COUNTY OF FLUVANNA

"Responsive & Responsible Government"

132 Main Street
P.O. Box 540
Palmyra, VA 22963
(434) 591-1910
Fax (434) 591-1911
www.fluvannacounty.org

PLANNING COMMISSION STAFF REPORT

To: Fluvanna County Planning Commission
From: Douglas Miles, AICP, CZA
Request: Utility-scale Solar Generation Facility
District: Fork Union Election District

***General Information*:** This Special Use Permit (SUP) request is to be heard by the Fluvanna County Planning Commission on Wednesday, November 8, 2023 at 7:00 pm at the Carysbrook Performing Arts Center.

***Applicant*:** White Oak Tree Solar, LLC / Commonwealth Energy Partners (CEP)

***Representatives*:** Harry Kingery and Tyson Utt – Commonwealth Energy Partners (CEP)

***Requested Action*:** **SUP 23:01 White Oak Tree Solar, LLC** – A Special Use Permit request in the A-1, Agricultural, General District to permit a Utility-scale, solar generation facility under §22-4-2.2 on 439 +/- acres and known as Tax Map 49 Section A Parcels 1, 5 and 8; Tax Map 48 Section A Parcel 35; Tax Map 48 Section 14 Parcels 4, 5, 6 and 6-A. These parcels are generally located east of Rockfish Run Road (SR 683) and west of Shores Road (SR 640) in the Rural Preservation Area and Fork Union Election District.

***Existing Zoning*:** A-1, General Agricultural Zoning District

***Existing Land Use*:** Land is used for silvicultural purposes covered with timber

***Planning Area*:** Rural Preservation Planning Area

***Solar Request*:** A 38 megawatts alternating current utility-scale solar generation facility is proposed on 435 acres of private land spanning eight (8) parcels with 87 acres being used for setbacks, vegetative buffers and natural resource protection while 343 acres will be used for the proposed solar land use.

The solar project will minimal visibility from public right of ways and adjacent properties through a combination of a retained vegetative buffer and additional planted buffers where necessary. The solar energy project will be interconnected to the existing electrical grid serving off-site uses.

Applicant Summary:

Please refer to the CEP Solar Special Use Permit Application, White Oak Solar Farm, Fluvanna, County, VA, Application Narrative Summary dated January 31, 2023, portions revised October 2, 2023 and on October 27, 2023. This twenty-eight (28) page binder contains everything from the Project Overview, Current and Proposed use, Conformity with the Comprehensive Plan, and Compliance with the Fluvanna County Zoning Ordinance which has been summarized but allows for referencing this project document.

Please utilize this summary document to gain more knowledge and information relative to the analytical and technical aspects like: Environmental, Cultural and Historic Resources, Facility Decommissioning, Recycling and Reuse of Solar Equipment, the Property Survey, Site Access and Layout specifications and the extensive Real Estate Impact Study and the positive Health and Safety aspects at this solar site.

Community Meeting:

CEP Solar held a community meeting on October 12, 2022 in the neighborhood at The Light Academy, 479 Cunningham Road from 6:30 pm to 8:00 pm. The meeting was well attended by adjacent property owners, County officials, County Administration and Planning staff and CEP Solar to answer questions. CEP Solar provided project summary sheets that answered most of the common questions about utility-scale solar generation facilities like the one that they plan to construct and operate in Fluvanna County. The main topic focused on not being able to see the solar panels and equipment from adjacent properties.

The main question was will the site be enclosed with a fence and they stated the project will have a 6' fence surrounding all of the solar panels and equipment with proper site access given to fire and rescue and there will be fire suppression chemicals and equipment in case there is a fire at the CEP solar project.

Comprehensive Plan:

The 2015 Fluvanna County Comprehensive Plan has this timberland and fields property within our Rural Preservation Planning Area that calls for rural residential uses that include both working farms and agricultural fields with limited, low-density residential development. The existing parcels have been privately owned by the Pruitt family from Henrico for several years and have harvested timber where the solar panels and the equipment would be located on the site.

The proposed solar facility's project lifespan is 40 years and at the end of such time the project owner and operator shall remove all improvements and the land use will revert to farmland or be placed into timber production. This planned land use restoration is consistent with the 2015 Plan's guiding principle of preserving Fluvanna County's rural character and its rural way of life. Staff finds the proposed solar facility, along with the conditions listed at the end of the staff report, is consistent with the 2015 Comprehensive Plan and is appropriate for a solar project use.

The current 2015 Comprehensive Plan contains a section about Green Infrastructure and Energy Efficiency where clean energy requests such as solar generation facilities help to support and implement such planning concepts to become an integral part of the built infrastructure like renewable energy in Fluvanna County. Preservation of wetlands, wildlife corridors and similar sensitive habitats lessens a new proposed project's environmental impact and improves the final product in this case as a solar facility use. Renewable resources such as solar energy production helps to conserve natural resources and the promotion of growth and limited solar development and it helps to preserve farmland, wildlife habitats and future recreational and environmental County amenities. So, Fluvanna County positively benefits from green energy infrastructure uses.

