Visual Resource Assessment (VRA)

Angelina Solar Farm (Case No. 18-1579-EL-BGN)

Dixon and Israel Townships, Preble County, Ohio

Respectfully Submitted to:

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November 2018

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1.0 INTRODUCTION

1.1 Purpose of the Investigation

Environmental Design & Research, Landscape Architecture, Engineering & Environmental Services, D.P.C. ("EDR") was retained by Angelina Solar I, LLC, an affiliate of Open Road Renewables, LLC ("the Applicant") to prepare a Visual Resource Assessment ("VRA") for the proposed Angelina Solar Farm ("Project"), which is proposed in the townships of Dixon and Israel in Preble County, Ohio. The proposed photovoltaic (PV) solar facility will have a total generating capacity of up to 100 megawatts (MW). This VRA was prepared as part of the review of the Project in accordance with Chapter 4906-4-08(D)(4) of the Ohio Administrative Code ("OAC"), Certificate Applications for Electric Generation Facilities. The information and recommendations included in this report are intended to assist the Ohio Power Siting Board ("OPSB"), other state agencies, interested stakeholders, and the general public in their review of the proposed Project in accordance with the requirements of Rule 4906-4-08(D).

The VRA has been prepared to satisfy those portions of the requirements of OAC Chapter 4906-04-08 (D) that relate to the identification of visually sensitive resources (VSRs) and potential visual impacts. The requirements of Rule 4906-4-08(D) of the OAC are as follows:

(D) The applicant shall provide information on cultural and archaeological resources

(1) The applicant shall indicate, on a map of at least 1:24,000 scale, any formally adopted land and water recreation areas, recreational trails, scenic rivers, scenic routes or byways, and registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significance within five miles of the project area. Landmarks to be considered for purposes of paragraph (D) of this rule are those districts, sites, buildings, structures, and objects that are recognized by, registered with, or identified as eligible for registration by the national registry of natural landmarks, the Ohio Historical Society, or the Ohio Department of Natural Resources.

(2) The applicant shall provide an evaluation of the impact of the proposed facility on the preservation and continued meaningfulness of these landmarks and describe plans to avoid or mitigate any adverse impact.

(3) The applicant shall describe the identified recreation areas within five miles of the project area in terms of their proximity to population centers, uniqueness, topography, vegetation, hydrology, and wildlife. Provide an evaluation of the impact of the proposed facility on identified recreational areas within five miles of the project area and describe plans to mitigate any adverse impact.

(4) The applicant shall evaluate the visual impact of the proposed facility within at least a five-mile radius from the project area. The applicant shall:

(a) Describe the visibility of the project, including a viewshed analysis and corresponding map of the study area.

(b) Describe the existing landscape and evaluate its scenic quality.

(c) Describe the alterations to the landscape caused by the facility, and evaluate the impact of those alterations to the scenic quality of the landscape.

(d) Evaluate the visual impacts to the resources identified in paragraph (D)(1) of this rule, and any such resources within ten miles of the project area that are valued specifically for their scenic quality.

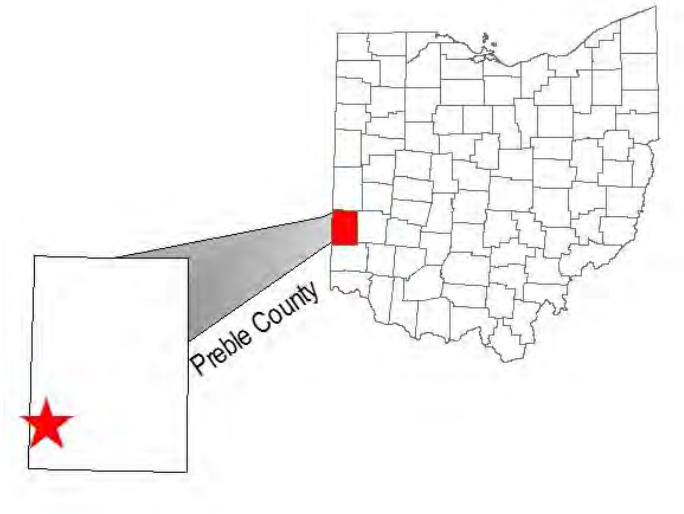
(e) Provide photographic simulations or artist's pictorial sketches of the proposed facility from public vantage points that cover the range of landscapes, viewer groups, and types of scenic resources found within the study area. The applicant should explain its selection of vantage points, including any coordination with local public officials and historic preservation groups in selecting these vantage points.

(f) Describe measures that will be taken to minimize any adverse visual impacts created by the facility, including, but not limited to, project area location, wind turbines, visual screening, and facility coloration. In no event shall these measures conflict with relevant safety requirements.

In support of these requirements this VRA will:

- Describe the visible components of the proposed Project.
- Define the visual character of the Project study area.
- Inventory and evaluate VSRs within the study area.
- Evaluate the potential visibility of the Project within the study area.
- Identify key observation points to assess the Project appearance.
- Assess and summarize the potential visual impacts associated with the proposal.

This VRA was prepared by a visual expert in accordance with the policies, procedures, and guidelines contained in established visual assessment methodologies (see References section).



Inset 1 – Regional Project Location

1.2 Project Location and Description

1.2.1 Project Location

The land on which the Project will be constructed and operated ("the Project Area") is located in Dixon and Israel Townships in Preble County, Ohio. It is bounded on the west by the Ohio/Indiana State Border and the Little Four Mile Creek corridor, on the south by Indiana State Route 44 and Ohio State Route 725, on the east by Ohio State Route 177 and County Road 41, and on the north by Toney Lybrook Road. The Project is located adjacent to a point in the regional transmission system

where the power generated from the proposed Project can be added to the grid without the need for substantial upgrades to the existing transmission system.

The Project Area is comprised of 16 separate parcels that share common borders. The total area of all properties that are under lease (or will be purchased pursuant to options) and available for use in the construction and operation of the Project is approximately 934 acres (see Figure 1). The Applicant expects to use up to 827 acres of this total for the construction and operation of the Project.

The land within the Project Area is primarily open, level agricultural land. It includes a small number of medium to large-scale agricultural operations which are currently involved in the production of corn and soybean crops and livestock rearing. Undeveloped land within in the Project area includes actively cultivated fields, small forested tracts and blocks, hedgerows, and fallow fields containing successional trees and shrubs. Other developed features in the Project Area include several electric transmission lines, including a 138 kV line operated by American Electric Power ("AEP") Ohio, two 115 kV lines, a 138 kV line operated by Indiana Michigan Power, and an electric substation (Indiana Michigan Power's 138 kV College Corner Substation), Additionally, the Project area hosts several public roads, single family homes, and structures associated with agricultural operations such as barns, silos, and mobile farm equipment. The Project Area itself does not include any population centers or major industries.

1.2.2 Project Description

The proposed Project evaluated in this VRA is a solar-powered electric generation plant with a generating capacity of up to 100 megawatts ("MW"). The Project will use arrays of ground-mounted photovoltaic modules, commonly known as solar panels, to generate clean and quiet renewable electricity for use by consumers in southwestern Ohio. Solar panels will be affixed to metal racking which will include piles that will be driven or screwed into the ground in rows or arrays. The arrays generally will follow the existing topography of the Project Area with minimal grading or alteration of existing contours. Arrays will be grouped in separate, contiguous clusters (or "solar fields"), each of which will be fenced with locked gates, for equipment security and public safety.

Along with the PV modules, the Project will include associated support facilities, including access roads, meteorological stations, buried electrical collection lines, inverter pads, a Project substation, and a short 138 kV transmission ("gen-tie") line that will connect the Project substation to the existing utility substation and the regional transmission system. The Project area is illustrated in Figure 1. The major components of the proposed Project are described below:

1.2.2.1 Photovoltaic Modules

The arrays of solar panels proposed for the Project will use either a fixed tilt or single-axis "tracking" style racking system. When using a system with tracking technology, the arrays will be oriented in a north-south direction and equipped with electric motors that slowly rotate the panels from east to west, so as to maintain a 90-degree angle relative to the direction of sunlight. Tracking arrays will face east at sunrise, rotate throughout the day, and end up facing west at sunset. The panels will then re-set to the east. When in the beginning and ending positions for each day, the low end of panels mounted on tracking arrays will be 2-3 feet above the ground, while the high end will be up to 14 feet above the ground surface. If the non-tracking, "fixed" style racking is chosen the arrays will be oriented from east to west with the panels fixed at a designated angle towards the south. Overall heights will remain similar for both styles of racking. For the purposes of this VIA, we assumed the use of single axis tracker solar panels. Figure 2 provides a rendering of the 3D model of the proposed solar panels under consideration for the Project.

1.2.2.2 Fencing and Setbacks

The above-ground components of the Project need to be fenced for safety and security purposes. As currently proposed, the Project will be surrounded by a 7-foot tall chain link fence or a 6-foot tall chain link fence with three strands of barbed wire at the top, bringing the total height to 7 feet. All fencing materials, including the posts, mesh, rails, and top wires will be composed of galvanized steel. This VRA assumes that the 7-foot tall chain link fence (without the barbed wire top) would enclose the proposed Project.

For the purposes of this VRA, minimum Project setbacks were assumed in order to allow a sufficient buffer between public rights of way ("ROW") and private residences/property lines. These setbacks will include:

- A 25-foot setback between the perimeter fence around a solar field and the edge of pavement of any public road.
- A 40-foot setback between the any above-ground equipment within a solar field and the edge of pavement of any public road.
- A 10-foot setback between the perimeter fence of a solar field and the property line of any parcel whose owner is not participating in the Project ("non-participating parcel").
- A 25-foot setback between any above-ground equipment within a solar field and any non-participating parcel, parcel line.
- A 100-foot setback between any above-ground equipment within a solar field and any habitable residence located on a non-participating parcel.

These setbacks are incorporated into the proposed Project layout, as illustrated in the visual simulations included in this VRA. As the Project design progresses, these setbacks may change somewhat based on legal property boundaries and ROW boundaries.

To further protect the public, appropriate warning signs will be posted and maintained for the solar fields and the Project substation. Such signs are not included in the visual simulations because of their relatively small and could include various designs and placements that are unknown at this time.

1.2.2.3 Electrical System

The Project's solar panels will generate electricity when photons in sunlight strike the solar panels and excite electrons in their semiconducting material to generate direct electric current ("DC"). The DC current will be converted to alternating electric current ("AC") through the use of inverters and gathered by a system of cables that terminate at the Project substation. The substation will then step-up the voltage and deliver the power through a gen-tie line to the existing utility substation. The visual aspects of each component that makes up the Project's electrical system is described below.

Collection System and Inverters: Within each solar field, a network of buried electric lines will collect power from the groups of solar panels and transmit it to an inverter, where it will be converted from DC to AC. Inverters come in various styles, but the majority of inverters are low profile and remain below the maximum height of the panels. Information on the location and design of the inverters was not available for the inclusion in the VRA and therefore are not represented in the simulations. However, it is not anticipated that the inverters will contribute to the overall visibility or visual impact of the Project due to their low profile and limited occurrence throughout the solar arrays. The collection system will then carry the power from each inverter to the Project substation. All portions of the collection system that lie outside the fenced solar fields and will be buried at least 36 inches below grade.

Project Substation: The Project substation will be located on a parcel of land that is across County Road 600 E and immediately east of the existing 138kV College Corner Substation. The Project substation will have a maximum size of just over 1 acre (200 feet by 250 feet), and tallest equipment within the station will be the lightning masts, which will have a maximum height of 70 feet. For equipment security and public safety, a chain-link fence with a locked access gate will be installed around the perimeter of the substation. The Project Substation is represented in the VRA visual simulations.

Gen-tie Line: A very short 138 kV transmission line will connect the Project substation to the existing utility substation. The gen-tie line will be approximately 700 linear feet and will be constructed either above or below grade. If built as an overhead line, the gen-tie line will be carried by two self-supporting steel structures; one located where the circuit leaves the Project substation and the other located where the circuit enters the utility substation. Typical heights for these dead-end structures range from 20–25 feet. The Gen-tie line is not depicted in the visual simulations, or evaluated as part of this VRA, because the design had not been determined at the time this study was prepared.

1.2.2.4 Access Roads

The Project will include a number of unpaved roads to access each solar field from adjacent public roads. The access roads will be used for construction of the Project, and during Project operation for maintenance, repair, and replacement of equipment, as well as access for emergency response. All permanent roads will be a maximum of 16 feet wide, though a number of roads may temporarily be up to 25 feet wide to accommodate construction activities. At the time the VRA was being prepared, designs for the access roads were not finalized. These roads represent minor alterations to the landscape that are rarely visible due to their low profile, unpaved surface, and location primarily within the solar field. For these reasons the access roads are not specifically evaluated in this VRA.

1.2.2.5 Meteorological Stations

The Project will include up to four meteorological stations. These stations will include pyranometers that measure the solar resource, as well as ancillary meteorological instruments such as an anemometer, wind vane, barometer, rain bucket, temperature probe, and associated communications equipment. The pyranometers and associated equipment will be installed on a prefabricated foundation or directly on the ground, and occupy less than 400 square feet. Because of the relatively low height of the pyranometer equipment (below the height of the panels) their visibility and appearance are not represented in the simulations or evaluated as part of this VRA.

1.2.2.6 Laydown/Staging Areas

The Project includes up to 14 temporary laydown areas to be used for construction staging, equipment storage, and parking for construction workers. The laydown areas are generally located along public roadways, and are placed, where possible, adjacent to the solar field entrances. The laydown areas will range from 1 to 5 acres in size, and collectively total around 14.6 acres. Exact locations of the laydown/staging are not known at this time. The staging areas are temporary features associated with construction of the Project and will be restored to pre-construction conditions upon completion of construction activities. Therefore, they are not evaluated as part of the is VRA.

2.0 BACKGROUND

2.1 Existing Visual Character

2.1.1 Visual Study Area

As discussed in Section 1.1, the OAC, Certificate Applications for Electric Generation Facilities, indicates that visual impacts to recreational, scenic, and historic resources from a proposed generating facility should be evaluated within a 5-mile radius (OPSB, 2015) and resources valued for their specifically for their scenic quality should be evaluated within 10 miles of the Project. However, the viewshed analysis, combined with field review, suggests that a 10-mile radius study area is not necessary to evaluate the potential visual effects of the proposed Project. To ensure that the defined study area was more than sufficient to capture potential visibility and resource impact, a 5-mile radius visual study area was determined to be appropriate. The 5-mile radius study area for the proposed Project encompasses a total of approximately 116 square miles, including Dixon, Israel, Gasper, and Somer Townships in Preble County, Oxford Township in Butler County, Ohio, as well as Wayne and Union Counties, Indiana. The Village of College Corner in Preble and Butler Counties, Ohio also occurs within the visual study area. The location and extent of the visual study area is illustrated in Figure 3.

2.1.2 Physiographic/Land Use Setting

The visual study area falls within the Till Plains section of the Central Lowlands physiographic province in Ohio (Fenneman and Johnson, 1946). This physiographic section covers most of western Ohio, and extends further west through Indiana and Illinois. The Ohio Division of Geological Survey (1998) further classifies this area as the Southern Ohio Loamy Till Plain physiographic region. This region is commonly associated with boulder belts and is cut by steep-valleyed large streams. The stream valleys are filled with outwash and alternate between broad plains and narrows. This region is characterized by moderate relief with elevations ranging from 530 to 1,500 feet above mean sea level ("AMSL"). The majority of topographic relief occurs along the valleys associated with the Four Mile Creek and the East Fork of Four Mile Creek. However, the Project area itself is relatively flat.

Vegetation in the visual study area consists largely of agricultural crops, including row crops such as corn and soybeans. Forested areas also occur throughout the visual study area. These areas range from small woodlots and hedgerows, which divide agricultural fields, to more substantial forested areas that occur primarily along stream corridors. Larger forested areas occur in the southeastern portion of the visual study area, associated with Hueston Woods State Forest. Forest vegetation is primarily deciduous (beech, maple, oak, elm, walnut, sycamore) mixed with some conifers.

Land use within the visual study area is primarily agricultural with scattered rural residential properties. This area is dominated by open land, farms and associated accessory structures and equipment. Although crop fields and pastures offer open views, the prevalence of small scattered woodlots and hedgerows combined with the relatively level terrain, interrupts long-distance views from many locations. Higher density developed areas include the Village of College Corner, Ohio which occurs approximately 3.6 miles south of the Project Area, the Town of West College Corner, Indiana which is situated approximately 3.6 miles south of the Project Area and the unincorporated settlement of Fairhaven, Ohio approximately 1.3 miles east of the Project. The more heavily traveled transportation routes that transverse the study area include United States Route 27 ("US RT 27") which runs through the southwestern portion of the visual study area, State Routes (SR) 227 and 177 which run roughly northwest-southeast through the visual study area and border the northeastern boundary of the Project Area, SR 44 which runs east-west and bisecting the visual study area, and SR 725 which runs along the southern boundary of the Project Area.

Water features within the visual study area include Fourmile Creek, Dixon Branch, Sugar Run, Opposum Run, East Fork Fourmile Creek, Torrey Run, Little Fourmile Creek, Church Run, Silver Creek, Harold Creek, Hanna Creek, Nutter Creek, Cottage Grove Creek, Sand Run, Brandywine Creek, West Fork Fourmile Creek, Fleisch Run, and their associated tributaries. Four Mile Creek is a 38-mile long tributary of the Great Miami River (USGS, 2018). Its headwaters originate in Preble County, Ohio and Union County, Indiana, and the creek meanders south into Butler County, passing through Acton Lake within Hueston Woods State Park before joining the Great Miami River (Ohio EPA, 2008).. East Fork Four Mile Creek, a small tributary of Four Mile Creek that runs within Preble County, Ohio, runs through the eastern portion of the visual study area. The majority of East Fork Four Mile Creek has a wooded shoreline adjacent to working agricultural fields.

