Technical Due Diligence Reporting for Solar PV Installation

Major Project, January-June 2025

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Roll No: R247221004, Semester: VII

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Under the guidance

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UNIVERSITY OF TOMORROW

ELECTRICAL CLUSTER

SCHOOL OF ADVANCED ENGINEERING

ACKNOWLEDGMENT

The completion of my major project could not have been possible without the kind support and help of many individuals. We would like to extend our sincere thanks, and gratitude to all of them. We take pleasure in presenting before you, our project, which is a result of studied blend of both research and knowledge. We are highly indebted to our mentor Dr. Yogesh Chandra Gupta for his guidance and constant supervision. We would like to express our gratitude towards our parents as without them, the support system that we needed would never would have been possible.

We would also extend our thanks to our batch mates and faculties of UPES for their kind cooperation and encouragement which motivated us and helped us in thinking of this project.

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Signature:

Date: 6/5/2025

DECLARATION

We hereby declare that this submission is our own and that, to the best of by knowledge and belief, if contains no material previously published or written by another person nor material which has been accepted for the award of another degree or diploma of the university or other higher learning institute. All the things in the report are by us and we are solely responsible for any plagiarism.

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Date: 6/5/2025

CERTIFICATE

This is to certify that Mr. Soumitra K Gupta, Roll no: R247221004 student of B.Tech-Renewable and sustainable energy (VIII Semester), from Electrical Cluster, School of Engineering, UPES, Dehradun (Uttarakhand) have completed their Major project entitled Technical Due Diligence Reporting For Solar PV Installation under the guidance of Dr. Yogesh Chandra Gupta, Industry Fellow in Electrical Cluster SOAE, UPES, Dehradun.

Signature:

Date: 6/5/2025

Name of Supervisor(s): Dr.Yogesh Chandra Gupta Designation:

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Department name: Electrical Cluster

Abstract

The Technical Due Diligence Report for a solar plant project is to deliver a thorough feasibility evaluation of a planned solar power facility, confirming its technical, financial, and regulatory viability. The research employs a systematic technique, encompassing land parcel assessment, solar resource appraisal, environmental due diligence, interconnection viability, and permitting stipulations.

The due diligence process commences with a site investigation, encompassing an assessment of land ownership, easements, zoning regulations, and geographic limitations. Critical elements like the existence of wetlands and floodplains, topographical variations, and soil characteristics—such as pH, corrosivity, hydric content, and erosion vulnerability—are evaluated to assess the land's appropriateness for solar installation. An assessment of solar radiation and meteorology is performed with industry-standard tools such as PVsyst and SolarGIS, offering insights into annual Global Horizontal Irradiance (GHI), wind conditions, and temperature fluctuations that affect energy yield.

The electrical infrastructure and connections feasibility study evaluates grid availability, hosting capacity, and network congestion to ensure effective power evacuation. Adjacent renewable energy initiatives and current interconnection queues are examined to predict possible transmission limitations. A desktop-based environmental due diligence procedure is conducted, assessing potential ecological implications including the presence of endangered species, archaeological significance, and conservation easements. Regulatory compliance is assessed by analyzing zoning rules, permits regulations, and National Environmental Policy Act (NEPA) factors. Financial factors, such as tax benefits and energy community designation, are evaluated to ascertain investor appeal. A risk study is conducted, encompassing hurricane susceptibility, flood hazards, and FAA/FCC adherence.

This due diligence report offers stakeholders a data-driven framework for decision-making, confirming the project's compliance with environmental standards, technical feasibility, and economic viability. This thorough assessment aids in reducing risks, enhancing design factors, and ensuring a seamless transition to the implementation stage.

Chapter 1: Introduction

The growing imperative to shift to renewable energy sources has established solar power as a fundamental component of global sustainable energy solutions. With the increase of solar projects, the need for thorough technical due diligence is essential to guarantee their viability and adherence to regulatory standards. This project centers on the Technical Due Diligence Reporting of a solar facility, intending to provide a thorough feasibility assessment that validates its technical, financial, and regulatory soundness. The technical due diligence process utilizes a methodical approach that includes numerous essential elements.

A comprehensive site analysis is performed, evaluating land parcel characteristics such as ownership, easements, zoning rules, and geographic limitations. This assessment is essential for ascertaining the suitability of the location for solar installation. Critical elements, including wetlands and floodplains, are rigorously examined in conjunction with topographical changes and soil properties—such as pH levels, corrosivity, hydric content, and erosion vulnerability—to determine the land's appropriateness for solar development.

An essential element of this analysis is the evaluation of solar resource availability. The research will employ industry-standard technologies like PVsyst and SolarGIS to assess annual Global Horizontal Irradiance (GHI) values, wind conditions, and temperature variations that directly affect energy yield. This quantitative analysis offers insights into the anticipated performance of the solar plant under diverse environmental conditions.

The feasibility study will assess the electrical infrastructure required for efficient power evacuation, in addition to resource evaluation. This encompasses an examination of grid accessibility, hosting capability, and possible network congestion. The study will also examine related renewable energy programs and existing interconnection queues to anticipate potential transmission constraints that may impact project feasibility.

Environmental due diligence constitutes a vital element of this evaluation. A desktop review would ascertain potential ecological implications, including the existence of endangered species and archeological significance inside or next to the proposed site. Regulatory compliance will be rigorously evaluated by examining local zoning rules, permitting obligations under the National Environmental Policy Act (NEPA), and other pertinent regulations that oversee solar project development.

Financial factors are essential to this due diligence study. The examination will include tax incentives, energy community classifications, and general investor attractiveness. A thorough risk assessment would evaluate elements such as hurricane vulnerability and flood risks, ensuring that all possible issues are identified and managed preemptively.

This Technical Due Diligence Report seeks to furnish stakeholders, including investors and regulatory bodies, with a comprehensive data-driven framework for informed decision-making. This study confirms the project's adherence to environmental standards and its technical and economic viability, thereby reducing risks and improving design considerations. The results will enable a smooth transition to implementation, aiding broader efforts to enhance renewable energy programs in accordance with sustainability goal

Chapter 2: Objectives

The main aim of this project is to perform a thorough technical due diligence evaluation of a planned solar power plant to analyze its viability, potential risks, and regulatory adherence. The precise aims of this investigation are-

Feasibility Assessment

- Assess the appropriateness of the chosen property piece considering ownership documentation, easements, zoning laws, and topographical limitations.
- Evaluate the solar resource potential with solar radiation data, including Global Horizontal Irradiance (GHI) and meteorological circumstances.
- Assess the energy yield potential by evaluating solar panel orientation, efficiency, and losses through the utilization of industry-standard technologies like PVsyst.

Analysis of Environmental and Land Utilization

- Perform a desktop environmental due diligence to detect wetlands, floodplains, and other ecological limitations.
- Assess the existence of threatened and endangered species, essential ecosystems, and conservation easements.
- Evaluate the soil properties, including pH levels, corrosiveness, moisture content, and erosion potential, to ascertain foundation appropriateness.

Viability of Electrical Infrastructure and Grid Interconnection

- Evaluate the closeness and capacity of adjacent transmission and distribution lines for interconnection. Assess the hosting capacity and current interconnection queue of the utility service provider to ascertain grid viability.
- Recognize possible transmission limitations, line loading challenges, and network congestion threats.

Adherence to Regulations and Licensing

- Examine zoning and permitting prerequisites for solar project authorization, encompassing land-use limitations and special use permissions.
- Ensure adherence to FAA, FCC, and environmental impact rules, encompassing NEPA and state-specific guidelines.

- Evaluate potential qualification for financial incentives, including Investment Tax Credits (ITC) and Energy Community advantages.

Risk Evaluation and Project Enhancement

- Assess potential climate hazards, encompassing hurricane susceptibility, inundation, and high temperature fluctuations.
- Propose mitigation measures for site-specific limitations, including land leveling, soil remediation, and erosion management.
- Deliver a conclusive feasibility assessment to aid investment decisions and project planning. This study adopts a methodical and data-driven methodology to assess the viability of the planned solar power plant, thereby aiding stakeholders in making informed decisions and successfully limiting risks.

Chapter 3: Project activities/ Methodology

The Technical Due Diligence Reporting of a Solar Plant requires a structured, multi-phase methodology to evaluate the feasibility, risks, and compliance requirements of the proposed project. This study involves data collection, site assessment, environmental analysis, energy yield estimation, grid interconnection feasibility, regulatory compliance evaluation, and risk assessment.
Since this is a desktop-based study, all assessments, analyses, and evaluations are conducted using digital resources, databases, simulation tools, and remote sensing techniques without requiring on-site visits. The methodology ensures that stakeholders receive a comprehensive understanding of the solar plant's viability and expected performance. This structured approach allows for efficient project planning and risk mitigation by leveraging modern computational tools to simulate real-world conditions accurately.

Digital and Computational Resources

Since this is a desktop due diligence report, the study relies on various software tools, databases, and online platforms to analyze the feasibility of the solar plant. These resources help in gathering data, processing information, and generating insights that would otherwise require extensive field surveys.

GIS and Mapping Software

To evaluate the land's suitability, Geographic Information System (GIS) software plays a critical role. Google Earth Pro, ArcGIS, and QGIS are used to analyze the site's topography, elevation, and land boundaries. These tools allow for the visualization of terrain conditions, identification of potential obstacles, and assessment of the land's suitability for solar panel installation.

Solar Resource and Energy Yield Assessment

Solar resource assessment is a crucial step in determining the project's feasibility. The study relies on PVsyst, SolarGIS, NASA-SSE,to collect data on Global Horizontal Irradiance (GHI), Direct Normal Irradiance (DNI), and Diffuse Horizontal Irradiance (DHI). These datasets help classify the site into low, moderate, or high irradiance zones based on historical solar radiation patterns, allowing for accurate estimation of energy generation potential.

Environmental and Ecological Analysis

Environmental factors play a significant role in project feasibility. To evaluate the ecological impact, the study uses databases such as US Fish and Wildlife Service (USFWS) for endangered species assessment, National Wetlands Inventory (NWI) for wetland mapping, FEMA Flood Maps to identify flood-prone zones, and MERLIN for conservation easements. By integrating these sources, the study ensures that the project does not interfere with protected habitats or violate environmental regulations.

Geotechnical and Soil Analysis

Soil properties affect both structural stability and solar panel efficiency. The USDA Web Soil Survey provides data on soil pH levels, hydric content, corrosion risks, and erosion susceptibility. These characteristics determine foundation stability, drainage capacity, and the potential impact of soil degradation on long-term project sustainability.

Climate and Meteorological Data

Climate variability directly influences solar panel performance. Data from NOAA, NASA-SSE, and NCDC help in analyzing historical wind speeds, temperature variations, and the number of clear sunny days per year. This information is vital in assessing the seasonal fluctuations in solar energy output, potential risks of weather-related damages, and the impact of extreme conditions on panel longevity.

Grid Interconnection Feasibility
The feasibility of integrating the solar plant with the electrical grid depends on the availability of transmission and distribution infrastructure. The study uses PJM Interconnection Queue, EIA Grid Maps, and Utility Hosting Capacity Reports to assess proximity to substations, grid congestion levels, and potential interconnection constraints.

By evaluating these factors, the study determines whether additional grid upgrades or reinforcements are needed for smooth energy transmission.

Regulatory Compliance and Permitting
To ensure legal compliance, the project must adhere to aviation and communication regulations. The FAA Obstruction Evaluation database is consulted to ensure that the solar plant does not interfere with flight paths or airspace clearance, while the FCC Licensing Database is reviewed to check for potential conflicts with communication infrastructure, such as radio towers or satellite stations.

Project Timeline Overview

The Technical and Environmental Due Diligence Reporting of a Solar Plant follows a structured timeline to assess land feasibility, environmental constraints, energy potential, grid connectivity, and regulatory compliance. This revised timeline ensures that Environmental Due Diligence is completed first to determine usable land before technical assessments.
The project is structured over 15 weeks (January 15 – May 1, 2025), ensuring efficiency while allowing flexibility for unforeseen delays.

The due diligence process is divided into the following six phases:

Table 1:DDR Timeline

Phase	Task Description	Timeline
Phase 1: Environmental and Land Feasibility Studies	Wetland, floodplain, endangered species, soil analysis, and archaeological review	**Jan 15 – Feb 4**
Phase 2: Preliminary Site Selection and Refinement	Identify usable land, evaluate ownership, easements, and zoning	**Feb 5 – Feb 15**
Phase 3: Solar Resource and Energy Yield Analysis	Solar radiation assessment, PVsyst simulations, energy output estimation	**Feb 16 – Mar 1**
Phase 4: Grid Interconnection and Infrastructure Feasibility	Substation proximity, grid hosting capacity, interconnection challenges	**Mar 2 – Mar 22**
Phase 5: Regulatory Compliance and Risk Assessment	Zoning, NEPA, FAA, FCC compliance, financial incentives	**Mar 23 – Apr 12**
Phase 6: Final Report Preparation and Review	Consolidate findings, recommendations, risk mitigation	**Apr 13 – May 1**

Phase-Wise Breakdown of Activities

Phase 1: Environmental and Land Feasibility Studies (Jan 15 – Feb 4)

Objective: To analyze environmental risks, soil conditions, and ecological constraints before selecting the final site.

Table 2: Phase-Wise Breakdown

Task	Start Date	End Date
Wetland and Floodplain Assessment	Jan 15	Jan 20
Threatened and Endangered Species Identification	Jan 21	Jan 24
Soil Analysis (pH, corrosivity, hydric content)	Jan 25	Jan 28
Archaeological and Cultural Significance Review	Jan 29	Jan 31
Conservation Easement Review	Feb 1	Feb 4

Phase 2: Preliminary Site Selection and Refinement (Feb 5 – Feb 15)

Objective: To identify land parcels viable for development based on environmental constraints and regulatory compliance

Task	Start Date	End Date
Land Ownership and Title Verification	Feb 5	Feb 7
Easements and Zoning Restrictions Review	Feb 8	Feb 10
Define Net-Usable Land Area	Feb 11	Feb 13
Finalize the Selected Land Parcel	Feb 14	Feb 15

Phase 3: Solar Resource and Energy Yield Analysis (Feb 16 – Mar 1)

Objective: To determine solar potential and estimate energy output from the usable land identified.

Task	Start Date	End Date
Solar Radiation Data Collection (GHI, DNI, wind, temperature)	Feb 16	Feb 18
PVsyst and SolarGIS Simulations	Feb 19	Feb 22
Shading and Obstruction Analysis	Feb 23	Feb 25
Panel Orientation and Tracking System Analysis	Feb 26	Feb 28
Solar Yield Feasibility Report	Mar 1	Mar 1

Phase 4: Grid Interconnection and Infrastructure Feasibility (Mar 2 – Mar 22

Objective: To evaluate the availability of transmission and distribution networks for power evacuation.

Task	Start Date	End Date
Identify Substation and Transmission Line Proximity	Mar 2	Mar 5
Evaluate Grid Hosting Capacity	Mar 6	Mar 9
Existing Renewable Projects in the Vicinity	Mar 10	Mar 12
Preliminary Interconnection Application Review	Mar 13	Mar 16
Assess Utility Constraints and Transmission Issues	Mar 17	Mar 20

Phase 5: Regulatory Compliance and Risk Assessment (Mar 23 – Apr 12)
Objective: To ensure the project adheres to federal, state, and local regulations.

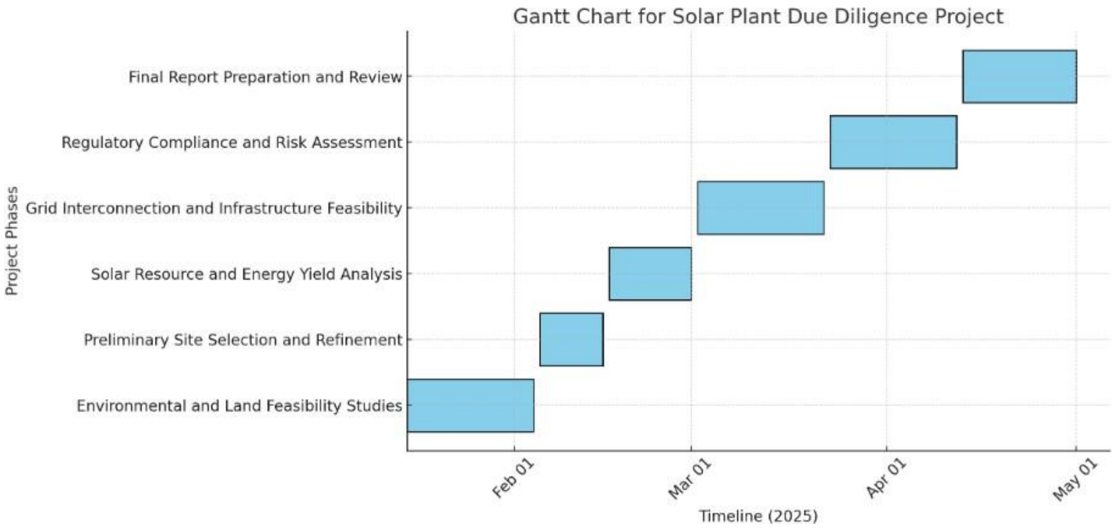
Task	Start Date	End Date
Review Zoning Regulations and Permitting Requirements	Mar 23	Mar 26
Ensure Compliance with NEPA	Mar 27	Mar 30
FAA and FCC Compliance Checks	Mar 31	Apr 3
Assess Financial Incentives (ITC, Energy Community Benefits)	Apr 4	Apr 7
Climate and Natural Disaster Risk Assessment	Apr 8	Apr 10
Compile Regulatory Compliance Report	Apr 11	Apr 12

Phase 6: Final Report Preparation and Review (Apr 13 – May 1)

Objective: To compile all findings and present recommendations for project execution.

Task	Start Date	End Date
Consolidate Environmental Due Diligence Report	Apr 13	Apr 16
Finalize Technical Feasibility Report	Apr 17	Apr 20
Risk Mitigation and Design Optimization Review	Apr 21	Apr 24
Prepare Final Project Report and Presentation	Apr 25	Apr 28
Conduct Stakeholder Review and Final Submission	Apr 29	May 1

Gantt Chart Representation



Chapter 4: Environmental And Technical Due Diligence

Desktop Based Environmental Due Diligence

Assessing wetlands, flood lands, and environmental due diligence is vital for a ground mount solar PV project installation. Wetland and Foodland assessments are crucial to ensure compliance with environmental regulations, protect local ecosystems, and mitigate potential flooding risks. The following section covers desktop based environmental due diligence for the proposed land parcels.

Wetlands

Presence of Wetlands and Types of Wetland / Jurisdictional Wetlands

The development team conducted an assessment of the National Wetlands Inventory and the Pennsylvania Lakes, Bays, and Wetlands dataset for the project site. A total of **10.33 acres** of federally regulated wetlands were identified within the land parcel, with **no state-regulated wetlands** observed, as illustrated in the figures below.