Zoning Definitions:

Utility-scale solar generation facility: a solar energy conversion system producing 2 MW or more of electricity to a utility provider. Such facilities interconnect with an existing electrical grid serving other off-site facilities which are not adjacent or under common use, ownership or control.

Special Use Permits:

When evaluating all proposed uses for a special use permit, in addition to analyzing the potential adverse impacts of the use, staff utilizes two (2) general guidelines for evaluation as set forth in the Zoning Ordinance. First, the proposed use should not tend to change the character and established pattern of the area or community. White Oak Solar aligns with the objectives of the A-1 zoning district by preserving land and causing minimal disturbance to the community during its operational life, with the understanding that the short period of site construction will need to be closely inspected and monitored for compliance purposes. The project will have a minimal impact on traffic, requires no additional infrastructure other than the necessary inverters, lines and substation equipment in order to create electricity and then to send it properly into the grid.

Second, the proposed use should be compatible with the uses permitted by right in that zoning district and shall not adversely affect the use of or the value of neighboring property or the farms.
White Oak Solar will not adversely affect the use or value of neighboring properties along with a study that was performed for CEP Solar by Kirkland Associates, a licensed appraiser, that found that the proposed solar facility use would have minimal impact on the value of adjoining or abutting properties. The proposed solar use is in harmony with the surrounding area in which it is located due to the extensive and mature timber managed on the subject properties to screen the proposed use. The property owners have been managing this site for many years within the area.

Transportation Planning:

Commonwealth Energy Partners (CEP Solar) has engaged Timmons Group to analyze the development of a solar facility known as White Oak Solar located along Shores Road and Rockfish Run Road within Fluvanna County, VA. The solar site will be served by three (3) entrances; two (2) on Shores Road (Route 640) and one (1) on Rockfish Run Road (Route 683) and which terminates at the solar project.

The northern site entrance on Shores Road will primarily serve as substation access while the two (2) southern entrances will serve site-related traffic both during construction and the operations and site maintenance phases. Four (4) primary roads were identified that will provide access to White Oak Solar. West River Road (Route 6), Cunningham Road (Route 697), Shores Road (Route 640) and Rockfish Run Road (Route 683) with Route 6 being the best route for construction and delivery traffic to the solar site.

Proposed Access Route: Based upon the project location and proposed entrances, it is recommended that site related traffic enter and exit via the proposed route: West River Road (Route 6) provides access to James Madison Highway (US Route 15) which can be used to access Interstate 64 to the north and US Route 60 to the south of the project site. All of the four primary roads listed above have the available carrying capacity to accommodate site-related traffic. However, it should be noted that the local nature of Routes 640, 683 and 697 indicate that these facilities are not designed to accommodate consistent truck traffic and may witness physical degradation through the construction of White Oak Solar. The applicant would be required to return all VDOT roads to the same if not better surface conditions for this project.

Substantial Accord:

Virginia State Code Section 15.2-2232 (A) and (H) requires a determination by the Planning Commission that the proposed facility is in substantial accordance with the 2015 Comprehensive Plan unless the facility is exempt under Section (H). The proposed solar facility is not exempt, therefore, the Planning Commission must make a determination based upon utility-scale solar generation facility use findings.

§ 15.2-2232. Legal status of plan.

> A. Whenever a local planning commission recommends a comprehensive plan or part thereof for the locality and such plan has been approved and adopted by the governing body, it shall control the general or approximate location, character and extent of each feature shown on the plan. Thereafter, unless a feature is already shown on the adopted master plan or part thereof or is deemed so under subsection D, no street or connection to an existing street, park or other public area, public building or public structure, public utility facility or public service corporation facility other than a railroad facility or an underground natural gas or underground electric distribution facility of a public utility as defined in subdivision (b) of § 56-265.1 within its certificated service territory, whether publicly or privately owned, shall be constructed, established or authorized, unless and until the general location or approximate location, character, and extent thereof has been submitted to and approved by the commission as being substantially in accord with the adopted comprehensive plan or part thereof. In connection with any such determination, the commission may, and at the direction of the governing body shall, hold a public hearing, after notice as required by § 15.2-2204.
>
> H. A solar facility subject to subsection A shall be deemed to be substantially in accord with the comprehensive plan if (i) such proposed solar facility is located in a zoning district that allows such solar facilities by right; (ii) such proposed solar facility is designed to serve the electricity or thermal needs of the property upon which such facility is located, or will be owned or operated by an eligible customer-generator or eligible agricultural customer-generator under § 56-594 or 56-594.01 or by a small agricultural generator under § 56-594.2; or (iii) the locality waives the requirement that solar facilities be reviewed for substantial accord with the comprehensive plan. All other solar facilities shall be reviewed for substantial accord with the comprehensive plan in accordance with this section. However, a locality may allow for a substantial accord review for such solar facilities to be advertised and approved concurrently in a public hearing process with a rezoning, special exception, or other approval process.
>
> Please Note that additional information will be provided to the Planning Commission and the General Public during the scheduled 6:00 pm Work Session prior to the scheduled 7:00 pm Public Hearing on White Oak Tree Solar, Inc. for better substantial accord determination information. The Comprehensive Plan generally provides for green energy recommendations and reference the Comprehensive Plan section of this case staff report.