Acton Lake, the only lake or pond within the visual study area, lies within Preble and Butler counties on the southwestern edge of Ohio. The lake is accessible by State Routes 177, 732, and 725, and US RT 27. Acton Lake is located within the Hueston Woods Park area and was formed as a result of a dam constructed on Four Mile Creek. The lake and its surrounding area offer a variety of recreational opportunities, including fishing, swimming, boating, picnic areas, hiking trails, horse trails and a stable, a nature center, a lodge, vacation cottages, and campgrounds (Ohio DNR, 2018)

2.1.3 Landscape Character

Definition of landscape character within the study area provides a useful framework for the analysis of the Project's potential visual effects. Landscapes within the visual study area were categorized based on the similarity of various features, including landform, vegetation, water, and/or land use patterns, in accordance with established visual assessment methodologies (Smardon et al., 1988; USDA Forest Service, 1995; USDOT Federal Highway

Administration, 1981; USDI Bureau of Land Management, 1980). The USGS National Land Cover Dataset ("NLCD") was used to help understand the location of various landscape character zones within the visual study area (Figure 4). The general character, use, and potential views to the proposed Project is within different landscape character zones described below.

Inset 2 – Representative Agricultural Farm Complex with visible transmission line, on State Route 725 in Israel Township, Preble County, Ohio (Viewpoint 13)

As mentioned previously, the majority of the visual study area is occupied by agricultural land use with associated rural residences. These areas include cropland, pastureland, farm buildings, houses, hedgerows, and woodlots (Insets 2-4). The open agricultural setting often presents open, medium to long distance views with hedgerows or small woodlots in the middle ground or background which may, in some locations, interrupt views of the Project. Uninterrupted views within these agricultural areas are typically found in discrete locations where large continuous fields are present. During the growing season, mature crops (primarily corn) can grow tall enough to screen views of the horizon and of the Project.

Inset 3 – Roadside agriculture with farm equipment, County Route 45 (Paint Creek 4 mile Rd.) on the boarder of Dixon and Israel Townships, Preble County, Ohio (Viewpoint 16)

Inset 4 – Roadside farm complex with residential structure and associated farm buildings, County Route 45 (Paint Creek 4 mile Rd.) on the boarder of Dixon and Israel Townships, Preble County, Ohio (Viewpoint 16)

Small portions of the visual study area include areas of forest vegetation (primarily deciduous stands interspersed with small coniferous groupings). Although small vegetated areas are found within the agricultural/rural residential areas in the form of smaller woodlots and hedgerows (Insets 5 & 6), forested areas are distinctly different in visual character due to the dominance of trees in the foreground (e.g. lining road edges) which eliminate or restrict open views. This type of landscape is relatively uncommon within the visual study area and occurs primarily along the two main creek corridors and in the southeastern corner of the visual study area. Larger forested areas in the visual study are most densely concentrated around Acton Lake and the Hueston Woods Park area between SR 177 and US RT 27, and in the area around Fairhaven between County Route (CR) 45 (Paint Creek 4 Mile Road) to the north and SR 725 to the south.

Inset 5 – Vegetative screening associated with a hedgerow dividing agricultural fields., Van Ausdal Rd. in Union County, Indiana (Viewpoint 20)

Inset 6 – View of woodlot located within agricultural fields, North 9 mile Rd in Union County, Indiana (Viewpoint 30)

The visual study area also includes the Village of College Corner, Ohio and the Town of West College Corner, Indiana. The Village of College Corner and the Town of West College Corner are visually and geographically similar. These population centers are generally situated along Main Street in Ohio and Liberty Avenue in Indiana (US RT 27). The coincident population centers are generally arranged in a grid pattern, with Main Street on an east-west orientation and side roads oriented in a north-south direction. This area is characterized by low to moderate-density residential and commercial development (typically 1-2 stories tall) which are the dominant character-defining features in the landscape (Inset 7). Buildings are more closely clustered within the village core and town center where County Line Street and Junction Street intersect. Development tends to become more widely spaced along the periphery of the Village/Town, eventually giving way to agricultural fields and woodlots. Activities within this zone are primarily associated with local business, residential uses, and local travel. Views within this zone are typically focused on the roadways and adjacent structures, and open outward views are typically restricted to open roads near the outskirts of the population centers, where housing and vegetation density decrease, and therefore screening is reduced.

Inset 7 – West College Corner, Indiana/College Corner, Ohio, US RT 27.

The visual study area also includes several highly traveled transportation corridors. These transportation corridors include US RT 27, SR 177 in Ohio, and SR 227 in Indiana. Surrounding land use is primarily agricultural, including active and harvested fields, but may also include low-density commercial and residential developments and the occasional forestland in the background. The road corridors are considered to have a visual character distinct from the other landscape types within the visual study area. Views along the transportation corridors are dominated by automobiles, pavement, guard rails, and various signage in the foreground. While in some locations structures and vegetation may screen outward views, in general the broad areas of pavement and adjacent open fields that characterize these routes allow for open views of the surrounding landscape.

Two existing overhead transmission line utility corridors are located within the visual study area. The 138 kV line originating in Ohio, and the 138 kV line located on the Indiana side of the border, which meet at the East Greenwood Church Road substation. The first 138 kV line, owned by American Electric Power ("AEP"), enters the visual study area

from the southeast through the College Corner Substation and then continues on the same transect to the northwest. The second 138 kV line, owned by Indiana Michigan Power, enters the visual study area in the southwest and proceeds to the northeast through the College Corner Substation. The corridor changes direction at South State Line Road and heads north paralleling the road to the College Corner Substation. From there, the line continues northeast out of the visual study area. The existing transmission lines and associated structures generally occur within agricultural fields and therefore the structures are visible over relatively long distances within the visual study area. (Insets 8 & 9).

Inset 8 – View of existing transmission corridor that transects the visual study area from South State Line Rd. in Israel Township, Preble County, Ohio (Viewpoint 3)

Inset 9 – View of existing transmission corridor and existing substation, from State Route 725 in Israel Township, Preble County (Viewpoint 12)

2.2 Visual Sensitivity

2.2.1 Visually Sensitive Resources

VSRs within the 5-mile study area were identified per the requirements of OAC Chapter 4906-04-08 (D). Sensitive sites were only identified within the State of Ohio, based on the OAC requirements. The identified VSR's are listed below.

<u>Resources of State-wide Significance</u>

The National Register of Historic Places ("NRHP")

Review of the NRHP online geographic information system ("GIS") mapping identified four NRHP-listed properties within 5 miles of the Project Area; These include, The Bunker Hill House (01NR01062), Harshman Covered Bridge (76001517), Historic Associate Reformed Church and Cemetery (08000161), and Howe Tavern (76001376).

- The Bunker Hill House (01NR01062) is located at 7919 OH State Route 177 in Fairhaven, Dixon Township and was built circa 1834, with additions added through 1862. It originally served as a roadside tavern and stagecoach stop along the turnpike (now SR 177), in addition to a stop on the Underground Railroad. When

the arrival of the Cincinnati, Chicago and St. Louis Railroad decreased coach travel, the tavern served as the Hawes General Store. The two-and-a-half-story brick building was designed using a combination of the Greek-Revival and Federal styles and is significant as an outstanding representation of pre-Civil War turnpike architecture. The Bunker Hill House was listed on the NRHP in 2001 (Unknown, 2001) and is located 1.2 miles east of the Project Area.

- The Harshman Covered Bridge occurs at the intersection of Concord-Fairhaven Road and Four Mile Creek. The bridge was built in 1894 by Everett S. Sherman and it one of seven surviving "Childs" patented truss covered bridges in the United States (Library of Congress, 2018).
- The Historic Associate Reformed Church and Cemetery is a federal style structure and associated grave yard built in 1825 in Israel Township, Preble County Ohio (NPS, 2018).
- Howe Tavern is in Oxford Township, Butler County, Ohio and was constructed as a hotel in 1832 under the direction of Gideon Sears Howe, around which he named the community of College Corner. This brick structure is one of the earliest examples of permanent construction in the Village of College Corner.

State Register of Historic Places ("SRHP")

Review of the SHPO online mapping system identified three SRHP-listed properties within the 5-mile radius visual study area (Ohio History Connection, 2018). These properties include the Howe Tavern, Historic Reformed Church and Cemetery and the Harshman Covered Bridge.

National Register Eligible ("NRE") Sites

EDR reviewed the list of NRE properties maintained by the Ohio Historic Preservation Office ("OHPO"), and three occur within the visual study area. Two of these are listed below as historic bridges (TR 235 and TR 218). One additional bridge is located on Longman Road and crosses Sugar Run Creek in Dixon Township, Preble County.

Ohio Department of Transportation ("ODOT") Historic Bridge Inventory

Two historic bridges are listed on the ODOT Historic Bridge Inventory within five miles of the Project Area.

- The TR 235 (Junction Road) Bridge over Four Mile Creek (Bridge ID 6841295) is located 1.2 miles north of Fairhaven, Dixon Township.
- The TR 218 (Concord Fairhaven Road) Bridge over Four Mile Creek (Bridge ID 63836402) is located 1.6 miles north of Fairhaven, Israel Township. Built in 1907, it is a steel Pratt through-truss designed by the Indiana Bridge Company.

National Heritage Areas ("NHA")

EDR reviewed the list of NHAs maintained by the National Park Service ("NPS") and none fall within the visual study area (NPS, 2018).

National Wildlife Refuges and State Wildlife Management Areas

Review of the U.S. Fish and Wildlife Service ("USFWS") National Wildlife Refuge System and the Ohio Department of Natural Resources ("ODNR") websites indicate that no National Wildlife Refuges or State Wildlife Management Areas (WMA) occur within the visual study area (USFWS, 2018; ODNR, 2018).

National Natural Landmarks ("NNL")

EDR reviewed the NNL Program, and one NNL occurs within the visual study area. Hueston Woods is located in Butler and Preble Counties and occurs within the Hueston Woods State Park boundary. This NNL is noted for having a beech-maple climax forest that has never been harvested (NPS, 2018).

National Historic Landmarks ("NHL")

EDR reviewed the list of NHLs maintained by the NPS as part of the Cultural Resource Records Review and none fall within the visual study area (NPS, 2018).

National Parks, Recreation Areas, Seashores and/or /Forests

The visual study area does not include any National Parks, Forests or Seashores (USFS/USDA Forest Service, 2013; NPS, 2017b).

Nationwide River Inventory ("NRI")

Review of the NPS NRI indicates that there are no federally designated wild, scenic or recreational rivers within the visual study area, nor are there any NRI-listed rivers within the study area. A portion of White Oak Creek runs through the visual study area, and a portion of White Oak Creek is NRI-listed; however, this section of White Oak Creek does not occur within the visual study area (NPS, 2017).

State Parks

Review of the ODNR website indicates that the study area includes portions of one state park (ODNR, 2018). Hueston Woods State Park, located in Butler and Preble counties, includes nearly 3,000 acres used for outdoor recreation such as hiking, fishing, canoeing, and unique to this region -- fossil hunting. The park surrounds 625-acre Acton Lake, and includes the following amenities: campsites, cabins, and a resort lodge.

Sites, Areas, Lakes, Reservoirs or Highways Designated or Eligible as Scenic

Acton Lake lies in Preble and Butler counties on the southwestern edge of Ohio. The lake is accessible by State Routes 177, 732, and 725 and US RT 27. ODNR maintains parking lots, boat ramps and rental docks, concessions, swimming beaches, picnic areas, hiking trails, bike trails, horse trails and a stable, a nature center, a lodge, vacation cottages, and a campground (ODNR, 2018).

The visual study area also contains a National Scenic Byway, the Presidential Pathways Ohio Scenic Byway. A small (approximately 0.5 mile) section of this Scenic Byway enters the southeastern portion of the visual study area bordering Hueston Woods State Park. The byway is approximately 4.6 miles from the proposed Project.

State and Federally Designated Trails

Review of the NPS websites indicates that no National Scenic Trails are located within the visual study area (NPS, 2018b). The area also does not include any state-designated trails (ODNR, 2018).

Ohio Archaeological Inventory ("OAI")

No OAI properties are recorded within 2 miles of the Project Area.

State Nature and Historic Preserve Areas

.A review of the ODNR Nature Preserve Inventory did not reveal any State Nature or Historic Preserves within the Visual Study Area.

State Historic Markers

Three state historic markers occur within the visual study area. These include, 7-68 Historic Hopewell, 3-68 Bunker Hill House (previously identified as an NRHP listed site), and 5-68 The Union School 1893-2004.

All inventoried VSRs of statewide significance are listed in Appendix A, along with distance to the Project Area and potential Project visibility. The locations of mapped VSRs within the visual study area are illustrated in Figure 5.

<u>Locally Significant/Sensitive Sites</u>

Beyond the scenic resources of statewide significance listed above, the 5-mile radius study area also includes areas that could also be considered regionally or locally significant/sensitive due to the type or intensity of land use they receive. These include streams, water bodies, schools, cemeteries, areas of concentrated human settlement and heavily traveled highways.

Areas of Concentrated Human Settlement

The Village of College Corner, Ohio and the unincorporated Fairview settlement occur within the visual study area.

Major Transportation Corridors

The visual study area also includes several major transportation corridors, including US RT 27 and Ohio State Routes 177, 725, & 732.

Local Parks and Playgrounds

None identified at this time.

Lakes and Rivers

No additional water bodies identified at this time.

Golf Courses

Hueston Woods Golf Course is contained within Hueston Woods State Park

Schools and Colleges

None identified

Cemeteries

Twenty-five cemeteries were identified within 5 miles of the Project Area. These cemeteries range in size from small, rural family plots with a small number of headstones, to multi-acre cemeteries associated with churches, which typically occur near population centers.

All inventoried VSRs of local or regional significance are listed in Appendix A. The locations of mapped VSRs within the visual study area are illustrated in Figure 5.

2.3 Distance Zones

Three distinct distance zones are typically defined in visual studies. Consistent with well-established agency protocols (e.g., Jones and Jones 1977; U.S. Forest Service, 1995), these zones are generally defined as follows:

- *Foreground*: 0 to 0.5 mile. At these distances, a viewer is able to perceive details of an object with clarity. Surface textures, small features, and the full intensity and value of color can be seen on foreground objects. The Project will be most visible and recognizable in the foreground distance zone.

- *Middle ground*: 0.5 to 3.5 miles. The middle ground is usually the predominant distance at which landscapes are seen. At these distances, a viewer can perceive individual structures and trees but not in great detail. This is the zone where the parts of the landscape start to join together; individual hills become a range, individual trees merge into a forest, and buildings appear as simple geometric forms. Colors will be clearly distinguishable, but will have a bluish cast and a softer tone than those in the foreground. Contrast in color and texture among landscape elements also will be reduced. From this distance zone, the Project could be visible, but individual components would become difficult to distinguish. At the outer limit of this zone, the Project would become difficult to discern as a solar installation.

- *Background*: Over 3.5 miles. The background defines the broader regional landscape within which a view occurs. Within this distance zone, the landscape has been simplified; only broad landforms are discernible, and atmospheric conditions often render the landscape an overall bluish color. Texture has generally disappeared and color has flattened, but large patterns of vegetation are discernible. Silhouettes of one land mass set against another and/or the skyline are often the dominant visual characteristics in the background. The background contributes to scenic quality by providing a softened background for foreground and mid-ground features, an attractive vista, or a distant focal point. Although the viewshed shows potential visibility within this zone, actual field conditions would make it challenging to discern the solar field from other man-made objects within the landscape.

2.4 Viewer/User Groups

Three categories of viewer/user groups were identified within the visual study area. These include the following:

- *Local Residents:* Local residents include those who live and work within the visual study area. They generally view the landscape from their yards, homes, local roads and places of employment. Residents are concentrated in and around the West College Corner and College Corner area, and the settlement of Fairfield, and along the main roadways such as US RT 27, Ohio State Routes 177, 725, & 732, and Indiana State Routes 44 & 227. However, residents are scattered throughout the entire visual study area. Except when involved in local travel, residents are likely to be stationary and have frequent or prolonged views of the landscape. Local residents may view the landscape from ground level or elevated viewpoints (typically upper floors/stories of homes). Residents' sensitivity to visual quality is variable, however, it is assumed that residents may be more sensitive to changes in particular views that are important to them.

- *Through Travelers/Commuters:* Commuters and travelers passing through the area view the landscape from motor vehicles on their way to work or other destinations. Commuters and through travelers typically are

moving, have a relatively narrow field of view, and are destination oriented. Drivers on major roads in the area (e.g., US RT 27 and Ohio State Routes 177, 725, & 732, along with Indiana State Routes 44 & 227) generally will be focused on the road and traffic conditions, but do have the opportunity to observe roadside scenery. Passengers in moving vehicles will have greater opportunities for prolonged off-road views than will drivers, and accordingly, may have greater perception of changes in the visual environment.