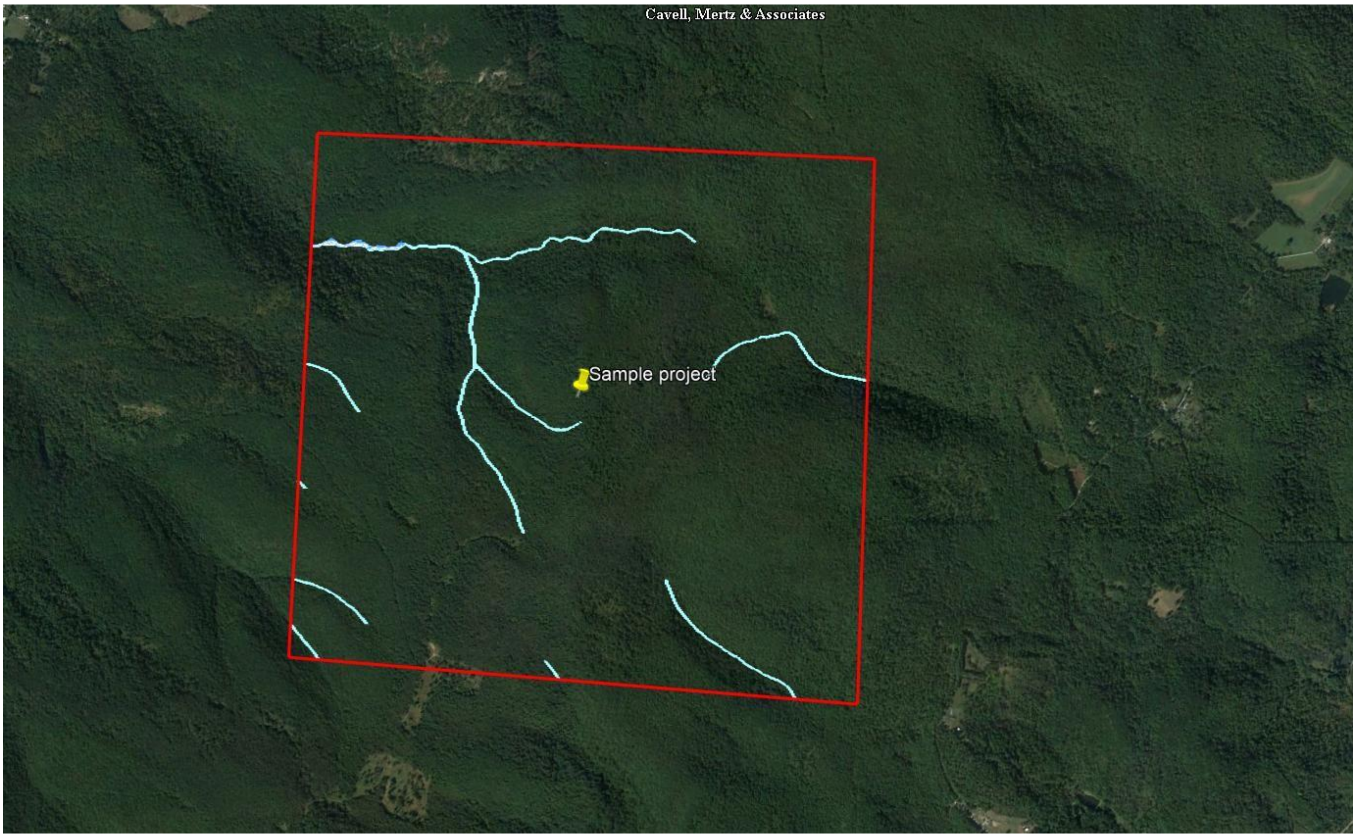


Figure 1: Federal Wetlands

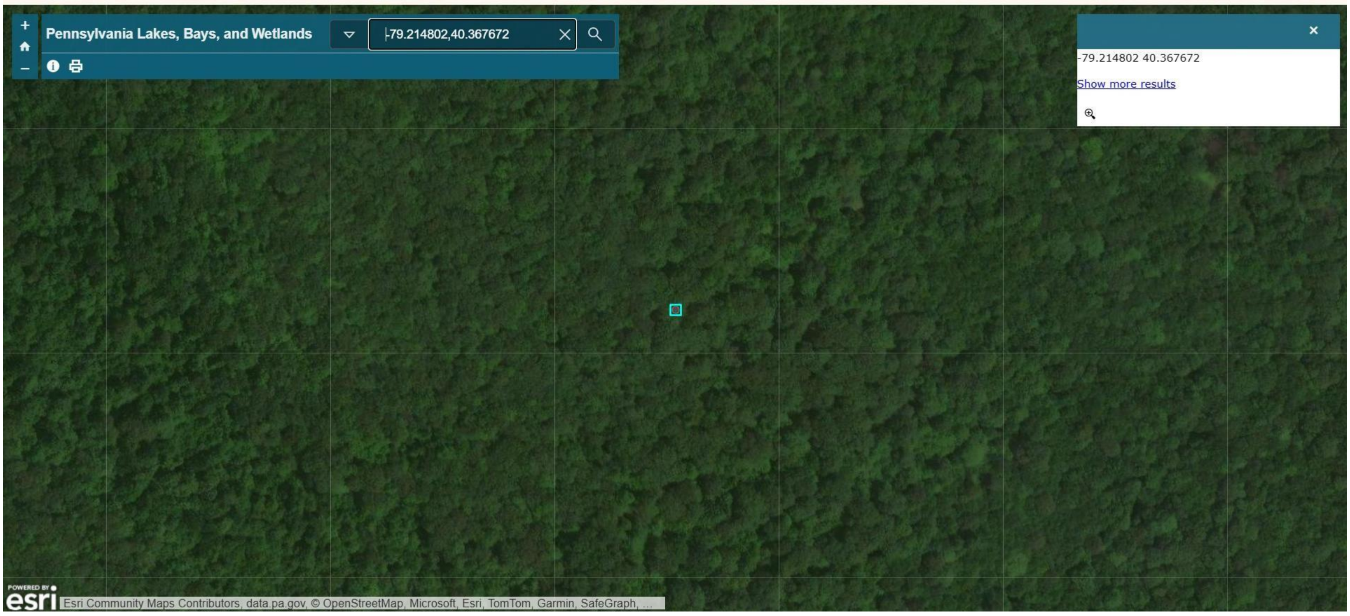


Figure 2: State level Wetlands

It is recommended to conduct an on-site wetland delineation survey and obtain an Approved Jurisdictional Determination (AJD) from the U.S. Army Corps of Engineers to ensure compliance with regulatory requirements after determining the impact of the project on the wetlands present within the project boundary.

T&E Species

Threatened and Endangered Species Review

A preliminary analysis of Threatened & Endangered Species has been performed using United States Fish and Wildlife Services IPaC Database. According to the U.S. Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IPaC) tool, the following is the status of threatened and endangered species identified within the project site location:

Table 3: Thretened and Endangered Species

1. Insects
a. Monarch Butterfly
There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat.
2. Mammals
a. Northern Long-eared Bat
No critical habitat has been designated for this species.
b. Indiana Bat
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
c. Tricolored Bat
No critical habitat has been designated for this species.
3. Critical Habitats
There are no critical habitats at this location

The initial environmental assessment indicates that the project does not adversely impact existing species at the proposed site. Additionally, according to the USFWS IPaC tool, no critical habitats have been identified within the land parcel. However, it is essential to consult with the USFWS and conduct an on-site environmental survey to assess the impact of any threatened and endangered species. This step is crucial to mitigate potential environmental risks and ensure compliance with regulatory requirements.

Archaeological Significance

Presence of Archaeological Significance within the Parcel

The development team reviewed the online the National Register of Historic Places database, and the PA-SHARE archive map by Pennsylvania State Historic Preservation Office. It was observed that a historical registered property is situated in the vicinity of the project land parcel.

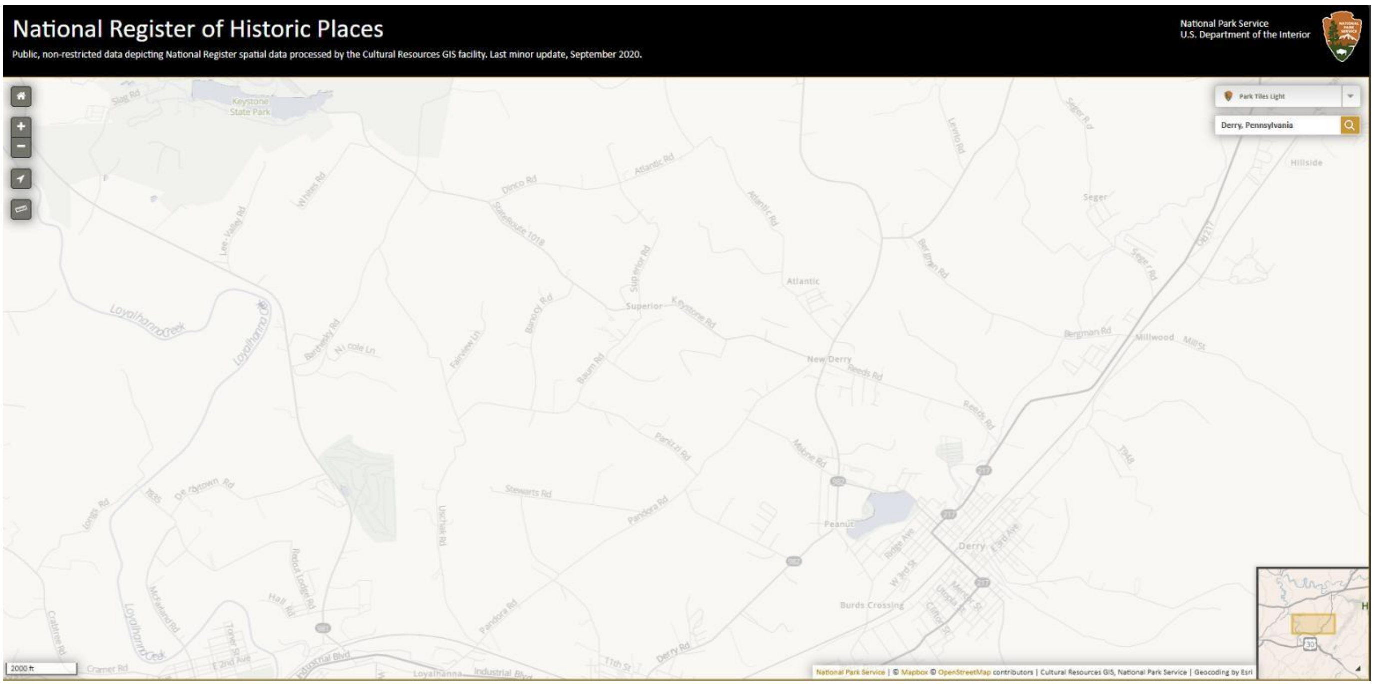


Figure 3:National Register Of Historic Places

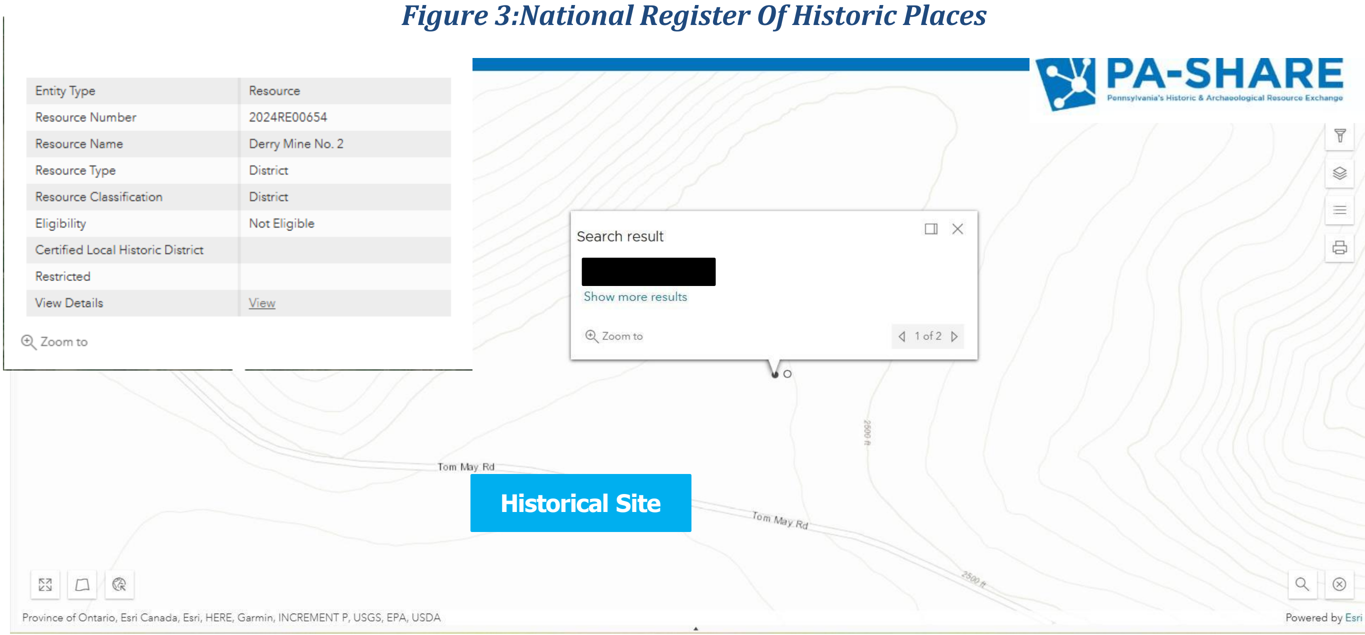


Figure 4:PA-SHARE

Figure 5: Derry Mines

Mine No. 2 is observed near the project land as shown in the figure above. Therefore, it is recommended to consult with the State Historic Preservation Office (SHPO) and conduct a Phase 1 Archaeological Survey to assess the presence and impact of potential historical sites, tribal land areas, areas of effect, and ensure the project does not affect any historical or archaeological sites and compliance with SHPO guidelines.

FEMA Flood Map / Plains

Flood Zone

A desktop assessment was conducted to evaluate flood-prone areas near the proposed site. Based on data from the FEMA database, the project land parcel area of approximately 51.8 acres of land area is located within Zone A. Development of utility-scale solar and energy storage project within Zone A can be considered with basic flood mitigation measures and implementation of proper drainage systems and erosion control measures to minimize risks associated with flooding. A detailed risk assessment should be conducted to mitigate the risks involved.

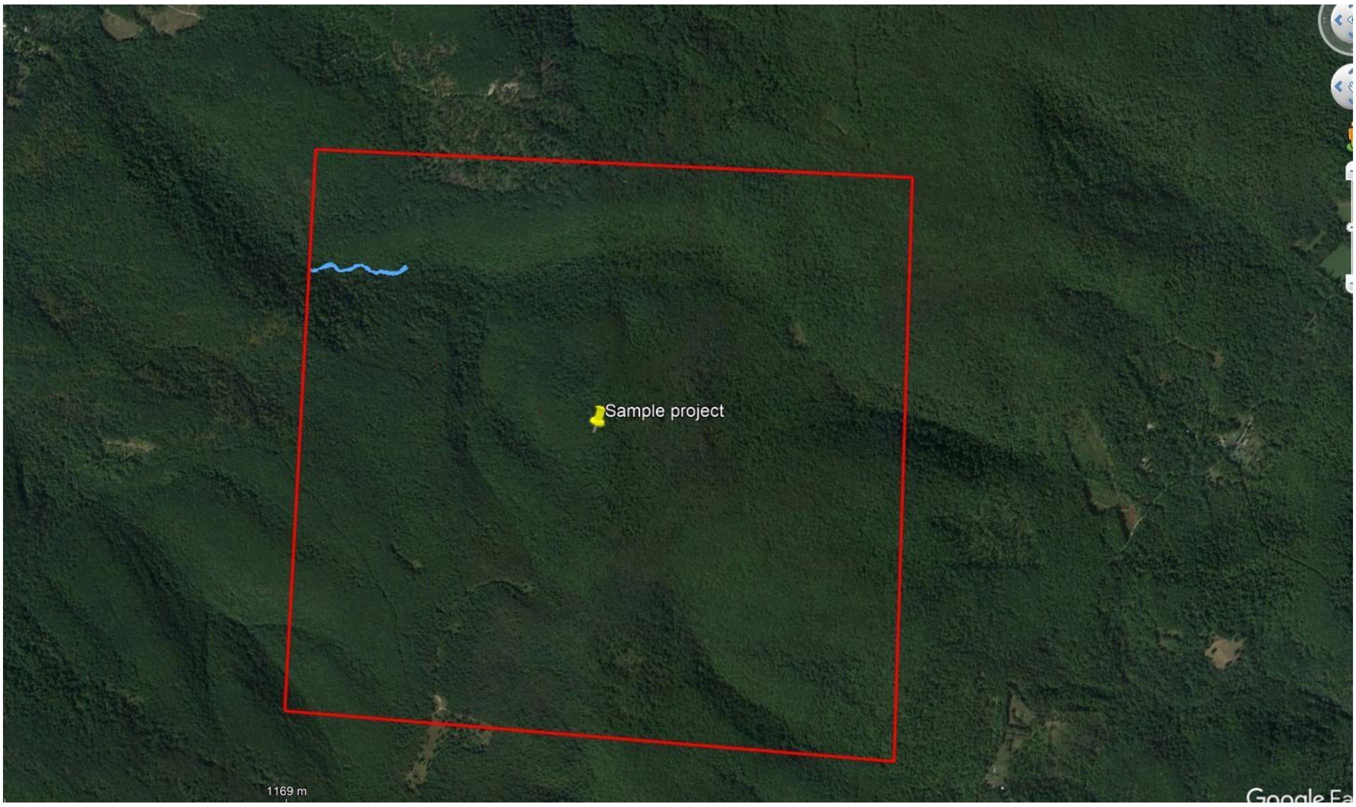


Figure 6: Flood Zone

Conservation Easement

The development team reviewed conservation data from the National Conservation Easement and PA Conserved Land Database, confirming that there are no conservation easements within the project site. However, there are conservation easements located adjacent to the site. It is recommended to conduct a detailed title search to verify the presence of any easements, encroachments, or other restrictions within the site that could potentially impact the project. Additionally, it is advisable to consult with the local authorities to ensure compliance with any nearby easement regulations.

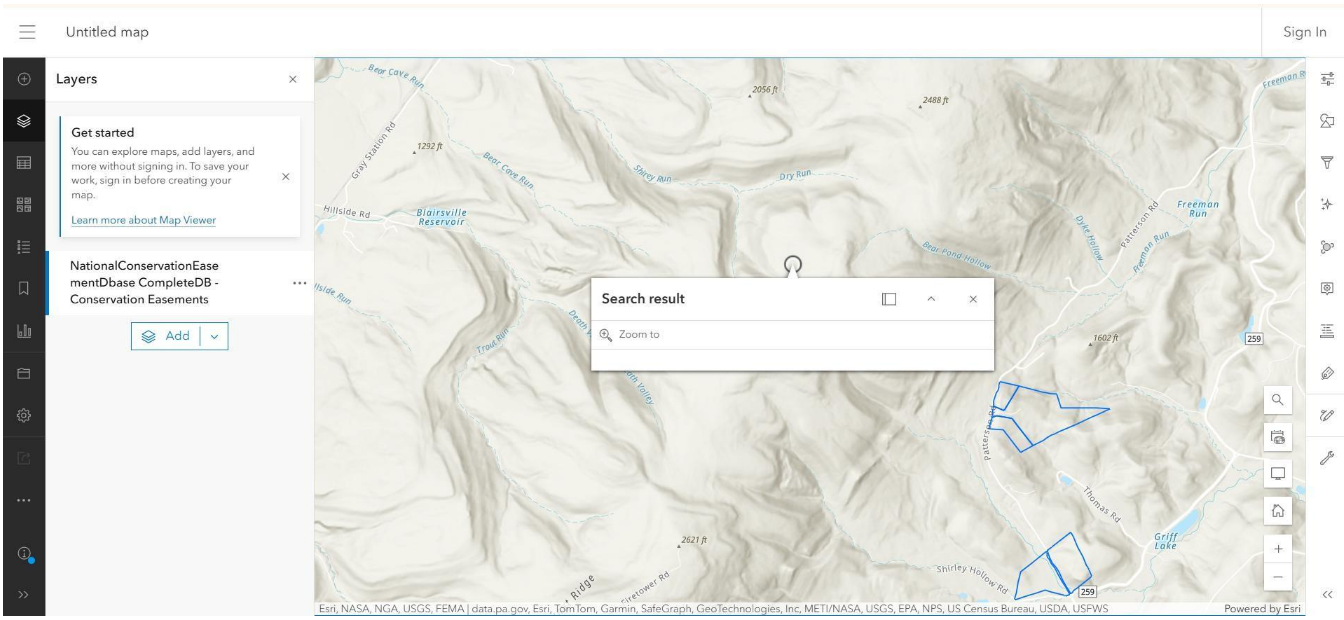


Figure 7:National Conservation Easement

Gas and Hazardous Liquid Pipelines and other Infrastructure

The development team has reviewed the Pipeline and Hazardous Materials Safety Administration (PHMSA) database and confirmed that no gas transmission pipeline traverses the project land parcel. Additionally, a review of the Pennsylvania Department of Environmental Protection's (DEP) Oil and Gas Mapping tool indicates no oil or gas wells or coal mines are located within the project site. Despite this, it is still recommended to conduct further due diligence to confirm the absence of any other potential underground utilities or hazards. Coordination with relevant authorities is advised to ensure full regulatory compliance and mitigate any unforeseen risks.

