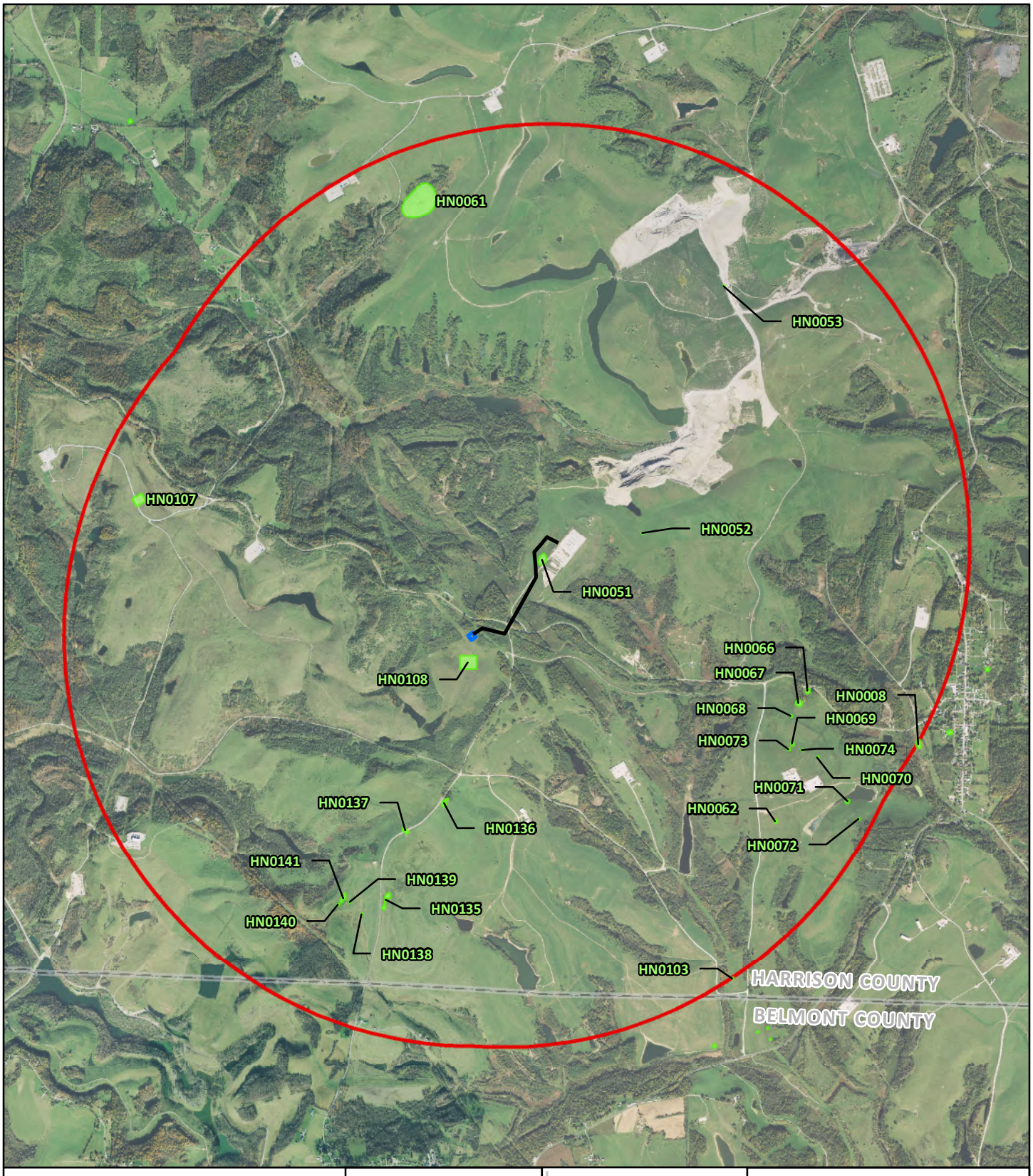
November 3, 2022

Figure 1
Proposed Nottingham Gen-Tie Transmission Line Project in Harrison County, Ohio

BQ Energy, llc.
Dedicated to the Development of Clean Energy Facilities

Nottingham Solar Project
138 kV Gen-Tie Line

0 1,000 2,000
Feet



Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Known Archaeological Sites
Study Area
County Boundary

Sources:
Cultural Data (SHPO 2021)
Imagery (OGRIP 2020)
Transportation (ODOT 2021)

State Plane Ohio North
NAD 83

November 2, 2022

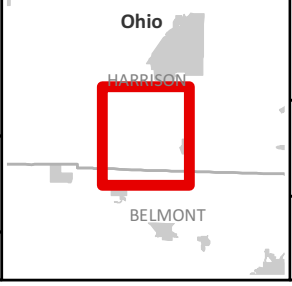
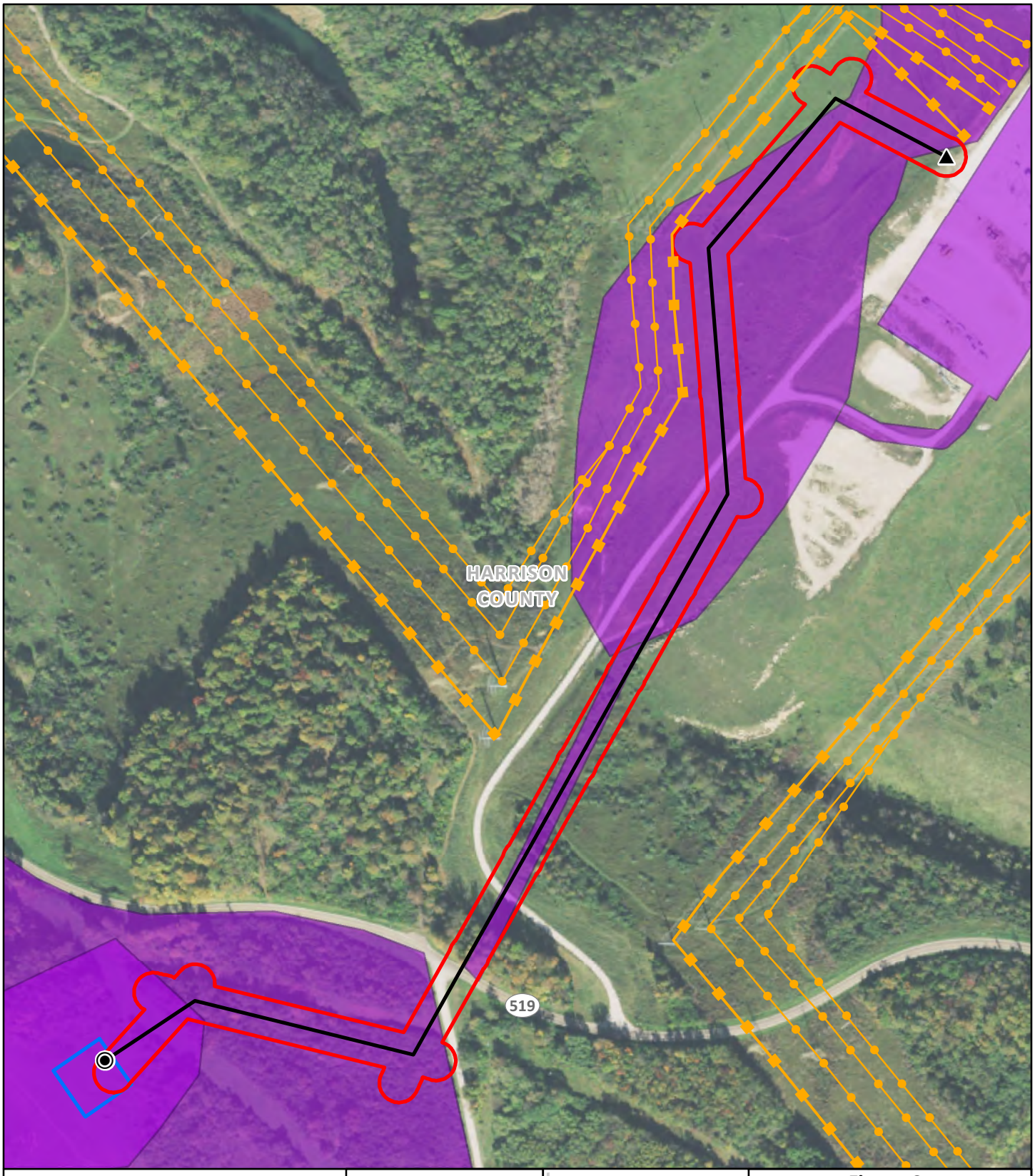


Figure 2
Known Archaeological Sites
within the Study Area

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 0.4 0.8
Miles



Existing AEP Substation
Proposed BQ Energy Substation
Proposed 138 kV Gen-Tie
Existing 138 kV Transmission Line
Existing 345 kV Transmission Line
Proposed Substation Fenceline
Previous Archaeological Surveys
Project Area

Sources:
Cultural Data (SHPO 2021)
Imagery (OGRIP 2020)
Transportation (ODOT 2021)

State Plane Ohio North
NAD 83

N

November 3, 2022

Figure 3

Previous Archaeological Surveys
within the Project Area

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 200 400
Feet

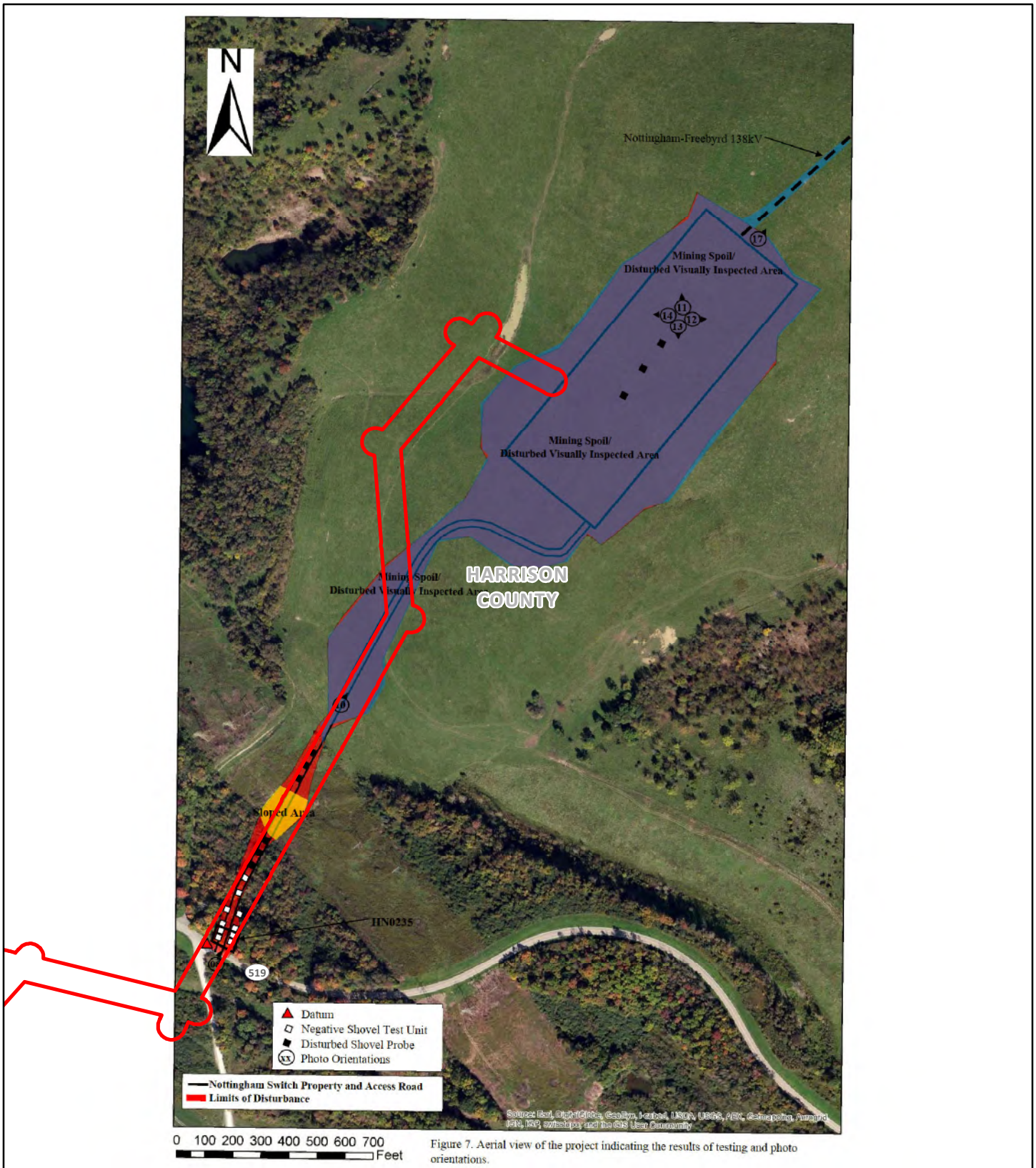


Figure 7. Aerial view of the project indicating the results of testing and photo orientations.