- *Tourists/Recreational Users:* Recreational users and tourists include local residents and out-of-town visitors involved in cultural and recreational activities. Members of this group may view the landscape from area highways while on their way to these destinations, or from the sites themselves. This group includes campers, bicyclists, recreational boaters, fishermen, hunters and those involved in more passive recreational activities (e.g., picnicking, sightseeing, or walking). Visual quality may or may not be an important part of the recreational experience for these viewers. However, for some, scenery will be a very important part of their experience, and in almost all cases enhances the quality of recreational experiences. Recreational users and tourists engaged in outdoor activities will often have continuous views of landscape features over relatively long periods of time and will typically view the surrounding landscape from ground or water-level vantage points. Recreational locations within the study area include the Hueston Woods State Park and Acton Lake areas.

3.0 VISUAL ASSESSMENT

The visual assessment procedures and analyses presented in this study are consistent with methodologies developed by various federal agencies, including the U.S. Department of the Interior, Bureau of Land Management (1986), the U.S. Department of Agriculture, National Forest Service (1996), the U.S. Department of Transportation, Federal Highway Administration (2015), and the U.S. Army Corps of Engineers (Smardon, et al., 1988). The specific techniques used to assess potential facility visibility and visual effects are described in the following section.

3.1 Viewshed Analysis

An analysis of the visibility of the Project was undertaken to identify those locations within the visual study area where there is potential for the major Project components to be seen from ground-level vantage points. This analysis included identifying potentially visible areas on viewshed maps and verifying visibility in the field. The methodology employed for each of these assessment techniques is described below.

3.1.1 Viewshed Methodology

Solar Panel Viewshed Analysis

A topographic viewshed map for the proposed solar panels was prepared using a bare earth digital elevation model ("DEM") derived from the Ohio Statewide Imagery Program's (OSIP) 2007 and the Indiana Geographic Information Office (2013) Light Detection and Ranging ("lidar") data for Preble and Union Counties along with sample points representing solar panel locations; an assumed maximum solar panel height of 14 feet; an assumed viewer height of 6 feet; and ESRI ArcGIS® software with the Spatial Analyst extension. Because the specific layout of solar panels is in the design phase, sample points representing solar panels were placed 200 feet apart in a grid pattern throughout all developable areas within the Project Area. See Figure 6, Viewshed Methodology for further information on the viewshed process.

The ArcGIS program defines the viewshed (using topography only) by reading every cell of the bare earth (or ground surface) DEM data and assigning a value based upon the existence of a direct, unobstructed line of sight to solar panel sample point location/elevation coordinates from observation points throughout the 5-mile radius study area. The resulting topographic viewshed map defines the maximum area from which any solar panel sample point could potentially be seen within the study area (i.e., ignoring the screening effects of existing vegetation and built structures). Because the screening provided by vegetation and buildings is not considered in this stage of the analysis, the topographic viewshed represents a "worst case" assessment of potential Project visibility. This "worst case" assessment significantly overstates the actual anticipated visibility of the Project, but accurately indicates areas where the Project will definitely be screened from view.

In addition, a second-level analysis was conducted to incorporate the screening effect of structures and vegetation by using the OSIP 2007 lidar data. A digital surface model ("DSM") of the study area was created from these lidar data, which includes the elevations of buildings, trees, and other objects large enough to be resolved by lidar technology. Transmission lines that were reflected in these lidar data were removed from the resulting DSM to avoid introducing artificial screening by these features. This modified DSM was then used as a base layer for the viewshed analysis, as described above. Once the viewshed analysis was completed, a conditional statement was used to set solar panel visibility to zero in locations where the DSM elevation exceeded the bare earth elevation by 6 feet or more. This was done for two reasons; 1) because in locations where trees or structures are present in the DSM, the viewshed would reflect visibility from the vantage point of standing on the tree top or building roof, which is not the intent of this analysis and 2) to reflect the fact that ground-level vantage points within buildings or areas of vegetation exceeding 6 feet in height will generally be screened from views of the Project.

Because it accounts for the screening provided by structures and trees, this second-level analysis is a more accurate representation of probable Project visibility. However, it is worth noting that because certain characteristics of the Project and the study area that may influence visibility (e.g., color, atmospheric/weather conditions, distance from viewer) are not into taken consideration in the viewshed analyses, being located within the DSM viewshed does not necessarily equate to actual Project visibility.

Substation Viewshed Analysis

Topographic and DSM viewshed maps also were prepared for the Project substation. The tallest proposed component of the substation are narrow lightning masts, with a maximum potential height of 70 feet. The precise location of these structures is not known at this time, so the analysis was run based on five representative points within the Project substation footprint, each with an assigned height of 70 feet. All other data sources and assumptions used in the substation viewshed analysis are as described above for the solar panel viewshed analysis.

3.1.2 Viewshed Results

Solar Panel Viewshed Analysis

The potential visibility of the Project, as indicated by the viewshed analyses, is illustrated in Figure 7, Sheet 1, and summarized in Table 1. As indicated by the DEM viewshed analysis of solar panel visibility, the Project will be screened by topography from approximately 36.7% of the visual study area by the limited intervening landforms. These areas include valleys along the Four Mile Creek, East Fork Four Mile Creek, and Little Four Mile Creek corridors along with the western portion of the study area where multiple river valleys and a general decrease in elevation effectively screen

views toward the Project. Similarly, in the Southeastern portion of the Study area, Action Lake and associated tributaries feeding the Lake, provide variable valley terrain which also screen views toward the Project. VSRs that will be fully screened from views of the Project based on the topography viewshed analysis are included in Appendix A. The remaining 63.3% of the visual study area is indicated as having potential visibility of some portion of the Project in this "worst case" scenario where the screening effect of existing vegetation and structures is not taken into consideration.

Table 1: Solar Panel Viewshed Analysis Results Summary

Analysis	Within the Project Area	Distance from Project Area				Comprehensive 5-Mile Study Area
		0-0.5 Mile	0.5-1 Mile	1-2 Mile	2-5 Mile	
DEM Viewshed Visibility (Based on Topography Only)	1.45 Mi^2 (100%)	6.23 Mi^2 (95.26%)	4.2 Mi^2 (70.83%)	13.23 Mi^2 (80.97%)	49.56 Mi^2 (57.10%)	73.23 Mi^2 (63.31%)
DSM Viewshed Visibility (Based on Topography, Structures, and Vegetation)	1.41 Mi^2 (97.24%)	5.38 Mi^2 (82.26%)	2.46 Mi^2 (41.48%)	5.03 Mi^2 (30.78%)	6.53 Mi^2 (7.52%)	19.42 Mi^2 (16.79%)
Total Area	1.45 Mi^2	6.54 Mi^2	5.93 Mi^2	16.34 Mi^2	86.8 Mi^2	115.67 Mi^2

Factoring in the screening effect of existing vegetation and structures, as indicated in the DSM viewshed analysis (Figure 7, Sheet 2) the potential visibility of the Project is substantially reduced. The DSM viewshed analysis provides a more realistic reflection of Project visibility, but does not consider the diminishment of Project visibility over distance due to atmospheric influences. This DSM viewshed indicates that the proposed solar panels will likely be screened by topography, vegetation and structures from approximately 83.2% of the visual study area. Visibility is concentrated within the Project Area, adjacent open fields and where multiple agricultural fields align. Long distance views are generally screened by woodlots and hedgerows and to a lesser extent as well by forest vegetation associated with the river valleys and the Acton Lake area. The DSM viewshed analysis indicates that potential Project visibility diminishes substantially at distances beyond 0.5 mile. Approximately 18% of the area within 0.5 mile is screened from view, while approximately 92.5% of the study area is screened from view at distances between 2 and 5 miles. Exceptions occur north of the Project site where multiple adjoining agricultural fields align with minimal intervening vegetation and structures.. The potential for limited visibility is indicated out to the 5 miles study area boundary. Overall, as indicated in Table 1, solar panel visibility decreases sharply with increasing distance from the Project Area. This decrease in visibility occurs both in terms of the number of solar panels visible and the geographic area from which views are available.

Based on the DSM viewshed analysis, the Project could potentially be visible from the following 5 inventoried VSRs: four transportation corridors (US RT 27, and Ohio State Routes 177, 725, & 732), and one un-named cemetery. A viewer located at one of these few resources may experience a mix of screened and open views of the Project, depending on the exact location of the viewpoint.

It should be noted that the viewshed analysis treats all structures and vegetation as if they were opaque, and therefore, small woodlots and hedgerows are assumed to fully block views of the Project. Considering leaf-on conditions, this likely will be the case. However, during leaf-off conditions, particularly narrow or sparsely wooded hedgerows and woodlots may not provide enough screening to fully obscure views of the Project. It is also important to note that the lidar data used in this analysis are from 2007, and therefore the analysis does not reflect any changes that have occurred since that time.

Substation Viewshed Analysis

As indicated by the viewshed analysis based solely on topography, the Project substation would be screened from view from 31.6% of the visual study area. Potential visibility is indicated in generally the same areas as was described for the solar panels. There are some areas where the Project substation may be visible but solar panels will be screened from view, due to the taller 70-foot structure height of the substation lightning mast compared to the maximum solar panel height of 14 feet. There are also areas along stream valleys where the topographic viewshed indicates that the substation will be screened from view but the solar panels may be visible, due to the discrete location of the substation compared to the relatively broad extent of solar panel arrays.

Factoring vegetation and structures into the substation viewshed analysis, however, greatly reduces the potential visibility of the Project substation (Figure 7, Sheets 2). Vegetation and structures, in combination with topography, will serve to screen views of the proposed substation from approximately 90.3% of the 5-mile radius visual study area (i.e., 9.7% of the study area is indicated as having potential visibility of the substation). This analysis indicates that views of the substation will be most available from open areas adjacent to the substation location with narrow bands of potential visibility extending out to the 2-mile radius and beyond. Inventoried VSRs that may have a view of the Project substation, according to this analysis, include the transportation corridors of Ohio State Routes 177 & 725. These sections of visibility are of short duration and do not extend for distances greater than 0.5 miles. Other VSRs with potential visibility are cemeteries that are within open fields and relatively close proximity to the proposed site. It is important to note that this is theoretical visibility, and that this analysis is conservatively based on five lightning mast locations within the substation footprint (as final substation design is not yet completed) and ignores the very narrow profile and gray color of the masts, which will make actual visibility difficult at greater distances.

3.2 Field Verification

3.2.1 Field Verification Methodology

EDR conducted a site visit to the visual study area on November 02, 2017. The purpose of this field review was to verify the potential visibility of the Project as suggested by the viewshed analysis, to document the type and extent of existing visual screening, and to obtain photographs for subsequent use in the development of visual simulations. Weather conditions in the field were mostly overcast with patchy sun occasionally breaking through the cloud cover. Visibility on November 2, 2017 was recorded as 10 miles which is more than adequate for the purposes of the field verification process. During the field visit consideration was also given to viewer orientation and time of day by strategically capturing the different angles at which the panels may be viewed.

During the field survey, EDR drove public roads and visited public vantage points within the study area to document points from which the Project likely would be visible, partially screened, or fully screened. These vantage points were determined by referencing certain landmarks in the landscape, such as the transmission line and lattice support structures that cross the Project Area and the existing substation. Photographs were taken from 34 representative viewpoints within the study area, as shown on Figure 8. Photographs were taken with a Nikon D7100 with a focal length between 28 and 35 mm (equivalent to between 45 and 55 mm on a full frame 35mm camera). This focal length most closely approximates the relative scale and perspective relationship of objects in the view (minimal distortion between foreground, mid-ground, and background elements). Viewpoint locations were recorded using hand-held global positioning system ("GPS") units, high resolution aerial photographs landmarks included in the photographs and high-resolution lidar data (to determine elevation). The time and location of each photograph were documented on all electronic equipment (camera, GPS unit, etc.) and recorded in field notes. Viewpoints photographed during field review generally represented the most open, unobstructed available views toward the Project Area. In instances where an open view from the Project was not available the dominant view was documented.

3.2.2 Field Verification Results

Field review suggested that the Project will be clearly visible from roadways and residential/agricultural properties directly adjacent to the Project Area. The greatest chance for visibility is where the panels are situated in open fields directly adjacent to public roadways.

Existing agricultural buildings, grain storage facilities, woodlots and hedgerows will screen the Project from more distant portions of the visual study area, as suggested by the DSM viewshed analysis. In the western portion of the study area, west of the Little Four Mile Creek corridor, the vegetation screens the view east towards the Project. To the north of the proposed arrays slightly elevated topography and the alignment of open agricultural fields allow for longer distance

views toward the Project Area. In higher density residential areas of West College Corner/College Corner and Fairview, visibility of the Project will be fully or substantially screened by the residential properties and their associated homes, out-buildings, vegetation along property lines, and suburban yard plantings. In most cases, visibility of the Project will not extend beyond adjacent roadways, and residences.. Long distance views across multiple fields are generally not available due to intervening hedgerows, which prevent open views across multiple fields. Depending on the growing season and time of year, the potential for visibility of the Project from non-adjacent residences and roadways may also be limited by crop (corn) growth in the foreground and middle ground agricultural fields. Where the Project does not occur immediately adjacent to a residence or roadway, and open fields do align, visibility of the Project will decrease dramatically as distance from the Project increases (see Figure 9). The combination of relatively low panel height, along with existing hedgerows, to a lesser extent slight topographic relief, and the atmospheric effects of distance, will limit visibility of the Project from the majority of the study area.

Field review indicated that the views from various portions of the road network within the study area will vary greatly depending of the road type/classification and associated visual character. US RT 27 has a wider corridor allowing for a more open feeling with longer distance views. However, field review confirmed the results of the viewshed analysis, which suggests that there is approximately a 0.5 mile stretch of US RT 27 with potential intermittent visibility of the proposed Project. The much smaller side/agricultural roads are more enclosed, with limited long-distance visibility. During the growing season agricultural crops can also create a tunnel effect along these roads. With the exception of roadways and resources directly adjacent to the Project, open views to the Project Area were generally not available from the majority VSRs within the study area. This is also confirmed by the DSM viewshed analysis.

3.3 Visual Simulations

Beyond evaluating the potential visibility of the Project, the VRA also examined the potential for visual impact associated with the proposed solar arrays and Project substation on the VSRs and viewer groups within the visual study area. This assessment involved accurately superimposing 3D models of the Project into existing photographs from key viewpoint locations in order to create visual simulations. . These simulations were used to characterize the type and extent of visual impact resulting from the construction and operation of the Project. Details of the visual impact assessment procedures are described below.

From the photographic documentation conducted during field review, EDR selected four viewpoints for the development of visual simulations. These viewpoints were selected based upon the following criteria:

1. They provide clear, unobstructed views of the planned Project (as determined through field verification).

2. They illustrate visibility of the Project from sensitive sites where views of the Project will be available.
3. They illustrate typical views from different landscape character zones where views of the Project will be available.
4. They illustrate typical views of the proposed Project that will be available to representative viewer/user groups within the visual study area.
5. They illustrate typical views from a variety of viewer distances and orientations.
6. They illustrate visibility/contrast of the solar arrays under different lighting conditions and with different panel orientations, to illustrate the range of visual change that will occur once the Project is in place.

The location of the selected viewpoints is indicated in Figure 8. Location details and the criteria for selection of each simulation viewpoint are summarized in Table 2, below:

Table 2. Viewpoints Selected for Simulation and Evaluation.

VP	Location	Township	Landscape Character	Distance to Nearest Module	Direction of View	Time Taken
03	South State Line Road	Israel	Agricultural /Utility	Adjacent	Northeast	4:30 pm
09	County Road 41 (Fairhaven College CRNR Rd.)	Israel	Agricultural	Adjacent	North	4:49 pm
15	South State Line Road	Israel	Agricultural /Utility	0.2 mile	Southeast	5:07 pm
23	State Route 177	Israel	Agricultural/ Transportation	0.42 mile	Northwest	5:34 pm

3.3.1 Visual Simulation Methodology

To show visual changes that are expected to occur as a result of Project installation, high-resolution 3D models were used to create realistic photographic simulations of the Project from each of the four selected viewpoints. These simulations were developed by constructing a three-dimensional computer model of the proposed solar panels, arrays and maximum layout based on specifications and survey coordinates provided by the client. For the purposes of this analysis, it was assumed that the solar panels would be single axis trackers, with dimensions and spacing as indicated in Figure 2.

Simulations were created by aligning each photographic viewpoint with the computer model of the Project and then superimposing the model on the photograph. This step involves utilizing aerial photographs and GPS data collected in the field to create an AutoCAD Civil 3D® drawing. The two-dimensional AutoCAD data were then imported into

AutoDesk 3ds MAX® and three-dimensional components (e.g., cameras, modeled arrays, fencing) added. These data were superimposed over photographs from each of the viewpoints, and minor camera changes (height, roll, precise lens setting) made, as necessary, to align all known reference points within the view. This process ensures that the elements of the Project are shown in proportion, perspective, and proper relation to the existing landscape elements in the view. Consequently, the alignment, elevations, dimensions, and locations of the proposed structures will be accurate and true in their relationship to other landscape features in the photograph.

At this point, a "wire frame" model of the Project and known reference points are shown on each of the photographs. The proposed exterior color/finish of the proposed equipment is then added to the model and the appropriate sun angle is simulated based on the specific date, time and location (latitude and longitude) at which each photograph was taken. This information allows the program to realistically illustrate highlights, shading and shadows for each individual array shown in the view. All simulations show the panels oriented perpendicular to the sun, on an east-west axis, and mounted on north-south aligned arrays. Figure 10 provides an illustrated presentation of the simulation process.

The visual simulations show the visual effect of the Project assuming that no vegetative screening or other potential visual mitigation measures are included in the Project, and therefore present a conservative scenario. However, potential visual mitigation measures for the Project are discussed in Section 4.2, and examples are provided in Figure 13.