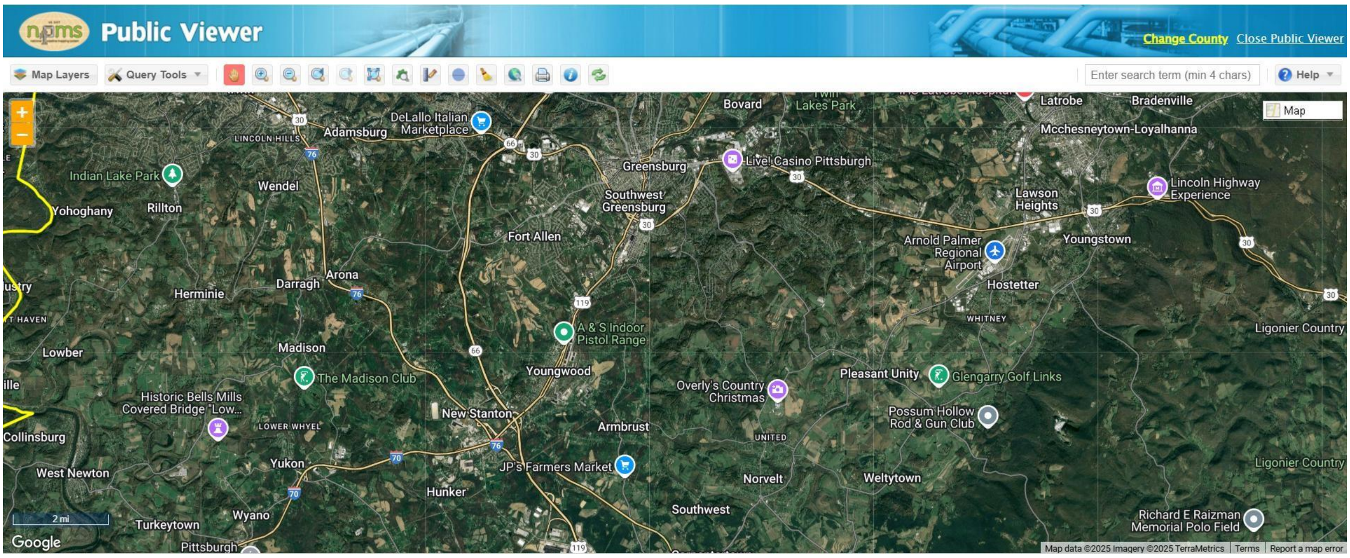


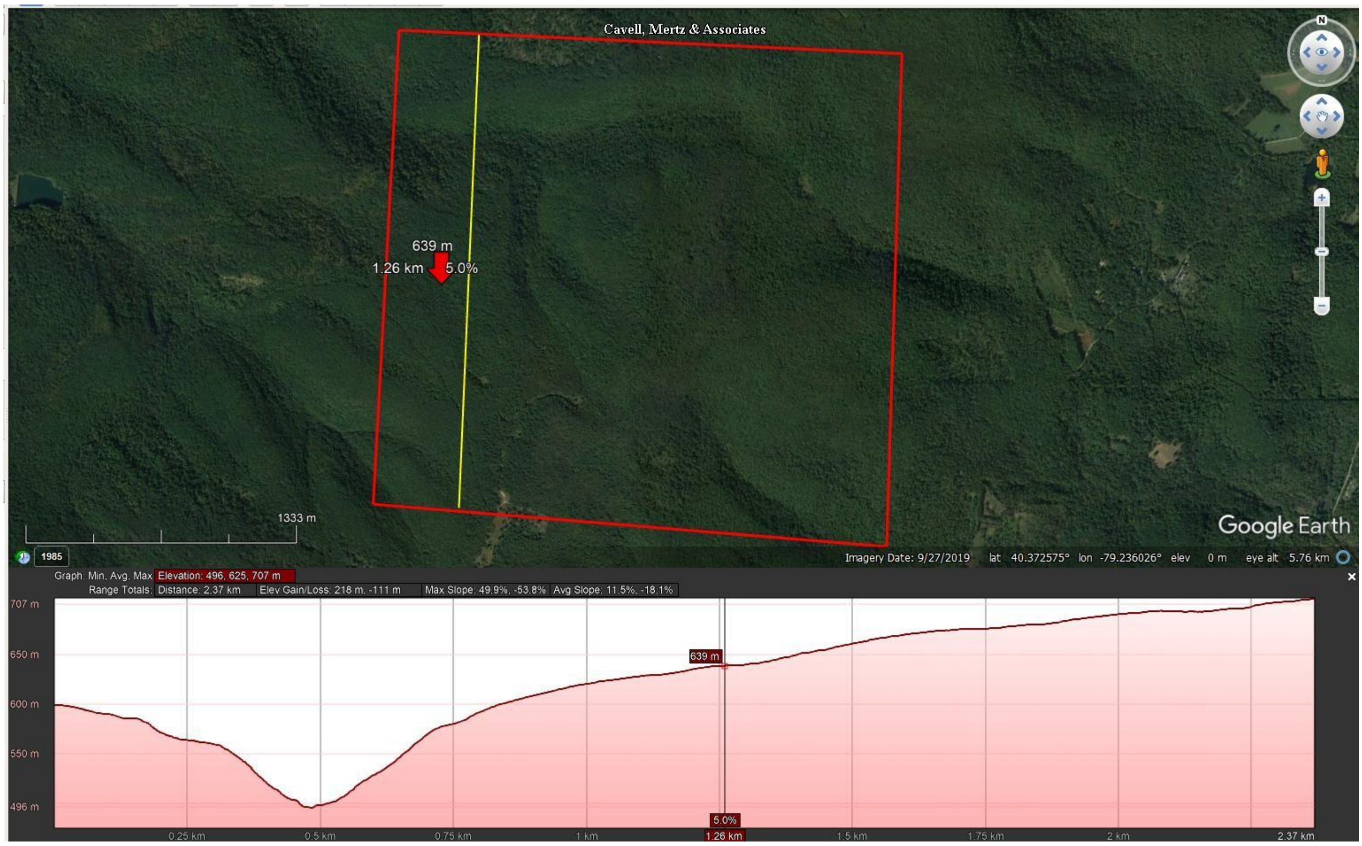
Figure 8: PHMSA

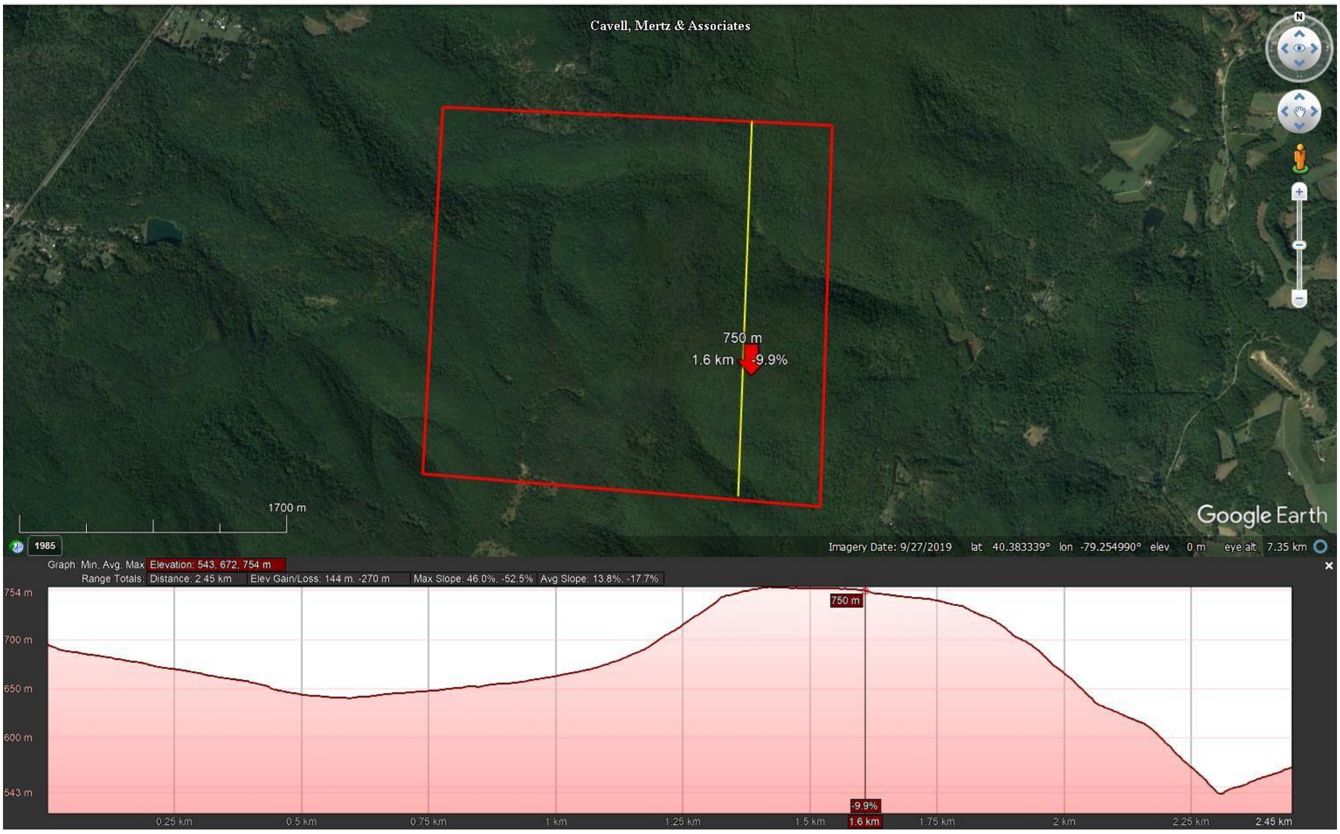
Topography of the Land

Elevation profile analysis

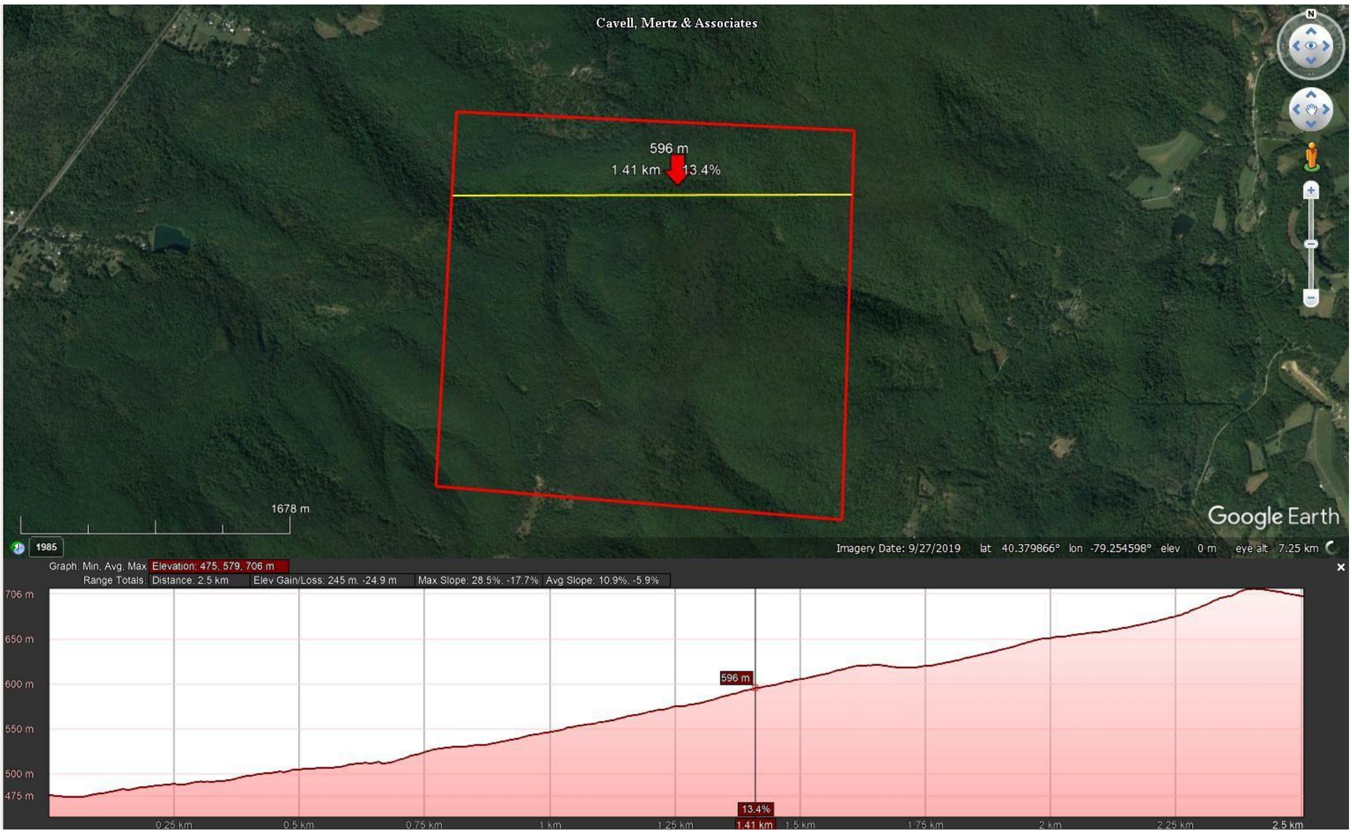
A topographic survey is an indispensable component in the planning and execution of a Solar PV ground mount system. Its significance lies in its ability to provide precise, three-dimensional data about the site's terrain. This information is invaluable for several reasons. Firstly, it assists in the design and layout of the solar ground mount system, ensuring that it is perfectly aligned with the landscape's contours, minimizing the need for extensive earthwork and grading. Secondly, the survey helps to identify any potential drainage issues or flood-prone areas, allowing effective implementation of water management strategies to safeguard the solar infrastructure. Moreover, accurate topographic data aids in the placement of support structures and foundations and guaranteeing their stability and longevity. In essence, a topographic survey is essential for optimizing the ground mount solar PV project's efficiency, safety, and long-term performance, making it an indispensable step in the project planning and installation process.

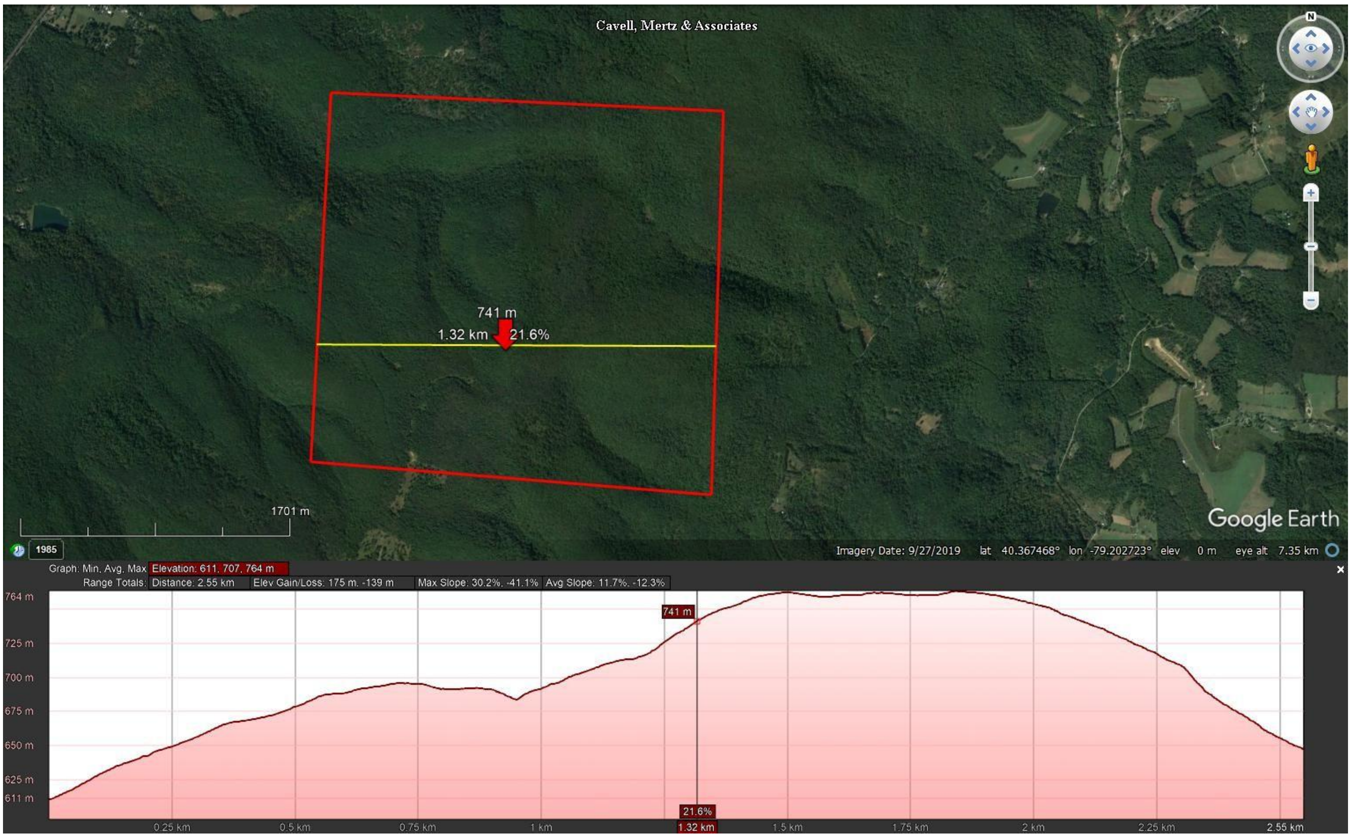
Development team has performed a desktop analysis to check the terrain profile of the proposed site both in the north-south (N-S) and east-west (E-W) directions. In the N-S direction, the maximum and average slopes are 54.4% & -33.46%, 6.73% & -6.20%, respectively, while in the E-W direction, the maximum and average slopes are 32.96% & -35.80%, 6.30% & -6.96%, respectively. For a suitable construction site, land levelling and grading may be necessary before starting project development. This analysis provides a general understanding of land slopes and elevation. However, a detailed topographic analysis for each parcel is crucial to determine the subsequent steps and necessary actions.



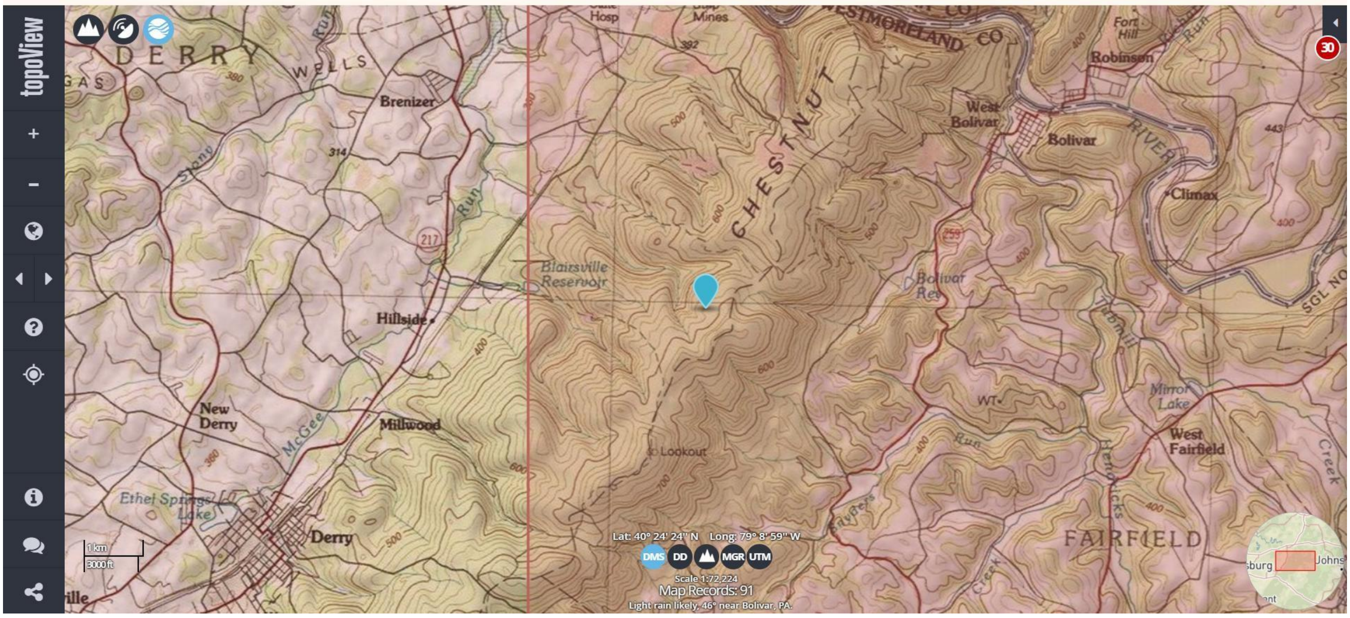


Elevation profile N-S





E-W Elevation Profile



Topographic View of Land Parcel

Soil Property Analysis

Soil analysis

Soil analysis plays a pivotal role in the successful installation of a ground mount solar PV project. Understanding the composition and characteristics of the soil at the installation site is crucial for several reasons. First, it determines the structural integrity of the foundations that will support the solar PV ground mount system, ensuring that they can withstand the weight and environmental conditions over time. Second, soil analysis helps assess the soil's ability to absorb and drain water effectively, which is essential for avoiding issues like flooding or erosion that can damage the solar infrastructure. Additionally, knowledge of soil quality aids in the design of efficient anchoring systems, optimizing the project's stability and longevity. Soil analysis is a fundamental step that not only guarantees the safety and reliability of the solar PV ground mount system but also contributes to its overall performance and resilience in the long run.