Recommended Conditions:

Fluvanna County Staff recommends Approval of the proposed Utility-scale solar generation facility provided that the impact upon the surrounding property owners is minimal. Staff has proposed recommended conditions to ensure that this use complies with all Federal, State and County Code requirements:

1. This Special Use Permit is granted for an up to 38-megawatt utility scale solar generation facility to White Oak Tree Solar, LLC or any successors as the owners or operators of such use on the Property.

2. All site activity required for construction, expansion, and/or operation of the utility scale solar generation facility (the "USSGF") shall be limited to the following days and times: All pile driving and site deliveries shall be limited to the hours from sunrise to sunset Monday through Saturday. All other site construction and expansion activity may occur Monday through Sunday from sunrise to sunset and be in compliance with the County noise ordinance, as amended.

3. A Construction Traffic Management Plan (the "CTMP"), including certain mitigation measures shall be developed by the applicant, owner, or operator and shall be submitted to the Virginia Department of Transportation (VDOT) and the County Administrator or his designee for review and approval. The CTMP shall address traffic control measures, pre- and post-construction road evaluation, and any necessary repairs to the public roads that are required as a result of any damage from the USSGF site construction and/or expansion.

4. A Site Parking and Staging Plan shall be submitted as a part of the Site Development Plan approval process that demonstrates a site access plan directing both employee and delivery traffic to minimize conflicts with local traffic and state roads leading into the site to avoid traffic delays during the peak construction times.

5. A Construction Mitigation Plan shall be submitted as a part of the Site Development Plan approval process that addresses dust mitigation whereby water trucks or other approved methods shall be utilized to minimize dust on all construction roads and keep soil and sediment on the Property. Burning operations must follow all local and state burning restrictions and distances from property lines and combustibles. The plan must address both dust and smoke migration so as not to be of a general nuisance to adjoining property owners during site construction, expansion, and/or burning operations on the Property.

6. A minimum one hundred fifty (150) foot setback shall be maintained from the property line to the solar panels or associated equipment from all public right-of-ways and all agriculturally and residentially zoned properties, either occupied or unoccupied, until such time the USSGF is decommissioned per the Decommissioning Plan. Once the USSGF had been decommissioned, the setback shall become the underlying zoning district setback amount for such district.

7. A minimum of three hundred (300) foot setback shall be maintained from occupied residential structures existing at the time of SUP approval to the solar panels or associated equipment.

8. The existing perimeter woodlands vegetation shall be preserved as a buffer strip with a minimum width of seventy-five (75) feet. The woodlands preservation area shall be placed in a recorded landscape easement to be recorded at the time of building permit issuance and shall terminate upon the decommissioning of the Project.

9. A fifty (50) foot vegetative buffer utilizing double staggered rows of evergreen trees planted every ten (10) feet on center with a minimum planting height of four (4) feet and achieving eight (8) feet in height within three (3) years shall be installed where there is not existing mature vegetation on the perimeter of the Property along the public right-of-way or adjacent to agricultural or residential land uses. Groundcover for the site should consist of a variety of native groundcovers that benefit bees, birds, and beneficial insects and the use of any synthetic herbicides to control and maintain groundcover areas post-construction or post-expansion shall not be permitted.

10. The applicant shall install a permanent security fence, consisting of chain link, 2-inch square mesh, (or comparable fencing) a minimum of 6 feet in height around the USSGF prior to the commencement of operations of the USSGF. Failure to maintain the fence in a good and functional condition will result in revocation of the special use permit.

11. The applicant, owners, or operator shall coordinate directly with the Fluvanna County Fire Chief to provide solar energy educational information and/or training to the respective County personnel. Such information and/or training shall address County personnel responses to the solar energy facility use in regards to how to respond to any emergencies that may occur on the Property. The Fire Chief shall be provided with the construction manager's direct contact information during construction or expansion and the remote manager's direct contact information during site operations.

12. Payment of all applicable rollback taxes for parcels in the land use program shall be paid a minimum of forty-five (45) days prior to the County's issuance of a land disturbance permit.