3.3.2 Visual Simulation Results

The four simulations prepared for the VRA illustrate views of the Project that will be available from representative distances, directions, VSRs, and/or landscape contexts within the study area. Potential visual effects of the Project that are illustrated in these simulations are summarized below. Full size versions of each visual simulation are included in Figure 11.

Simulation 1 (Viewpoint 3): Proposed Conditions

Inset 10 - Proposed Conditions

Viewpoint 3 is situated on South State Line Road in Israel Township, looking north-northeast. The existing view features an agricultural setting, with open, harvested fields in the foreground backed by active corn fields in the middle ground. Beyond the active agricultural fields, parts of a rural residence, a red barn, and associated agricultural fields are visible. South State Line Road is lined with roadside signs and utility poles, and proceeds away from the viewer towards a distant tree line, which forms the visible horizon. In the middle ground, an overhead transmission line crosses the road and runs perpendicular to the existing roadside utility lines.

With the proposed Project in place, the fields east of South State Line Road are now occupied with solar equipment enclosed by chain-link fencing. While some of the distant tree line and middle ground foliage are still visible, a majority of the middle ground landscape features are screened by the solar equipment in the foreground. Much of the horizon is now occupied by the proposed Project. The setback of the Project from the edge of pavement to the boundary fence maintains an open view corridor down the axis of

Inset 11 - Existing Conditions

South State Line Road. However, the Project becomes the dominant feature in the view and changes the character of the view from agricultural to utilitarian.

Simulation 2 (Viewpoint 9): Proposed Conditions

Inset 12 - Proposed Conditions

Viewpoint 9 is looking north-northwest from County Road 41 (Fairhaven College CRNR Road) in Israel Township. The existing view features a harvested agricultural field in the foreground, interrupted by an irregular line of hedgerows and denser woodlots in the background. County Road 41 is lined with utility poles which proceed away from the viewer towards the wooded background. To the northwest, an additional utility line is faintly visible between the harvested fields and the hedgerow. The existing view feels open and expansive, with minimal man-made features in the landscape.

Inset 13 - Existing Conditions

With the proposed Project in place, the foreground field is now occupied by an array of solar panels and enclosed by chain-link fencing. A portion of the lower and more distant hedgerows become screened by the proposed Project, the higher woodlots, closer to the roadside are still visible above the solar equipment. The solar array also blocks partial views of the utility line to the northwest, and the bisected utility poles can be seen projecting above the solar panels. A strip of open field remains at the road edge, but the solar panels become the visual focal point, and in combination with the presence of the existing utility structures, enforce the utilitarian character of the view.

Simulation 3 (Viewpoint 15): Proposed Conditions

Inset 14 - Proposed Conditions

Viewpoint 15 is to the east from South State Line Road in Israel Township, approximately 0.2 miles from the proposed Project. The existing view features a harvested corn field in the immediate foreground that backs up to a farm with a residence and associated barns. Beyond the harvested field in the foreground, a patchwork of open fields surrounding the farmstead are visible. Around the cluster of buildings that comprise the farmstead, a few trees and a row of ornamental shrubs can be seen. The horizon is defined by a dense tree line, which blocks views of more distant landscape features and is partially screened by an active agriculture field in the background. The existing landscape is predominantly rural/agricultural. With the proposed Project in place, the middle ground and background agricultural fields are now occupied by an array of solar panels enclosed by a chain link fence. Due to their distance from the viewer and uniform shape and color, it is difficult to distinguish individual panels within the array. The rural residence and associated buildings in the background are now partially screened by the addition of the proposed Project, with only the upper portions of the buildings visible above the array. Although a background feature, the solar panels introduce a new land use and change the character of the view from rural/agricultural to more utilitarian.

Inset 15 - Existing Conditions

Simulation 4 (Viewpoint 23): Proposed Conditions

Inset 16 - Proposed Conditions

Viewpoint 23 looks northwest from State Route 177 in Israel Township, approximately 0.4 miles from the nearest portion of the Project Area. The existing view features an active cornfield that follows the length of the road towards the visible horizon. The field is backed by a row of deciduous trees, and in the middle ground small woodlots interrupt the agricultural fields along the roadside. On the eastern side of the road, the road is lined with utility poles that proceed away from the viewer. The horizon is formed by a distant tree line, which blocks views of more distant landscape features. With the proposed Project in place, the middle ground and background agricultural fields are now occupied by an array of solar equipment. From this distance, it is difficult to distinguish individual solar panels among the array. The panels appear to be similar in scale to the existing crop, but contrast in color and form. While the dark color and man-made nature of the panels is different than rural residential/agricultural character of the existing view, the contrast of the structures is lessened by their low height, the presence of existing utility structures, and the effects of distance. The panels do not significantly alter the rural character of the view and, and the Project's overall visual effect is minimal from this viewpoint.

Inset 17 - Existing Conditions

3.4 Electrical System

Inset 18 – Existing Substation as viewed from South State Line Road in Israel Township, Preble County Ohio. (Viewpoint 4)

Inset 19 – Example of a substation within the landscape similar in size to the proposed substation.

The proposed substation is located in an agricultural field, adjacent to a farm complex on the east side of South State Line Road, just north of East Greenwood Church Road. The proposed substation will tie into the existing College Corner Substation which is located on the west side of South State Line Road.

Due to the presence of the existing substation in the vicinity of the proposed substation, it is unlikely that the addition of the proposed substation will diminish the existing visual character of the visual study area. The collection system will be buried underground and have no above ground components and therefore will not introduce any visual changes. The gen-tie, if installed as an overhead line, will consist of two additional structures in the vicinity of much taller structures associated with the existing College Corner Substation.

The proposed substation will incorporate movement sensors for the security lighting, which will minimize off-site lighting impacts. In addition, all security and work related lights will be full cut-off, downward facing fixtures designed to minimize light pollution and/or direct glare lighting impacts.

3.5 Reflectivity and Glare

The potential for reflectivity or glare from a PV system is generally lower than the glare and reflectance generated by common reflective surfaces in the surrounding environment. However, glare is frequently raised as a possible concern for solar PV installations. PV panels are designed to absorb as much of the solar spectrum as possible to maximize

generation efficiency and there is an inverse correlation between light absorption and reflection. Consequently, virtually all PV panels installed in recent years have at least one anti-reflective coating to minimize reflection and maximize absorption. The reflectivity of a surface is often measured as albedo, which is the fraction of solar energy reflected by that surface. For comparison, the albedo of PV panels (0.10 -0.30) (Lasnier and Ang, 1990) is generally similar to, or lower than many natural surfaces such as coniferous forests (0.20), grasslands (0.25), dry sand (0.45), and snow cover (0.50) (Budikova, 2010). Furthermore, the glare and reflectivity of PV panels have been found to be lower than the glare and reflectivity generated by standard glass (SunPower, 2009).

4.0 CONCLUSIONS

4.1 Visual Assessment Summary

The results of the VRA for can be summarized as follows:

- Land use within the 5-mile radius visual study area can be generally characterized by a mix of open agricultural fields with of farm buildings and grain silos, sparse rural residential properties, forested hedgerows and woodlots, and utility corridors. The Project Area itself is located on private active agricultural land.
- Multiple visual resources of statewide and national significance exist within the visual study area. These include four NRHP sites, one state park, one national natural landmark, one NRE site, two historic bridges, and one National Scenic Byway. None of these resources will have Project visibility based on the DSM viewshed analysis and/or field review.
- The viewshed analysis, based on topography alone determined that views of the proposed panels will be fully screened in 36.7% of the study area.
- Factoring structures and vegetation into the viewshed analysis drastically reduces potential visibility of the Project, and is a far more accurate reflection of the likely extent of Project visibility. This analysis indicates that the proposed solar panels will be screened from view in approximately 83.2% of the visual study area, and the proposed substation will be screened from 90.3% of this area. Visibility is concentrated within the the open fields located immediately adjacent to the Project. The viewshed analysis indicates that the Project will generally not be visible from areas located more than 2.5 miles away.
- Field review indicated that the actual visibility of the Project is likely to be even more limited than suggested by the DSM viewshed analysis. Visibility of the Project is largely restricted to areas within 0.5 mile of the Project Area, including portions of Ohio State Route 177 and 725. Beyond 0.5 miles, screening provided by woodlots and hedgerows, in combination with the low height of the Project, significantly limit Project visibility. Even where open views may be available, visibility of the Project beyond 2.5 miles is anticipated to be insignificant because the proposed solar panels, due to their low profile, will become indistinguishable from surrounding landscape features. The absence of elevated vantage points further adds to the lack of visibility from the background and midground distance zones.
- Four visual simulations illustrate representative views of the Project from various foreground and near mid-ground distances, as well as different viewer circumstances, and landscape contexts within the study area. Simulation 1 (Viewpoint 3) was selected to provide a representative view from an adjacent road corridor within the study area with the panel angle facing the viewer which reveals the maximum height and exposure of the Project. This simulation also provides a view of the proposed substation.

- Simulation 2 (Viewpoint 9) provides another example of views looking down a local transportation corridor demonstrating panels in the neighboring fields. However, from this viewpoint the angle of the panels in this view demonstrates potential views of the back of the panels and supporting racking system.
- Simulation 3 (Viewpoint 15) demonstrates the relative diminishment of Project visibility when viewed from locations outside of the Project area. Due to the low profile of the solar panels and fence enclosure, the Project tends to become less dominant in the landscape.
- Simulation 4 (Viewpoint 23) demonstrates a more distant view of the Project (0.42 miles) from SR 177. At this distance, the Project becomes a minor feature in the landscape and foreground crops combined with existing midground features such as hedgerows and utility poles remain a dominant feature in the landscape.
- The proposed Project will introduce a new utilitarian feature to the landscape, which may adversely impact the agrarian character of the area, particularly when viewed from roads and residential areas that are situated directly adjacent to the Project.
- Viewshed analysis, field review, and visual simulations indicate that the Project's visibility and visual impact will be minimal at distances beyond 0.5 mile.

4.2 Mitigation

There are a variety of visual mitigation options that can be applied to solar projects. Visual mitigation options are typically evaluated based on the existing visual character, the type and location of existing aesthetic features, existing vegetative screening, and the visual sensitivity of impacted areas. Approaches to visual mitigation for solar projects typically include selection of equipment/technology, siting/setbacks, fencing, and screening. Each of these mitigation options is further discussed below:

- *Equipment/Technology:* Photovoltaic panels have a low-profile (i.e., typically lower than 14 feet in height), which limits their visibility and potential visual effect in terms of the distance from which the panels will be visible. However, the large horizontal areas required to achieve the necessary scale of electrical production for utility-scale solar projects can result in visual impacts for viewers located in areas immediately adjacent to the project. Other elements of project design, such as burying proposed electrical interconnects, are intentional design measures that avoid visual impacts.

- *Siting*: Proper siting considerations for solar projects include avoidance of areas with significant VSRs and selection of project sites that are not in the vicinity of resources used by the public for recreation. Siting the project in open agricultural lands minimizes the potential need for tree clearing and associated visual impacts, and the network of existing woodlots and hedgerows around those agricultural fields serve to minimize project

visibility from nearby areas. In addition, collocating electrical facilities (such as the substation) with existing electrical infrastructure minimizes visual impacts.

- *Setbacks:* Appropriate setback distances should be determined based on the sensitivity of the adjacent uses. For instance, larger setbacks may be appropriate for areas adjacent to residences or public recreational areas, but smaller setbacks would be acceptable in areas adjacent to agricultural, industrial, forest, or vacant land.

- *Fencing*: Security fencing can contribute to the visual impact of solar projects sited in rural areas. However, security fencing is required for solar projects for safety and security of the public. Depending on specific codes, permitting, and safety concerns, decorative or specific vernacular fence styles in selected locations may be considered if there are specific existing styles, materials, or designs that relate to existing features in the project area. In these cases, selection of fence styles is typically based on precedent examples on adjacent properties or within the local community so that when installed, the project would better blend into the existing visual setting.

- *Screening*: Visual screening typically involves planting of vegetation intended to screen or soften views of the solar project. Common approaches to visual screening include:

    - *Pollinator-Friendly Grasses and Wildflowers*: In many agricultural areas, installation of hedges or shrubs may not be in keeping with the existing visual setting, which is typically characterized by open fields backed by occasional hedgerows or woodlots. Trees, shrubs, or tall vegetation along roadsides are often atypical in these settings. An alternative form of vegetative screening that may be appropriate in these areas is use of tall native grasses and wildflowers along selected roadsides and other fence lines to soften the appearance of the project and better integrate the project into the landscape. Regionally appropriate plantings can also provide habitat for pollinator species when planted around the periphery of the site and/or in locations on site where mowing can be restricted during the summer months. Leaving the taller plants un-mowed during the summer provides benefits to pollinators, habitat for ground nesting/feeding birds, and cover for small mammals, in addition to softening the appearance of the project. Consistent with this approach, low growing/groundcover native species can also be planted under the solar panels and between arrays.
    - *Evergreen Hedges*: Use of vegetation for mitigation can include installing a screening hedge made up of evergreen trees and shrubs along roadways and/or selected portions of the exterior fence line of the Project. This approach is effective and commonly implemented in urban and suburban settings, however, it may not be appropriate in some settings where the introduction of evergreen hedges

would be inconsistent with the native vegetation and existing visual setting. Evergreen vegetation also provides year-round screening of the Project.

- *Native Shrubs and Trees*: An alternative to evergreen hedges, which may not appear naturalized or appropriate in many settings, is use of native shrub and tree plantings along road frontages and/or selected portions of the exterior fence line of the project. This approach does not typically result in plantings that completely screen views of the project, but instead serve to soften the overall visual effect of the project and can help to better integrate the project into the surrounding landscape. Plantings should be selected based on aesthetic properties, to match with existing vegetation in the project vicinity, and the ability to grow in the specific conditions of a project area. In addition to helping to blend the project into the surrounding landscape, use of native plant species can also provide food and cover for local wildlife communities. Additionally, depending on the region, evergreen planting can be included in the native plant palette.

Mitigation concepts that have been considered for this Project are illustrated in Figure 12. Visual simulations that show potential visual mitigation treatments for the Project are shown in Figure 13.

Specific mitigation measures that have been incorporated into the Project design and/or are being considered for the Project include the following:

Equipment/Technology

- The specific materials, and the associated textures and colors, to be used in the components of the Project have not yet been determined, but will be typical of other large-scale, ground-mounted solar projects in the U.S. Racking will be largely metal, such as aluminum and galvanized steel, and will have a smooth texture and be of a grey or silver color. Panels will be comprised of the materials previously described, with the exterior layer consisting of a glass cover within a metal frame. The panels will have a relatively smooth texture and are black or another dark color.
- The Applicant holds land rights to operate the Project for up to 40 years, and the Project is expected to operate for at least that period of time. At the end of that period, Applicant would either re-power the Project with state-of-the-art PV technology, which would require the consent of the participating land owners, or remove the Project. With very few concrete foundations, the equipment less than 3 feet below grade can be easily removed and the land restored to essentially its original condition. If the participating land owners desire, the land can be returned to cultivation.
- The proposed collection lines will be buried underground to avoid visual impacts.

- Proposed substation equipment will be similar in technology, materials, appearance, and scale to existing substation, which will minimize contrast with the existing landscape.
- Other than the substation, and a few other select locations, no facilities within the Project will require night lighting, which will minimize light pollution/nighttime visual impacts.
- The proposed substation will incorporate movement sensors for the security lighting, which will minimize the amount of time that the lights are on and avoid significant off-site lighting impacts.
- All security and work related lights will be shielded, downward facing fixtures design to minimize light pollution and/or off-site lighting impacts.

Siting/Setbacks

- The Project has been sited so as to avoid or minimize visual impacts to the surrounding area. Due to the screening provided by existing woodlots and hedgerows, visibility will generally be concentrated within 0.5 miles of the Project and there is very limited visibility of the Project at distances greater than 1 mile (see Section 3.1.2 and Table 1).
- The Project is sited so that there is no visibility from any historic structure and very limited visibility from other VSRs within the study area (i.e., visibility is essentially restricted to adjacent public roads).
- The solar arrays will generally follow the existing topography of the Project Area, and will be constructed on existing grades. Only minimal grading or vegetation clearing will be required and most of the land surface within each solar field, including almost all of the area below the arrays themselves, will be planted with a robust, low-growing seed mix, consisting primarily of native grasses.
- The Project substation has been co-located with the existing College Corner Substation located off of County Road 600 (Stateline Road). This avoids the introduction of electrical infrastructure in new areas where that infrastructure could contrast with existing landscape character.
- To provide appropriate distances between the Project and the general public, the solar arrays will be designed to incorporate several minimum setbacks. These will include the following:
    1. a 25-foot setback between the perimeter fence of a solar array and the edge of pavement of any public road,
    2. a 40-foot setback between the any above-ground equipment within a solar array and the edge of pavement of any public road,
    3. a 10-foot setback between the perimeter fence of a solar array and the property line of any non-participating parcel,
    4. a 25-foot setback between any above-ground equipment within a solar array and the property line of any non-participating parcel, and

5. a 100-foot setback between any above-ground equipment within a solar array and any habitable residence located on a non-participating parcel.

Fencing

- Fencing is expected largely to be standard, 7-foot tall chain-link material.
- The use of alternative fencing such as black vinyl coated fencing, or wood post and welded wire fencing, could be implemented in selected areas in response to any specific public and/or landowner concerns, so long as these options comply with current or future codes governing electric generating facility safety and security.