The development team conducted a comprehensive soil subsurface condition study using the USDA Natural Resources Conservation Service's Web Soil Survey tool. The site exhibits a diverse range of soil types and slopes, which will present both opportunities and challenges for the proposed development. The land is predominantly covered by **Buchanan loam** (0 to 8% slopes), comprising 2.4% of the area, and **Hazleton-Clymer complex** (0 to 8% slopes), making up 3.4% of the area. These soils offer favorable conditions for construction due to their moderate slopes and stability. However, areas with steeper slopes, such as **Hazleton-Clymer complex** (8 to 25% slopes) and **Macove-Gilpin channery silt loams** (35 to 70% slopes), covering significant portions of the land, will require additional grading and erosion control measures. Some soils, such as **Laidig gravelly loam** (8 to 25% slopes), though more challenging, can still be utilized with proper site preparation. Special attention should be given to areas with steeper slopes and potentially unstable soils to ensure the stability of the site during and after development.

Figure 9: Soil Map

Table 4: Soil Types

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony	365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony	301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony	2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	14.4	1.0%
LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony	15.6	1.1%
LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony	87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony	309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony	27.3	1.9%

MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony	103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony	5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony	9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony	10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony	30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	50.2	3.4%
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LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony	301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony	2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	14.4	1.0%
LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony	15.6	1.1%
LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony	87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony	309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony	27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony	103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony	5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony	9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony	10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony	30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	50.2	3.4%

Corrosivity of Soil

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion.

The preliminary analysis indicates that approximately **66.2%** of the land parcel exhibits high soil corrosivity. The soil types with high corrosivity include Buchanan loam (0 to 8% slopes, extremely stony), Buchanan loam (8 to 25% slopes, extremely stony), Hazleton-Clymer complex (8 to 25% slopes, extremely stony), Laidig gravelly loam (8 to 25% slopes, extremely stony), Macove-Gilpin channery silt loams (35 to 70% slopes, extremely stony), and Meckesville channery silt loam (25 to 70% slopes, extremely stony). To address this, corrosion-resistant materials such as galvanized steel should be used for racking and foundations. Additional mitigation measures, such as cathodic protection, concrete encapsulation, and soil treatment, may be necessary. Implementing regular monitoring and maintenance plans will help ensure the project's structural integrity over time.

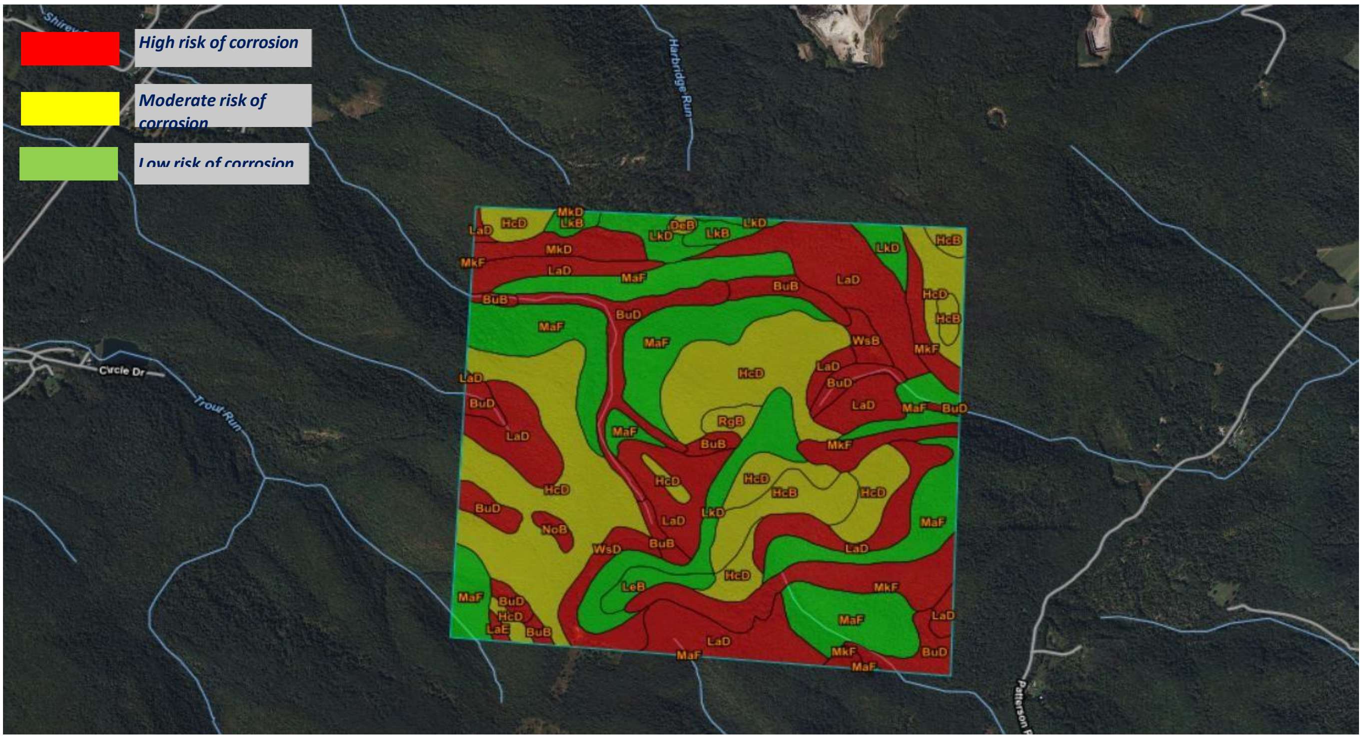

Figure 10: Soil Corrosion

Table 5: Soil Corrosion

Symbol	Map Unit Name	Rating	Acres in AOI	Percent of AOI
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	High	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	High	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	Moderate	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	Moderate	50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony	Moderate	365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony	High	301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony	High	2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	Low	14.4	1.0%

LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony	Low	15.6	1.1%
LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony	Low	87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony	Low	309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony	High	27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony	High	103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony	High	5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony	Moderate	9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony	High	10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony	High	30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	High	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	High	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	Moderate	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	Moderate	50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony	Moderate	365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony	High	301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony	High	2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	Low	14.4	1.0%
LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony	Low	15.6	1.1%
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MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony	Low	309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony	High	27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony	High	103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony	High	5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony	Moderate	9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony	High	10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony	High	30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	High	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely	High	100.1	6.8%
	stony			
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	Moderate	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	Moderate	50.2	3.4%

pH of Soil

A soil reaction (pH) is a measure of acidity or alkalinity. The pH scale ranges from 0 to 14; a pH of 7 is considered neutral. If pH values are greater than 7, the solution is considered basic or alkaline; if they are below 7, the solution is acidic. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion. In general, soils that are either highly alkaline or highly acidic are likely to be very corrosive to steel.

Based on the data, the soil on the site is characterized as acidic, with a pH of less than 7. For utility-scale plant installation, consider incorporating soil amendments to increase the soil's pH level. This will create a more suitable environment for structure installation and help protect against soil corrosion.

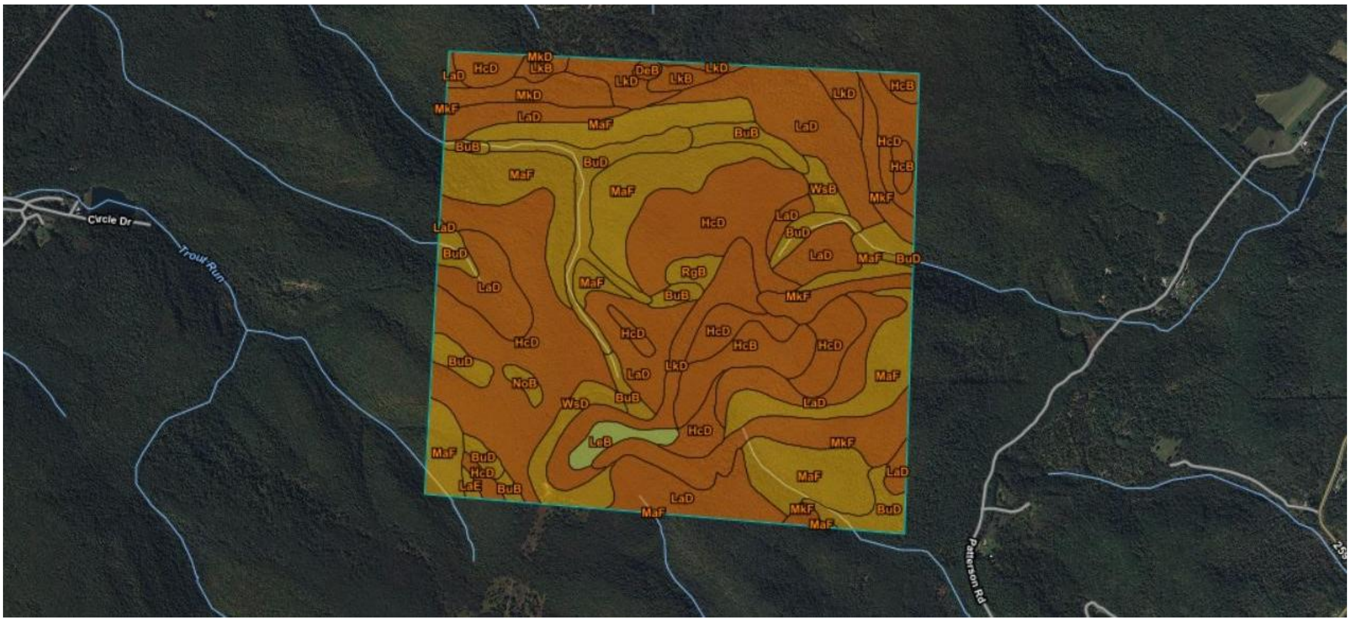


Figure 11:Soil PH

Table 6: Soil PH

Symbol	Map Unit Name	Rating	Acres	% AOI
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	4.5	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	4.5	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	4.3	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	4.3	50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony	4.3	365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony	4.3	301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony	4.5	2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	5.6	14.4	1.0%
LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony	4.3	15.6	1.1%

LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony	4.3	87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony	5.0	309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony	4.3	27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony	4.3	103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony	5.0	5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony	5.0	9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony	5.0	10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony	5.0	30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	4.5	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	4.5	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	4.3	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	4.3	50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony	4.3	365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony	4.3	301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony	4.5	2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	5.6	14.4	1.0%
LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony	4.3	15.6	1.1%
LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony	4.3	87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony	5.0	309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony	4.3	27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony	4.3	103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony	5.0	5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony	5.0	9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony	5.0	10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony	5.0	30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	4.5	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	4.5	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	4.3	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	4.3	50.2	3.4%

Hydric Soil Analysis

Soil hydric characteristics play a crucial role in land development and environmental planning. Under natural conditions, soils may be saturated or inundated long enough to support hydrophytic vegetation. The hydric rating assesses the percentage of map units that meet the criteria for hydric soils, which are composed of one or more soil components rated as hydric or non-hydric. While some map units predominantly contain hydric soils with minor non-hydric areas at higher elevations, others primarily consist of non-hydric soils with minor hydric components in lower areas.

A thematic map categorizes soil hydric composition into five classes: 100 percent hydric, 66 to 99 percent hydric, 33 to 65 percent hydric, 1 to 32 percent hydric, and less than 1 percent hydric components. This classification aids in identifying potential wetland areas and informs construction and land-use planning.

The hydric soil analysis reveals that approximately **6.4%** of the project site contains soils with notable hydric characteristics. Key soil types include **Buchanan loam (0 to 8% slopes, extremely stony)**, **Wharton silt loam (0 to 8% slopes, very stony)**, and **Leck Kill channery silt loam (3 to 8% slopes)**, all of which present hydric characteristics. These areas may require special consideration for hydrology management and potential mitigation strategies, such as wetland preservation or drainage controls, to ensure the project complies with environmental standards.

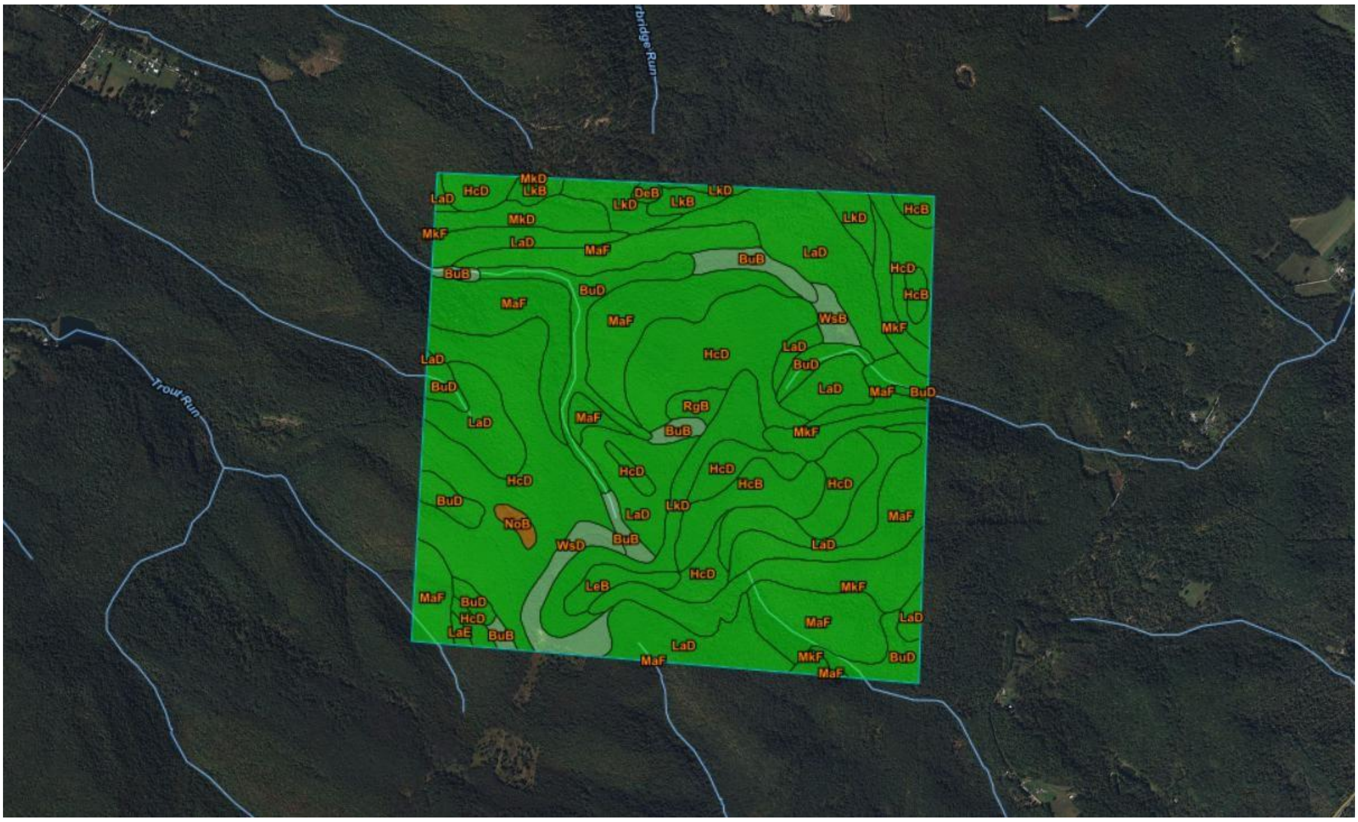


Figure 12:Hydric Soil Analysis

Table 7:Hydric Soil Analysis

Symbol	Map Unit Name	Rating	Acres in AOI	Percent of AOI
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	5	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	0	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	0	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	0	50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony	0	365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony	0	301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony	0	2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	0	14.4	1.0%
LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony	0	15.6	1.1%
LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony	0	87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony	0	309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony	0	27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony	0	103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony	80	5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony	0	9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony	5	10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony	5	30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	5	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	0	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	0	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	0	50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony	0	365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony	0	301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony	0	2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	0	14.4	1.0%

LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony	0	15.6	1.1%
LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony	0	87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony	0	309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony	0	27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony	0	103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony	80	5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony	0	9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony	5	10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony	5	30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony	5	35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony	0	100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony	0	3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony	0	50.2	3.4%

K Factor of Soil

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to erosion. "Erosion factor Kw (whole soil)" accounts for rock fragments that modify erodibility estimates.

The K Factor analysis reveals that the soil in the land parcel exhibits varying erosion susceptibility.

The K-factor analysis reveals varying levels of soil erosion susceptibility across the project site. A significant portion of the area consists of soils with moderate erosion potential, including **Buchanan loam (0 to 8 percent slopes, extremely stony)** and **Hazleton-Clymer complex (0 to 8 percent slopes, extremely stony)**, which cover **2.4%** and **3.4%** of the area, respectively. Other soils, such as **Buchanan loam (8 to 25 percent slopes, extremely stony)** and **Laidig gravelly loam (8 to 25 percent slopes, extremely stony)**, exhibit higher susceptibility to erosion, covering **6.8%** and **20.5%** of the site. These areas will require special consideration for erosion control during development to ensure long-term stability. Implementing soil stabilization techniques, such as mulching or terracing, will be necessary in the more susceptible areas to reduce erosion risks.

Figure 13: K Factor

Table 8: K Factor

Symbol	Map Unit Name	Rating	Acres in AOI	Percent of AOI
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony		35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony		100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony		3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony		50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony		365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony		301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony		2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	.20	14.4	1.0%
LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony		15.6	1.1%
LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony		87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony		309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony		27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony		103.2	7.0%

NoB	Nolo loam, 0 to 8 percent slopes, very stony		5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony		9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony		10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony		30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony		35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony		100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony		3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony		50.2	3.4%
HcD	Hazleton-Clymer complex, 8 to 25 percent slopes, extremely stony		365.0	24.8%
LaD	Laidig gravelly loam, 8 to 25 percent slopes, extremely stony		301.0	20.5%
LaE	Laidig gravelly loam, 25 to 35 percent slopes, extremely stony		2.5	0.2%
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	.20	14.4	1.0%
LkB	Leck Kill channery silt loam, 0 to 8 percent slopes, extremely stony		15.6	1.1%
LkD	Leck Kill channery silt loam, 8 to 25 percent slopes, extremely stony		87.2	5.9%
MaF	Macove-Gilpin channery silt loams, 35 to 70 percent slopes, extremely stony		309.8	21.1%
MkD	Meckesville channery silt loam, 8 to 25 percent slopes, extremely stony		27.3	1.9%
MkF	Meckesville channery silt loam, 25 to 70 percent slopes, extremely stony		103.2	7.0%
NoB	Nolo loam, 0 to 8 percent slopes, very stony		5.5	0.4%
RgB	Rayne channery silt loam, 0 to 8 percent slopes, very stony		9.2	0.6%
WsB	Wharton silt loam, 0 to 8 percent slopes, very stony		10.2	0.7%
WsD	Wharton silt loam, 8 to 25 percent slopes, very stony		30.0	2.0%
BuB	Buchanan loam, 0 to 8 percent slopes, extremely stony		35.6	2.4%
BuD	Buchanan loam, 8 to 25 percent slopes, extremely stony		100.1	6.8%
DeB	Dekalb-Hazleton channery sandy loams, 0 to 8 percent slopes, extremely stony		3.0	0.2%
HcB	Hazleton-Clymer complex, 0 to 8 percent slopes, extremely stony		50.2	3.4%

Nearby High-Rise, Residential, and Commercial Buildings

Few residential and commercial buildings are observed within and near the project site. Notably, no high-rise buildings are present in the vicinity, eliminating concerns about shadowing and ensuring optimal sunlight exposure for the solar panels, maximizing energy production. The presence of residential and commercial properties increases the likelihood of community opposition or concerns related to visual impact, noise, or property value depreciation. Mitigation measures will be necessary to address these potential concerns.