Project Area

Sources:
Basemap (Weller 2014)
Transportation (ODOT 2021)

State Plane Ohio North
NAD 83

November 2, 2022

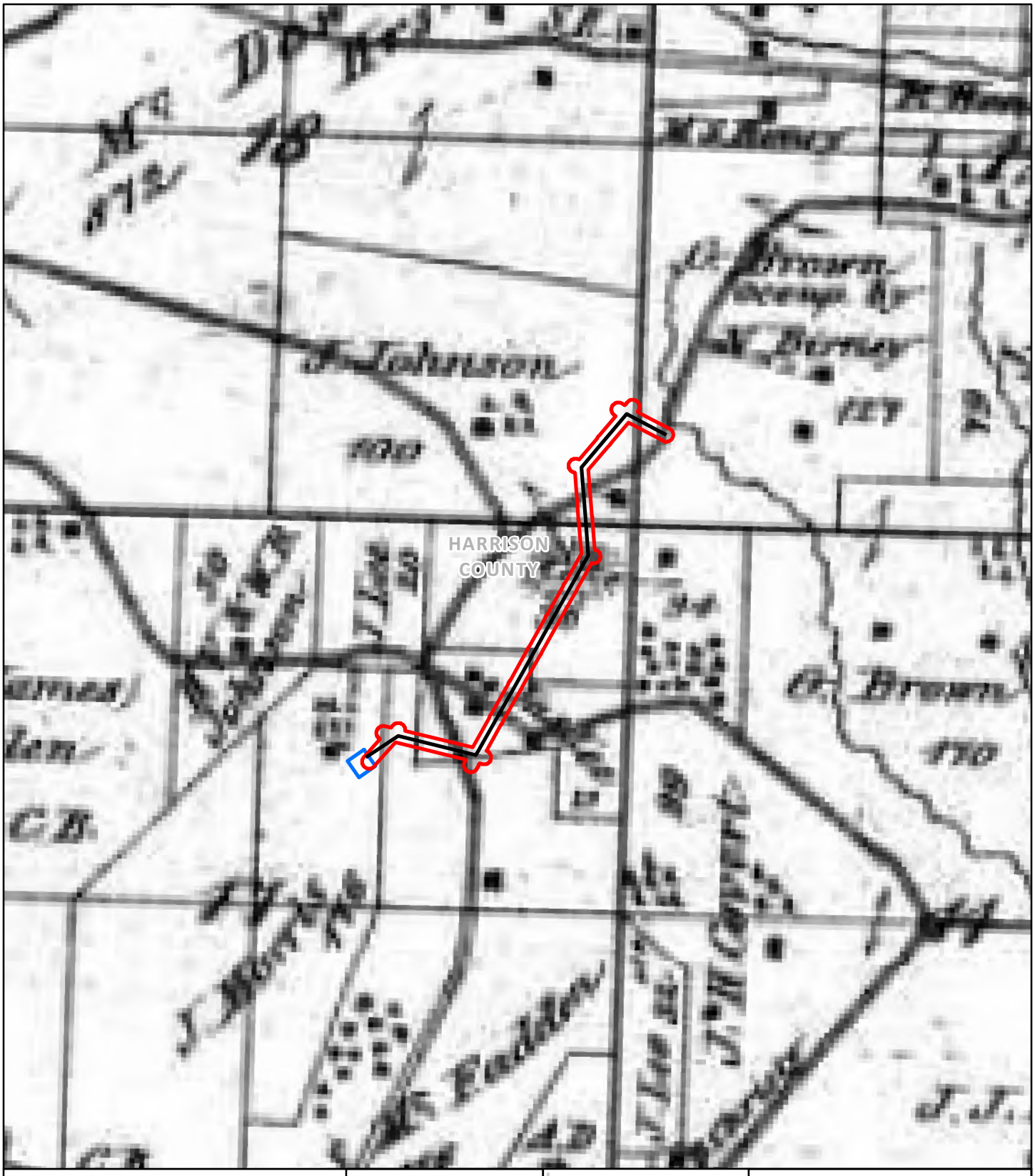
Figure 4

Results of the Weller 2014 Archaeological Survey within the Project Area

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 250 500
Feet



Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Project Area

Sources:
Basemap (J.A. Caldwelll 1975)

State Plane Ohio North
NAD 83

November 2, 2022

Figure 5
Caldwell's 1875 Map of Project Area

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 500 1,000
Feet

Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Project Area

Sources:
Basemap (Harrison County 1881)

State Plane Ohio North
NAD 83

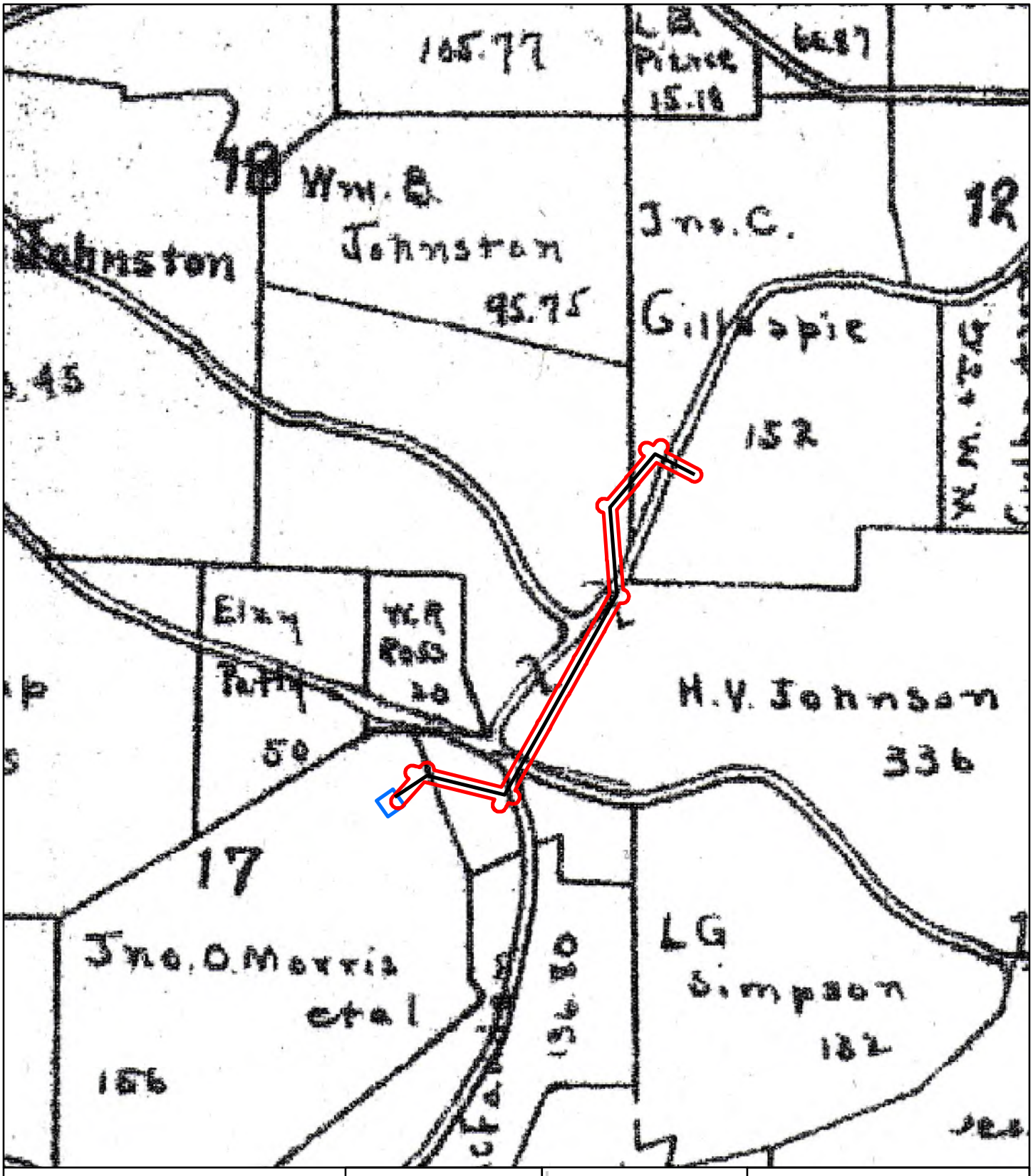
November 2, 2022

Figure 6
1881 Harrison County Map of Project Area

BQ Energy, llc.
Dedicated to the Development of Clean Energy Facilities

Nottingham Solar Project
138 kV Gen-Tie Line

0 500 1,000
Feet



Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Project Area

Sources:
Basemap (Harrison County 1919)

State Plane Ohio North
NAD 83

November 2, 2022

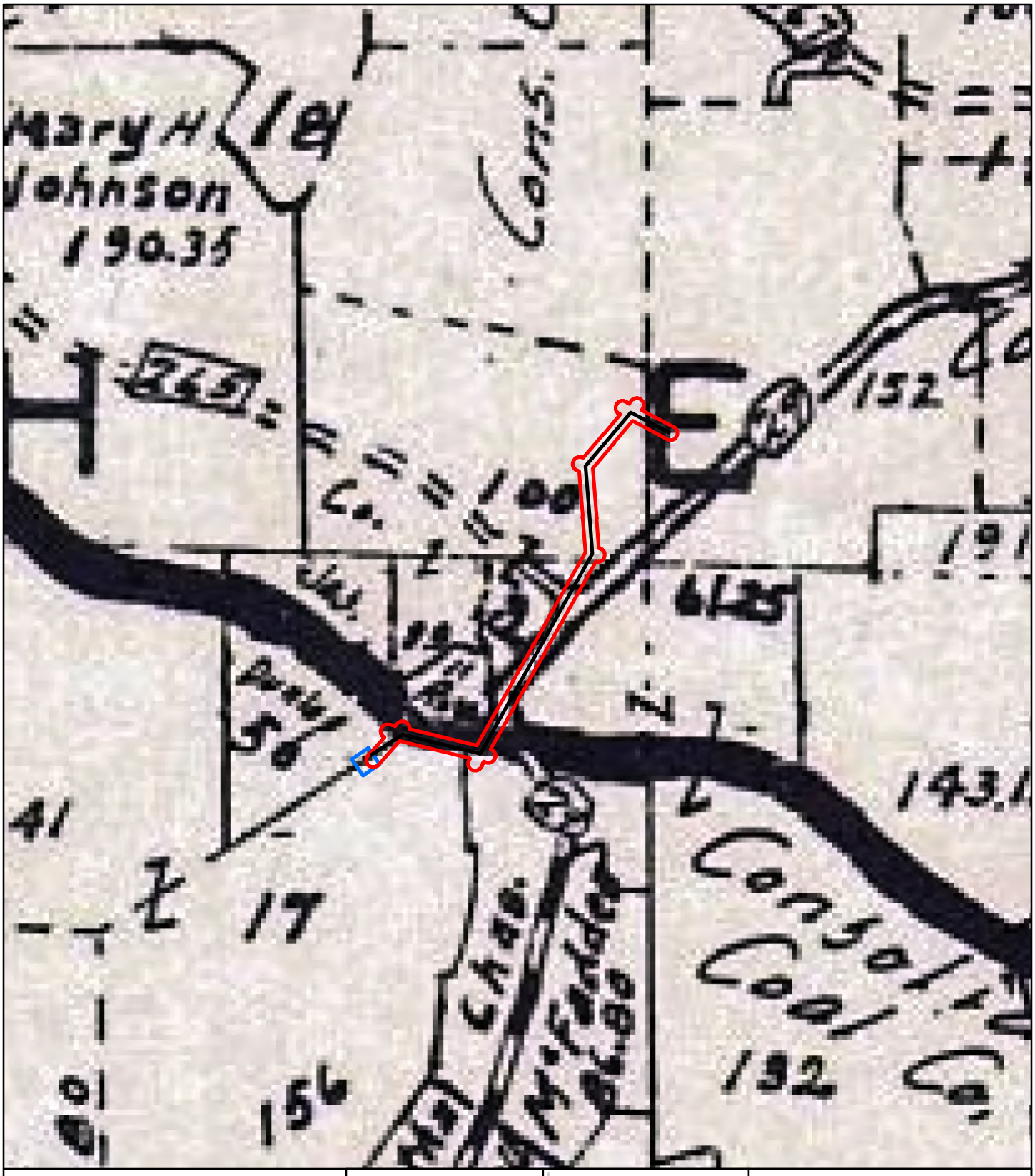
Ohio
HARRISON
BELMONT

Figure 7
1919 Harrison County Map of Project Area

BQ Energy, llc.