Screening

- A landscape plan showing potential mitigation areas and design will be part of the final Project.
- The Applicant is considering including as a component of the landscape plan, pollinator-friendly grasses and wildflowers along selected roadsides and other fence lines to soften the appearance of the Project and better integrate the Project into the landscape (see example simulations included in Figure 13). The Applicant anticipates using a mix of native pollinator wildflowers and grasses that will be selected based on their aesthetic and environmental properties, and their ability to grow in the conditions of the Project Area. Examples of the types of seed mixes that are being considered include the Eastern Great Lakes Native Pollinator Mix and the Wet Soil Native Seed Mixes[1]. These plantings would be installed in the setback space between the Project perimeter fence and the edge of road rights-of-way. The recommended seed mix would grow to an average height of 4-6 feet during the growing season. As shown in Figure 13, the introduction of the pollinator species would soften the horizontal lines created by the security fence and reduce the visual contrast resulting from the Project. In addition, leaving the taller plants un-mowed during the summer would provide ecological benefits including, pollinator benefits, and habitat for small mammals and birds. As noted previously, low growing/groundcover native species will be planted under the solar panels and between arrays to minimize the need for maintenance (mowing) while maintaining the naturalized appearance of the Project Area.
- The Applicant is considering the installation of native shrubs and trees in selected sensitive areas, such as along fence lines adjacent to residences. Use of native shrubs and trees would serve to soften the overall visual effect of the Project. The landscape planting plan would consider existing aesthetic properties, and

[1] These seed mixes are available from the Ohio Prairie Nursery (www.ohioprairienursery.com) and are representative of the types of plantings that will be considered for the Project.

would complement the existing vegetation at a given location. In addition to the screening benefits, the use of native plant species would also provide wildlife habitat benefits.

- The introduction of earthen berms (or other earthworks) would likely require material to be imported to the site, which is not being considered for this Project. Additionally, due to the relatively flat terrain in the Project area, berms can appear out of character.
- The Applicant anticipates that selecting locations for the potential placement and/or installation of plantings for visual mitigation will be determined based on review of public comments and/or concerns raised by individual landowners.

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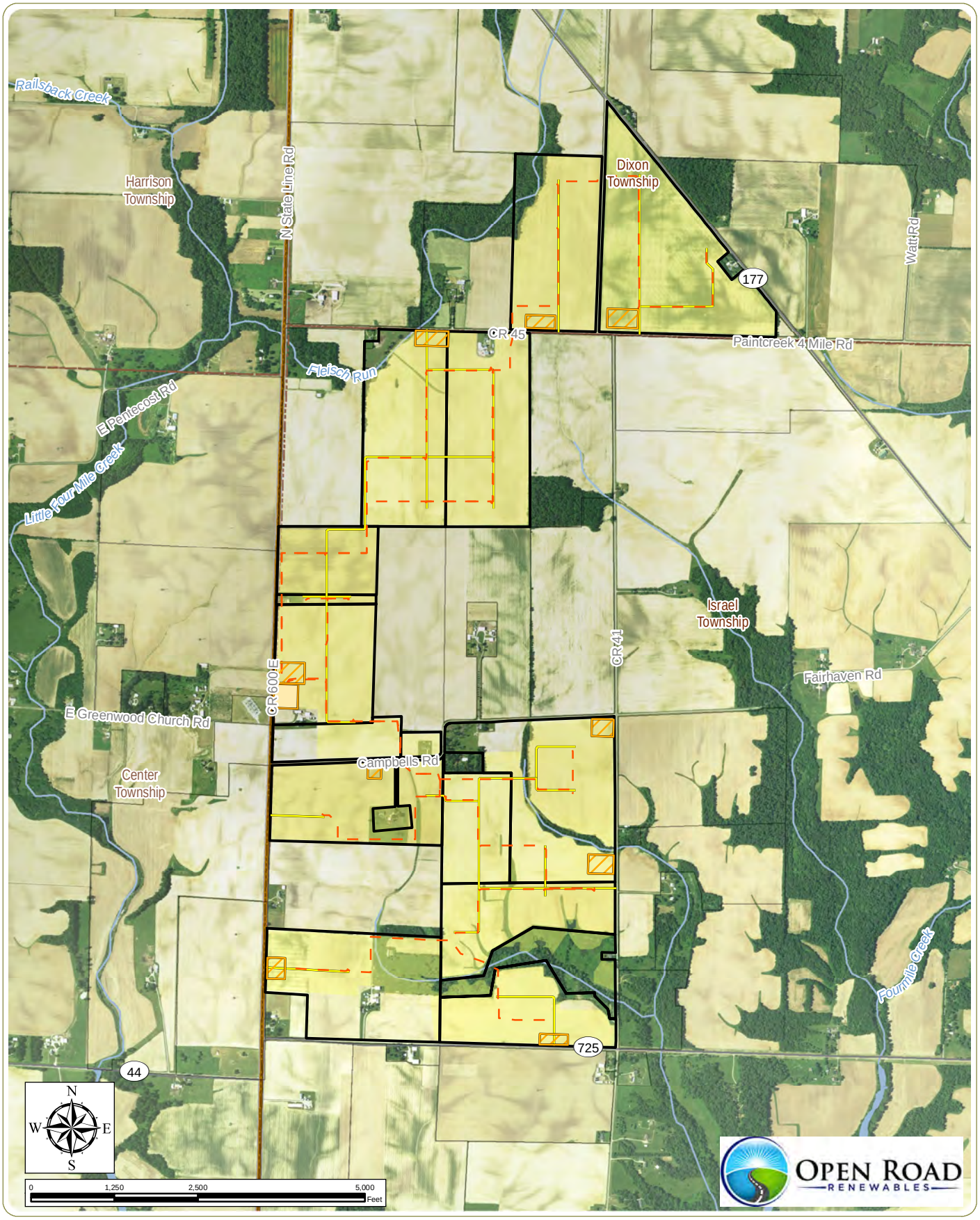
Figures



Angelina Solar

Dixon and Israel Townships, Preble County, Ohio

Figure 1: Proposed Project Layout

Notes: 1. Basemap: USDA NAIP "Ohio 0.5m" orthoimagery map service. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

- Access Road
- Collection Line
- Laydown Yard
- Substation
- Potential Solar Array
- Project Area
- State Boundary
- County Boundary
- Township Boundary

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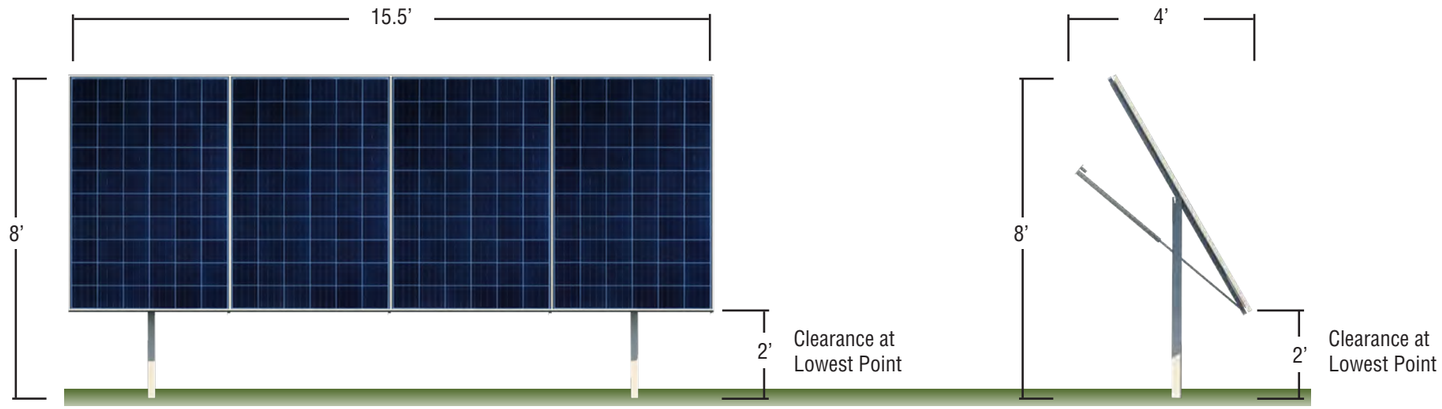
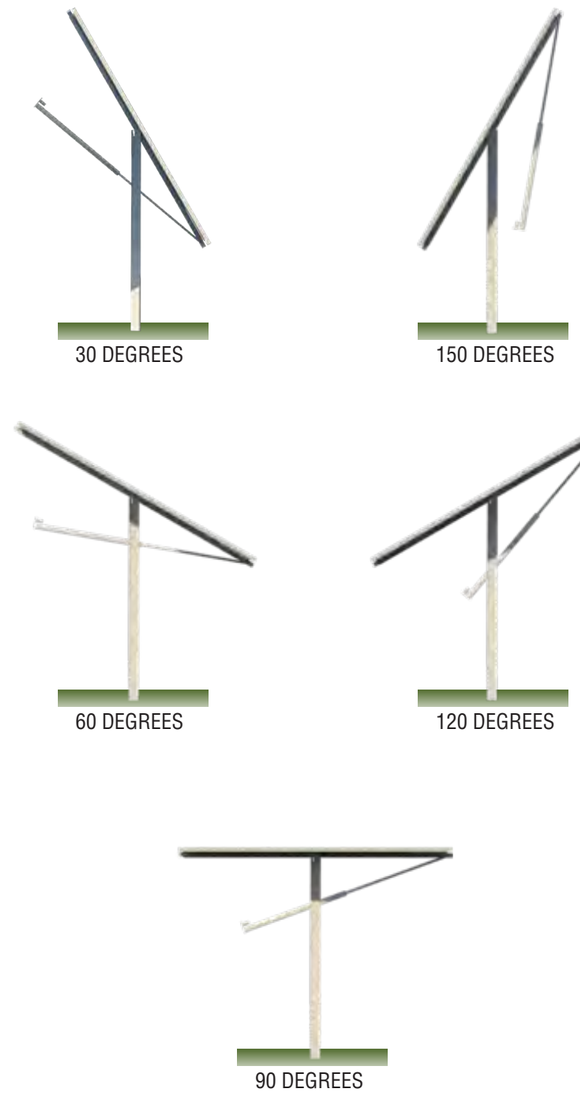
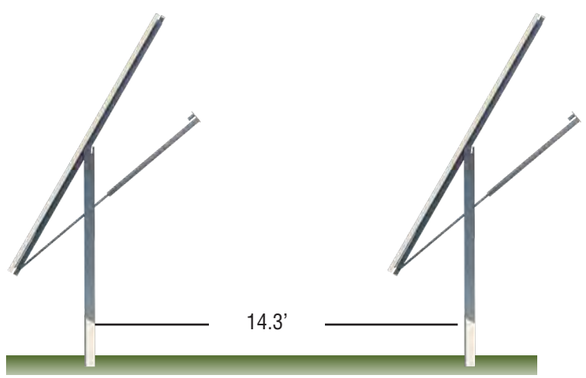


Solar Panel - Q Cell

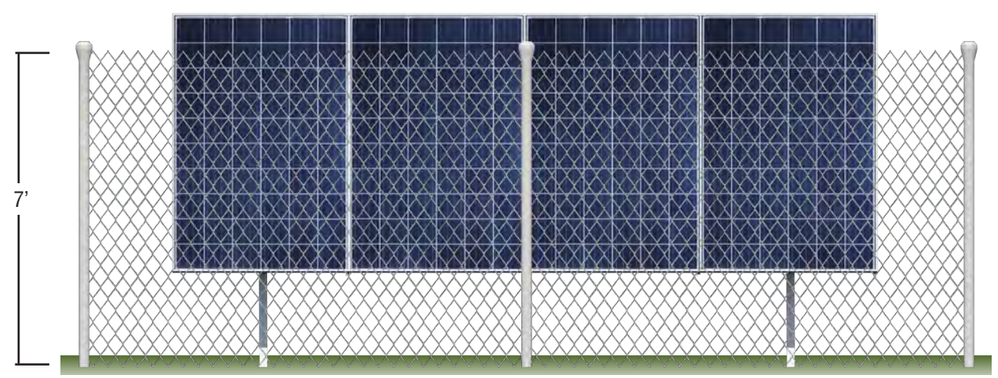
Solar Panel - Q Cell

Solar Panel - Sun Angle Based Tracking





14.3' Spacing Between Rows



Proposed Fencing - Chain link Fence

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Figure 2: Computer Model of Solar Panel
Sheet 1 of 2

OPEN ROAD RENEWABLES

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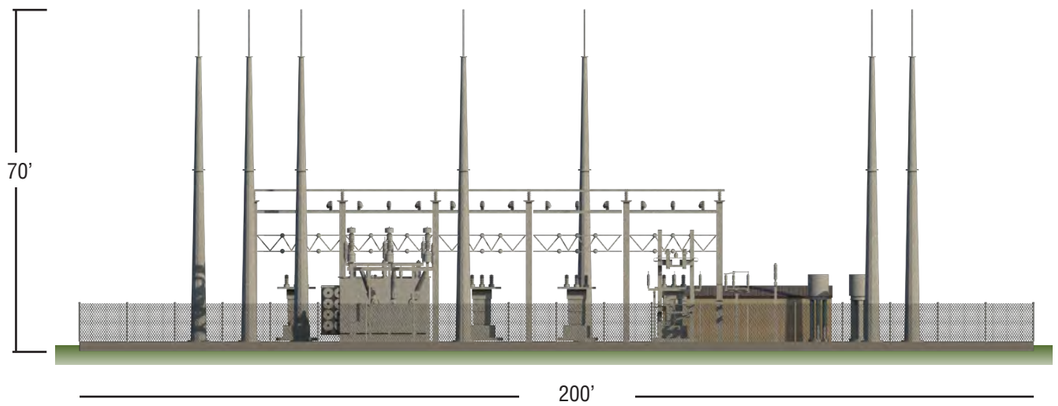
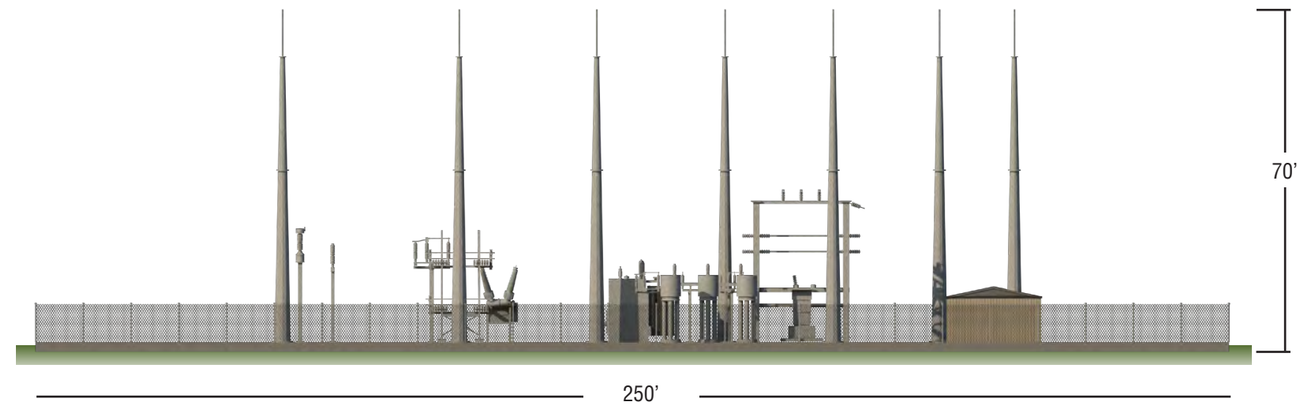
Representative Substation - Front Elevation



Representative Substation - Side Elevation



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Dixon and Israel Townships, Preble County, Ohio