13. The applicants, owners or operator shall notify VDOT and Fluvanna County in writing thirty (30) days prior to commencing any site construction or logging activity on the Property.

14. A Decommissioning Plan shall be approved by the County Administrator or his designee prior to approval of a Site Development Plan or any building permits being issued for the USSGF. If the USSGF is completely inactive or substantially discontinuing the delivery of electricity to an electrical grid for a continuous twenty-four (24) month period, it shall be considered abandoned. The applicant, owners, or operator shall provide notice to the County Administrator or his designee in writing once the property becomes completely inactive as a USSGF. The decommissioning of the site shall commence within six (6) months of the date of receipt of such notice from the applicant, owners, or operator to the County. Such notice shall contain the name and physical address of the entity performing the decommissioning of the solar generation facility.

15. Surety. Unless the utility scale solar generating facility project is owned by a public utility within the Commonwealth of Virginia, the net costs of decommissioning shall be secured by an adequate surety in a form agreed to by the County Attorney, including but not limited to a letter of credit, cash, bond or a guarantee by an investment grade entity, posted within 30 days of the project receiving its certificate of completion or equivalent from Fluvanna County to operate the

use. If adequate surety is required, the cost estimates of the decommissioning shall be updated at least every five (5) years by the applicant, owners or operator, and provided to the County. If the USSGF is sold to an entity that is not a public utility, the Special Use Permit shall not transfer to the purchaser until such time as adequate replacement surety is provided for the USSGF. At its option, the County may require that a surety amount be increased based upon the net cost of decommissioning the use and as approved by the County Attorney.

Suggested Motions:

I move that the Planning Commission (does / does not) find White Oak Tree Solar, Inc. as a utility-scale solar generation facility use in Substantial Accord with the 2015 Comprehensive Plan. It (does / does not) adhere to the general guidance of the Comprehensive Plan, including the standard recommended Solar conditions and Site design details can be considered in this request.

I move that the Planning Commission recommends (approval / denial / deferral) of SUP 23:01 White Oak Tree Solar, Inc. as a Special Use Permit in the A-1, Agricultural, General District to permit a Utility-scale solar generation facility under 22-4-2.2 on 439 +/- acres and known as Tax Map 49 Section A Parcels 1, 5, and 8; Tax Map 48 Section A Parcel 35; Tax Map 48 Section 14 Parcels 4, 5, 6, and 6-A along with the fifteen (15) recommended conditions found in the staff report.

COUNTY OF FLUVANNA

"Responsive & Responsible Government"

132 Main Street
P.O. Box 540
Palmyra, VA 22963
(434) 591-1910
Fax (434) 591-1911
www.fluvannacounty.org

MEMORANDUM

Date: October 30, 2023

From: Valencia Porter

To: Douglas Miles

Subject: APO Memo Complete

Please be advised the attached letter went out to the attached list of Adjacent Property Owners for the November 8, 2023 Planning Commission meeting.

COUNTY OF FLUVANNA

"Responsive & Responsible Government"

132 Main Street
P.O. Box 540
Palmyra, VA 22963
(434) 591-1910
Fax (434) 591-1911
www.fluvannacounty.org

PUBLIC HEARING NOTICE

October 30, 2023

SUP 23:01 White Oak Tree Solar, LLC – Special Use Permit Utility-scale Solar Generation Facility

This is to notify you that the Fluvanna County Planning Commission will hold a public hearing on:

Meeting: Planning Commission Regular meeting

Date: **Wednesday, November 8, 2023 at 7:00 pm**

Location: Carysbrook Performing Arts Center
8880 James Madison Highway Fork Union, VA 23055

SUP 23:01 White Oak Tree Solar, LLC – A Special Use Permit request in the A-1, Agricultural, General District to permit a Utility-scale, solar generation facility under §22-4-2.2 on 439 +/- acres and known as Tax Map 49 Section A Parcels 1, 5 and 8; Tax Map 48 Section A Parcel 35; Tax Map 48 Section 14 Parcels 4, 5, 6 and 6-A. These parcels are generally located east of Rockfish Run Road (SR 683) and west of Shores Road (SR 640) in the Rural Preservation Area and Fork Union Election District.

Please be advised that you can attend the meeting in person where you will have an opportunity to provide any Public comments. Instructions for public participation in the Public Hearing will be available on Fluvanna County's website along with the Meeting Agenda and Staff Report.