Nottingham Solar Project
138 kV Gen-Tie Line

0 500 1,000
Feet



Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Project Area

Sources:
Basemap (Harrison County 1961)

State Plane Ohio North
NAD 83

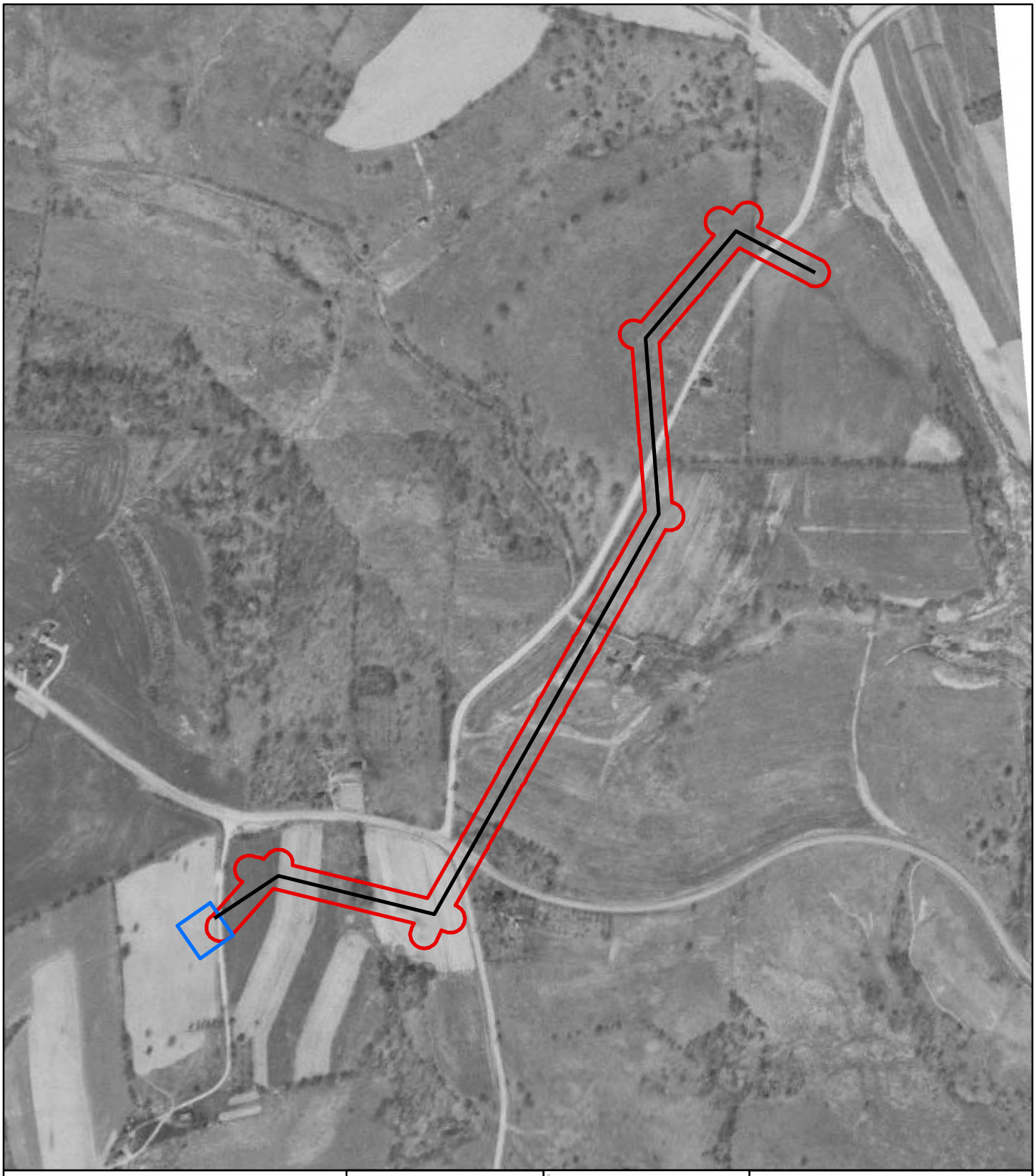
November 2, 2022

Figure 8
1961 Harrison County Map of Project Area

BQ Energy, llc.
Dedicated to the Development of Clean Energy Facilities

Nottingham Solar Project
138 kV Gen-Tie Line

0 500 1,000
Feet



Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Project Area

Sources:
Imagery (Earth Explorer 1960)

State Plane Ohio North
NAD 83

November 2, 2022

Figure 9
1960 Aerial Photograph of the
Project Area (Earth Explorer 1960)

BQ Energy, llc.
Dedicated to the Development of Clean Energy Facilities

Nottingham Solar Project
138 kV Gen-Tie Line

0 250 500
Feet

Proposed 138 kV Gen-Tie
Proposed Substation Fenceline
Project Area

Sources:
Imagery (Earth Explorer 1982)

State Plane Ohio North
NAD 83

November 2, 2022

Figure 10
1982 Aerial Photograph of the
Project Area (Earth Explorer 1982)

BQ Energy, llc.
Dedicated to the Development of Clean Energy Facilities

Nottingham Solar Project
138 kV Gen-Tie Line

0 250 500
Feet

Appendix D Wetland Delineation Report

NOTTINGHAM SOLAR 138 KV GEN-TIE TRANSMISSION LINE PROJECT

WETLAND DELINEATION REPORT

PROJECT NO.: EE1009829.0002
DATE: OCTOBER 2022

Nottingham Solar LLC
400 Market Industrial Park, Suite 32
Wappinger Falls, NY 12590

WSP USA
312 ELM STREET, SUITE 2500
CINCINNATI, OH 45202

WSP.COM

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APPENDICES

1 INTRODUCTION

On behalf of Nottingham Solar LLC, WSP USA (WSP) conducted an environmental survey of the proposed Nottingham Solar 138 kV Gen-Tie Transmission Line Project ("Project") located in Athens Township, Harrison County, Ohio. This included a wetland and stream delineation, agency coordination regarding threatened and endangered species, and characterization of vegetation and habitat types. The wetland delineation was performed by individuals trained in the three-parameter methodology (hydrophytic vegetation, wetland hydrology, and hydric soils) adopted by the U.S. Army Corps of Engineers (USACE) as outlined in the USACE *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, Version 2.0* (USACE, 2012) and in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987).

This report presents the results of the ecological considerations and review of the Project Area's existing and reasonably foreseeable site conditions at the time of the environmental surveys. The results cannot apply to site changes occurring after the survey which WSP has not had the opportunity to review. During the course of any survey, site conditions may change over time due to human and/or natural causes; as such, the results presented in this report may be invalidated, either wholly or in part, by changes beyond the control of WSP.

2 BACKGROUND INFORMATION

2.1 PROJECT AREA

The approximately 0.8-mile Project is located within Athens Township, Harrison County, Ohio. The 150-foot wide Environmental Survey Corridor (ESC) originates at the proposed BQ Energy Substation (40.1900°, -81.0408°), and extends generally northwest to an existing AEP Substation (40.1964°, -81.0329°) (Figure 1, Appendix A). The approximately 14.4-acre ESC is within the Flushing, Ohio U.S. Geological Survey (USGS) 7.5-minute topographic map quadrangle boundary. Table 2-1 provides an overview of the project location.

TABLE 2-1: GENERAL PROJECT INFORMATION

COUNTY:	Harrison
TOWNSHIP:	Athens
END POINT COORDINATES:	proposed substation: 40.1900°, -81.0408° existing substation: 40.1964°, -81.0329°
USGS QUADRANGLE:	Flushing, Ohio
ENVIRONMENTAL SURVEY CORRIDOR LENGTH (mi.):	0.8
ENVIRONMENTAL SURVEY CORRIDOR WIDTH (ft.):	150
ENVIRONMENTAL SURVEY CORRIDOR SIZE (ac.):	14.4
ELEVATION RANGE (ft. above sea level):	1,200 – 1,300
8-DIGIT HYDROLOGIC UNIT CODE:	05030106 05040001
12-DIGIT HYDROLOGIC UNIT CODE(S) :	05030106-03-01 05040001-13-04 05040001-14-02
DATE(S) OF SURVEY :	September 20, 2021 September 14, 2022

2.1.1 DRAINAGE BASINS

All streams in the vicinity of the ESC drain to tributaries to either the Tuscarawas River or the Ohio River, which are traditionally navigable waterways (TNW). The ESC is located within the Tuscarawas (hydrologic unit code [HUC] 05040001) and Upper Ohio-Wheeling (HUC 05030106) drainage basins. The ESC lies within three 12-digit HUCs, as outlined in Table 2-2 (USDA, 2019).

The OEPA *401 Water Quality Certification for the Nationwide Permits Web Mapping Application* indicates that field-assessed streams within both 12-digit sub-watersheds are denoted as “eligible”; indicating that stream impacts within the ESC will not require an individual 401 water quality certification provided that the OEPA’s general and special limitations and conditions for the nationwide permits are met (OEPA, 2020).

TABLE 2-2: 12-DIGIT HUC'S CROSSED BY THE PROJECT

8-DIGIT HUC CODE[1]	8-DIGIT HUC CODE NAME[1]	12-DIGIT HUC CODE[1]	12-DIGIT HUC NAME[1]	OHIO EPA SECTION 401 ELIGIBILITY[2]
05030106	Upper Ohio – Wheeling	05030106-03-01	Crabapple Creek	Eligible
05040001	Tuscarawas	05040001-13-03	Boggs Fork	Eligible
		05040001-14-03	Brushy Fork	Eligible

[1]Source: USDA, 2019
[2]Source: OEPA, 2020

3 METHODOLOGY

On September 20, 2021, and September 14, 2022, a WSP ecologist traversed the approximately 0.8-mile long and 150-foot-wide ESC (approximately 14.4-acres) to conduct a wetland and waters delineation. The physical boundaries of aquatic resources were recorded using a Trimble Global Positioning System (GPS) unit rated for sub-decimeter accuracy. The GPS data was then geo-corrected using Trimble GPS Pathfinder Office software (version 5.60) and reviewed for quality control.

Prior to conducting field surveys, a WSP ecologist completed a desktop review by analyzing several federal and state documents for the presence of wetland and streams. This review included Natural Resources Conservation Service (NRCS) soil survey data, U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps of Ohio, USGS 7.5-minute topographic maps, and USGS National Hydrography Dataset (NHD) stream and river data as an exercise to identify the occurrence and location of potential wetlands and streams.

3.1 WETLAND AND STREAM DELINEATION

3.1.1 WETLAND DELINEATION

The USACE and the U.S. Environmental Protection Agency (USEPA) define wetlands as areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR, Part 328.3).

Wetlands were delineated according to Section 404 of the Clean Water Act, Technical Report Y-87-1 *Corps of Engineers Wetlands Delineation Manual ('87 Manual)* (Environmental Laboratory, 1987), and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont, (Version 2.0)* (*Regional Supplement*) (USACE, 2010). Representative data points were collected for wetlands and corresponding, adjacent upland areas. Wetland data was recorded on the USACE *Regional Supplement* Wetland Determination Data Forms.

Wetland vegetation communities were classified according to the *Classification of Wetlands and Deepwater Habitats of the United States*, commonly referred to as the Cowardin Classification System (Cowardin et al., 1979). Wetlands within the ESC were assessed using the OEPA *Ohio Rapid Assessment Method for Wetlands v. 5.0* (ORAM) to determine the ecological quality and level of disturbance (Mack, 2001).

3.1.2 STREAM DELINEATION AND ASSESSMENT

Streams were identified by the presence of a defined bed and bank, and evidence of an ordinary high-water mark (OHWM). The OHWM is defined in the USACE *Regulatory Guidance Letter No. 05*-05 (USACE, 2005). Generally, the OHWM is identified by a clearly defined, natural line along the stream bank created by fluctuations and flow of water; this may include changes in contours, substrate, vegetation, and debris (USACE, 2005).

Stream assessments were conducted using the methods described in the OEPA's Methods for Assessing Habitat in Flowing Waters: Using OEPA's *Qualitative Habitat Evaluation Index* (Rankin, 2006) and *Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams, Version 3* (Davic, 2012).

4 RESULTS

A WSP ecologist surveyed the ESC on September 20, 2021, and September 14, 2022, by walking the approximately 14.4-acre ESC and evaluating for wetlands and other WoUS. The WSP ecologist identified one wetland within the ESC. No streams or freshwater ponds were identified within the ESC. The identified water resources are depicted on the Delineated Features Map (Figure 3, Appendix A).

4.1 DESKTOP REVIEW

4.1.1 SOILS EVALUATION

According to the NRCS Soil Data for Harrison County, Ohio, there are five soil map units shown within the ESC, as presented in Table 4-1. The soils observed by the WSP ecologist during the reconnaissance of the ESC were consistent with the NRCS soil survey mapping.

TABLE 4-1: SOIL UNITS MAPPED WITHIN THE ESC

SOIL UNIT SYMBOL	SOIL UNIT NAME	PERCENT HYDRIC	HYDRIC RATING[1]	AREA WITHIN ESC (ac.)
AbC2	Aaron silty clay loam, 6 to 15 percent slopes, eroded	0	Non-Hydric	28
LoD2	Lowell silty clay loam, 15 to 25 percent slopes	0	Non-Hydric	3.4
Mwc3B	Morristown silty clay loam, 0 to 8 percent slopes, reclaimed	0	Non-Hydric	0.3
Mwc3D	Morristown silty clay loam, 8 to 25 percent slopes, reclaimed	0	Non-Hydric	7.1
Mwc3F	Morristown silty clay loam, 25 to 70 percent slopes, reclaimed	0	Non-Hydric	0.8
			Total Area of Non-Hydric Soils	14.4

[1]Non-Hydric = 0% hydric soil component; Predominantly Non-Hydric = 1-32%; Partially Hydric =33-65%; Predominantly Hydric = 66-99%; and All Hydric = 100%.
Source: Soil Survey Staff, NRCS. Web Soil Survey.