Figure 2: Computer Model of Representative Substation

Sheet 2 of 2

OPEN ROAD RENEWABLES

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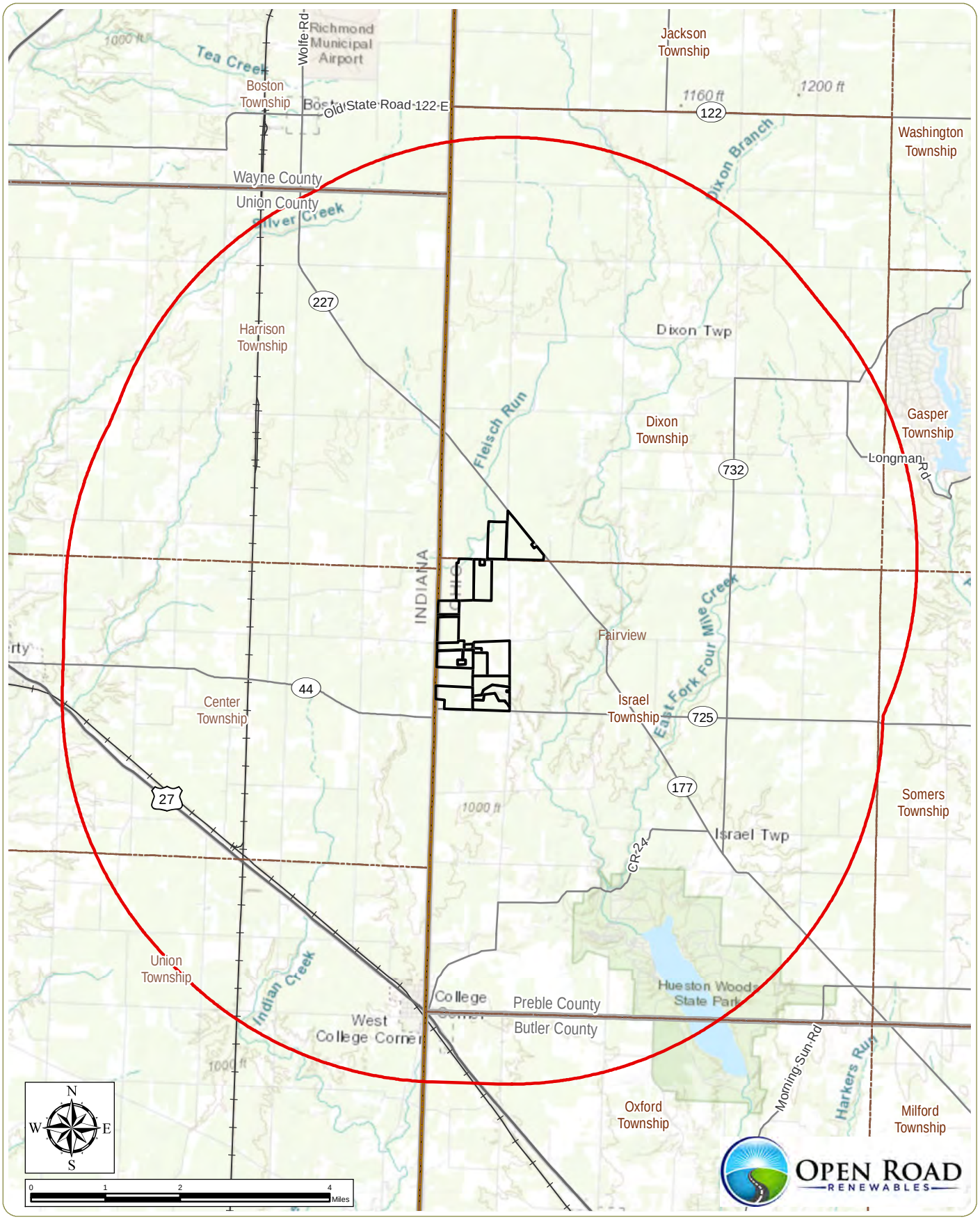

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Figure 3: Visual Study Area

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

- 5 Mile Study Area
- Project Area
- State Boundary
- County Boundary
- Township Boundary

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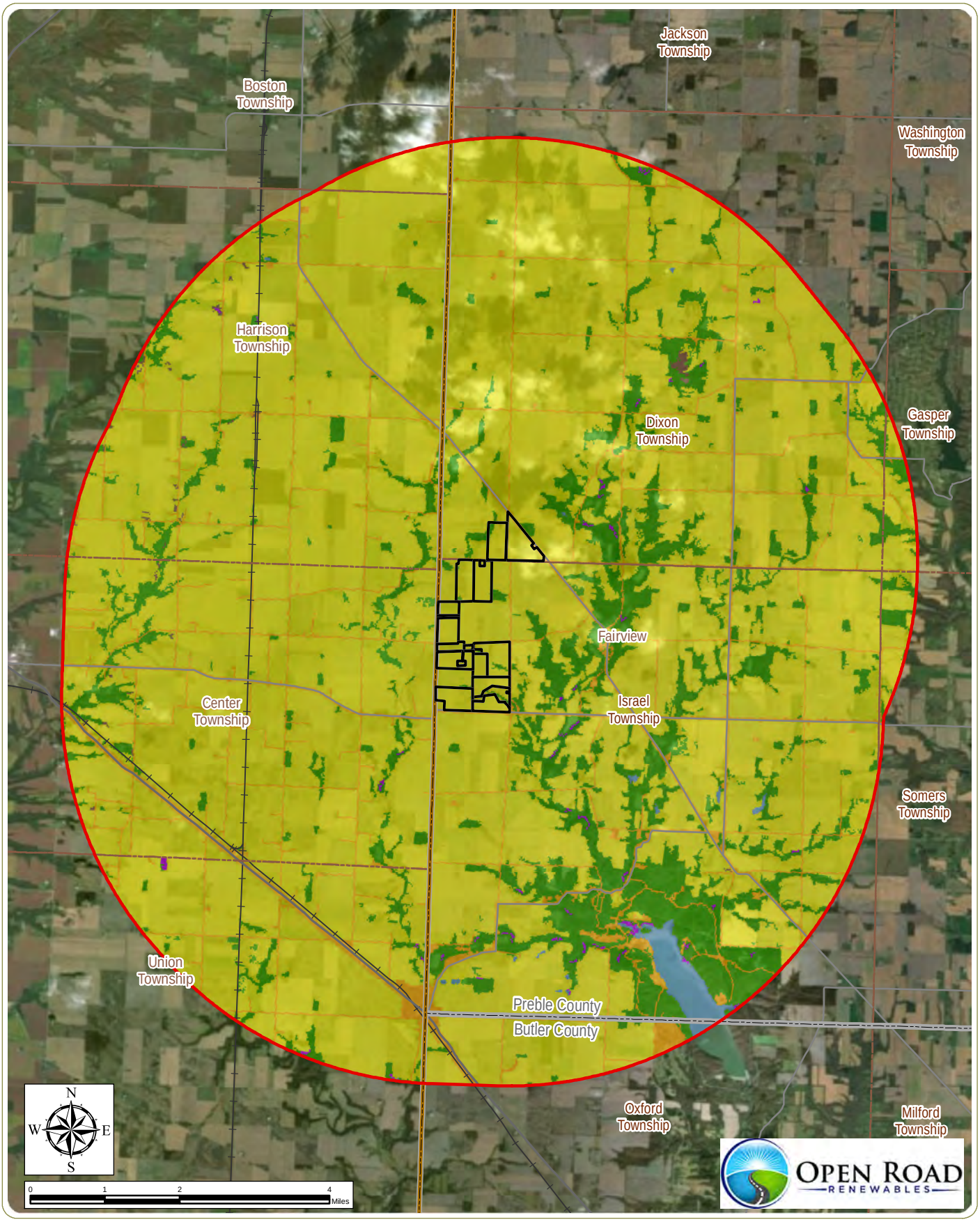

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Figure 4: Land Use

5 Mile Study Area
Project Area
State Boundary
County Boundary
Water
Developed
Barren Land
Forest
Grassland/Shrubland
Agricultural
Wetland

Notes: 1. Basemap: ESRI ArcGIS Online "World Imagery" map service.
2. This map was generated in ArcMap on November 28, 2018.
3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

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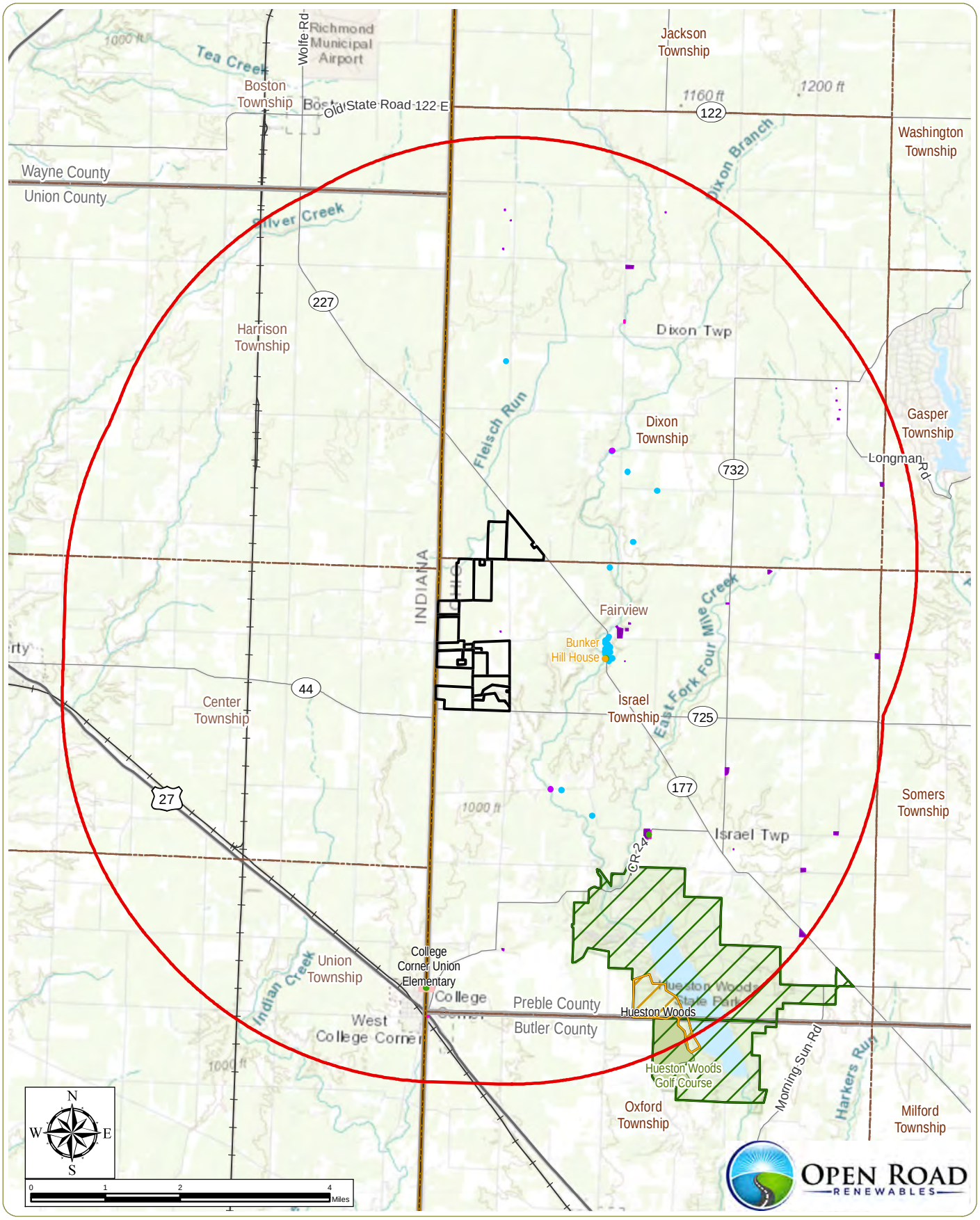

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Figure 5: Visually Sensitive Resources

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

- NRHP Listed Resource
- ODOT Bridge
- Ohio Historical Marker
- Ohio Historic Structure
- School
- Cemetery
- National Natural Landmark
- NRHP-Eligible Site
- ODNR State Park
- Golf Course
- Project Area
- 5 Mile Study Area
- Township Boundary
- County Boundary
- State Boundary

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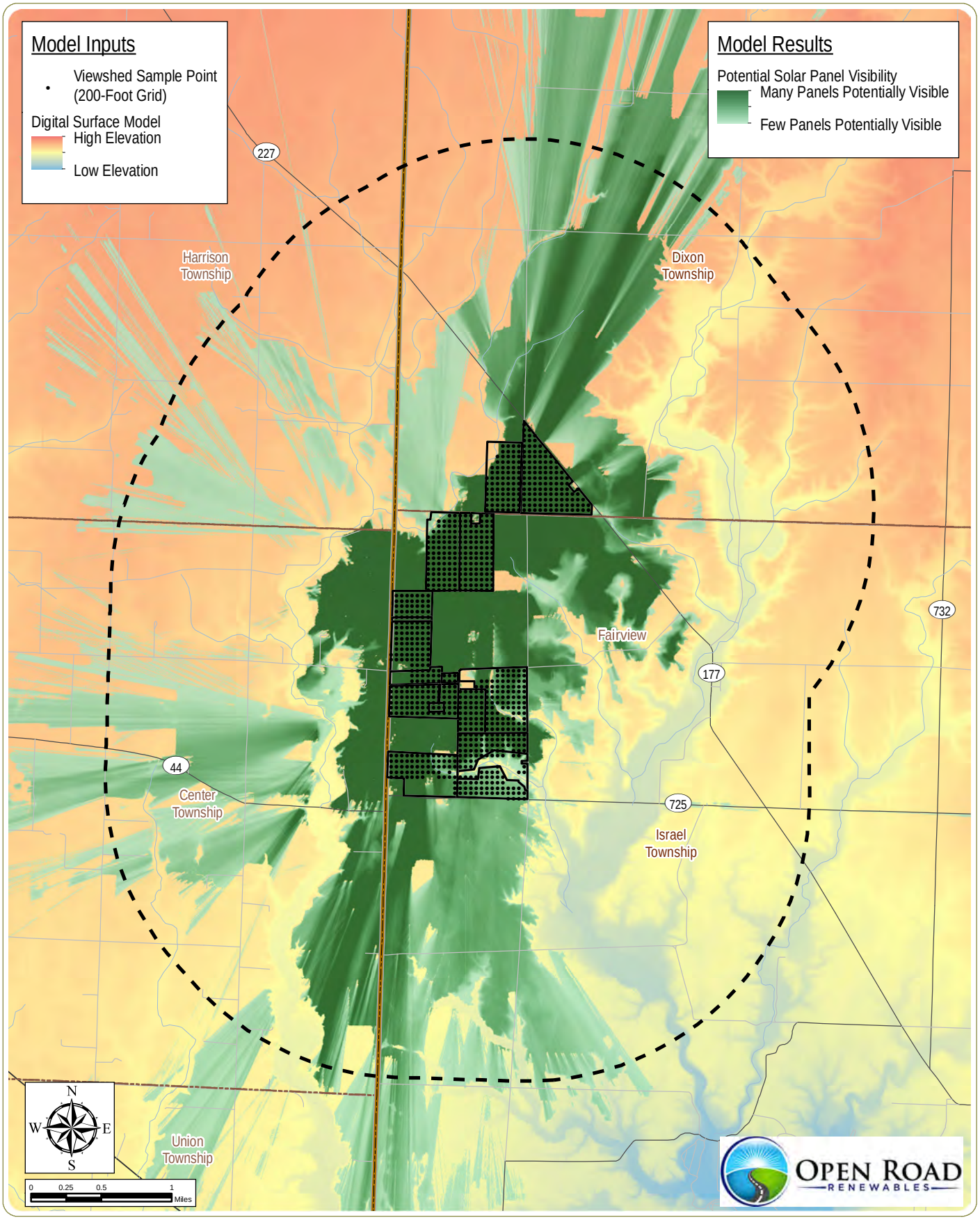

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2 Mile Study Area
Project Area
State Boundary
Township Boundary
County Boundary

Figure 6: Viewshed Methodology

Notes: 1. Basemap: ESRI StreetMap North America, 2012. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data. 4. CONFIRM Potential solar panel viewshed visibility is based on the screening effects of topography, vegetation, and man-made structures as represented in the OGRIP State of Ohio 2007 LIDAR dataset (resampled to 5-foot resolution). Sample points representing solar panels were placed on all developable areas within the Project parcels in a grid pattern with a spacing of 200 feet as a basis for this analysis. Viewshed analysis based on assumed maximum solar

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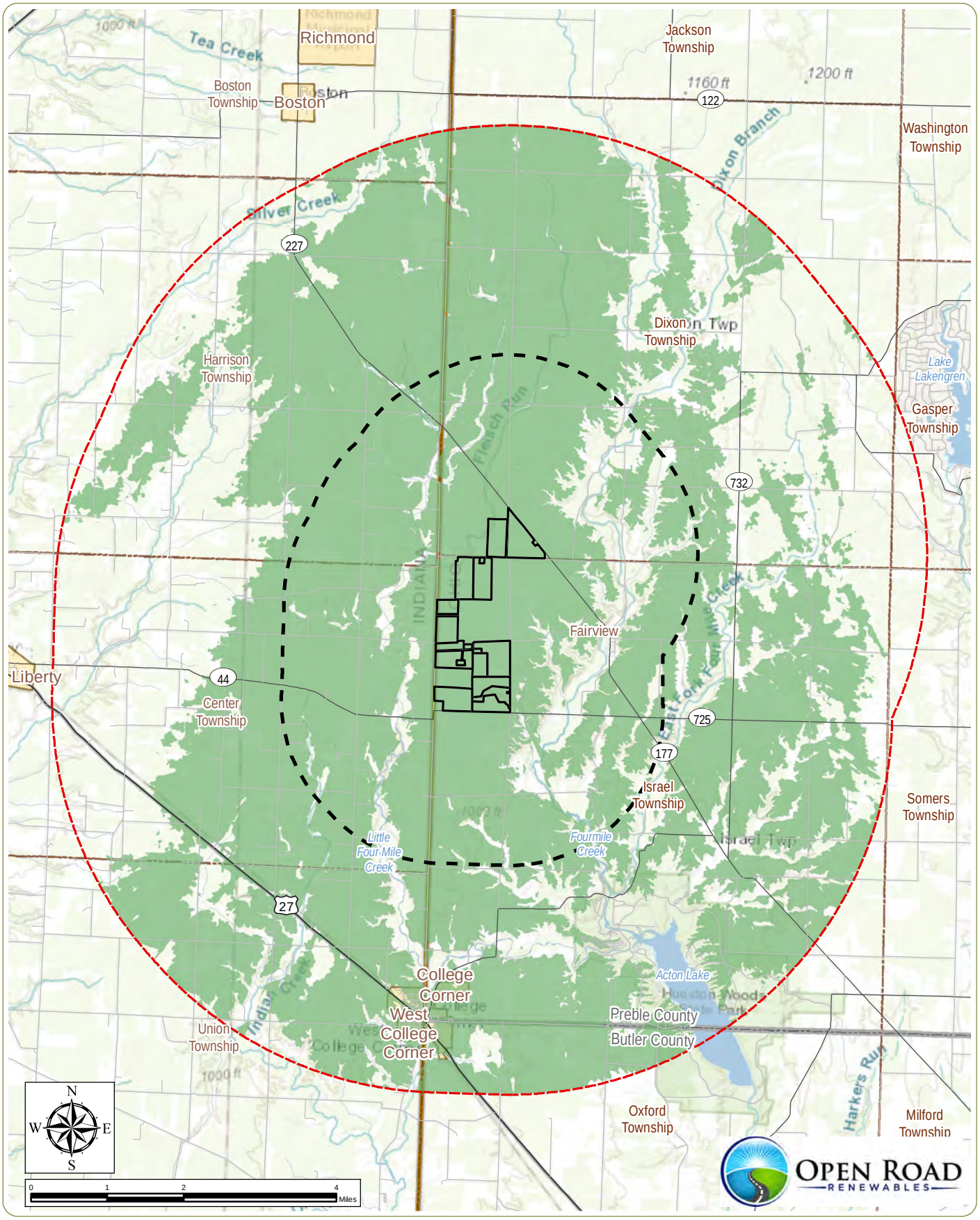

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Figure 7: Viewshed Analysis

Sheet 1 of 4: Solar Panel Visibility to 5 Miles Based on Topographic Only

Project Area
2 Mile Study Area
5 Mile Study Area
State Boundary
County Boundary
Township Boundary
Urban Area
Potential Solar Panel Visibility

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data. 4. Potential solar panel viewshed visibility is based on the screening effects of topography, vegetation, and man-made structures as represented in the OGRIP State of Ohio 2007 lidar dataset (resampled to 5-foot resolution). Sample points representing solar panels were placed on all developable areas within the Project parcels in a grid pattern with a spacing of 200 feet as a basis for this analysis. Viewshed analysis based on assumed maximum solar panel height of 15-feet.