You can visit Fluvanna County, 8:00 am – 5:00 pm, Monday through Friday, if you have any questions regarding this Special Use Permit application request. Please contact the Fluvanna County Planning & Community Development at 434.591.1910 or at dmiles@fluvannacounty.org

Sincerely,

Douglas Miles

Douglas Miles, AICP, CZA
Community Development Director

ADJACENT PROPERTY OWNERS SUP 23:01

TAX MAP	NAME	ADDRESS	CITY/STATE/ZIP
39-A-34	WILLIAM E & ANNE C DAVIS	PO BOX 692	SCOTTSVILLE, VA 24590
39-13-51	KECK ROSEWOOD MANOR LLC	8 LOWER TUCKAHOE RD WEST	RICHMOND, VA 23238
49-A-2	BENCO LLC	5578 RICHMOND RD STE 201A	TROY, VA 22974
48-A-18	SUSAN E SWALES	PO BOX 566	SCOTTSVILLE, VA 24590
49-A-6	TRAVUN D CHAMBERS & TAYLOR JACOBS	1184 SHORES RD	PALMYRA, VA 22963
48-A-33	WELLS TRUST	281 ROCKFISH RUN ROAD	SCOTTSVILLE, VA 24590
49-4-3	ROBERT BRYANT	1248 SHORES ROAD	PALMYRA, VA 22963
49-4-2	CHARLES M & SUSAN R REEVES	1118 DOULTON CIRCLE	LYNCHBURG, VA 24503
49-4-1	ROSA B BRUCE	105 CARRSBROOK CT	CHARLOTTESVILLE, VA 22901
48-A-31	DANIELLE FITZ-HUGH	6303 OLD WREXHAM PL	CHESTERFIELD, VA 23832
49-A-9C	NOKO, LLC	16860 SILVER OAK CIR	DELRAY BEACH, FL 33445
49-A-7	DONNA BELL, STEVEN ANDREW, & JEREMY	4100 MAUREEN LN	FAIRFAX, VA 22033
48-A-32A	WALLACE W WELLS	281 ROCKFISH RUN RD	SCOTTSVILLE, VA 24590
48-A-30	LORENZO WELLS JR	357 WHITE CEDAR RD	BARBOURSVILLE, VA 22923
48-14-1	BETH FANNON & KAREN MANN	398 ROCKFISH RUN RD	SCOTTSVILLE, VA 24590
48-14-2	SHERYL HOPPER	448 ROCKFISH RUN RD	SCOTTSVILLE, VA 24590
48-14-3	CLYDE & MARIANNE ROYSTON	534 ROCKFISH RUN RD	SCOTTSVILLE, VA 24590
48-A-43	CHRISTOPHER SCHMIDT	964 ROCKFISH RUN RD	SCOTTSVILLE, VA 24590
48-A-36,48-A-37	ANTHONY BURGOS & KIMBERLY DURDEN	745 ROCKFISH RUN RD	SCOTTSVILLE, VA 24590
48-A-38	CHRISTOPHER MUNDY	751 ROCKFISH RUN RD	SCOTTSVILLE, VA 24590
39-A-55	WESLEY WALKER	434 SHORES ROAD	PALMYRA, VA 22963
49-A-1, 49-A-5, 49-A-8	ROCKFISH TRACT LLC	2425 GRENOBLE RD	RICHMOND, VA 23294
48-14-6, 48-A-35,48-14-6A, 48-14-5, 48-14-4	FOOLS GOLD LLC	2425 GRENOBLE RD	HENRICO, VA 23294

RECEIVED

Fluvanna County Planning Dept

COMMONWEALTH OF VIRGINIA

COUNTY OF FLUVANNA

Application for Special Use Permit (SUP)

Owner of Record: Fool s Gol d, LC

Address: 2425 Grenoble Rd., Richmond, VA 23294

Phone: 804-672-6487 Fax: 804-672-3305

Email:

Applicant of Record: White Oak Tree Solar, LLC

Address: 1801 Bayberry Court, Suite 100, Richmond, VA 23226

Phone: 804-285-3800 Fax: 804-285-7240

Email: Thomas_Pruitt@pruittcompanies.com

Representative: CEP Solar, LLC

Address: 2201 W. Broad St. Suite 200, Richmond, VA 23220

Phone: 804-789-4040 ext. 707 Fax: N/A

Email harry.kingery@cepsolar.com

Note: If applicant is anyone other than the owner of record, written authorization by the owner designating the applicant as the authorized agent for all matters concerning the request shall be filed with this application.

Tax Map and Parcel(s) 48-A-35

If property is in an Agricultural Forestal District, or Conservation Easement, please list information here:

N/A

Acreage 131 **Zoning** A-1

Deed Book and Page: Plat Book 2, Page 58

Location of Parcel: Latitude, Longitude: 37.7831848, -78.369263

If any Deed Restrictions, please attach a copy

TUP 10/2/23

Request for an SUP for the purpose of: Construction of a utility scale solar generation facility ~~and energy storage system~~

*Ten copies of a sketchplan (8.5x11inches or11x17inches) must be submitted, showing size and location of the lot, dimensions and location of the proposed building, structure or proposed use, and the dimensions and location of the existing structures on the lot.