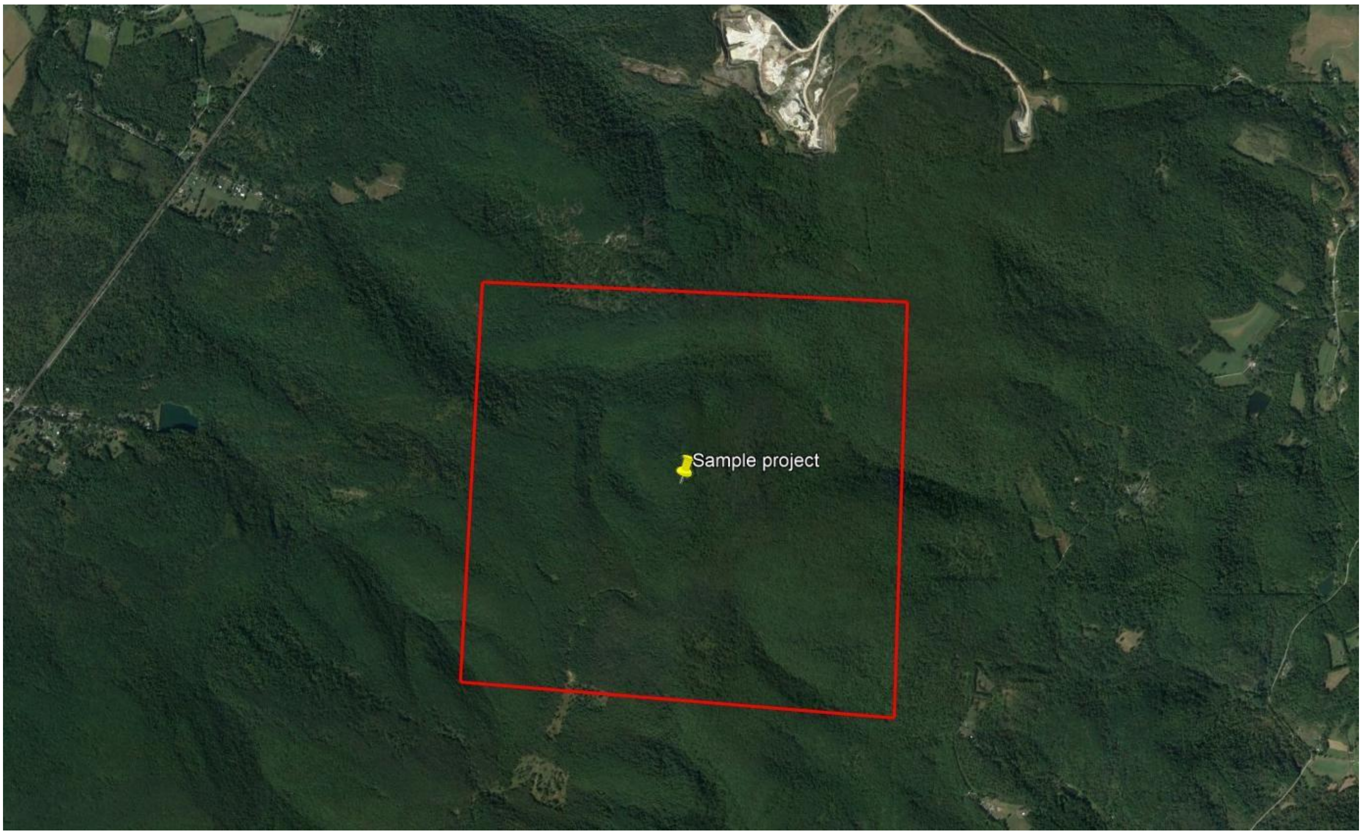


Figure 14:Nearby High-Rise, Residential, and Commercial Buildings

Site Access

The Pittsburgh Road passing along the selected project site provides easy access for the transport of site materials, as shown in the figure below. A driveway access permit from Derry Township and Westmoreland County may be required during the later stages of development for new or expanded access roads, crossing leading to the site, especially if they intersect public roads.

The contiguous area provides an optimal layout for integrating renewable energy solutions, including solar photovoltaic systems and battery energy storage systems. To connect these systems, power must be routed underground within the parcels and through county and township roads such as Barkley Road, Seger Road, McBroom Road, Pizza Barn Road, Bergman Road, Road 982, Stewart Road, along with other township roads. It is advisable to consult with the utility company, gas pipeline owner and other relevant authorities regarding existing easements and the requirements for laying underground cables and crossings before commencing development.

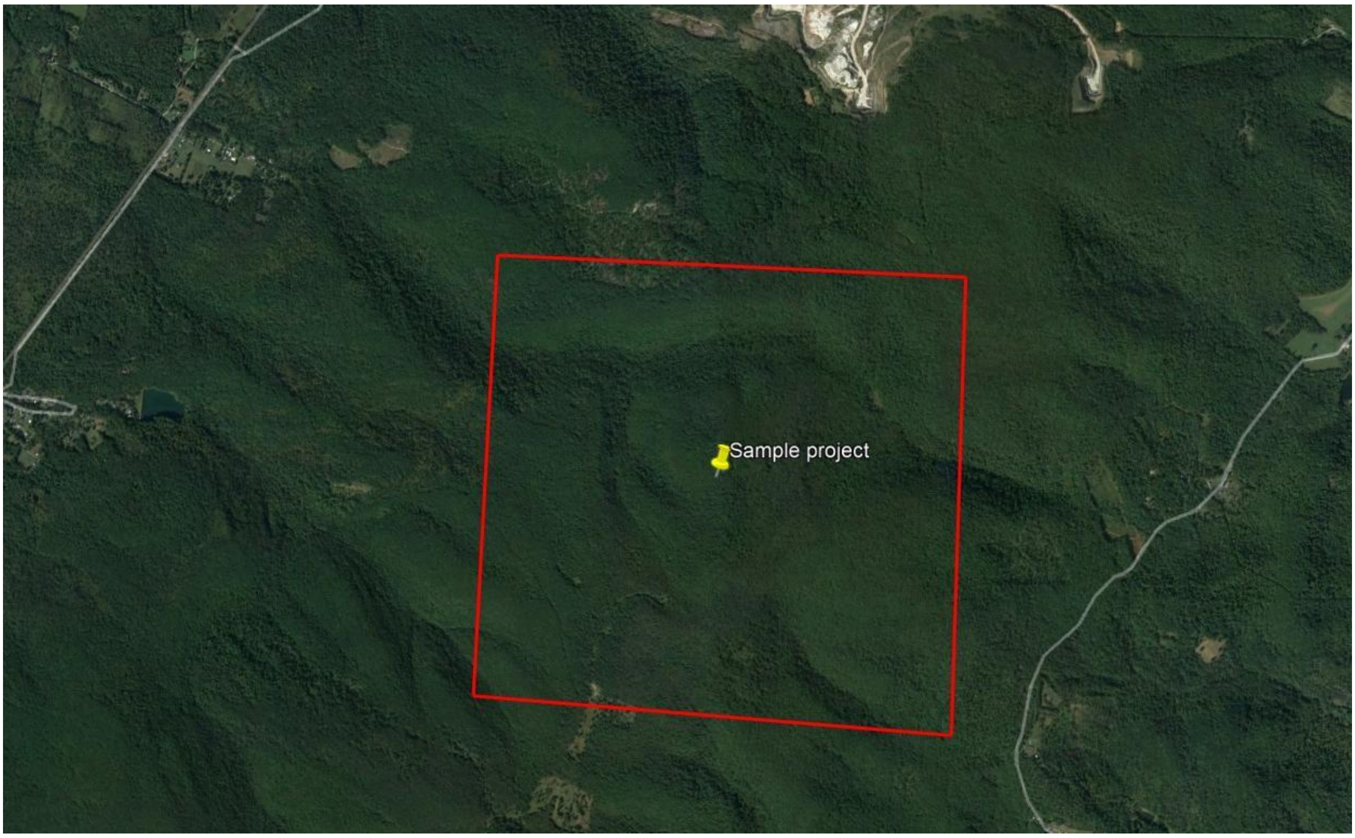


Figure 15:Site Access

Communication and Aviation Compliance

FCC (Federal Communication Commission) Compliance

At the late development stage, it is critical to evaluate and ensure compliance with Federal Communications Commission (FCC) regulations, which govern potential interference with communication systems such as radio frequencies, telecommunication networks, and broadcast operations near the proposed project site.

As part of this process, a comprehensive assessment has been conducted to identify existing communication infrastructure in the vicinity of the site. Based on the findings, there are three (2) communication towers near the proposed site. The presence of nearby communication infrastructure significantly increases the risk of radio frequency interference or other related challenges that could otherwise lead to regulatory complications. By proactively addressing FCC compliance, the project is well-positioned to mitigate potential delays, avoid unexpected regulatory hurdles, and maintain alignment with federal requirements

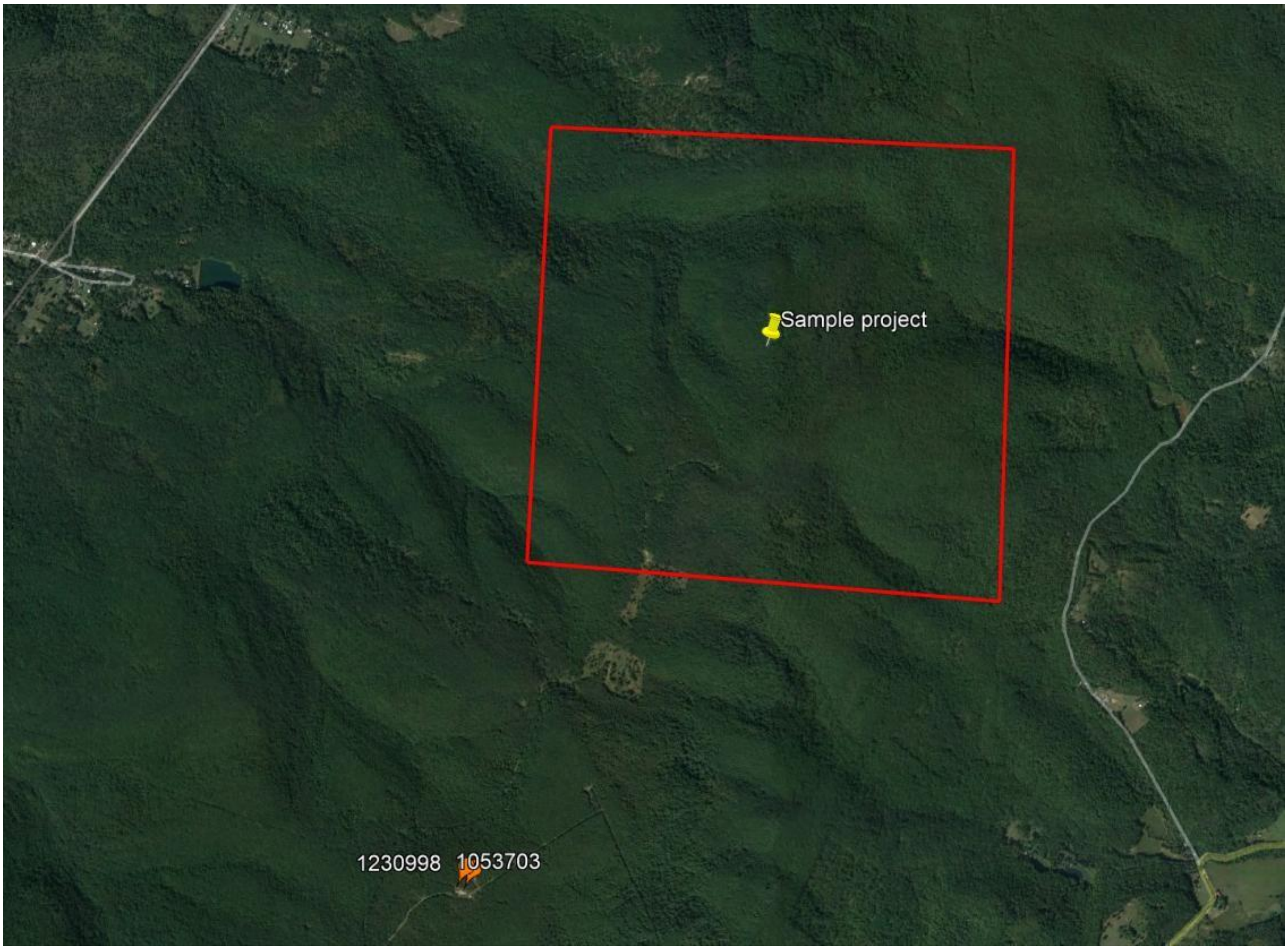


Figure 16:FCC

FAA (Federal Aviation Administration) Compliances

Based on a thorough analysis of FAA compliance requirements and available USAF data, it has been determined that there are Two FAA-registered obstructions located in close vicinity of the proposed land parcel designated for solar project development. This identified obstruction mandates formal approval from the Federal Aviation Administration (FAA) prior to the commencement of any project-related activities. Early engagement with the FAA is critical to mitigate potential regulatory bottlenecks, ensure smooth project progression, and uphold compliance standards. Proactively addressing FAA clearance requirements, including the timely submission of all necessary documentation, is essential to avoid delays.

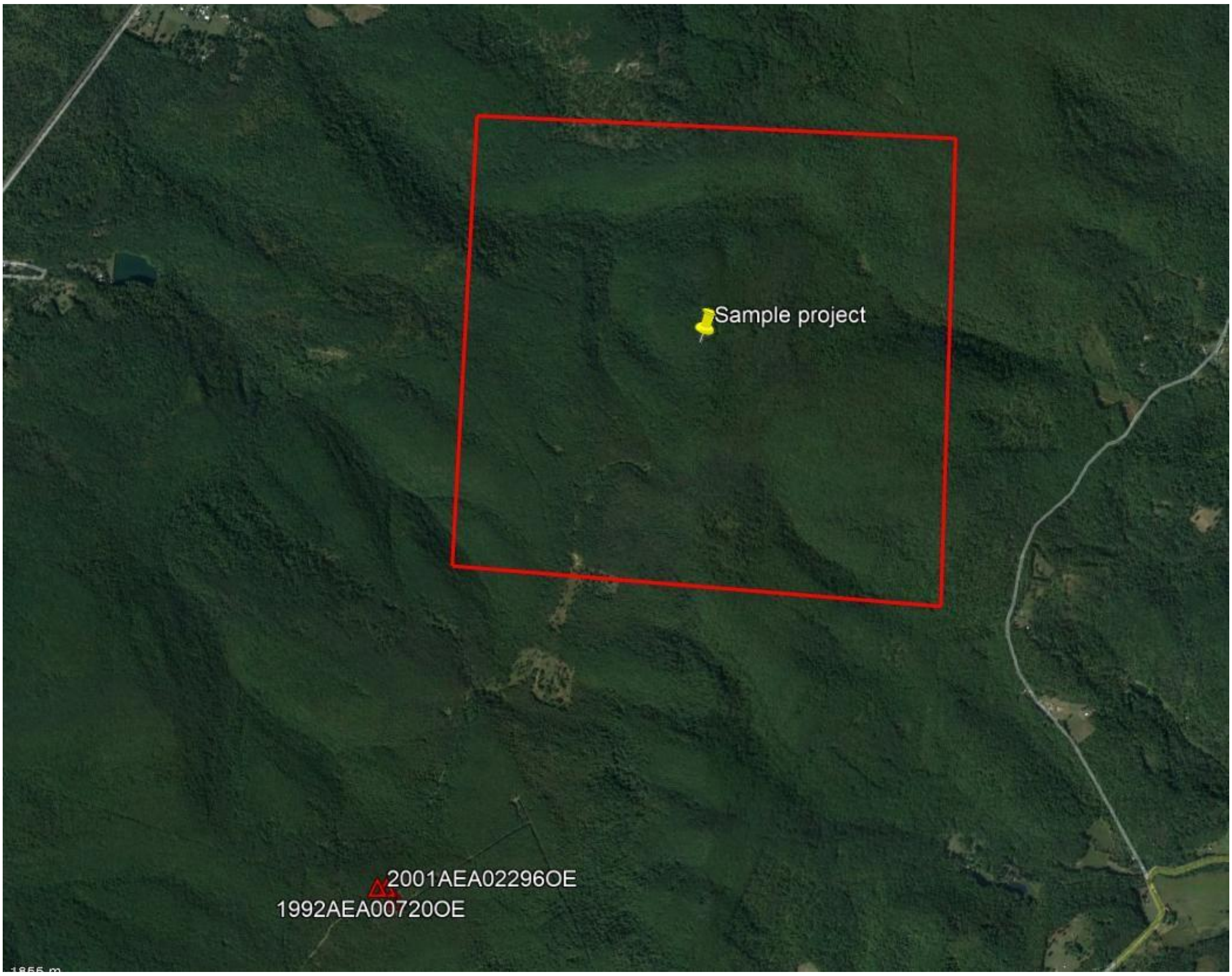


Figure 17:FAA

FAA Notice Criterion Obstruction Evaluation / Airport Airspace Analysis

The Notice Criteria screen summarizes the filing requirements specified in Title 14 of the Code of Federal Regulations Part 77.9 Notice Criteria. The results will advise if there's an exceed requiring you to file notice to the FAA. As per the FAA Notice Criterion tool, proposing a solar plant on the project ground mount area should not exceed the notice criteria set forth by FAA.

According to the FAA Notice Criteria Tool, **the proposed structure does not exceed the notice criteria**. Therefore, no application filing with the FAA would be required 45 days prior to construction.

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2018.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

* **Structure Type:**	SOLAR | Solar Panel Please select structure type and complete location point information.
Latitude:	[redacted]
Longitude:	[redacted]
Horizontal Datum:	NAD83
Site Elevation (SE):	1300 (nearest foot)
Structure Height :	15 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.

Zoning

The purpose of zoning in Derry Township is to ensure the permissibility of land use activities while safeguarding residents and property values. Westmoreland County does not have countywide zoning; instead, zoning authority is entirely under the purview of local municipalities.

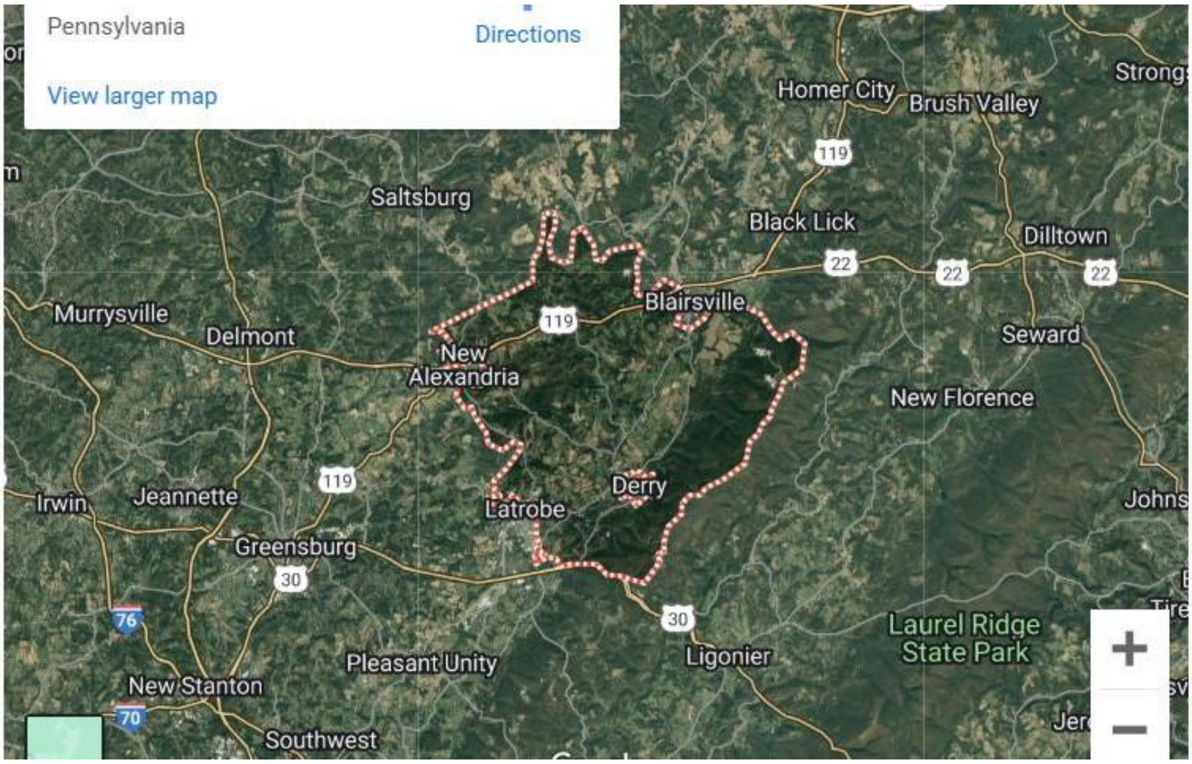


Figure 18:Zoning

A review of the Township website confirms that the township does not have zoning regulations. Furthermore, an assessment of the county's Subdivision and Land Development Ordinance (SALDO) indicates that the permissibility of a solar power plant within the township's jurisdiction is unclear. Specific guidelines for the construction of solar facilities and battery energy storage systems are not outlined at either the township or county level.