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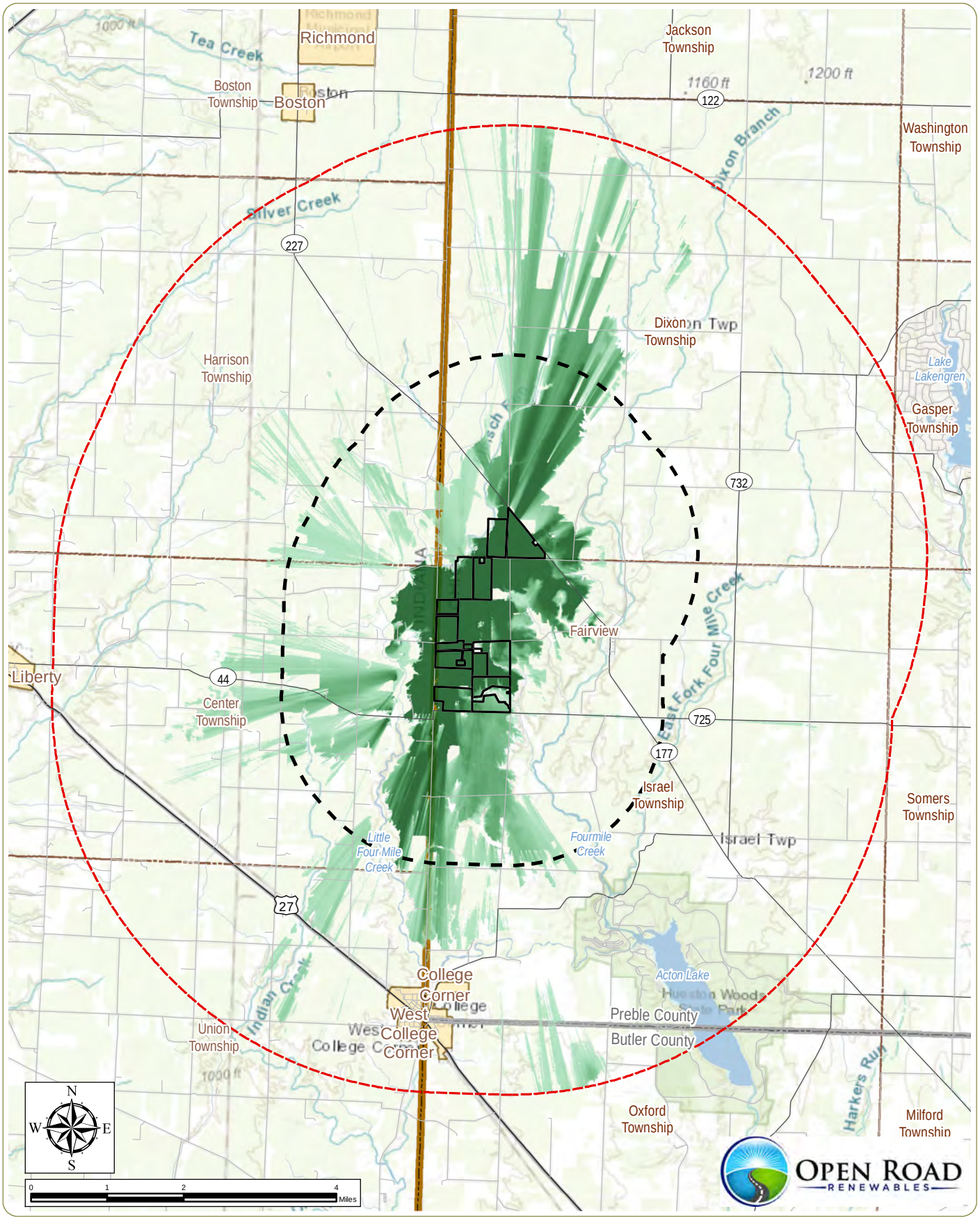

Angelina Solar

Dixon and Israel Townships, Preble County, Ohio

Figure 7: DSM Viewshed Analysis

Sheet 2 of 4: Solar Panel Visibility to 5 Miles

Project Area
2 Mile Study Area
5 Mile Study Area
State Boundary
County Boundary
Township Boundary
Urban Area

Potential Solar Panel Visibility:
High
Low

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data. 4. Potential solar panel viewshed visibility is based on the screening effects of topography, vegetation, and man-made structures as represented in the OGRIP State of Ohio 2007 lidar dataset (resampled to 5-foot resolution). Sample points representing solar panels were placed on all developable areas within the Project parcels in a grid pattern with a spacing of 200 feet as a basis for this analysis. Viewshed analysis based on assumed maximum solar panel height of 15-feet.

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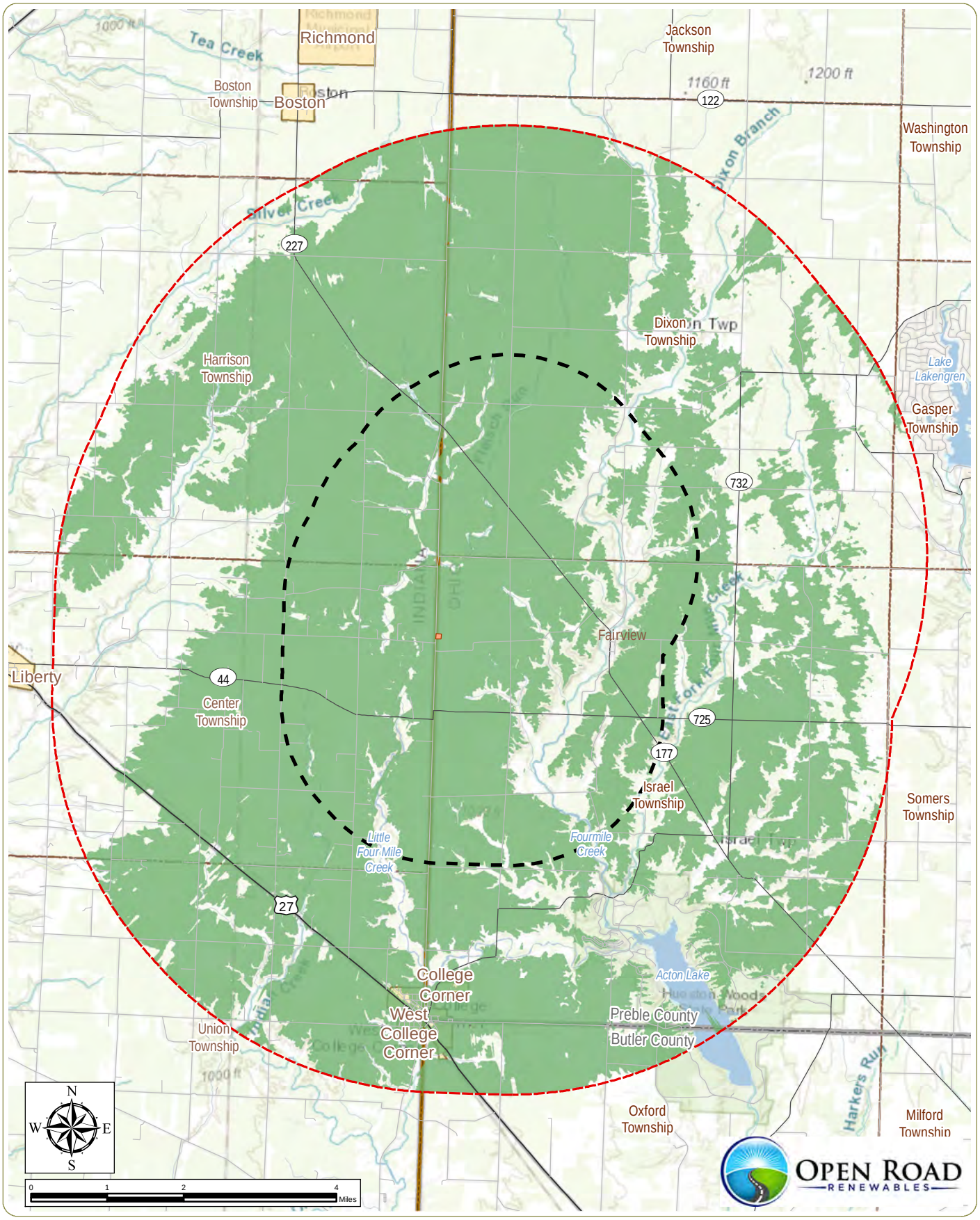

Angelina Solar

Dixon and Israel Townships, Preble County, Ohio

Figure 7: Viewshed Analysis

Sheet 3 of 4: Substation Visibility to 5 Miles Based on Topography, Vegetation, and Structures

Substation
2 Mile Study Area
5 Mile Study Area
Potential Substation Visibility
State Boundary
County Boundary
Township Boundary
Urban Area

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data. 4. Potential substation viewshed visibility is based on the screening effects of topography, vegetation, and man-made structures as represented in the OGRIP State of Ohio 2007 lidar dataset (resampled to 5-foot resolution). Viewshed analysis based on assumed maximum proposed component height, lightning rode, of 70-feet.

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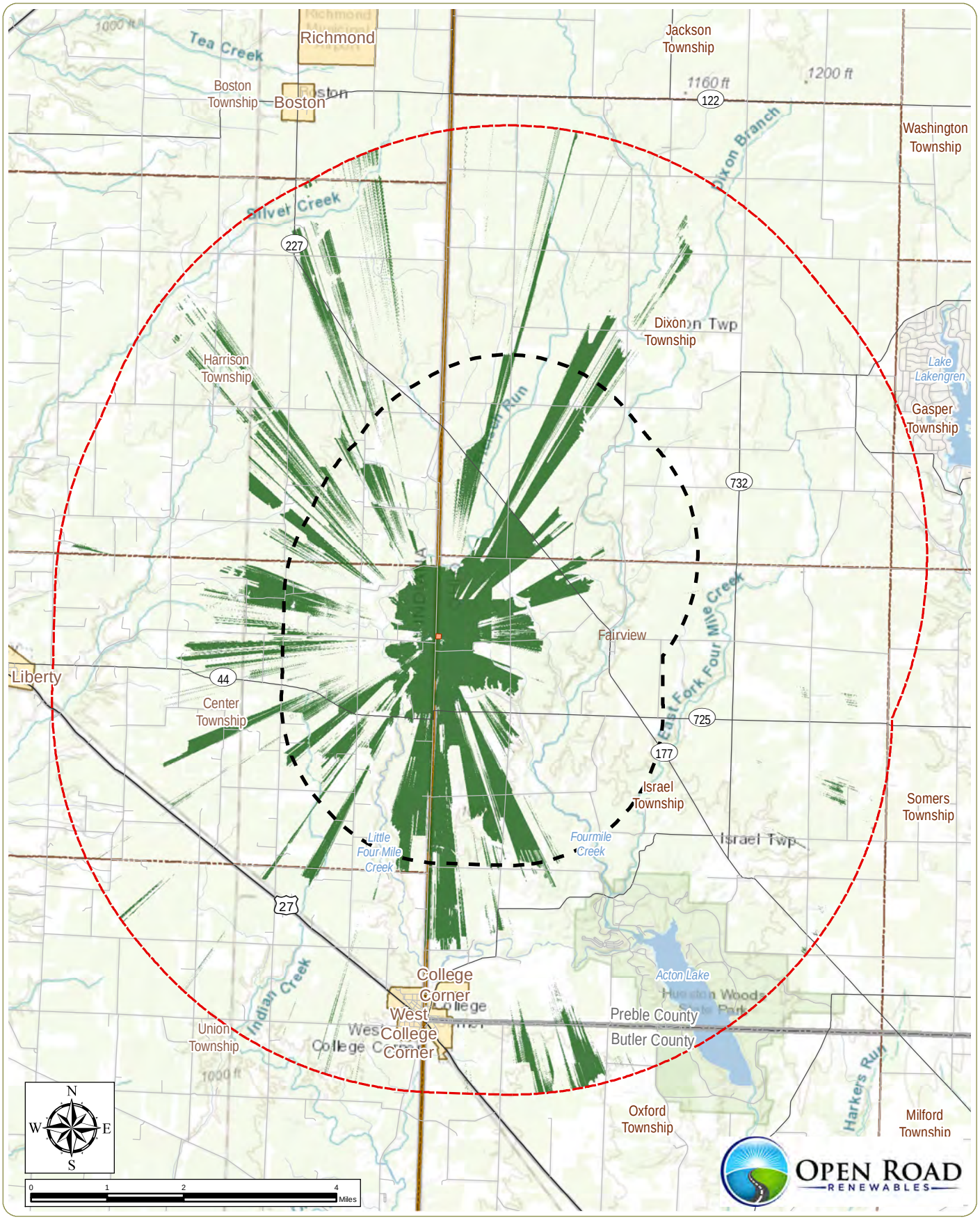

Angelina Solar

Dixon and Israel Townships, Preble County, Ohio

Figure 7: Viewshed Analysis

Sheet 4 of 4: Substation Visibility to 5 Miles Based on Topography, Vegetation, and Structures

Substation
2 Mile Study Area
5 Mile Study Area
Potential Substation Visibility
State Boundary
County Boundary
Township Boundary
Urban Area

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data. 4. Potential substation viewshed visibility is based on the screening effects of topography, vegetation, and man-made structures as represented in the OGRIP State of Ohio 2007 lidar dataset (resampled to 5-foot resolution). Viewshed analysis based on assumed maximum proposed component height, lightning rode, of 70-feet.