4.1.2 NATIONAL WETLAND INVENTORY REVIEW

According to the NWI maps of the Flushing, Ohio quadrangle boundary, there are no mapped NWI features within the ESC, as presented in Figure 2 (Appendix A).

4.1.3 FEMA FLOODPLAIN REVIEW

According to Federal Emergency Management Agency (FEMA) National Flood Hazard Layer, there are no 100-year floodplains or regulated floodways within the ESC.

4.2 DELINEATED WETLANDS

During environmental surveys of the ESC, the WSP ecologist identified one emergent wetland (Wetland NS-24), containing a mix of wet-mesic species, dominated by herbaceous plants including *typha sp*. and *scirpus sp*. The identified wetland totaled 0.31 acres within the ESC. Wetland NS-24 was assessed as a Category One wetland and drains westward off-site towards an unnamed tributary (UNT) to South Fork. Therefore, Wetland NS-24 likely to be considered jurisdictional by the USACE. It should be noted that final determination of wetland jurisdiction will be made by the USACE.

Table 4-2 provides specific wetland habitat types, acreages within the ESC, ORAM category, as well as information regarding jurisdictional status. The location of the delineated wetland and corresponding data points is displayed on Figure 3 (Appendix A). USACE wetland determination forms are provided in Appendix B. ORAM forms are included in Appendix C. Representative photographs of the wetland as well as the upland verification data point were taken and are provided in Appendix D.

TABLE 4-2: WETLANDS DELINEATED WITHIN THE ESC

WETLAND ID	LOCATION		COWARDIN CLASS.[1]	DELINEATED AREA[2] (acres)	ORAM		HYDROLOGIC CONNECTION	PROXIMAL WATERBODY
	LAT.	LON.			SCORE[3]	CATEGORY		
Wetland NS-24	40.1967	-81.0339	PEM	0.31	19	1	Jurisdictional	UNT to South Fork
			Sum of PEM Wetland Areas	0.31				
			Sum of PSS Wetland Areas	0.00				
			Sum of PFO Wetland Areas	0.00				
			Total Wetland Area	**0.31**				

[1]PEM = palustrine emergent, PSS = palustrine scrub/shrub. PFO = palustrine forested;
[2]Acreages reflect the area delineated within the ESC and are approximate based on GPS data and are rounded to the nearest 0.01-acre.

4.3 STREAMS AND RIVERS

No streams were identified within the ESC during the environmental surveys.

4.4 PONDS AND OPEN WATER

No ponds or open water areas were identified within the ESC during the environmental surveys.

4.5 VEGETATIVE COMMUNITIES

The WSP ecologists conducted a general habitat survey in conjunction with the stream and wetland field surveys. A variety of woody and herbaceous habitats, as described below in Table 4-3, are present within the ESC. A breakdown of vegetated land cover is provided, overlain on aerial photography in Figure 4 (Appendix A).

TABLE 4-3: VEGETATIVE COMMUNITIES WITHIN THE ESC

VEGETATIVE COMMUNITY	DESCRIPTION	ACREAGE WITHIN THE ESC	PERCENTAGE OF ESC
Developed, High Intensity	These areas consist of developed residential, industrial, and commercial land uses, including roads, buildings, and parking lots. These areas are generally devoid of significant vegetation.	0.5	3.5%
Grassland	Herbaceous cover dominated by native and non-native grasses with intermixed forbs and few woody shrubs.	1.8	12.3%
Old Field	Old Field habitats represent the successional stage between Developed, Open Space and Scrub/Shrub habitat. Often times these areas are previously developed areas that have been left fallow, which area maintained (mowed) once or twice a year.	8.8	61.1%
Scrub/Shrub	Scrub/shrub habitats represent the successional stage between old field and second growth forest, and often emerge in recently harvested forests responding to the lack of overhead canopy.	1.7	12.2%
Successional Hardwood Woodland[1]	Successional hardwood woodlands were present within the ESC. Dominant woody species within these areas include red maple (*Acer rubrum*) and shagbark hickory (*Carya ovata*).	1.3	8.8%
Delineated Wetland	Wetlands delineated within the ESC boundaries.	0.3	2.1%
	Total	**14.4**	**100%**

4.6 THREATENED AND ENDANGERED SPECIES COORDINATION

WSP submitted a coordination request regarding federally listed threatened and endangered species to the USFWS as well as a request for Environmental Review to the Ohio Department of Natural Resources (ODNR) on October 25, 2022. Responses have not been received at this time. The results of coordination efforts and an assessment of potentially suitable habitat within the ESC will be provided in an addendum to this report.

5 SUMMARY

WSP conducted environmental surveys of the proposed approximately 0.8-mile long Project on September 20, 2021 and September 14, 2022. One wetland, totaling 0.31 acres was identified within the 14.4-acre ESC. No streams or open water features were delineated within the ESC.

The identified Wetland (Wetland NS-24) was assessed as a Category One PEM wetland that drains westward off-site towards an unnamed tributary (UNT) to South Fork. The location of the delineated wetland and corresponding data points are displayed on Figure 3 (Appendix A). USACE wetland determination forms are provided in Appendix B. ORAM forms are included in Appendix C. Representative photographs of the wetland as well as the upland verification data point were taken and are provided in Appendix D.

WSP submitted coordination requests regarding threatened and endangered species to the USFWS as well as the Ohio Department of Natural Resources (ODNR) on October 25, 2022. Responses have not been received at this time and will be provided along with an assessment of potentially suitable habitat within the ESC in an addendum to this report.

6 REFERENCES

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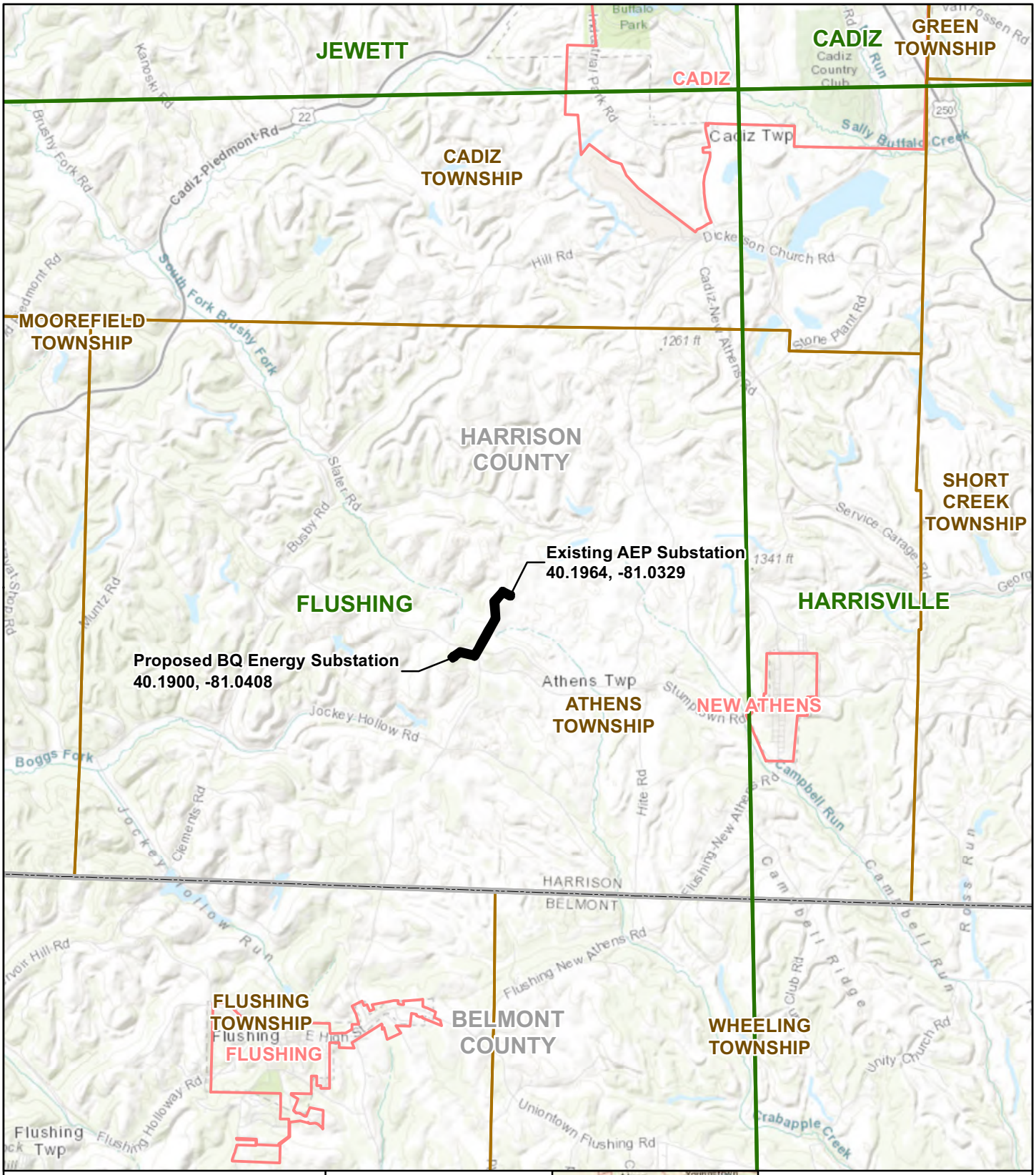
APPENDIX

A FIGURES



Environmental Survey Corridor
Municipal Boundary
Township Boundary
County Boundary
USGS 24k Topo Quad Boundary

Sources:
Topo (USGS)
Quad Boundaries (USGS)

Coordinate System:
State Plane Ohio North
NAD 1983

October 24, 2022

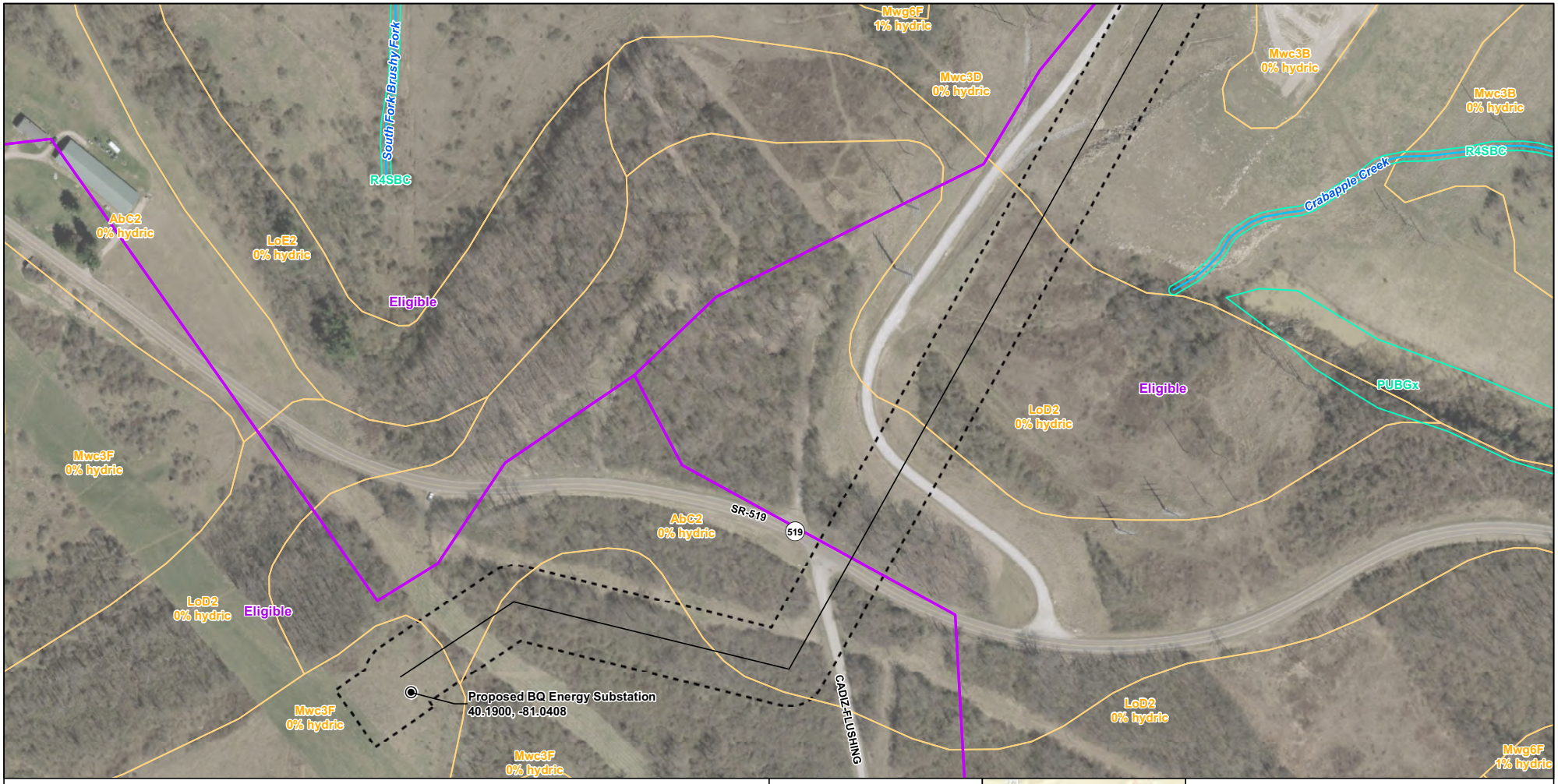
NOTTINGHAM SOLAR
138 KV GEN-TIE TRANSMISSION LINE PROJECT

Figure 1. Project Location Map

BQ Energy, llc.