	Development & Regulations
Zoning	No
SALDO	County
Comprehensive Plan	Yes
Building Inspector	Merle Musick 724-694-8835
Sewage Enforcement	Emil Bove 724-925-9269
Municipal Engineer	Gibson-Thomas Engineering 724-539-8562
Water	Derry Boro/Latrobe/Highridge Water/MAWC (724)694-2305/537-3378/459-8033/755-5800
Sewage	Derry Township Municpal Authority 724-694-2513

There is no mention of a solar or battery energy systems ordinance in County or Township. In cases where the permissibility of a use or activity is uncertain, the Planning Department is responsible for interpreting the applicable regulations. It is recommended to contact the Board of Supervisors to ensure that the project aligns with the local zoning requirements of Township (where the project will likely originate) and County.

Contact Us

Jason Rigone
Director
Email

Fifth Floor, Suite 520
40 N. Pennsylvania Ave.
Greensburg, PA 15601

Ph: (724) 830-3600
Fx: (724) 830-3611

Inquiry Form

Directory

Code Officer
Emergency Management Director
Terry A. Giannini
5321 Route 982
Derry, PA 15627
724-694-8835
724-640-0100 (cell)

Solicitor
Dodaro, Matta & Cambest
5321 Route 982
Derry, PA 15627
724-694-8835
Fax: 724-694-5860

Sewage Enforcement Officer
Emil A. Bove
Bove Engineering Co.
8201 Route 819
Greensburg, PA 15601
724-925-9269
Fax: 724-925-1216

Building Code Official
Merle Musick
724-422-7393 (cell)

Engineer
Gibson - Thomas Engineering
1004 Ligonier Street
PO Box 853
Latrobe, PA 15650
724-539-8562
Fax: 724-539-3697

CPA
DeBlasio Group
4000 Hempfield Blvd
Greensburg, PA 15601
724-836-3449

District Justice
Kelly Tua Hammers (2028)
5092 Route 982
Bradenville, PA 15620
724-539-7200
Fax: 724-539-7217

Derry Twp. Municipal Authority
5760 Route 982
P.O. Box 250
New Derry, PA 15671
724-694-2513 724-694-0785
Fax: 724-694-6156 Web site

It is advisable to verify the maximum permissible battery energy and solar capacity with broader zoning regulations, including accessory uses, building setbacks, outdoor lighting standards, and the overall compatibility with the development guidelines of the county and the township.

Financial Incentives

Low-Income Community Analysis

On August 16, 2022, President Biden signed the Inflation Reduction Act, a significant move by Congress addressing clean energy and climate change. This law modifies clean energy tax credits like the Production Tax Credit (PTC) and Investment Tax Credit (ITC) to encourage investment in low-income areas. It provides bonus credits for projects in energy communities, low-income neighbourhoods, and Tribal lands. The act also emphasizes job creation by offering incentives for projects that pay fair wages, employ apprentices, and use domestic materials like steel and iron.

As per the increase in energy credit for solar and wind facilities placed in service in connection with Low-Income Communities program under the Inflation Reduction Act, solar and wind facilities in low-income communities with a maximum net output of less than 5 MW, including associated energy storage technology are eligible for an additional 10% investment tax credit.

According to the Low-Income Community Map, the proposed site is classified as a low-income community. Since the project capacity exceeds 5MW, **it is not eligible for the additional 10% Investment Tax Credit (ITC).**

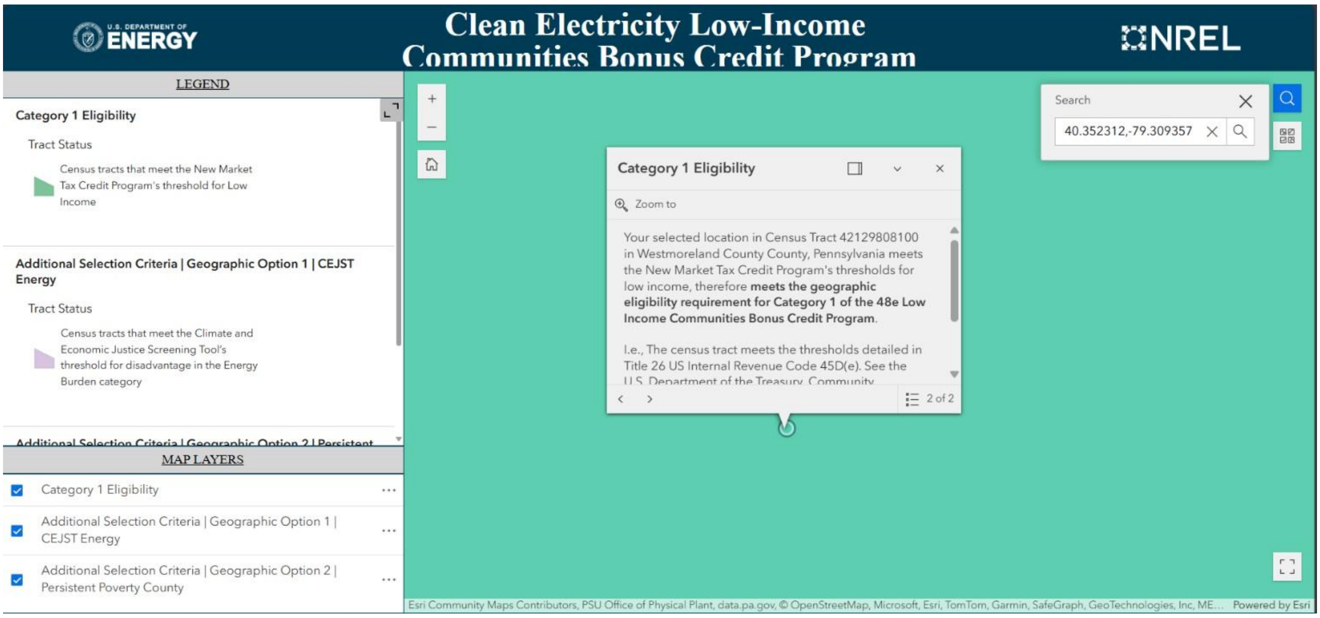


Figure 19:Low-Income Community Analysis

Energy Community Analysis

As defined in the Inflation Reduction Act (IRA), the Energy Community Tax Credit Bonus applies a bonus of up to 10% (for production tax credits) or 10 percentage points (for investment tax credits) for projects, facilities, and technologies located in energy communities. Increased credit amounts or rates are available to taxpayers that satisfy certain energy community requirements under Section 45, 48, 45Y, or 48E of the Internal Revenue Code.

The IRA defines energy communities as:

- A "brownfield site" (as defined in certain subparagraphs of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA))
- A "metropolitan statistical area" or "non-metropolitan statistical area" that has (or had at any time after 2009)
  - 0.17% or greater direct employment or 25% or greater local tax revenues related to the extraction, processing, transport, or storage of coal, oil, or natural gas; and
  - has an unemployment rate at or above the national average unemployment rate for the previous year.
- A census tract (or directly adjoining census tract) in which a coal mine has closed after 1999; or in which a coal-fired electric generating unit has been retired after 2009.

According to the U.S. Department of Energy, the proposed site qualifies as an energy community due to the closure of a coal mine and its adjacency to a tract with a coal facility closure. Therefore, the proposed project site qualifies as an energy community, as shown in the figure below. **Thus, an additional 10% Investment Tax Credit (ITC) is applicable.**

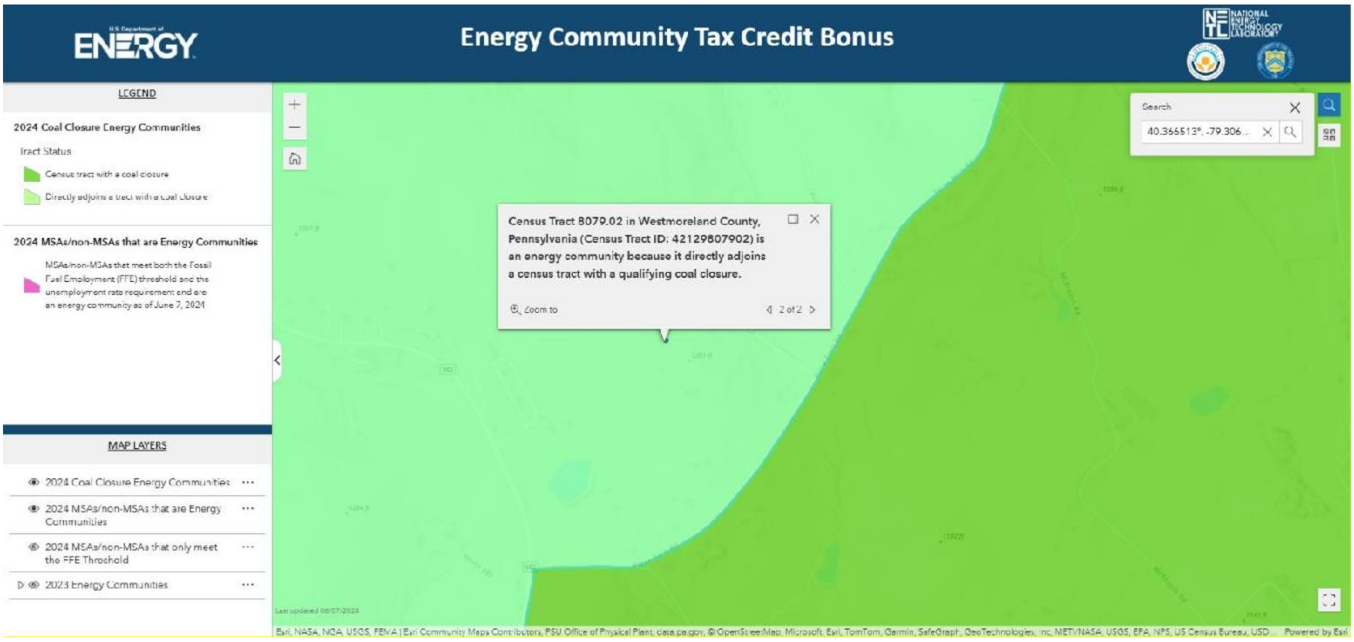
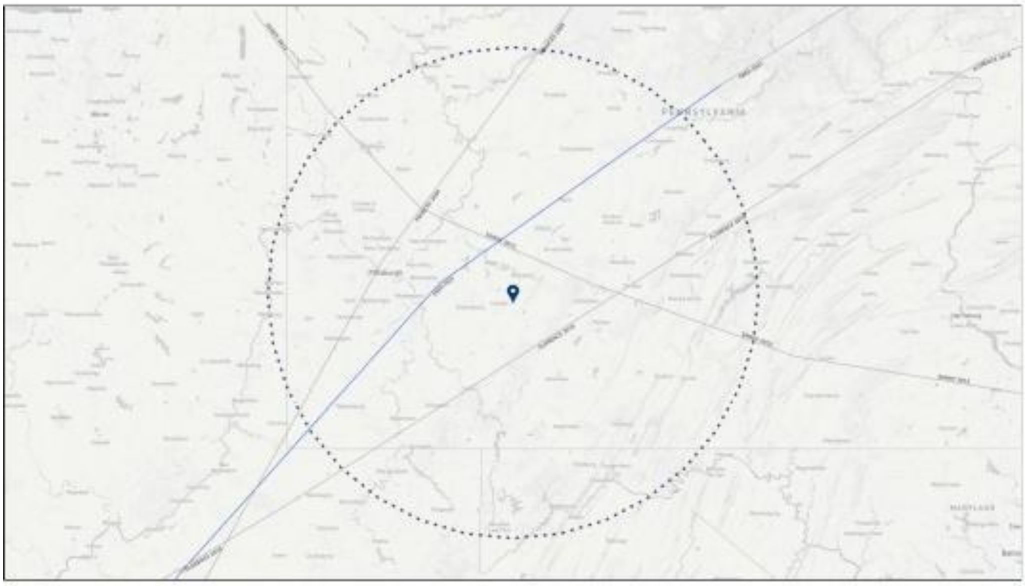


Figure 20:Energy Community Analysis

Hurricane Analysis

According to data from NOAA, four hurricanes have been reported in the vicinity of the proposed location in the past 20 years.

Hurricane List



Search Filter Criteria

[redacted]

Categories: H5, H4, H3, H2, H1, TS, TD, ET
Months: ALL
Years: 2025, 2024, 2023, 2022, 2021, 2020, 2019, 2018, 2017, 2016, 2015, 2014, 2013, 2012, 2011, 2010, 2009, 2008, 2007, 2006, 2005, 2004
El Niño-Southern Oscillation (ENSO): ALL
Minimum Pressure (mb) below: 1030

Buffer Distance: 60
Buffer Unit: Nautical Miles

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
FRED 2021	Aug 09, 2021 to Aug 20, 2021	55	991	TS
FLORENCE 2018	Aug 30, 2018 to Sep 18, 2018	130	937	H4
SANDY 2012	Oct 21, 2012 to Oct 31, 2012	100	940	H3
FRANCES 2004	Aug 25, 2004 to Sep 10, 2004	125	935	H4

Community Sentiment Analysis

Westmoreland County, Pennsylvania, is experiencing a significant shift towards renewable energy, marked by the implementation of various solar initiatives aimed at enhancing sustainability and reducing dependence on traditional power sources. Projects such as the 3 MW-AC utility-scale solar installation for the Municipal Authority of Westmoreland County (MAWC) and the Westmoreland County Solar Co-op reflect a growing commitment to clean energy solutions. While these efforts demonstrate substantial progress, community sentiment remains mixed, encompassing both optimism and apprehension.

Support for Renewable Energy Initiatives

A considerable segment of the community views the transition to solar energy positively, highlighting benefits such as reduced carbon emissions, energy independence, and long-term cost savings. The MAWC solar project, for instance, is expected to generate over 3 million kilowatt-hours annually, offsetting the energy consumption of the authority's largest wastewater treatment plant. Similarly, the Westmoreland County Solar Co-op, facilitated by Solar United Neighbors, encourages residents to collectively invest in solar power, making it more accessible and cost-effective for homeowners. These initiatives underscore a regional push toward sustainability and reflect confidence in Westmoreland County's potential as a renewable energy hub.

Concerns and Apprehensions

Despite the enthusiasm for solar energy, some residents express concerns regarding the rapid development of large-scale solar installations. Issues related to the aesthetic and environmental impact of expansive solar farms have been raised, particularly by those residing near newly developed sites. For example, residents in Cook Township have voiced apprehension over the transformation of scenic landscapes into vast arrays of solar panels, altering the visual character of their communities. Additionally, municipalities such as Sewickley Township are exploring regulatory measures to address potential issues, including noise levels, land use conflicts, and long-term sustainability. These concerns highlight the necessity for careful planning to balance renewable energy development with community interests.

Regulatory and Planning Considerations

In response to these concerns, local officials are working to establish guidelines that regulate the placement and operation of solar farms. Municipal ordinances aimed at defining appropriate zoning, setback distances, and operational standards are under consideration to ensure responsible development. Concurrently, the Westmoreland County Department of Planning and Development, along with the Redevelopment Authority, is engaging in broader sustainability and community revitalization efforts. By implementing clear regulations and fostering dialogue among stakeholders, these initiatives seek to address public apprehensions while supporting the county's transition to clean energy.

Future Outlook

Despite the varied community sentiment, the ongoing development of solar energy projects in Westmoreland County indicates strong momentum in the renewable energy sector. By addressing public concerns through transparent planning, regulatory oversight, and community engagement, these projects have the potential to serve as a model for balancing environmental sustainability with economic and social interests. As solar adoption increases, continued collaboration among residents, developers, and policymakers will be essential in shaping a future that aligns with both community priorities and broader sustainability goals.

Under this section, the expected annual solar radiation, and key meteorological parameters i.e., wind speed zone, annual temperature and clear sunny days have been analysed.

Solar Radiation and Resource Assessment

Annual Global Horizontal Irradiance

The annual GHI of the location is a key factor in selecting the appropriate land. It directly gives the annual expected energy yield based on the selected technology and the type of structure used. As per the SolarAnywhere database, the land falls under low radiation zone in the US and receives an **annual GHI of 1387.9kWh/m²**.

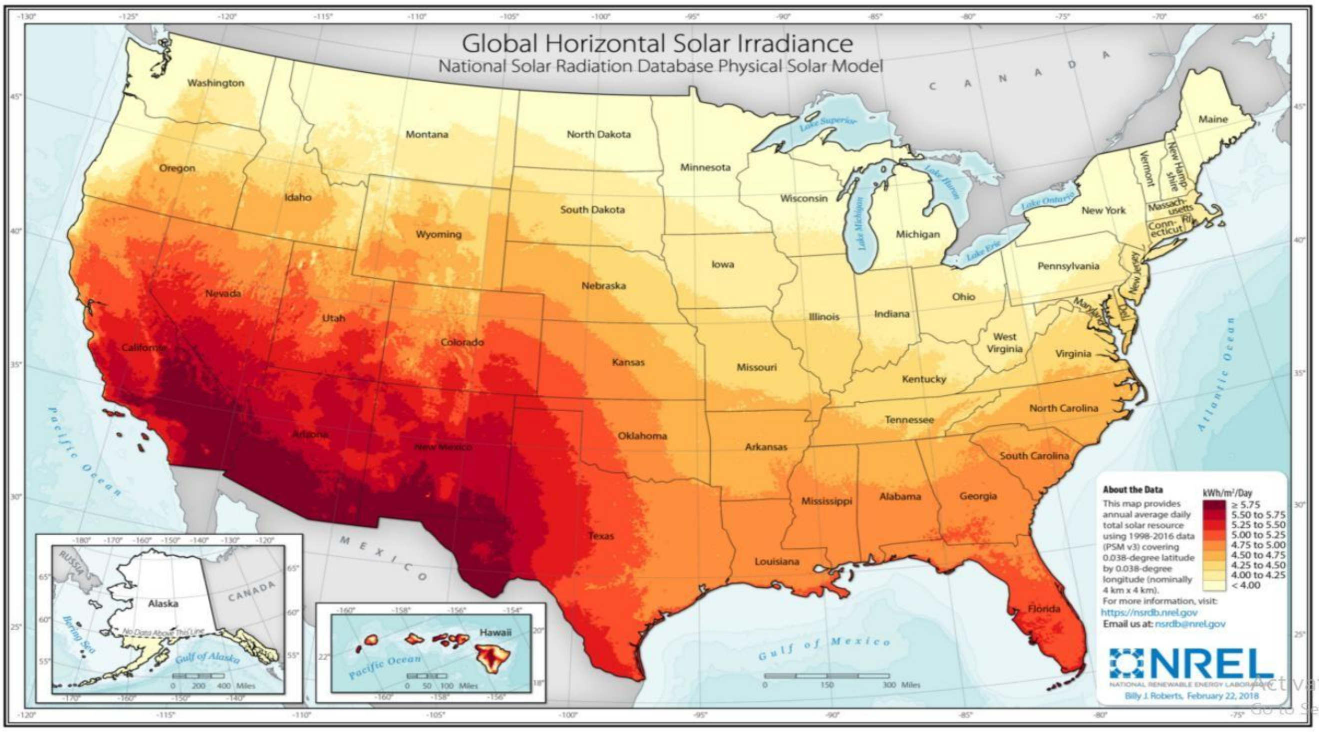


Figure 21: GHI Map

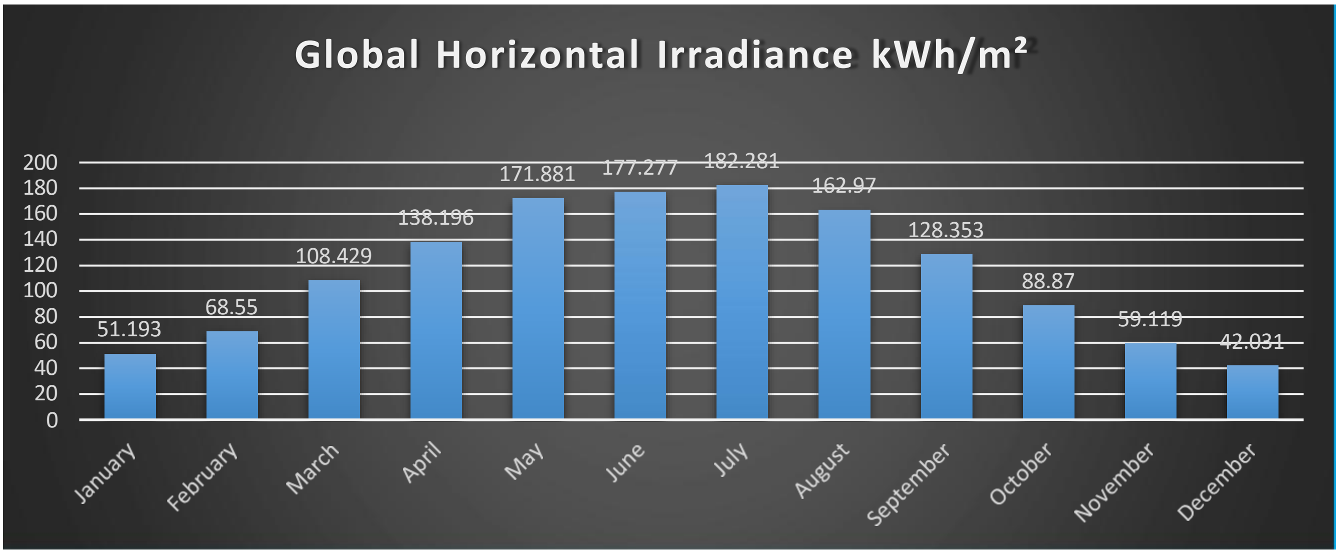


Figure 22: GHI

Meteorology Assessment

Wind Zone
Wind speed is an important parameter to consider while designing the racking/structure for a Solar Power Plant.