By signing this application, the undersigned owner/applicant authorizes entry onto the property by County Employees, the Planning Commission, and the board of Supervisors during the normal discharge of their duties in regard to this request and acknowledges that county employees will make regular inspections of the site.

Date: 12/13/2022 **Signature of Owner/Applicant:** [signature]

Subscribed and sworn to before me this 13th day of December ,2022

Notary Public: Terry Bolton Scott Register # 796 5063

My commission expires: 2/28/2025

Certification: Date:

TERRY BOLTON SCOTT NOTARY PUBLIC REG. #7965063 MY COMMISSION EXPIRES 2/28/2025 COMMONWEALTH OF VIRGINIA

Date Received: 02/01/2023	Pre-Application Meeting:	PH Sign Deposit Received: 02/01/2023	Application #: SUP 23 : 01
$800.00 fee plus mailing costs paid: Chek 1166		Mailing Costs: $20.00 Adjacent Property Owner(APO) after 1st 15, Certified Mail	
Amendment of Condition: $400.00 fee plus mailing costs paid:			
Telecommunications Tower fee plus mailing costs paid:		Telecom Consultant Review fee paid:	
Election District: **Fork Union**		Planning Area: **Rural Preservation**	

Planning Commission	Board of Supervisors
Advertisement Dates:	Advertisement Dates:
APO Notification:	APO Notification:
Date of Hearing:	Date of Hearing
Decision:	Decision:

WHITE OAK SOLAR

SPECIAL EXCEPTION PERMIT

38 MW PV SOLAR ELECTRIC POWER GENERATION FACILITY

FLUVANNA COUNTY, VIRGINIA

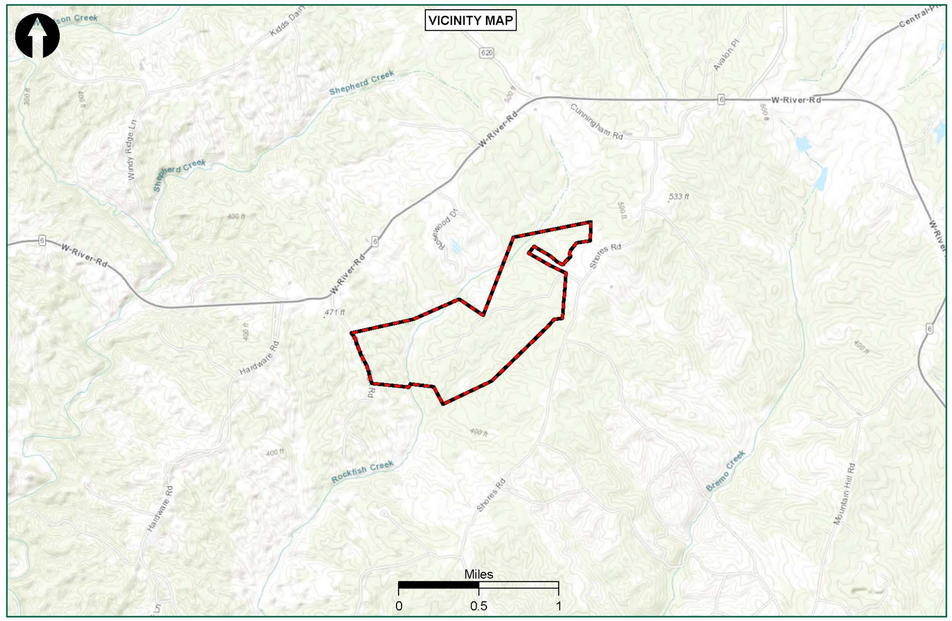


TABLE OF CONTENTS	
SHEET	**DESCRIPTION**
C1.0	COVER SHEET
C2.0	COUNTY MAP
C3.0	PARCEL AND ZONING MAP
C4.0	PRELIMINARY SITE PLAN
C4.1	PRELIMINARY SITE PLAN NOTES AND DETAILS
C5.0	PROPOSED LANDSCAPING MAP
C5.1	PROPOSED LANDSCAPING NOTES AND DETAILS
C6.0	PRESERVED FORESTS MAP
C7.0	EXISTING BUILDINGS MAP

WHITE OAK SOLAR

DEVELOPER

2201 W Broad Street, Suite 200
Richmond, VA 23220
TEL: 804.789.4040
Email: tyson.utt@cep-solar.com

TIMMONS GROUP

ENGINEER

1001 Boulders Parkway, Suite 300
Richmond, VA 23221
TEL 804.200.6446
www. timmons.com

PRELIMINARY SITE PLANS PREPARED BY TIMMONS GROUP

MARCH 16, 2023

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/16/2023
PROJECT NUMBER: 47661.004
PROJECT NAME: WHITE OAK SOLAR
DESIGNED BY / DRAWN BY: J. STICKLEY
PLAN SEAL/SIGNATURE:

REVISIONS

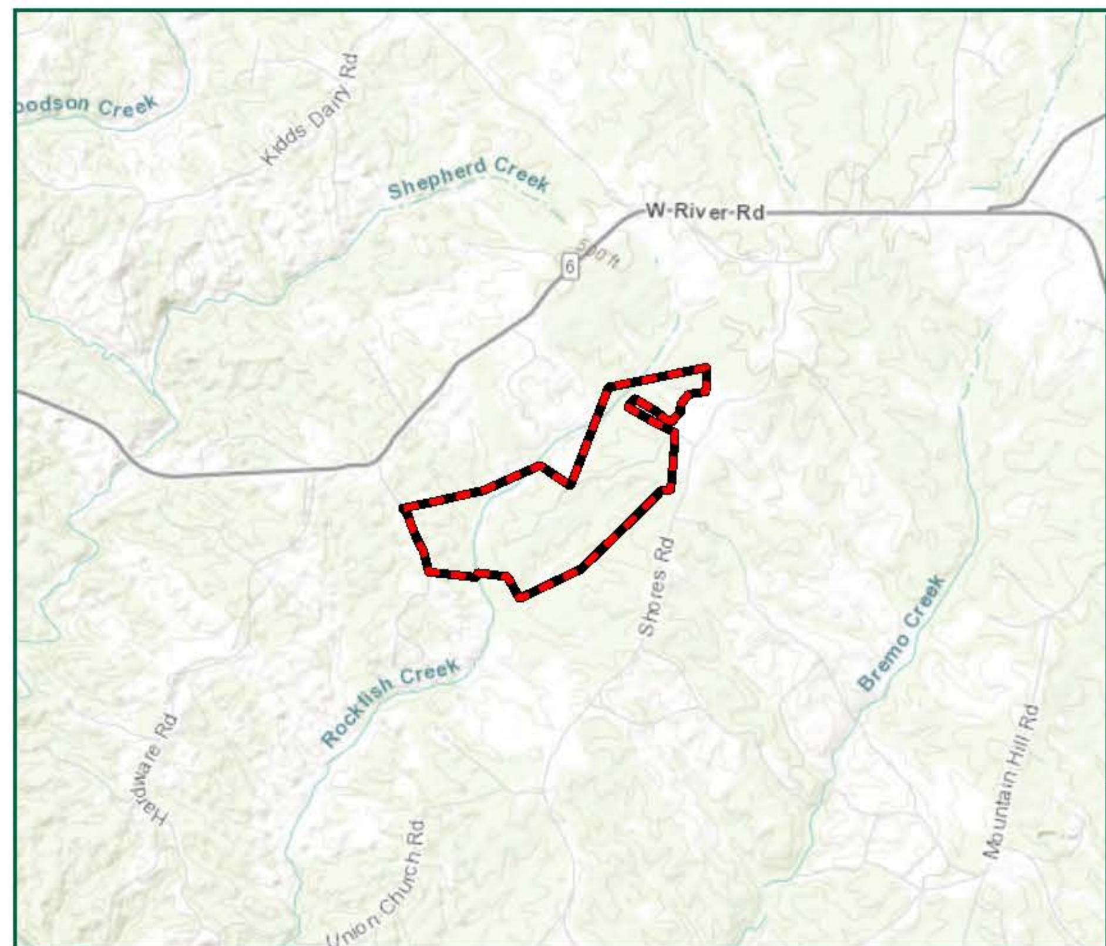
#	MM/DD/YY	DESCRIPTION

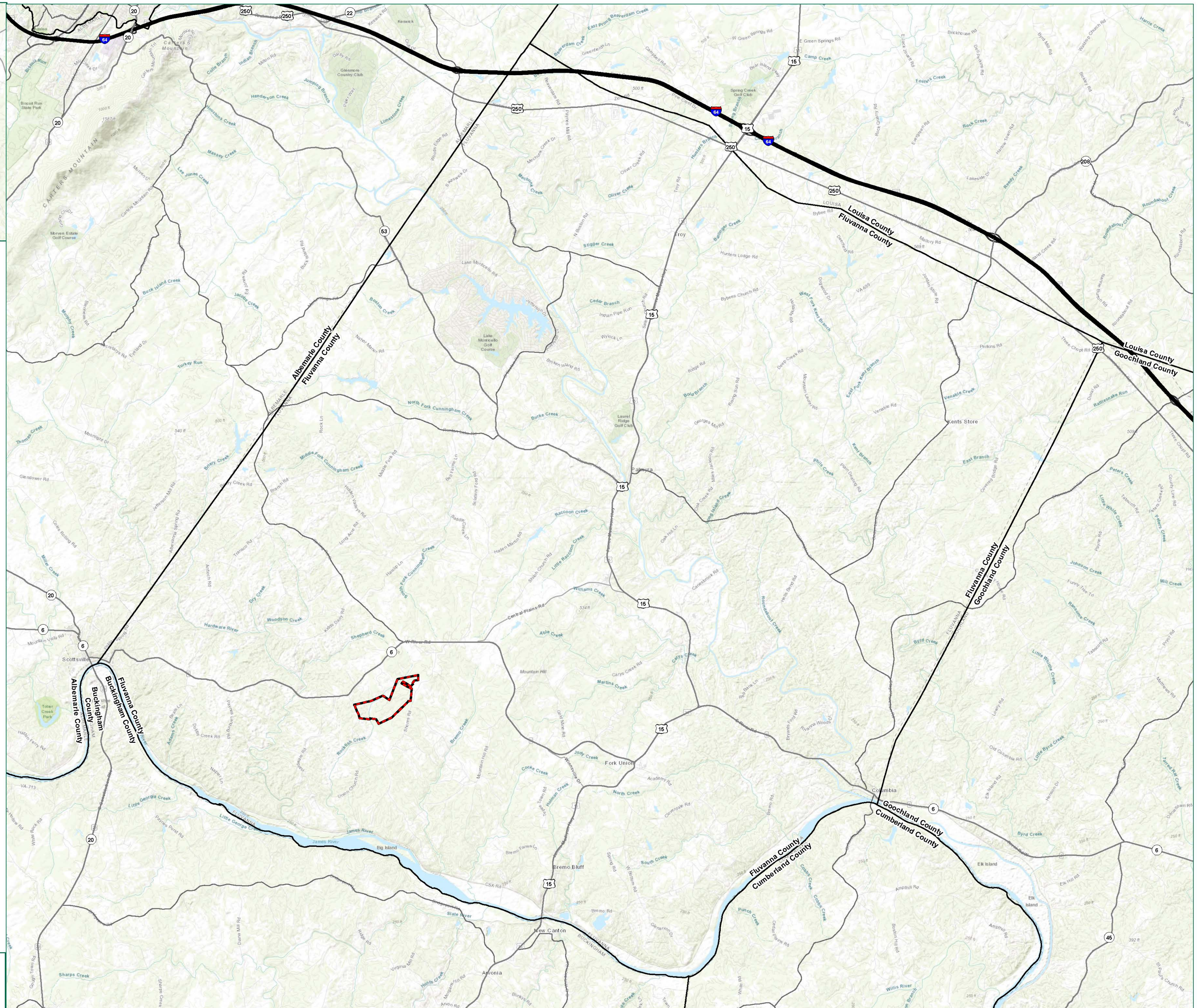
DRAWING DESCRIPTION: COVER SHEET

PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
	C1.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Cover Sheet.mxd





Legend

Project Study Limits - 434.7 Acres

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. COUNTY DATA FROM VDEM.
3. LATITUDE: 37.852248 | LONGITUDE: -78.094620
4. USGS QUADRANGLES: SCOTTSVILLE, PALMYRA | DATES: 2019, 2019
5. WATERSHED: MIDDLE JAMES-BUFFALO (JAMES RIVER BASIN)
6. HYDROLOGIC UNIT CODE: 02080203
7. WORLD TOPOGRAPHIC BASEMAP FROM ESRI.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE	03/16/2023