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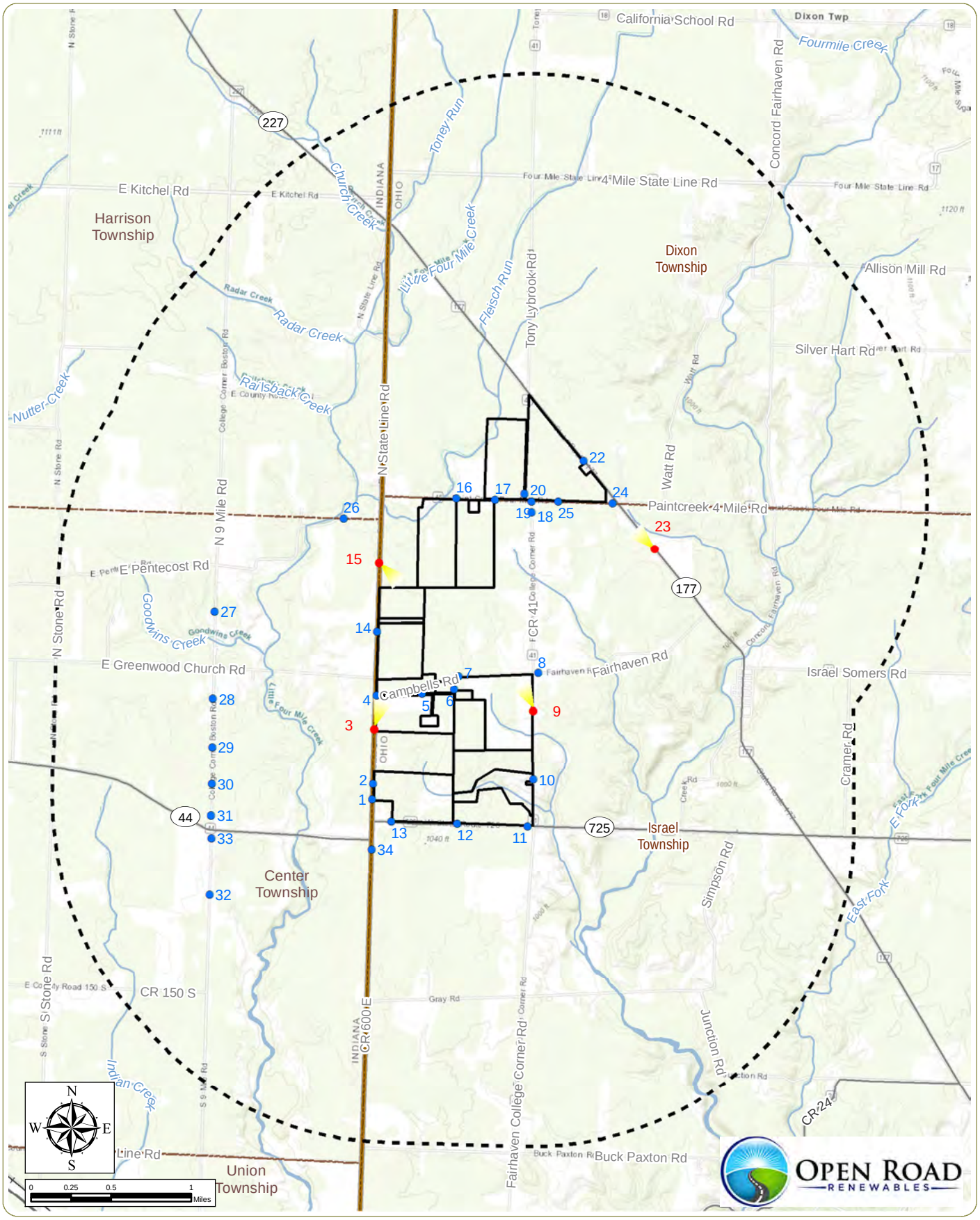

Angelina Solar

Dixon and Israel Townships, Preble County, Ohio

Figure 8: Viewpoint Locations

Selected Viewpoint

Viewpoint

2-Mile Study Area

Project Area

State Boundary

County Boundary

Township Boundary

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on November 28, 2018. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

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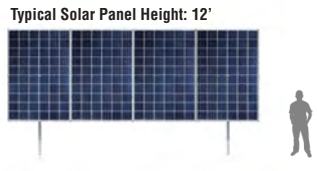
Angelina Solar Farm
Dixon and Israel Townships, Preble County, Ohio

Figure 9: Distance Comparison



Solar Panel/Array Information

Orientation of Array:.....North/South

Panel Rotation Axis:.....East/West

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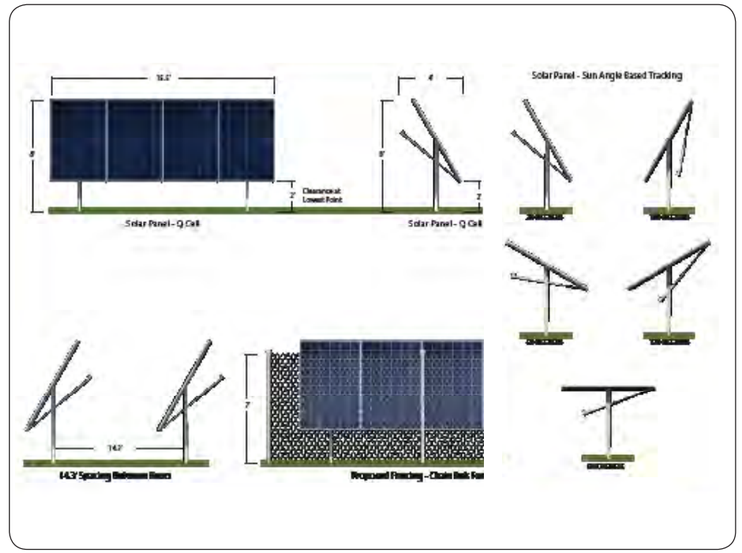
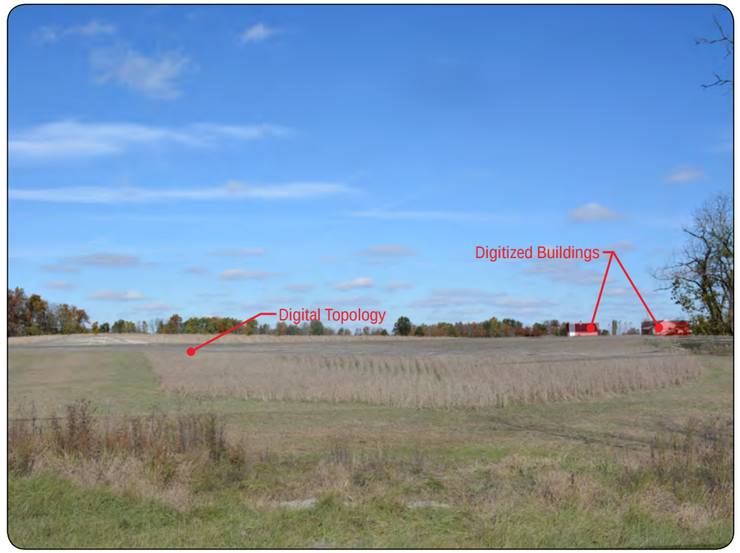
1. Photos are selected to illustrate typical views of the proposed project that will be available to representative viewer/user groups from the major landscape similarity zones and sensitive sites within the study area.

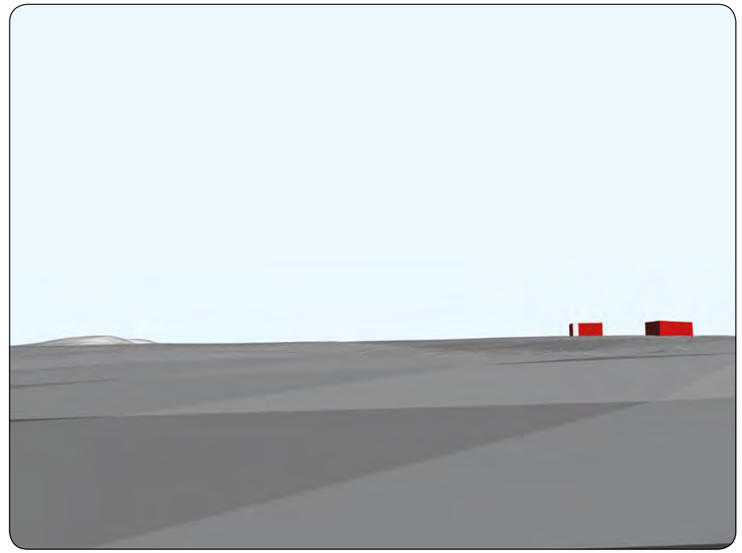


2. A three-dimensional computer model of the project is built based on proposed specifications of the solar panels and racking.

3. Aerial photographs and GPS data collected in the field are used to create an AutoCAD Civil 3D® drawing.



4. These data are superimposed over photographs from each of the viewpoints, and minor camera changes are made to align all known reference points within the view.



5. View of the three-dimensional computer model made from DEM information and digitized reference points shown without the photograph.

6. The proposed exterior color/finish of the associated equipment was then added to the model and the appropriate sun angle is simulated based on the specific date, time and location (latitude and longitude) at which each photo was taken.

Angelina Solar Farm

Dixon and Israel Townships, Preble County, Ohio

Figure 10: Visual Simulation Methodology

Sheet 1 of 1

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 4:30 PM
Weather: Clear

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from S State Line Road

Viewer Orientation: North-Northeast

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio

Figure 11: Simulation 1: *Viewpoint 3*

Sheet 1 of 8

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 4:30 PM
Weather: Clear

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from S State Line Road

Viewer Orientation: North-Northeast

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio

Figure 11: Simulation 1: *Viewpoint 3*

Sheet 2 of 8

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 4:49 PM
Weather: Partly Cloudy

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from County Road 41 (Fairhaven College CRNR Road)

Viewer Orientation: North-Northwest

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio
Figure 11: Simulation 2: *Viewpoint 9*
Sheet 3 of 8

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 4:49 PM
Weather: Partly Cloudy

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from County Road 41 (Fairhaven College CRNR Road)

Viewer Orientation: North-Northwest

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio
FIgure 11: Simulation 2: *Viewpoint 9*
Sheet 4 of 8

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 5:07 PM
Weather: Partly Cloudy

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from S State Line Rd

Viewer Orientation: Southeast

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio

Figure 11: Simulation 3: *Viewpoint 15*

Sheet 5 of 8

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 5:07 PM
Weather: Partly Cloudy

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from S State Line Rd

Viewer Orientation: Southeast

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio
FIgure 11: Simulation 3: *Viewpoint 15*
Sheet 6 of 8

OPEN ROAD RENEWABLES

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 5:34 PM
Weather: Partly Cloudy

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from State Route 177

Viewer Orientation: Northwest

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio

FIgure 11: Simulation 6: *Viewpoint 23*

Sheet 7 of 8

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 5:34 PM
Weather: Partly Cloudy

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from State Route 177

Viewer Orientation: Northwest

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio

FIgure 11: Simulation 6: *Viewpoint 23*

Sheet 8 of 8

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Mitigation Material Options

Fencing Options

Galvanized Chainlink

Black Vinyl Agricultural Mesh

Wooden Post Galvanized Agricultural Mesh

Plant Material Options

Native Pollinator Mix Examples

Screening Trees

Screening Shrubs

Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 4:30 PM
Weather: Clear

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from S State Line Road

Viewer Orientation: North-Northeast

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio

Figure 13: Mitigation Simulation 1: *Viewpoint 3*

Sheet 1 of 4

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 4:30 PM
Weather: Clear

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from S State Line Road

Viewer Orientation: North-Northeast

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio

Figure 13: Mitigation Simulation 1: *Viewpoint 3*

Sheet 2 of 4

OPEN ROAD RENEWABLES

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 4:49 PM
Weather: Partly Cloudy

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from County Road 41 (Fairhaven College CRNR Road)

Viewer Orientation: North-Northwest

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio
Figure 13: Mitigation Simulation 2: *Viewpoint 9*
Sheet 3 of 4

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Simulation Information

Photograph Data

Date Taken: 11/02/2017
Time: 4:49 PM
Weather: Partly Cloudy

Camera Information

Camera Make/Model: Nikon D7100
Camera Height: 5'

View Location

Location: View from County Road 41 (Fairhaven College CRNR Road)

Viewer Orientation: North-Northwest

Angelina Solar Project
Dixon and Israel Townships, Preble County, Ohio
Figure 13: Mitigation Simulation 2: *Viewpoint 9*
Sheet 4 of 4

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Appendix A

Visually Sensitive Resource	Location		Distance[1] Miles from Project Area	Project Visibility	
	Address/Township	County/ State		DTM Topography, Only	DSM Topography, Vegetation & Structures
Properties listed on the National or State Register of Historic Places					
National Register of Historic Places					
Bunker Hill House	Fairhaven, 45311	Preble/ OH	1.2	-	-
Howe Tavern	US 27- College Corner	Butler / OH	3.9	+	-
Historic Reformed Church and Cemetery	6471 Camden- College Corner Rd	Preble/ OH	2.5	+/-	-
Harshman Covered Bridge	4 miles N of Fairhavene on Concord- Fairhaven Rd.	Preble/ OH	3.0	-	-
Properties eligible for inclusion in the National or State Register of Historic Places					
Longman Road at Sugar Run	Dixon Township	Preble/ OH	4.7	-	-
Historic Bridges					
TR 218 (NRHP- Eligible Bridge)	North of Fairhaven	Preble/ OH	1.6	-	-
TR 235 (Junction Rd.)(NRHP- Eligible Bridge)	South of Fairhaven	Preble/ OH	1.2	+/-	-
National Heritage Areas					
None identified					
National Wildlife Refuges, State Game Refuges and State Wildlife Management Areas					
None in the Study Area.					
National Natural Landmarks					
Hueston Woods	Israel and Oxford Township	Preble and Butler/ OH	4.0	+/-	-
National Historic Landmarks					
None identified					
National Parks, Recreation Areas, Seashores and/or Forests					
None identified					

Visually Sensitive Resource	Location		Distance[1] Miles from Project Area	Project Visibility	
	Address/Township	County/ State		DTM Topography, Only	DSM Topography, Vegetation & Structures
National or State Designated Wild, Scenic, or Recreational Rivers					
None identified					
State Parks					
Hueston Woods State Park	Israel Township	Preble/ OH	2.6	+/-	-
Sites, Areas, Lakes, Reservoirs or Highways Designated or Eligible as Scenic					
Presidential Pathways Ohio Scenic Byway	Oxford Township	Butler County	4.6	+/-	+/-
Acton Lake	Israel Township	Preble/OH	3.9	-	-
State and Federally Designated Trails					
None identified					
State Nature and Historic Preserve Areas					
None identified					
State Historic Markers					
7-68 Historic Hopewell	Israel Township	Preble/ OH	2.5	+	-
3-68 Bunker Hill House	Israel Township	Preble/ OH	1.3	-	-
5-68 The Union School 1893-2004	Israel Township	Preble/ OH	3.8	+	-
Locally Important Resources					
Areas of Intensive Land Use (City, Village, Hamlet)					
College Corner	College Corner	Preble & Butler/ OH	4.0	+/-	-
Transportation Corridors					
United States Route 27	Union and Center Township (Indiana) and Oxford Township (Ohio)	IN-OH	3.3	+	+/-
State Route 725	Union and Center Township (Indiana) and Oxford Township (Ohio)	IN-OH	0.0	+	+

Visually Sensitive Resource	Location		Distance[1] Miles from Project Area	Project Visibility	
	Address/Township	County/ State		DTM Topography, Only	DSM Topography, Vegetation & Structures
State Route 177	Israel and Dixon Townships (Ohio)	IN-OH	0.0	+	+
State Route 732	Harrison Township (Indiana) and Israel and Dixon Townships (Ohio)	OH	2.5	+	+/-
Recreation Resources					
Local Parks and Playgrounds					
West College Corner Town Park	West College Corner	Union/ IN	4.2	+	-
Lakes and Rivers					
No additional water bodies identified					
Golf Courses					
Included in Hueston Woods State Park					
Schools and Colleges					
Union Elemetary School	230 Ramsey St.	Union/ IN	3.8	+	-
Cemeteries					
Ailes-Asay-White Cemetery	Israel Township	Preble/ OH	3.0	-	-
Beechwood-Covanentor Cemetery	Israel Township	Preble/ OH	4.9		
Caldwell Cemetery	Israel Township	Preble/ OH	1.5	+	-
Campbell Cemetery	Israel Township	Preble/ OH	0.1	+	+
College Corner Cemetery	Oxford Township	Butler/ OH	4.5	+	-
Concord Cemetery	Dixon Township	Preble/ OH	3.6	+	-
Conger-North Cemetery	Dixon Township	Preble/ OH	4.4	-	-
Conger-South-Sugar Valley Cemetery	Dixon Township	Preble/ OH	4.3	-	-
Dixon Township Cemetery	Dixon Township	Preble/ OH	3.9	+	+

Visually Sensitive Resource	Location		Distance[1] Miles from Project Area	Project Visibility	
	Address/Township	County/ State		DTM Topography, Only	DSM Topography, Vegetation & Structures
Fairhaven Cemetery	Israel Township	Preble/ OH	1.5	+	-
Friends-Quaker-Westfield Cemetery	Israel Township	Preble/ OH	4.6	+/-	-
Gamble-Hays-Steele Cemetery	Israel Township	Preble/ OH	2.5	-	-
Gard-Winholt Cemetery	Dixon Township	Preble/ OH	4.6	-	-
Hopewell Cemetery	Israel Township	Preble/ OH	2.4	+/-	-
Johnson Cemetery	Dixon Township	Preble/ OH	4.5	+	-
Joseph Caldwell Cemetery #1	Israel Township	Preble/ OH	1.6	+/-	-
Joseph Caldwell Cemetery #2	Israel Township	Preble/ OH	1.7	+	-
Kingerly-College Corner Cemetery	Israel Township	Preble/ OH	3.2	+/-	-
Pioneer Graves Cemetery	Israel Township	Preble/ OH	4.4	+/-	-
Ramsey-Old Settler Cemetery	Israel Township	Preble/ OH	4.6	+/-	-
Thomas Cemetery	Dixon Township	Preble/ OH	4.5	-	-
Toney Cemetery	Dixon Township	Preble/ OH	3.5	+	+/-
Unnamed Cemetery #2	Dixon Township	Preble/ OH	4.5	-	-
Unnamed Cemetery #3	Dixon Township	Preble/ OH	4.0	+	+
Unnamed Cemetery #4	Israel Township	Preble/ OH	3.5	+/-	-
William Ramsey Cemetery	Israel Township	Preble/ OH	3.0	+/-	-
Other Local Resources					
None identified					

[1] For large areas and linear sites, approximate distance to the Project Area was measured from the respective area's closest point.

Appendix B

Viewpoint #: 1

Location: S State Line Road

Latitude: 39.628454
Longitude: -84.814771

Viewpoint #: 2

Location: S State Line Road

Latitude: 39.629864
Longitude: -84.814718

Viewpoint #: 3

Location: S State Line Road

Latitude: 39.634795
Longitude: -84.814705

Viewpoint #: 4

Location: intersection of Campbells Road & S State Line Road

Latitude: 39.637829
Longitude: -84.814543

This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

12/3/2018 2:38:37 PM

in

Case No(s). 18-1579-EL-BGN

Summary: Application Exhibit I, Part 1 of 2 electronically filed by Mr. Michael J. Settineri on behalf of Angelina Solar I, LLC