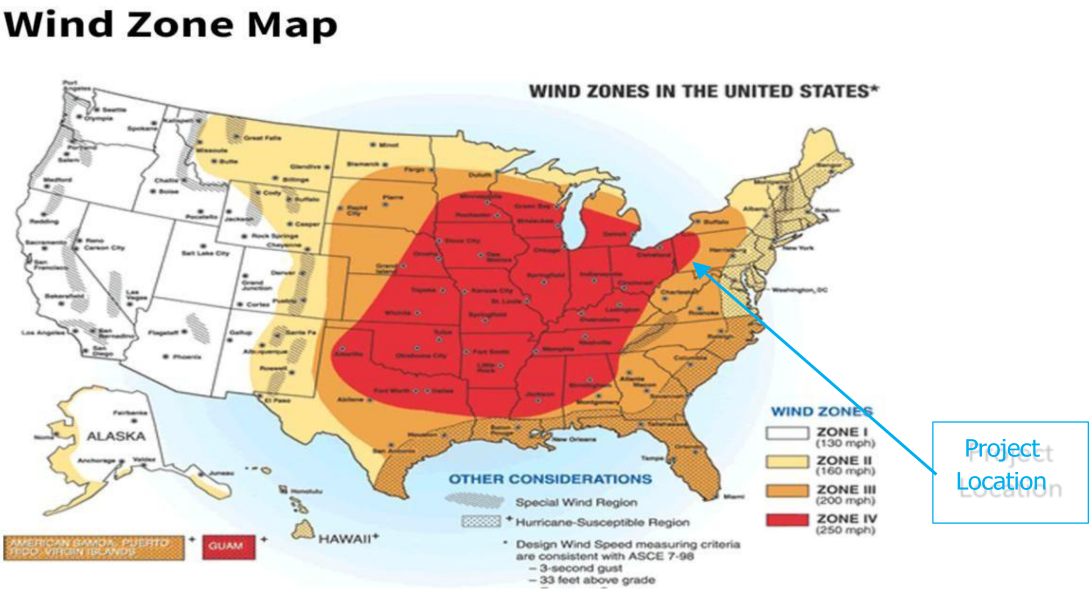


Figure 23:Wind Zone

The location falls under Wind zone-IV as per the wind zone map provided by FEMA. The maximum wind speed for structure/racking design should be 250 miles per hour. Hence, the proposed project should be designed while considering high wind load conditions.

Ambient Temperature
The ambient temperature is a key parameter that affects the power generated through Solar PV Module. Based on the SolarAnywhere data, the average ambient temperature has been analysed and given below:

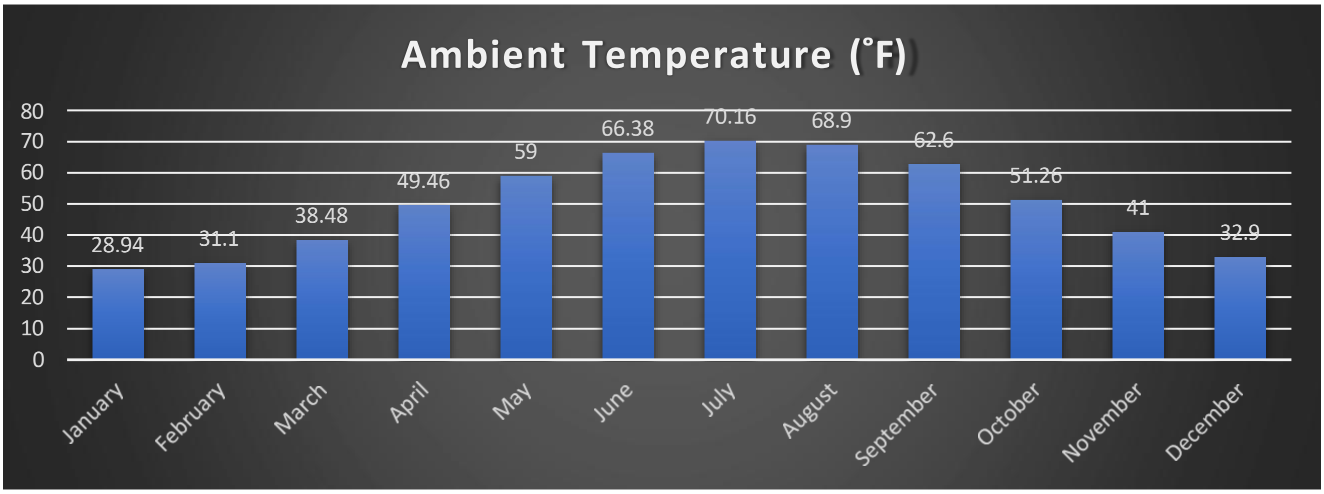


Figure 24: Ambient Temperature

The annual average temperature of the location is **50.01°F.**

Clear Sunny Days

As per NASA-SSE (Surface meteorology and Solar Energy), the clear sunny days are defined as "the total time for which the sunshine reaches the surface of Earth expressed as a percentage of the maximum amount possible from sunrise to sunset under clear sky conditions." If the clear sunny days are higher, that location receives a higher a mount of solar radiation throughout the year. Pennsylvania receives 45% (164 days out of 365) of clear sunny days throughout the year.

PVsyst

General parameters

Grid-Connected System

Orientation #1
Tracking horizontal axis
Axis azimuth 0 °
Phi min / max. -/+ 60 °
Tracking algorithm
Astronomic calculation
Backtracking activated

Unlimited trackers

Field properties
Nb. of trackers 334 units
Unlimited trackers
Sizes
Tracker Spacing 5.76 m
Collector width 2.38 m
Average GCR 41.3 %
Backtracking limit angle
Phi limits +/- 65.6 °
Backtracking parameters
Backtracking pitch 5.76 m
Backtracking width 2.38 m
Left inactive band 0.00 m
Right inactive band 0.00 m
Backtracking GCR 41.3 %
Parameters choice:Automatic

Models used
Transposition Perez
Diffuse Imported
Circumsolar separate

Horizon
Average Height 12.0 °

Near Shadings
no Shadings

User's needs
Unlimited load (grid)

Bifacial system definition
Orientation #1
Bifacial system
Model Unlimited Trackers 2D model
Bifacial model geometry
Tracker Spacing 5.76 m
Tracker width 2.38 m
GCR 41.3 %
Axis height above ground 2.10 m
Nb. of sheds 334 units
Bifacial model definitions
Ground albedo average 0.23
Bifaciality factor 70 %
Rear shading factor 5.0 %
Rear mismatch loss 10.0 %
Shed transparent fraction 0.0 %

Grid power limitation
Active power 150.0 MWac
Pnom ratio 1.300

Monthly ground albedo values

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.43	0.42	0.17	0.18	0.18	0.20	0.18	0.19	0.18	0.16	0.18	0.31	0.23

PV Array Characteristics

PV module		Inverter	
Manufacturer	Canadian Solar Inc.	Manufacturer	Sungrow
Model	CS7N-650MB-AG 1500V	Model	SG4400-UD-MV-US
(Custom parameters definition)		(Original PVsyst database)	
Unit Nom. Power	650 Wp	Unit Nom. Power	4400 kWac
Number of PV modules	300000 units	Number of inverters	35 units
Nominal (STC)	195.0 MWp	Total power	154000 kWac
Modules	10000 string x 30 In series	Operating voltage	915-1337 V
At operating cond. (50°C)		Pnom ratio (DC:AC)	1.27
Pmpp	177.9 MWp	Power sharing within this inverter	
U mpp	1011 V		
I mpp	176010 A		
Total PV power		**Total inverter power**	
Nominal (STC)	195000 kWp	Total power	154000 kWac
Total	300000 modules	Number of inverters	35 units
Module area	933336 m²	Pnom ratio	1.27

Array losses

Array Soiling Losses
Average loss Fraction 1.1 %

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
4.0%	3.6%	1.5%	0.5%	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.6%	2.8%

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 0.095 mΩ
Loss Fraction 1.5 % at STC

LID - Light Induced Degradation
Loss Fraction 2.0 %

Module Quality Loss
Loss Fraction 0.0 %

Module mismatch losses
Loss Fraction 1.0 % at MPP

Strings Mismatch loss
Loss Fraction 0.2 %

IAM loss factor
ASHRAE Param.: IAM = 1 - bo (1/cosi -1)
bo Param. 0.04

System losses

Unavailability of the system
Time fraction 0.4 %
1.5 days,
3 periods

Auxiliaries loss
Proportional to Power 2.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 34500 Vac tri
Loss Fraction 0.70 % at STC
Inverter: SG4400-UD-MV-US
Wire section (35 Inv.) Copper 35 x 3 x 2000 mm²
Average wires length 160865 m

AC wiring losses

MV line up to HV Transfo

MV Voltage	34.5 kV
Wires	Copper 3 x 4000 mm²
Length	15750 m
Loss Fraction	1.20 % at STC

AC losses in transformers

MV transfo

Medium voltage	34.5 kV
Transformer from Datasheets	
Nominal power	150000 kVA
Iron Loss (24/24 Connexion)	150.00 kVA
Iron loss fraction	0.10 % of PNom
Copper loss	1500.00 kVA
Copper loss fraction	1.00 % at PNom
Coils equivalent resistance	3 x 79.35 mΩ

HV transfo

Grid voltage	138 kV
Transformer from Datasheets	
Nominal power	150000 kVA
Iron Loss (24/24 Connexion)	75.00 kVA
Iron loss fraction	0.05 % of PNom
Copper loss	600.00 kVA
Copper loss fraction	0.40 % at PNom
Coils equivalent resistance	3 x 31.74 mΩ

Horizon definition

CSV horizon file, Latitude 40°, Longitude -79°

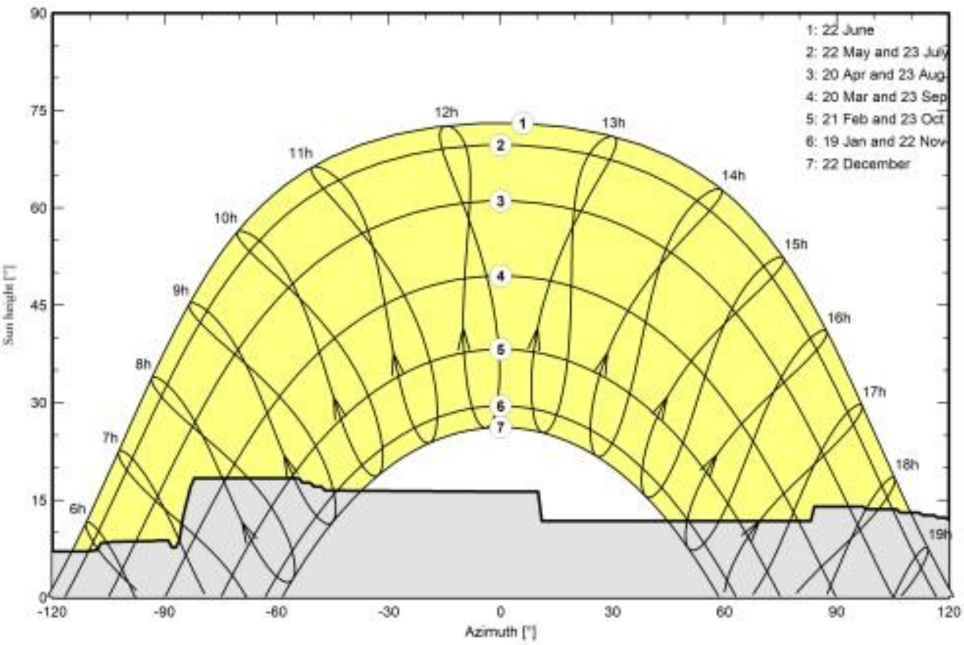
Average Height	12.0 °	Albedo Factor	0.41
Diffuse Factor	0.93	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-168	-167	-162	-157	-155	-154	-152	-151	-145	-144	-141	-139	-138	-135
Height [°]	4.8	4.7	4.6	2.7	2.6	2.9	2.6	2.5	2.4	5.2	5.5	5.7	5.9	6.1
Azimuth [°]	-133	-132	-130	-129	-126	-111	-110	-108	-105	-104	-93	-92	-88	-87
Height [°]	6.3	6.6	6.6	6.8	7.1	7.1	7.2	7.3	8.5	8.6	8.7	8.8	7.7	7.7
Azimuth [°]	-86	-85	-83	-82	-54	-51	-50	-48	-47	0	10	11	83	97
Height [°]	8.8	12.5	17.1	18.4	18.4	17.7	17.1	17.1	16.5	16.3	16.3	11.8	11.8	14.0
Azimuth [°]	98	106	107	113	116	117	119	122	123	170	172	175	176	177
Height [°]	13.6	13.6	13.1	12.7	12.7	12.3	12.3	12.0	11.8	11.3	6.7	6.8	6.5	4.9

Sun Paths (Height / Azimuth diagram)

Orientation #1



Main results

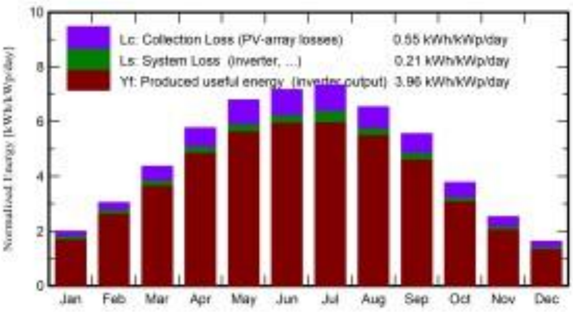
System Production

Produced Energy 281.52 GWh/year

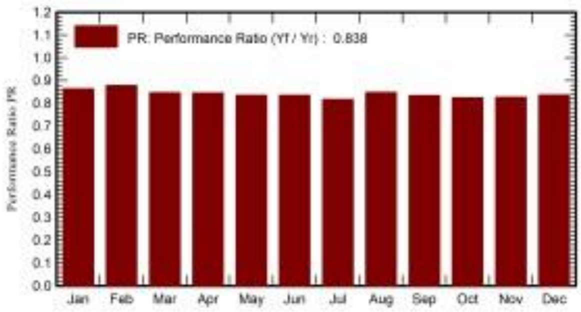
Specific production 1444 kWh/kWp/year

Perf. Ratio PR 83.85 %

Normalized productions (per installed kWp)



Performance Ratio PR

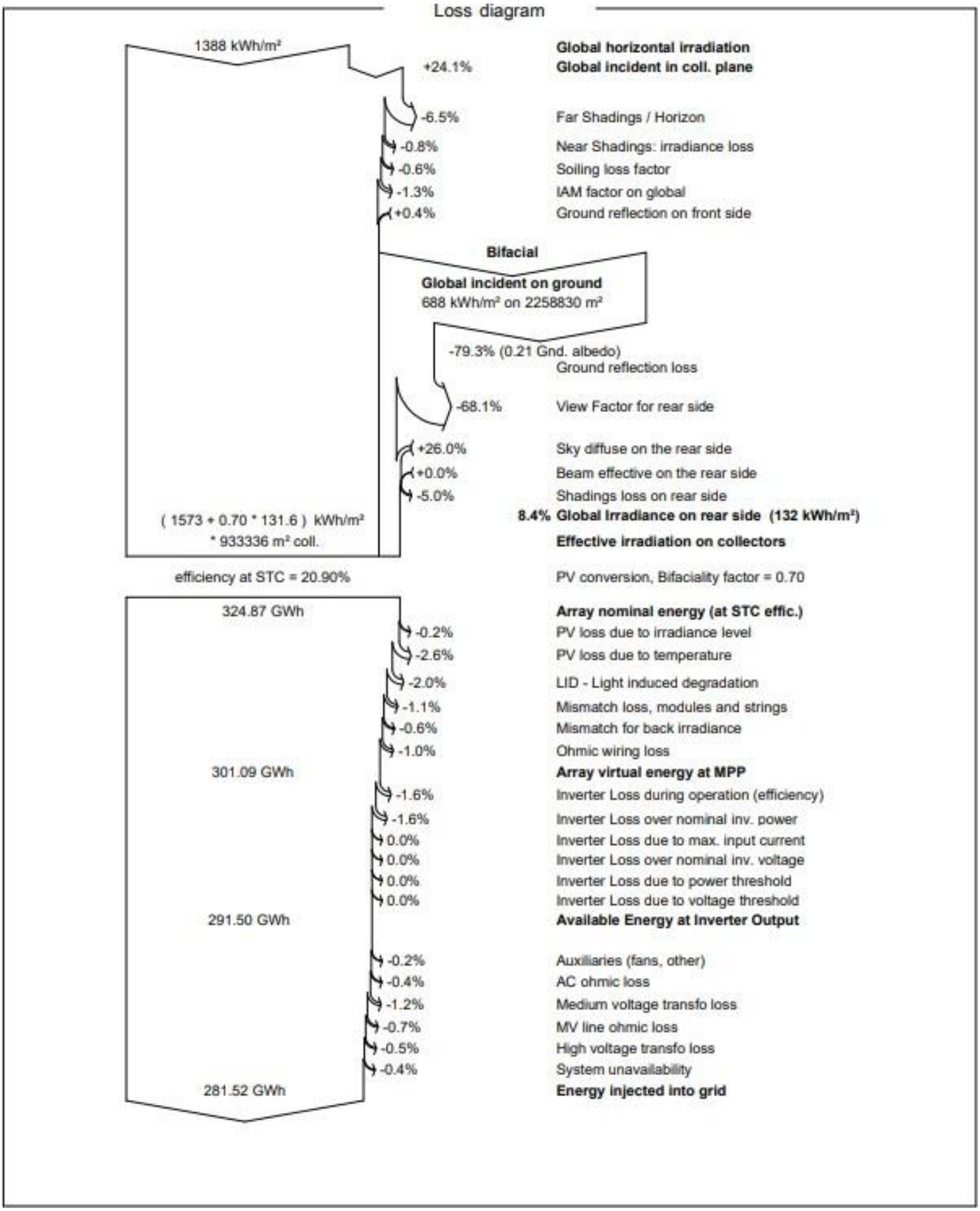


Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray GWh	E_Grid GWh	PR ratio
January	51.5	31.95	-0.56	62.0	50.4	11.18	10.44	0.864
February	69.1	37.48	4.06	85.2	72.3	15.35	14.60	0.879
March	109.8	55.45	5.79	135.3	119.7	23.43	22.34	0.846
April	139.6	68.60	10.31	173.3	160.6	29.93	28.59	0.846
May	172.6	85.31	19.34	210.5	198.7	35.88	34.32	0.836
June	177.1	81.54	19.30	215.1	203.9	36.64	35.03	0.835
July	183.6	81.05	22.32	227.6	215.9	38.85	36.29	0.818
August	163.1	72.77	19.60	202.7	191.0	35.05	33.51	0.848
September	129.5	52.08	17.72	166.8	153.9	28.61	27.14	0.834
October	90.0	39.44	10.67	117.2	102.3	19.78	18.84	0.825
November	59.6	29.22	6.14	75.7	64.0	12.86	12.20	0.827
December	42.4	26.44	0.06	50.5	40.6	8.77	8.23	0.837
Year	1387.9	661.31	11.26	1721.8	1573.3	296.34	281.52	0.838

Legends

GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio



Yield Factor

The yield factor represents the cumulative effect of all system losses within a solar photovoltaic (PV) power plant. These losses occur throughout various stages of operation and include factors such as module efficiency, environmental effects, temperature impact, electrical losses, and conversion inefficiencies. It provides an estimation of the net energy that can be delivered to the electrical grid after accounting for all such deductions.