WSP

0 0.5 1 Miles



▲ Existing AEP Substation
◉ Proposed BQ Energy Substation
— Proposed 138 kV Gen-Tie
▭ Environmental Survey Corridor

NHD Stream
NHD Waterbody
NWI Wetlands
Soil Map Unit
FEMA 100-Yr Floodplain
Ohio EPA 401 Eligibility

Sources:
Imagery (OGRIP)
Road Labels (ODOT)

Coordinate System:
Ohio State Plane North
NAD 1983

October 24, 2022

NOTTINGHAM SOLAR
138 KV GEN-TIE TRANSMISSION LINE PROJECT

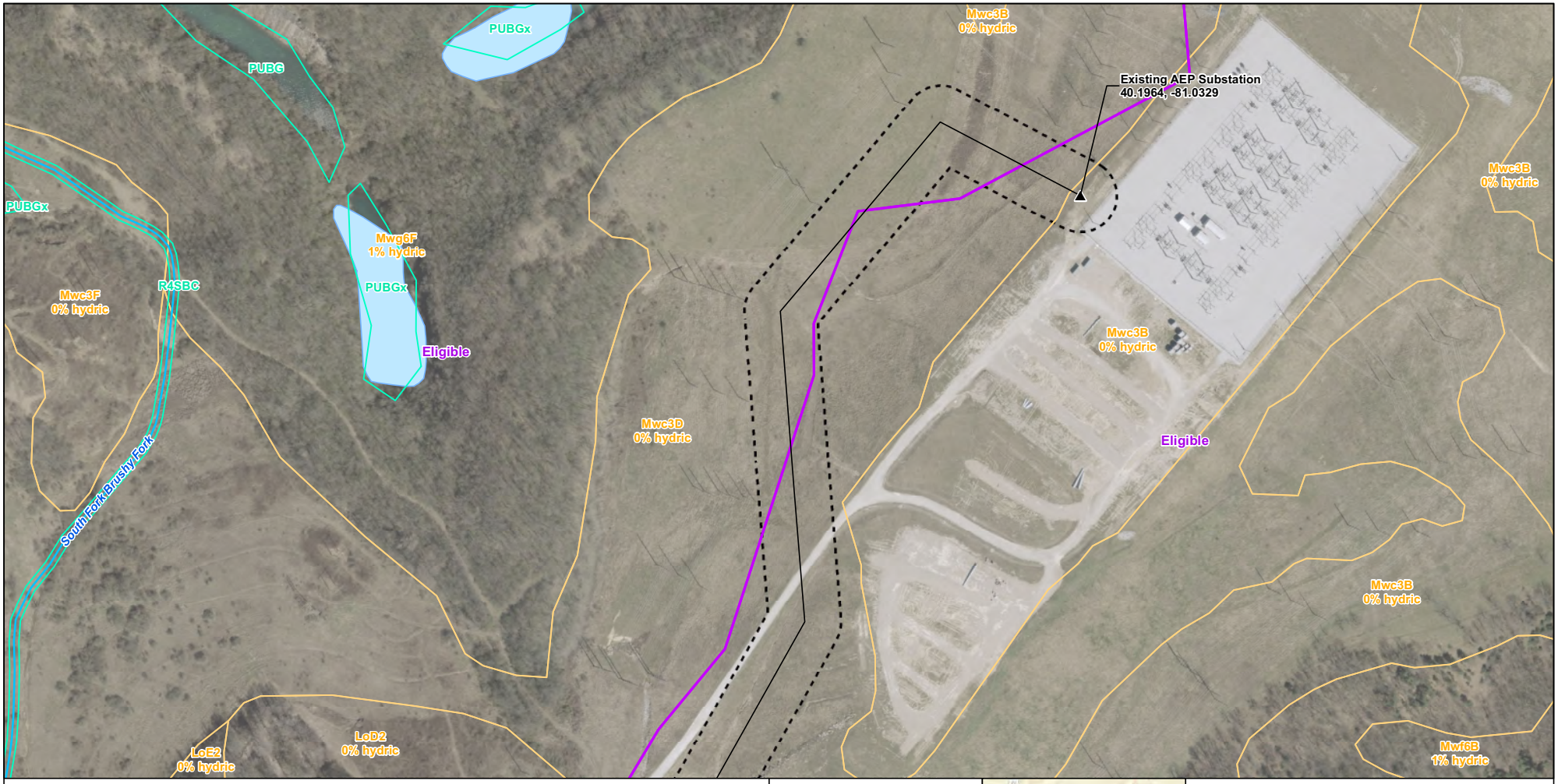
Figure 2. Environmental Basemap

BQ Energy, llc.

WSP

N

0 200 400 Feet



- Existing AEP Substation
- Proposed BQ Energy Substation
- Proposed 138 kV Gen-Tie
- Environmental Survey Corridor
- NHD Stream
- NHD Waterbody
- NWI Wetlands
- Soil Map Unit
- FEMA 100-Yr Floodplain
- Ohio EPA 401 Eligibility

Sources:
Imagery (OGRIP)
Road Labels (ODOT)

Coordinate System:
Ohio State Plane North
NAD 1983

October 24, 2022

NOTTINGHAM SOLAR
138 KV GEN-TIE TRANSMISSION LINE PROJECT

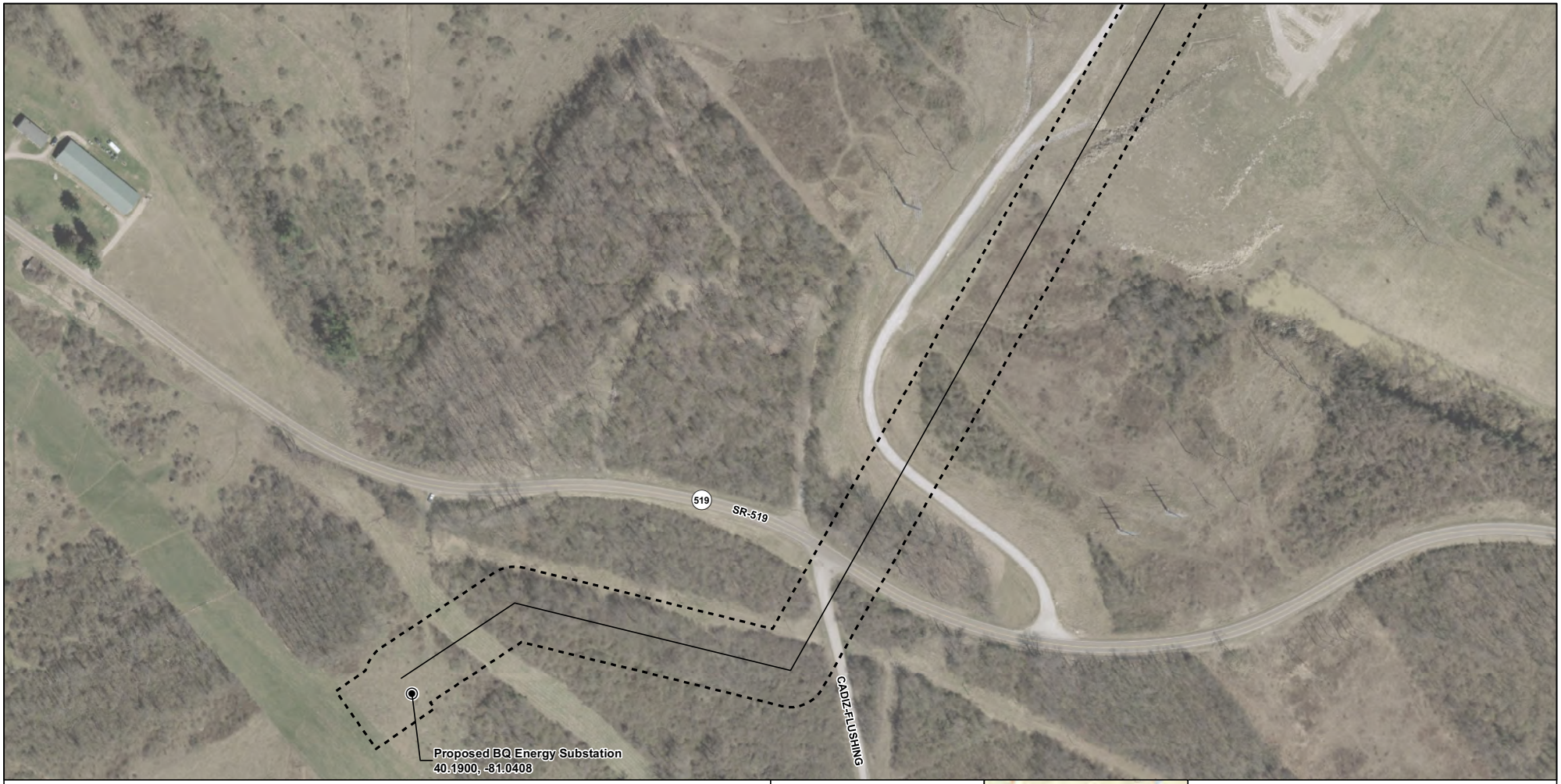
Figure 2. Environmental Basemap

BQ Energy, llc.

WSP

N

0 200 400 Feet



- Existing AEP Substation
- Proposed BQ Energy Substation
- Proposed 138 kV Gen-Tie
- Environmental Survey Corridor
- Upland Data Point
- Wetland Data Point
- Delineated Wetland

Sources:
Imagery (OGRIP)
Road Labels (ODOT)

Coordinate System:
Ohio State Plane North
NAD 1983

October 24, 2022

NOTTINGHAM SOLAR
138 KV GEN-TIE TRANSMISSION LINE PROJECT

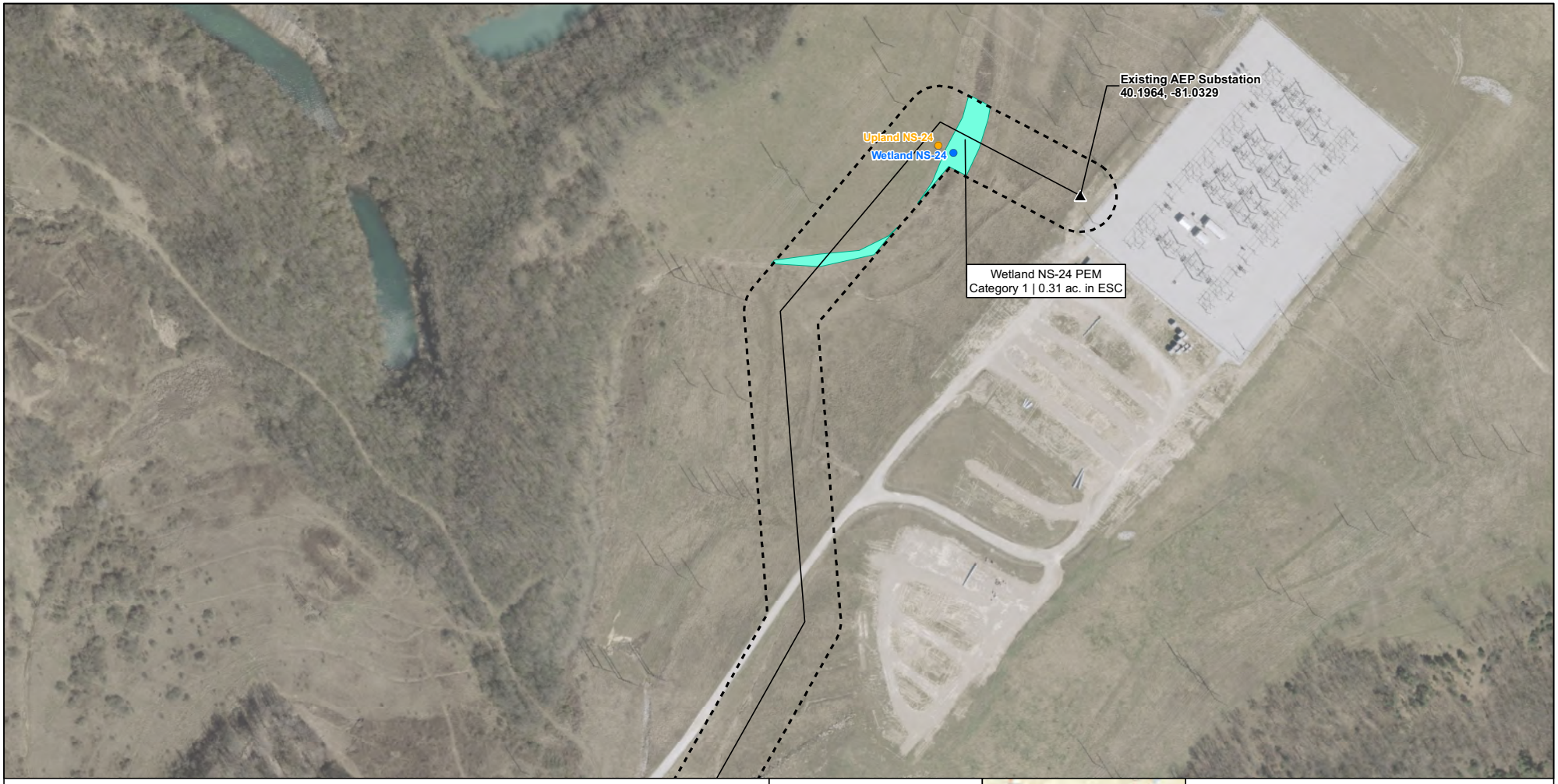
Figure 3. Delineated Features

BQ Energy, llc.

WSP

N

0 200 400 Feet



- Existing AEP Substation
- Proposed BQ Energy Substation
- Proposed 138 kV Gen-Tie
- Environmental Survey Corridor
- Upland Data Point
- Wetland Data Point
- Delineated Wetland

Sources:
Imagery (OGRIP)
Road Labels (ODOT)

Coordinate System:
Ohio State Plane North
NAD 1983

October 24, 2022

NOTTINGHAM SOLAR
138 KV GEN-TIE TRANSMISSION LINE PROJECT

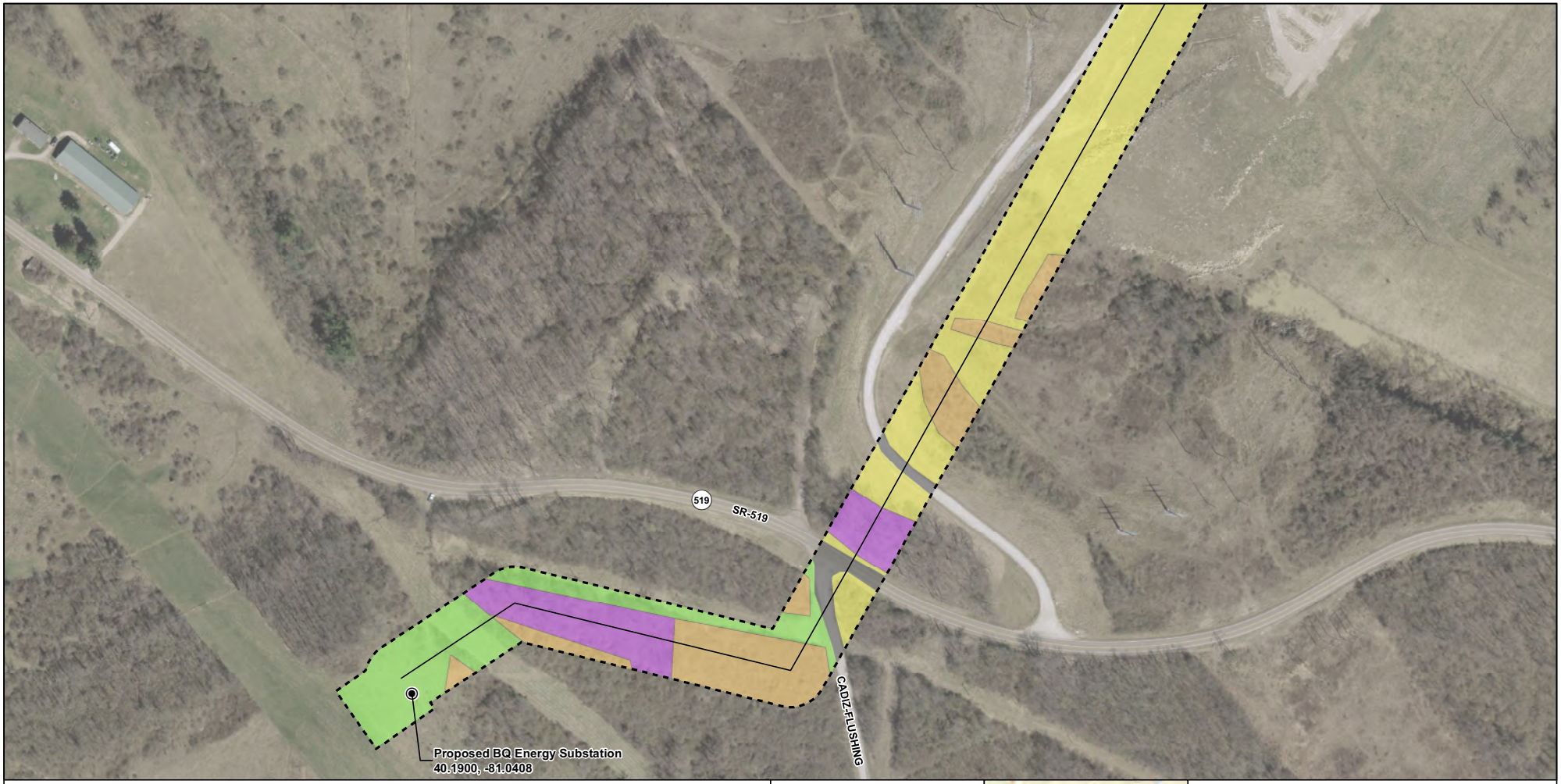
Figure 3. Delineated Features

BQ Energy, llc.

WSP

N

0 200 400 Feet



- Existing AEP Substation
- Proposed BQ Energy Substation
- Proposed 138 kV Gen-Tie
- Environmental Survey Corridor
- Delineated Wetland
- Grassland
- Old Field
- Scrub/Shrub
- Successional Hardwood Woodland
- Developed, High Intensity

Page 1 of 2

Sources:
Imagery (OGRIP)
Road Labels (ODOT)

Coordinate System:
Ohio State Plane North
NAD 1983

October 24, 2022

NOTTINGHAM SOLAR
138 KV GEN-TIE TRANSMISSION LINE PROJECT

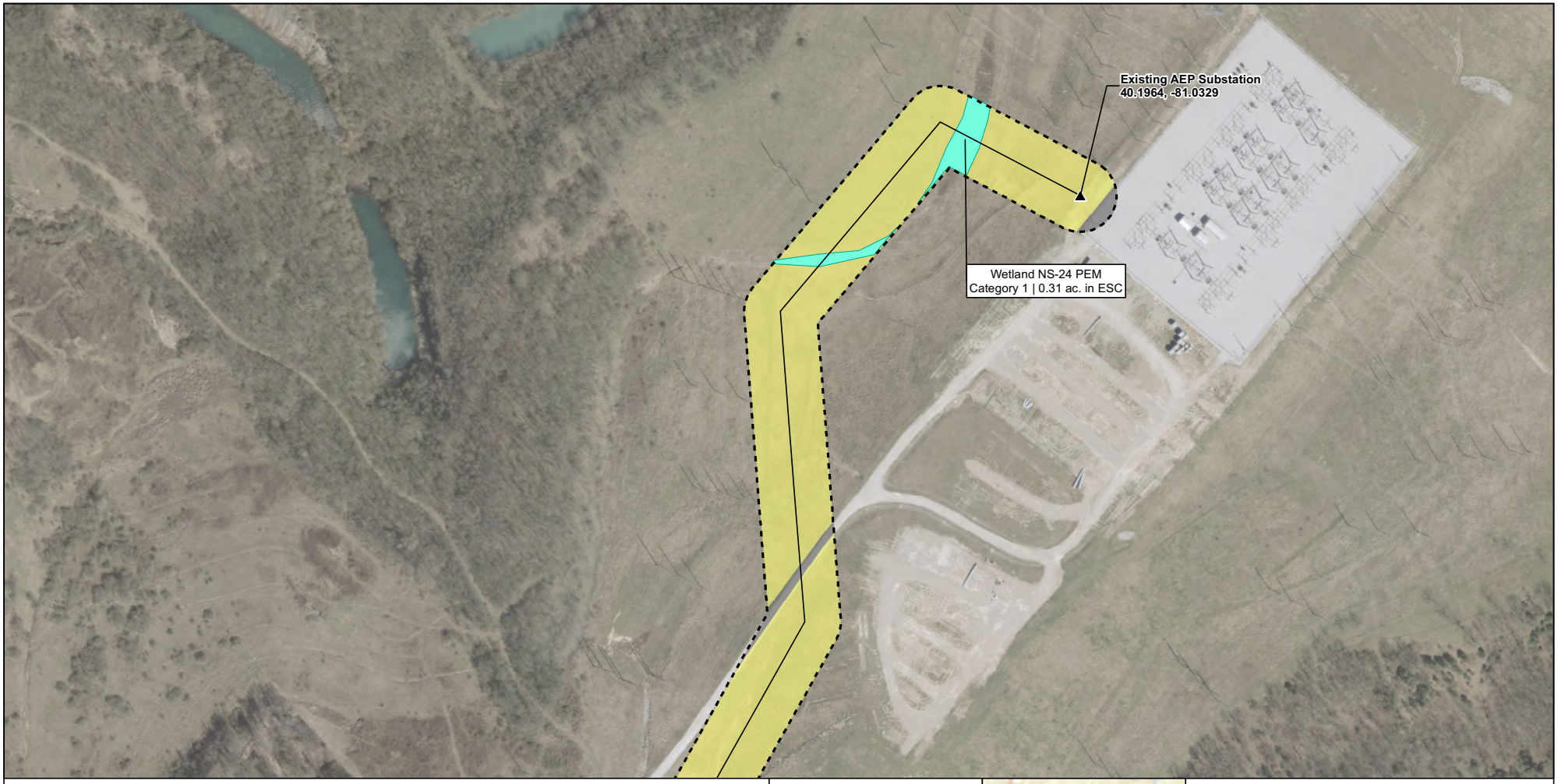
Figure 4. Vegetation Coverage

BQ Energy, llc.

WSP

N

0 200 400 Feet



- Existing AEP Substation
- Proposed BQ Energy Substation
- Proposed 138 kV Gen-Tie
- Environmental Survey Corridor
- Delineated Wetland
- Grassland
- Old Field
- Scrub/Shrub
- Successional Hardwood Woodland
- Developed, High Intensity

Page 2 of 2

Sources:
Imagery (OGRIP)
Road Labels (ODOT)

Coordinate System:
Ohio State Plane North
NAD 1983

October 24, 2022

NOTTINGHAM SOLAR
138 KV GEN-TIE TRANSMISSION LINE PROJECT

Figure 4. Vegetation Coverage

BQ Energy, llc.

N

0 200 400 Feet

APPENDIX

B USACE WETLAND DETERMINATION FORMS

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Nottingham Solar Site City/County: Harrison County Sampling Date: 9/14/2022
Applicant/Owner: Nottingham Solar LLC State: OH Sampling Point: Wetland NS-24
Investigator(s): P. Renner Section, Township, Range:
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 3
Subregion (LRR or MLRA): LRR N Lat: 40.1967 Long: -81.0339 Datum: NAD83
Soil Map Unit Name: Morristown silty clay loam, 8 to 25 percent slopes, reclaimed NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:
PEM wetland in reclaimed mineland.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No _____	Depth (inches): 3
Water Table Present?	Yes ✓	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland NS-24

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: r=15')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: r=15')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: r=5')			
1. Phragmites australis	10	No	FACW
2. Typha angustifolia	55	Yes	OBL
3. Scirpus cyperinus	25	Yes	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90 = Total Cover		

50% of total cover: 45 20% of total cover: 18

Woody Vine Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ✔ 1 - Rapid Test for Hydrophytic Vegetation
- ✔ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✔ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: Wetland NS-24

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 5/2	95	10YR 6/6	5	C	M	silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✔ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✔ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Nottingham Solar Site City/County: Harrison County Sampling Date: 9/14/2022
Applicant/Owner: Nottingham Solar LLC State: OH Sampling Point: Upland NS-24
Investigator(s): P. Renner; M. Thomayer Section, Township, Range:
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 2
Subregion (LRR or MLRA): LRR N Lat: 40.1967 Long: -81.0340 Datum: NAD83
Soil Map Unit Name: Morristown silty clay loam, 8 to 25 percent slopes, reclaimed NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:
Non-wetland data point corresponding to Wetland NS-24

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Upland NS-24

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: r=15')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: r=15')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: r=5')			
1. Setaria faberi	15	No	UPL
2. Phleum pratense	20	Yes	FACU
3. Solidago canadensis	30	Yes	FACU
4. Daucus carota	35	Yes	UPL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

50% of total cover: 50 20% of total cover: 20

Woody Vine Stratum (Plot size: r=30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	70	x 4 =	280
UPL species	30	x 5 =	150
Column Totals:	100 (A)		430 (B)

Prevalence Index = B/A = 4.30

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes _____ No ✔

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: Upland NS-24

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/3	100					silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✔

Remarks:

APPENDIX

C OEPA ORAM DATA FORMS

Site: Nottingham Solar Project	**Rater(s):** P. Renner	**Date:** 9/14/2022

Field ID: W-PJR-20220914-1
Report ID: Wetland NS-24

Metric 1. Wetland Area (size).

1	1
max 6 pts.	subtotal

Select one size class and assign score.