Dirt, Dust, and Snow Losses

Accumulation of dirt and dust on the surface of solar modules can hinder the passage of sunlight, thereby reducing the output. Similarly, snowfall obstructs sunlight when it covers the panels. These losses vary depending on the season and site conditions. For the evaluated site, this type of loss is estimated at 0.6%.

Module Mismatch Losses

Even though each solar module is designed to operate under similar conditions, slight variations in their electrical characteristics can lead to inconsistencies in output. When combined in an array, the overall performance is slightly less than the sum of individual modules, resulting in mismatch losses. This is typically considered to be around 1.1%.

AC Cable Losses

Electrical energy is also lost due to resistance in the alternating current (AC) cabling network. Although minimizing this loss is a design priority, maintaining losses below 0.4% is often challenging in practice.

DC to AC Conversion Losses

The electricity generated by PV modules is in direct current (DC), which must be converted to alternating current (AC) for grid compatibility. In this conversion process, some energy is inevitably lost. The inverter selected for the system offers a high conversion efficiency, rated at 98.41%.

Transformer Losses

Energy losses also occur during voltage transformation due to core and resistive losses in the transformer. These are taken into account, with the estimated loss being approximately 0.7%.

Temperature Losses

As ambient temperatures rise, so do the temperatures of PV modules. Higher module temperatures negatively affect energy output, as performance declines with temperature. The extent of this loss depends on the temperature coefficient specified by the module manufacturer.

Shading and Irradiance Losses

Shading caused by nearby obstructions such as buildings, trees, or structural elements like inverter rooms can reduce the amount of sunlight reaching the panels. While ground-mounted PV systems are generally optimized for exposure, shading in early mornings or late evenings is common, especially in large-scale installations. These partial shading instances contribute to reduced energy yields.

Electrical Infrastructure and Interconnection

One of the most crucial requirements for power delivery to the existing grid is the ease of interconnection to the existing electrical grid. The proposed project lies in the service territory of West Penn Power Company (First Energy Corp), which comes under the planning area of PJM Interconnection LLC (PJM).

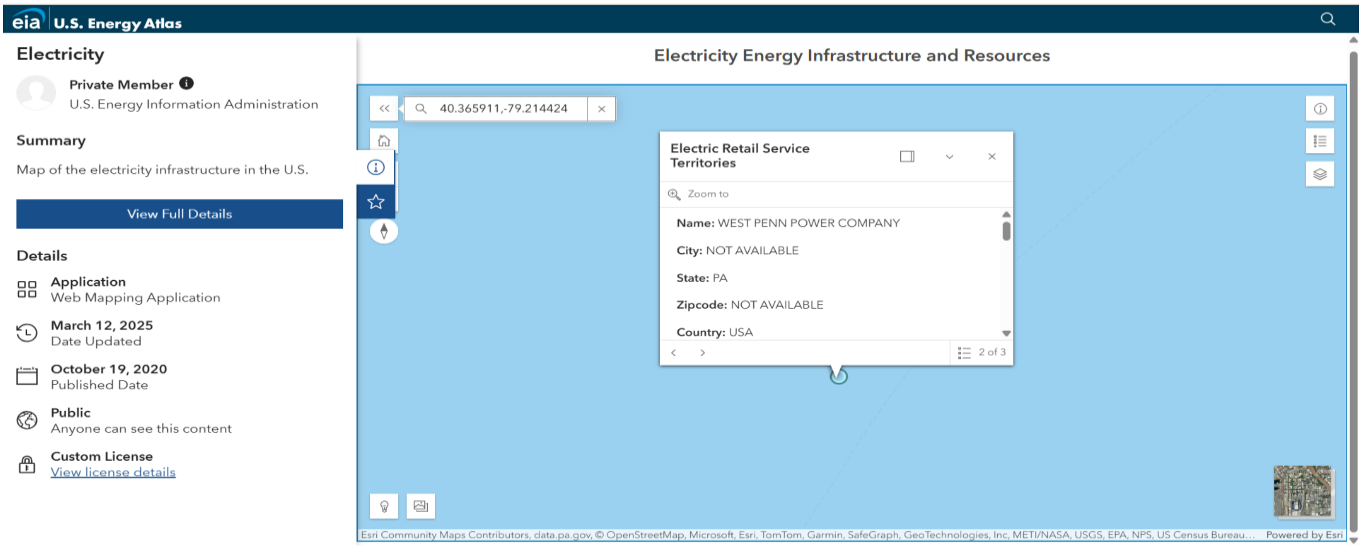


Figure 25:Service Territory

An existing 138kV transmission line, owned and operated by West Penn Power Company, passes near the southern edge of the project site, providing a direct connection between the A Substation and B substation.

Voltage Class	Owner	Substations
138kV (Proposed POI)	A	B

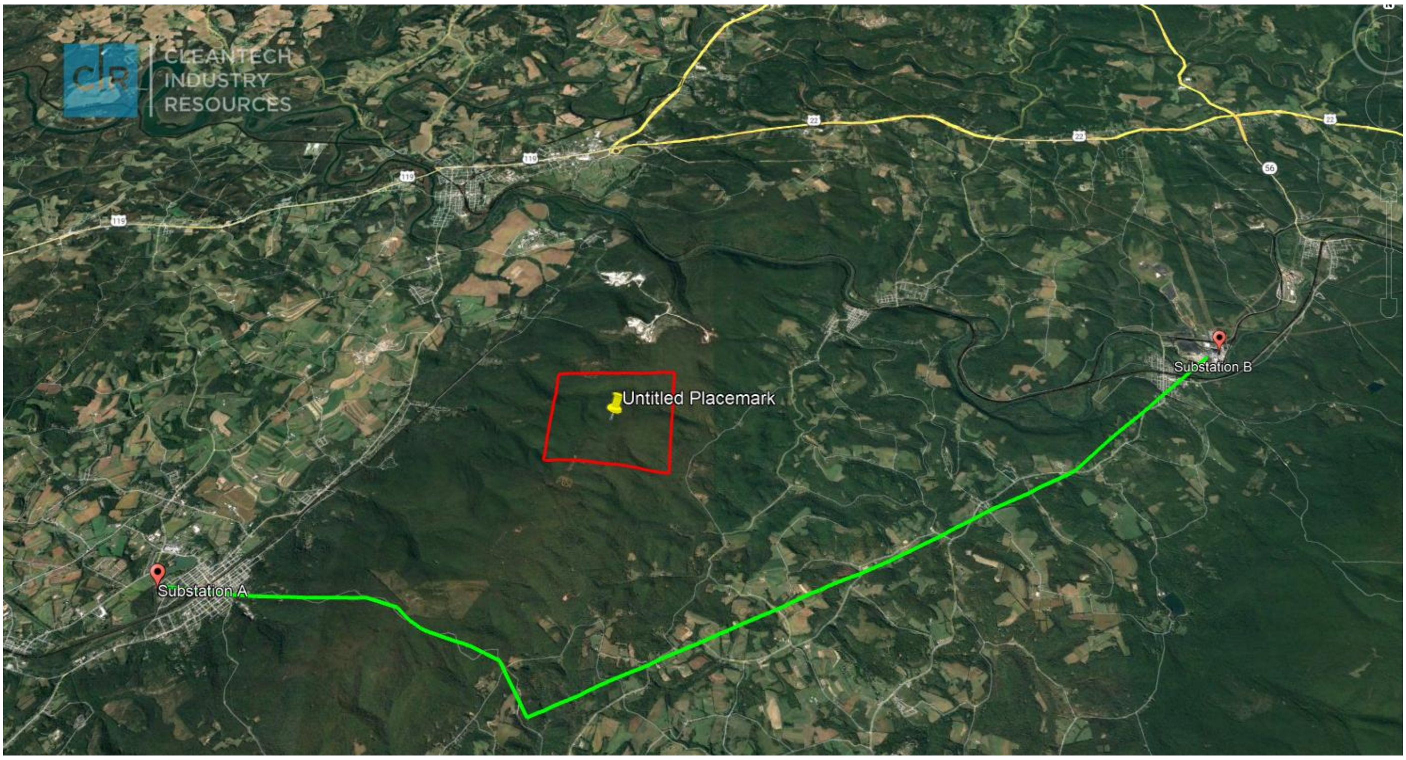
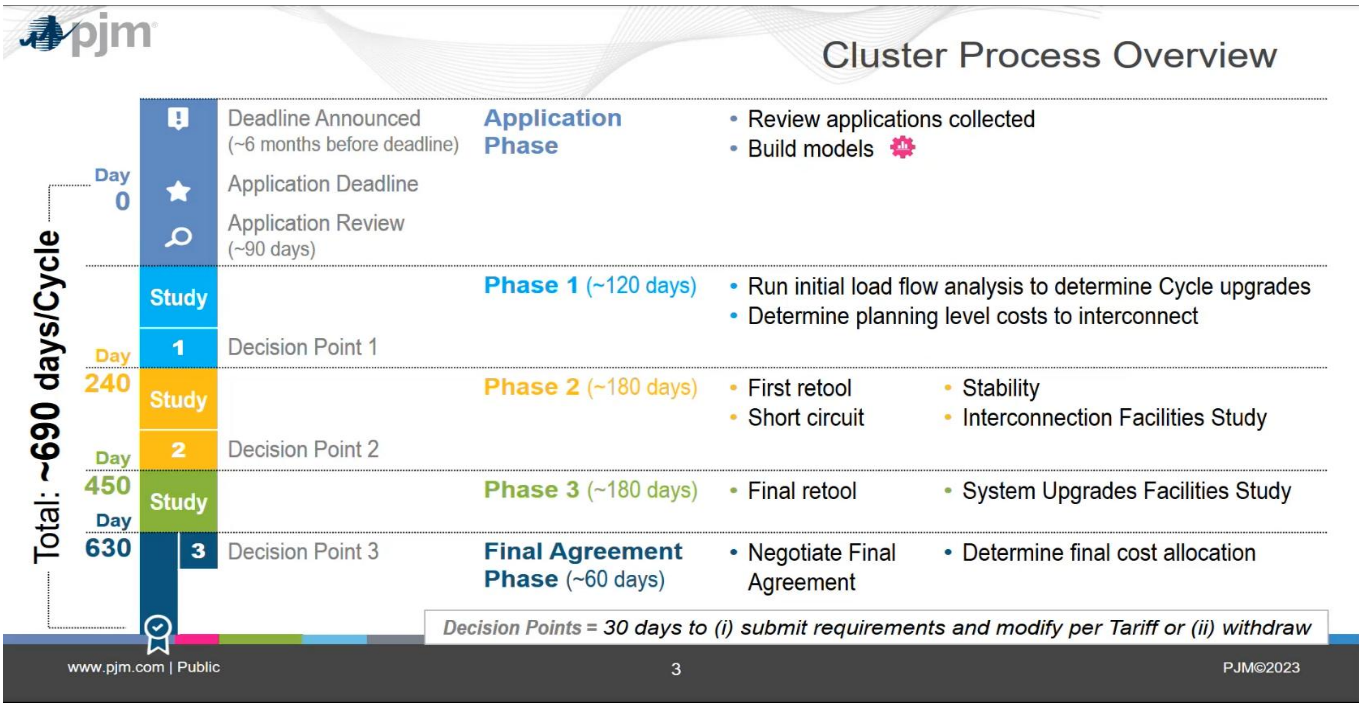


Figure 26: Electric Infrastructure

Interconnection Queue

Project ID	Name	State	Status	TO	MFO	MW Energy	MW Capacity	MW In Service	Fuel
									All
AG2-037	Findlay-Clinton 23 kV	PA	Active	DL	4.7	4.7	2.82		
AG2-150	*River Dock 23 kV*	*PA*	*Withdrawn*	*DL*	*5.25*	*5.25*	*5.25*		
AH1-562	Springdale 138kV	PA	Active	APS	356.0	250.0	250.0		

Interconnection Procedure Overview and Timeline



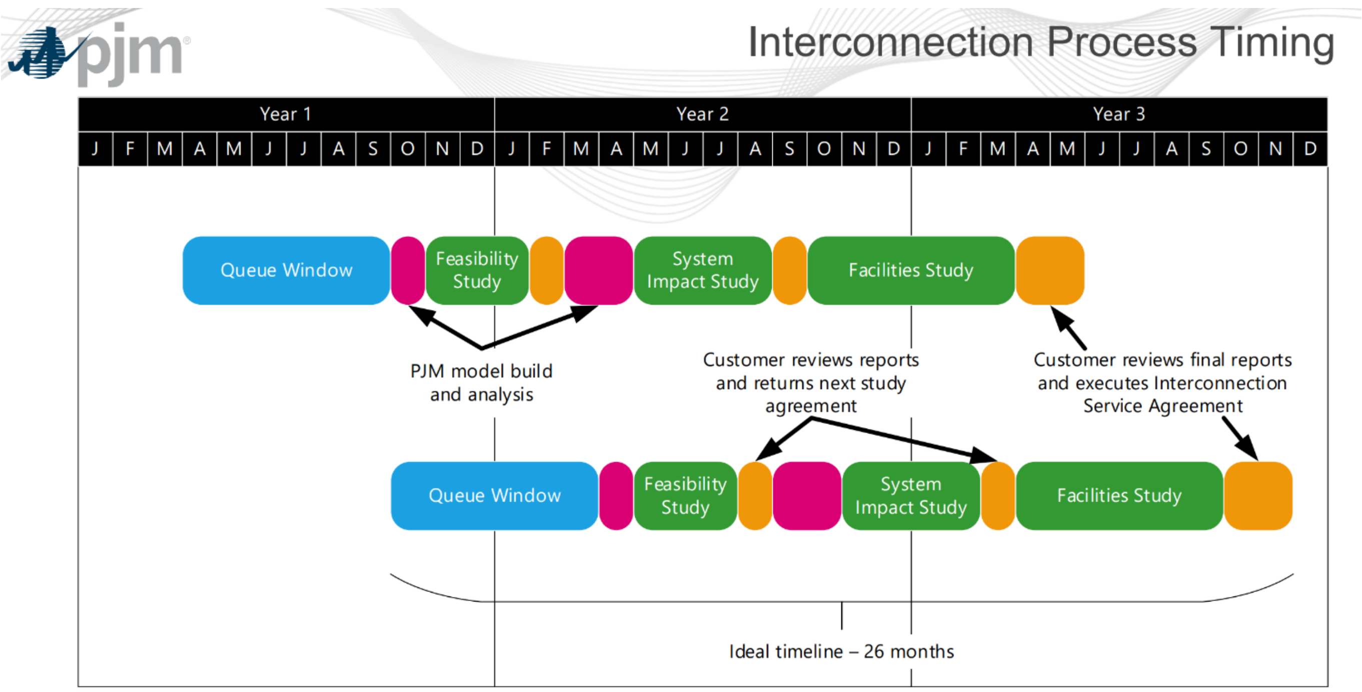


Figure 27: PJM Interconnection Process Diagram and Timeline

Operational Projects in the vicinity of the Proposed Project

No operational power plants have been observed in the proposed project's vicinity.

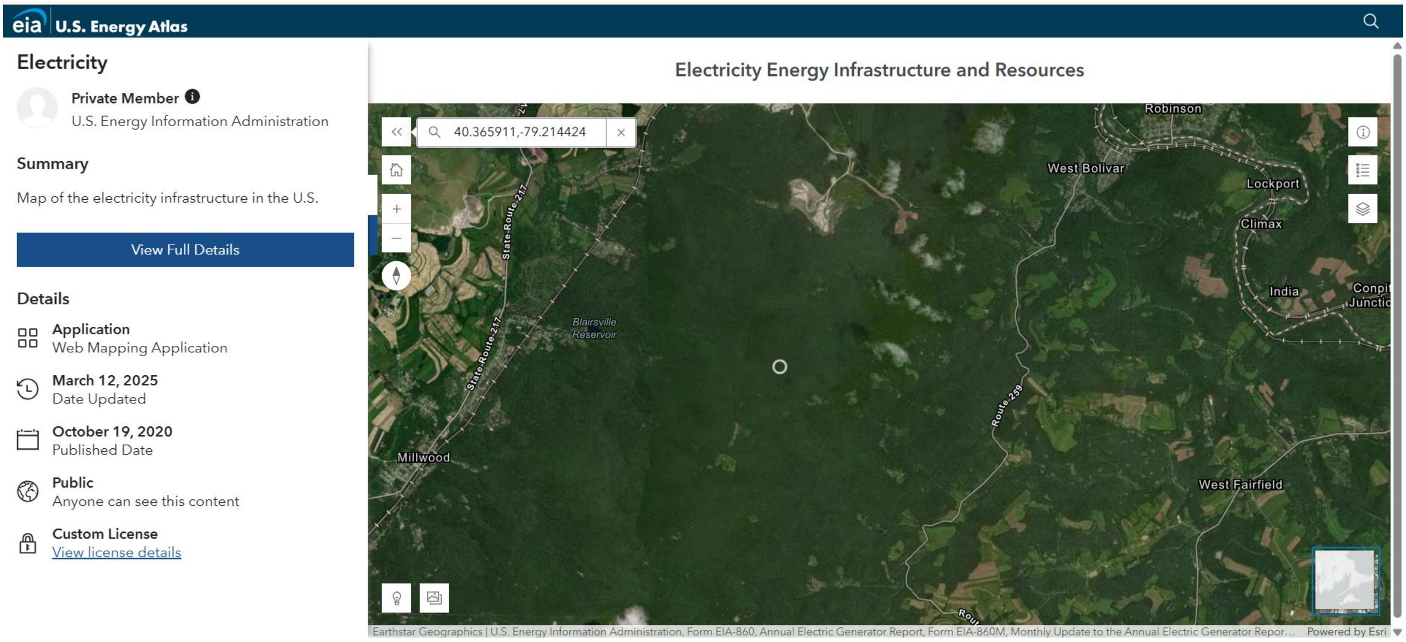


Figure 28: Nearby Power Plants and Existing Power Mix at the proposed project location

Chapter 5: Conclusion

The Technical Due Diligence conducted for the proposed solar power project has systematically evaluated all critical aspects influencing its viability, including land suitability, solar resource availability, environmental and regulatory compliance, grid connectivity, financial implications, and potential risks. Through the use of industry-standard tools and methodologies, the report establishes a robust framework for understanding the project's strengths and challenges.

The findings confirm that the selected site possesses the essential geographical, technical, and regulatory conditions required for solar development. Solar irradiance levels and meteorological data support favorable energy yield projections, while the analysis of electrical infrastructure demonstrates the feasibility of efficient grid integration. Environmental assessments have not revealed any major constraints, and applicable regulations and permitting requirements have been clearly identified.

Moreover, financial evaluations, including available incentives and tax benefits, enhance the investment appeal of the project. The incorporation of risk mitigation strategies for natural hazards and regulatory concerns further strengthens the project's implementation potential.

In conclusion, this due diligence study validates the technical, environmental, and economic feasibility of the solar power facility. It equips stakeholders with the necessary insights to make informed decisions, while also laying the foundation for a smooth transition from planning to execution. The comprehensive analysis not only minimizes risk but also optimizes project design, ensuring long-term sustainability and success.

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