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [x] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

3	4
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [ ] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [x] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [x] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [ ] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

11	15
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [x] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [ ] 100 year floodplain (1)
- [x] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [ ] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [x] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- [ ] Semi- to permanently inundated/saturated (4)
- [x] Regularly inundated/saturated (3)
- [ ] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [x] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [x] ditch
- [ ] tile
- [x] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [x] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

5	20
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

- [ ] None or none apparent (4)
- [ ] Recovered (3)
- [ ] Recovering (2)
- [x] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [x] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [x] Recovering (3)
- [x] Recent or no recovery (1)

Check all disturbances observed

- [x] mowing
- [ ] grazing
- [x] clearcutting
- [ ] selective cutting
- [x] woody debris removal
- [ ] toxic pollutants
- [x] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [x] sedimentation
- [x] dredging
- [ ] farming
- [ ] nutrient enrichment

20
subtotal this page

last revised 1 February 2001 jjm

Site: Nottingham Solar Project	Rater(s): P. Renner	Date: 9/14/2022

20
subtotal first page

Metric 5. Special Wetlands.

0	20
max 10 pts.	subtotal

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

Metric 6. Plant communities, interspersion, microtopography.

-1	19
max 20 pts.	subtotal

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [ ] Shrub
- [ ] Forest
- [ ] Mudflats
- [ ] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [ ] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [✔] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [ ] Extensive >75% cover (-5)
- [✔] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [0] Vegetated hummucks/tussucks
- [0] Coarse woody debris >15cm (6in)
- [0] Standing dead >25cm (10in) dbh
- [1] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

19

End of Quantitative Rating. Complete Categorization Worksheets.

APPENDIX

D REPRESENTATIVE PHOTOGRAPHS

PHOTOGRAPH 1

Wetland NS-24 (PEM) facing north on September 14, 2022.

PHOTOGRAPH 2

Wetland NS-24 (PEM) facing south on September 14, 2022.

PHOTOGRAPH 3

Wetland NS-24 (PEM) facing east on September 14, 2022.

PHOTOGRAPH 4

Wetland NS-24 (PEM) facing west on September 14, 2022.

PHOTOGRAPH 5

Upland NS-24 facing north on September 14, 2022.

PHOTOGRAPH 6

Upland NS-24 facing south on September 14, 2022.

PHOTOGRAPH 7

Upland NS-24 facing east on September 14, 2022.

PHOTOGRAPH 8

Upland NS-24 facing west on September 14, 2022.

PHOTOGRAPH 9

Representative view of old field habitat in the ESC, facing northeast on September 14, 2022.

PHOTOGRAPH 10

Representative view of developed, high intensity land use in the ESC, facing northeast on September 14, 2022.

PHOTOGRAPH 11

Representative view of scrub/shrub habitat in the ESC,
facing northeast on September 14, 2022.

Appendix E Agency Consultation

October 20, 2022

Ms. Patrice Ashfield
U.S. Fish and Wildlife Service
Ohio Ecological Services Office
4625 Morse Road, Suite 104
Columbus, OH 43230
Sent Via Email

Subject: Preliminary Threatened & Endangered Species Review;
Project Code: 2023-0003608
Nottingham Solar 138 KV Gen-Tie Transmission Line Project;
Athens Township, Harrison County, Ohio.

Dear Ms. Ashfield:

WSP USA (WSP) has been retained by Nottingham Solar LLC to conduct environmental permitting activities for the approximately 0.8-mile Nottingham 138 KV Gen-Tie Transmission Line Project (Project), connecting a utility-scale solar photovoltaic generation facility to existing transmission assets, in the vicinity. The Project Area is located within Athens Township, Harrison County, Ohio. The Project is within the Flushing, Ohio USGS 7.5-minute quadrangle map, as shown on Figure 1. WSP is submitting this letter to inquire about current federally-listed rare, threatened, and endangered species and habitat that are known to occur, or that could potentially occur, in the vicinity of the Project.

The proposed Project begins at the proposed BQ Energy Substation (approximate coordinate: 40.1900°, -81.0408°) and heads generally north and east to an existing AEP Substation (approximate coordinate: 40.1964°, -81.0329°). The Project Area is best characterized as Developed, High Intensity land use in addition to, Grassland, Old Field, Scrub/Shrub and Successional Hardwood Woodland habitats.

On behalf of Nottingham Solar LLC, WSP is requesting that the U.S. Fish and Wildlife Service review the Project details provided above as well as the attached Figure 1, official IPaC Species list, and Project shapefile, and provide information regarding federally-listed species.

WSP has sent a similar request to the Ohio Department of Natural Resources to review the Project regarding the potential to impact state-listed species.

If you have any questions regarding this request, please contact me at brad.rolfes@wsp.com or by phone at 859.321.1058.

Kind regards,

Bradley J. Rolfes
Environmental Scientist

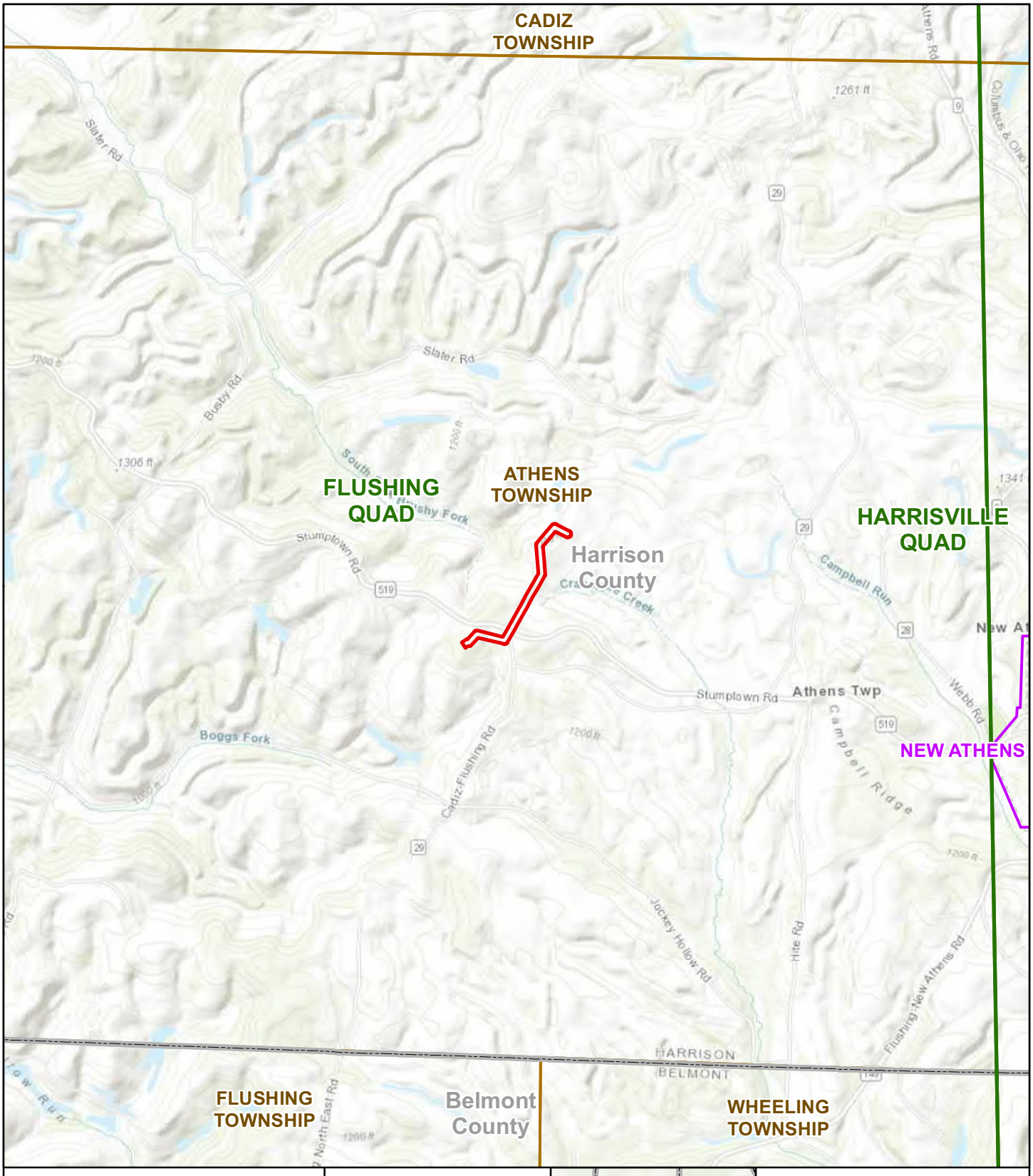
Matthew D. Thomayer
Senior Lead Consultant, Environmental Scientist

Attachments:

Figure 1 – Project Overview Map

Official USFWS IPaC Species List

Project Survey Area ArcGIS shapefile



Ecological Survey Area
USGS 24k Topo Quad Boundary
County Boundary
Township Boundary
Municipal Boundary

Sources:
Topo (USGS)
Quad Boundaries (USGS)

Coordinate System:
State Plane Ohio South
NAD 1983

October 20, 2022

BQE NOTTINGHAM SOLAR 138 KV GEN-TIE TRANSMISSION LINE PROJECT

Figure 1. Project Location Map

BQ Energy, llc.

WSP

0 0.4 0.8 Miles

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, OH 43230-8355
Phone: (614) 416-8993 Fax: (614) 416-8994

In Reply Refer To: October 12, 2022
Project Code: 2023-0003608
Project Name: Nottingham Solar 138 KV Gen-Tie Transmission Line Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, OH 43230-8355
(614) 416-8993

Project Summary

Project Code: 2023-0003608
Project Name: Nottingham Solar 138 KV Gen-Tie Transmission Line Project
Project Type: Transmission Line - New Constr - Above Ground
Project Description: Nottingham Solar LLC plans to construct the approximately 0.8-mile Nottingham 138 KV Gen-Tie Transmission Line Project (Project), connecting a utility-scale solar photovoltaic generation facility to existing transmission assets, in the vicinity. The Project Area is located within Athens Township, Harrison County, Ohio

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@40.1934222,-81.03550059831265,14z

Counties: Harrison County, Ohio

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Incidental take of the northern long-eared bat is not prohibited at this location. Federal action agencies may conclude consultation using the streamlined process described at https://www.fws.gov/midwest/endangered/mammals/nleb/s7.html Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPaC User Contact Information

Agency:	WSP USA
Name:	Bradley Rolfes
Address:	312 Elm Street
Address Line 2:	Suite 2500
City:	Cincinnati
State:	OH
Zip:	45212
Email	brad.rolfes@wsp.com
Phone:	5136392152

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / FAX (614) 416-8994

November 9, 2022

Project Code: 2023-0003608

Reference: Nottingham Solar 138kV Gen Tie Project

Dear Mr./Ms,

The U.S Fish and Wildlife Service (Service) has received your recent correspondence requesting information about the subject proposal. We offer the following comments and recommendations to assist you in minimizing and avoiding adverse impacts to threatened and endangered species pursuant to the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq), as amended (ESA).

Federally Threatened and Endangered Species: The endangered Indiana bat (*Myotis sodalis*) and threatened northern long-eared bat (*Myotis septentrionalis*) occur throughout the State of Ohio. The Indiana bat and northern long-eared bat may be found wherever suitable habitat occurs unless a presence/absence survey has been performed to document absence. Suitable summer habitat for Indiana bats and northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and breed that may also include adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, woodlots, fallow fields, and pastures. Roost trees for both species include live and standing dead trees ≥3 inches diameter at breast height (dbh) that have any exfoliating bark, cracks, crevices, hollows and/or cavities. These roost trees may be located in forested habitats as well as linear features such as fencerows, riparian forests, and other wooded corridors. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet of other forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat. In the winter, Indiana bats and northern long-eared bats hibernate in caves, rock crevices and abandoned mines.

Seasonal Tree Clearing for Federally Listed Bat Species: Should the proposed project site contain trees ≥3 inches dbh, we recommend avoiding tree removal wherever possible. If any caves or abandoned mines may be disturbed, further coordination with this office is requested to determine if fall or spring portal surveys are warranted. If no caves or abandoned mines are present and trees ≥3 inches dbh cannot be avoided, we recommend removal of any trees ≥3 inches dbh only occur between October 1 and March 31. Seasonal clearing is recommended to avoid adverse effects to Indiana bats and northern long-eared bats. While incidental take of northern long-eared bats from most tree clearing is exempted by a 4(d) rule (see https://ecos.fws.gov/ecp/species/9045), incidental take of Indiana bats is still prohibited without

a project-specific exemption. Thus, seasonal clearing is recommended where Indiana bats are assumed present.
If implementation of this seasonal tree cutting recommendation is not possible, a summer presence/absence survey may be conducted for Indiana bats. If Indiana bats are not detected during the survey, then tree clearing may occur at any time of the year. Surveys must be conducted by an approved surveyor and be designed and conducted in coordination with the Ohio Field Office. Surveyors must have a valid federal permit. Please note that in Ohio summer mist net surveys may only be conducted between June 1 and August 15.

Section 7 Coordination: If there is a federal nexus for the project (e.g., federal funding provided, federal permits required to construct), then no tree clearing should occur on any portion of the project area until consultation under section 7 of the ESA, between the Service and the federal action agency, is completed. We recommend the federal action agency submit a determination of effects to this office, relative to the Indiana bat and northern long-eared bat, for our review and concurrence. This letter provides technical assistance only and does not serve as a completed section 7 consultation document.

Stream and Wetland Avoidance: Over 90% of the wetlands in Ohio have been drained, filled, or modified by human activities, thus is it important to conserve the functions and values of the remaining wetlands in Ohio (https://epa.ohio.gov/portals/47/facts/ohio_wetlands.pdf). We recommend avoiding and minimizing project impacts to all wetland habitats (e.g., forests, streams, vernal pools) to the maximum extent possible in order to benefit water quality and fish and wildlife habitat. Additionally, natural buffers around streams and wetlands should be preserved to enhance beneficial functions. If streams or wetlands will be impacted, the U.S. Army Corps of Engineers should be contacted to determine whether a Clean Water Act section 404 permit is required. Best management practices should be used to minimize erosion, especially on slopes. Disturbed areas should be mulched and revegetated with native plant species. In addition, prevention of non-native, invasive plant establishment is critical in maintaining high quality habitats.

Due to the project type, size, and location, we do not anticipate adverse effects to any other federally endangered, threatened, or proposed species, or proposed or designated critical habitat. Should the project design change, or additional information on listed or proposed species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, coordination with the Service should be initiated to assess any potential impacts.

Thank you for your efforts to conserve listed species and sensitive habitats in Ohio. We recommend coordinating with the Ohio Department of Natural Resources due to the potential for the proposed project to affect state listed species and/or state lands. Contact Mike Pettegrew, Acting Environmental Services Administrator, at (614) 265-6387 or at mike.pettegrew@dnr.state.oh.us.

If you have questions, or if we can be of further assistance in this matter, please contact our office at (614) 416-8993 or ohio@fws.gov.

Sincerely,

Patrice Ashfield
Field Office Supervisor

cc: Nathan Reardon, ODNR-DOW
Eileen Wyza, ODNR-DOW

October 20, 2022

Attention: Mike Pettigrew
Office of Real Estate
Ohio Department of Natural Resources
2045 Morse Road, Building E-2
Columbus, OH 43229
Sent Via Email to environmentalreviewrequest@dnr.state.oh.us

Subject: Preliminary Threatened & Endangered Species Review;
Nottingham Solar 138 KV Gen-Tie Transmission Line Project;
Athens Township, Harrison County, Ohio.

Dear Mr. Pettigrew:

WSP USA (WSP) has been retained by Nottingham Solar LLC to conduct environmental permitting activities for the approximately 0.8-mile Nottingham 138 KV Gen-Tie Transmission Line Project (Project), connecting a utility-scale solar photovoltaic generation facility to existing transmission assets in the vicinity. The Project Area is located within Athens Township, Harrison County, Ohio. The Project is within the Flushing, Ohio USGS 7.5-minute quadrangle map, as shown on Figure 1. WSP is submitting this letter to inquire about current state-listed rare, threatened, and endangered species and habitat that are known to occur, or that could potentially occur, in the vicinity of the Project.

The proposed Project begins at the proposed BQ Energy Substation (approximate coordinate: 40.1900°, -81.0408°) and heads generally north and east to an existing AEP Substation (approximate coordinate: 40.1964°, -81.0329°). The Project Area is best characterized as Developed, High Intensity land use, in addition to Grassland, Old Field, Scrub/Shrub and Successional Hardwood Woodland habitats.

On behalf of Nottingham Solar LLC, WSP is requesting that the Ohio Department of Natural Resources review the Project details provided above as well as the attached Figure 1 and Project shapefile and provide information regarding state-listed species. Additionally, WSP is requesting Natural Heritage Database (NHDB) location information. This request is included in the attached NHDB request form. WSP has sent a similar request to USFWS to review the Project for the potential to impact federally protected species.

If you have any questions regarding this request, please contact me at brad.rolfes@wsp.com or by phone at 859.321.1058.

Kind regards,

Bradley J. Rolfes
Environmental Scientist

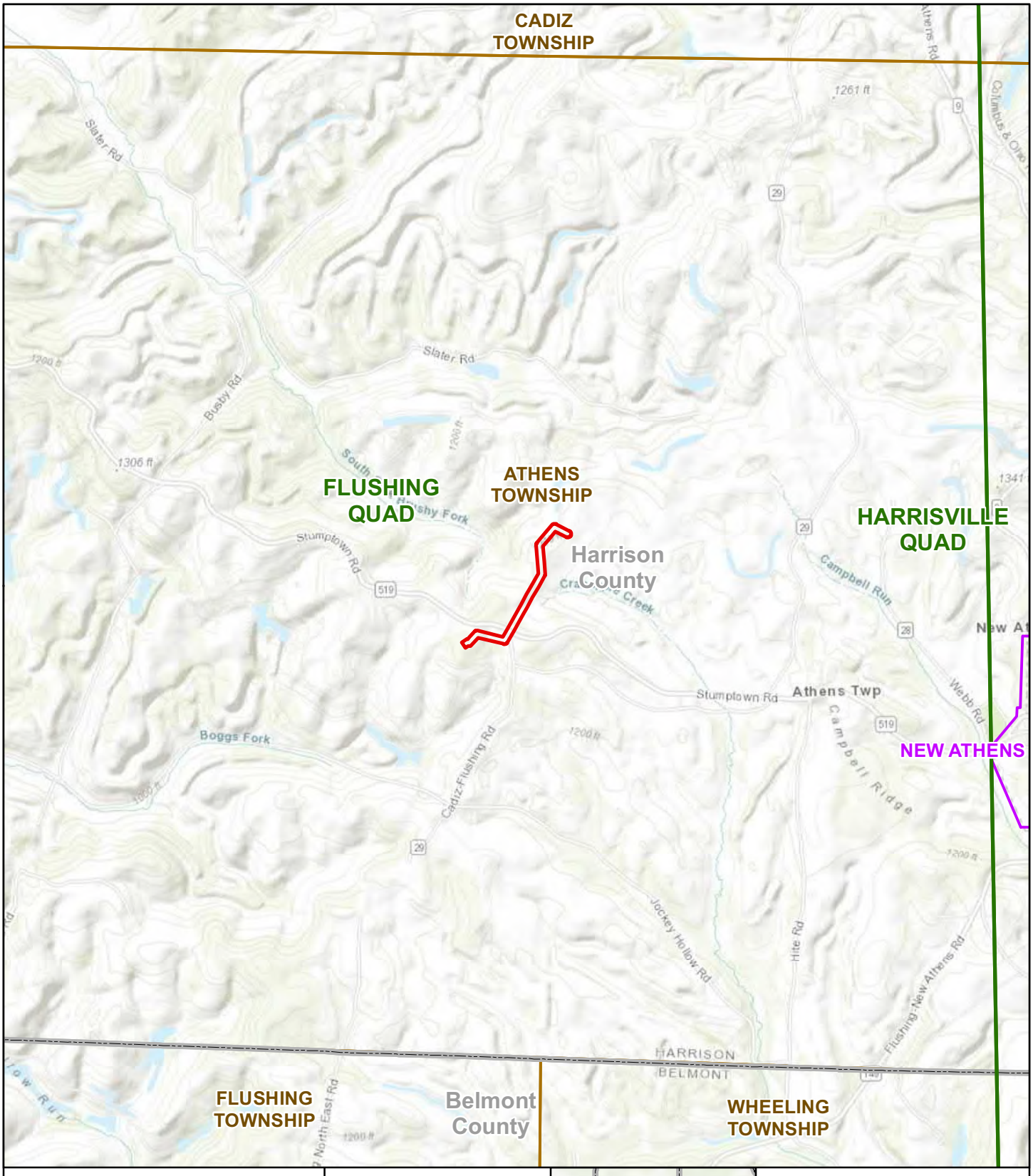
Matthew D. Thomayer
Senior Lead Consultant, Environmental Scientist

Attachments:

Figure 1 – Project Overview Map

Project Centerline ArcGIS shapefile

ODNR Natural Heritage Database Request Form



Ecological Survey Area
USGS 24k Topo Quad Boundary
County Boundary
Township Boundary
Municipal Boundary

Sources:
Topo (USGS)
Quad Boundaries (USGS)

Coordinate System:
State Plane Ohio South
NAD 1983

October 20, 2022

BQE NOTTINGHAM SOLAR 138 KV GEN-TIE TRANSMISSION LINE PROJECT

Figure 1. Project Location Map

BQ Energy, llc.

WSP

0 0.4 0.8 Miles

N

Ohio Department of Natural Resources
DIVISION OF WILDLIFE

DNR 5203 (R1017)

NATURAL HERITAGE DATA REQUEST FORM

ODNR Division of Wildlife
Ohio Natural Heritage Program
2045 Morse Rd., Bldg. G-3
Columbus, OH 43229-6693
Email: NHDRequest@dnr.state.oh.us
Phone: 614-265-6818

WHAT KIND OF REVIEW DO I NEED?

ODNR provides two kinds of project reviews, an Ohio Natural Heritage Database (ONHD) data request and an Environmental Review (ER). ONHD data requests will be processed for projects that meet one of the following four criteria:

- consultant prepared reports for ODOT projects
- completion of OEPA's Ohio Rapid Assessment Method for wetlands
- academic research projects
- other non-development or non-construction projects

As applicable to your project, the ONHD will provide records for state and federally listed plants and animals, high quality plant communities, geologic features, breeding animal concentrations, scenic rivers, protected natural areas (managed areas), and significant unprotected natural areas (conservation sites). A one mile radius around the project site will automatically be searched. Because the ONHD contains sensitive information, it is our policy to provide only the data needed to complete your specific project.

If your project does not meet one of these criteria, you will need to submit it for an ER. An ER includes comments on potential impacts to the species and their habitats, and therefore constitutes coordination with ODNR under NEPA, the Fish & Wildlife Coordination Act, the Federal Water Pollution Control Act, and other laws. If your project requires ODNR coordination, please go to http://realestate.ohiodnr.gov/environmental-review for additional information including appropriate contacts. An ONHD search is included as part of the environmental review process.

INSTRUCTIONS:

Please complete all the information on both sides of this form, sign (required) and email it to NHDRequest@dnr.state.oh.us. Please provide a description of the work to be performed at the project site, and a map detailing your project site boundaries. If you request a GIS response, please also submit a shapefile of your project site (unbuffered). Data requests will be completed within approximately 30 days. There is currently no charge to process requests.

Date: 10/12/2022 **Company name:** WSP USA

Name of person response letter should be addressed to:

Mr. ☑ **Ms.** ☐ Bradley Rolfes

Address: 312 Elm Street, Suite 2500

City/State/Zip: Cincinnati, Ohio 45202

Phone: 859-321-1058

E-mail address: brad.rolfes@wsp.com

Project Name: BQ Solar Nottingham Solar Gen-Tie 138 kV Transmission Line Project

Project Site Address: Stumptown Rd, Cadiz, OH 43907 (40.190334, -81.036164)

Project County: Harrison

Project City or Township: Athens Township

Project site is located on the following USGS 7.5 minute topographic quad(s):

Flushing, Ohio

Project latitude and longitude: 40.1900°, -81.0408° / 40.1964°, -81.0329°

Description of work to be performed at the project site:

Wetland delineation, assessment and permitting in support of the a 0.8-mile 138 kV transmission line between a Proposed BQ Substation and an existing AEP Substation in Athens Township, Harrison County, Ohio.

How do you want your data reported? Both formats provide the same data. The manual search is most appropriate for small scale projects or for those without GIS capabilities. With this option we will send you a letter with a list of records and a map showing their location. If you request a GIS shapefile, we will send you a letter and shapefile of data layers. You will then need to make your own map and list of data for your report. You must have GIS capabilities. If you do not make a selection or if you choose both options, a manual search will be performed (Please choose only one option).

☐ **Printed list and map (manual search)** **OR** ☑ **GIS shapefile (computer search)**

The standard data we search includes state and federally listed plants and animals, high quality plant communities, geologic features, breeding animal concentrations, scenic rivers, managed areas, and conservation sites, including a one mile radius around your project area. List any information in addition to this that you require:

All natural heritage database information within a one-miles radius of the Project area, as provided in the attached GIS shapefiles.

How will the information be used?

Natural Heritage Data is specifically needed in order to accurately complete the Ohio Rapid Assessment Method for Wetlands, delineated within the Project Area. An environmental review of the Project is being submitted, but location information is required to complete the "Special Wetlands" metric in ORAM.

The chief of the Division of Wildlife has determined that the release of the ONHD data you have requested could be detrimental to the conservation of a species or unique natural feature. Pursuant to section 1531.04 of the Ohio Revised Code, this information is not subject to section 149.43 of the Revised Code. By signing below, you certify that the data provided will not be disclosed, published, or distributed beyond the scope of your project.

Signature Rolfes, Brad (USBR696974) Digitally signed by Rolfes, Brad (USBR696974) DN: cn=Rolfes, Brad (USBR696974), ou=Active, email=Brad.Rolfes@wsp.com Date: 2022.10.03 11:30:53 -04'00' **Date:** 10/12/2022

Summary: Letter of Notification for the Nottingham Solar 138 kV Gen-Tie Transmission Line Project electronically filed by Teresa Orahood on behalf of Devin D. Parram