PROJECT NUMBER	47661.004
PROJECT NAME	WHITE OAK SOLAR
DESIGNED BY / DRAWN BY	J. STICKLEY

REVISIONS

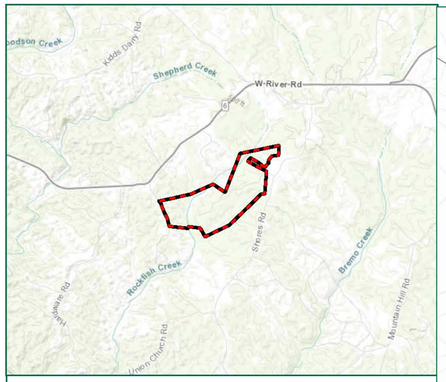
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
COUNTY MAP

SCALE (FEET)
0 6,000 12,000
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 6,000 '	C2.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-VIC.mxd



Legend

- Project Study Limits - 434.7 Acres
- Fluvanna County Parcels

Zoning Classification

- A-1 - Agricultural General District

Project Parcel Information		
Map Identifier	**Parcel Identifier**	**Owner Name**
1	49-A-1	ROCKFISH TRACT, LLC
2	49-A-5	ROCKFISH TRACT, LLC
3	48-A-35	FOOLS GOLD LLC
4	48-14-6	FOOLS GOLD LLC
5	49-A-8	ROCKFISH TRACT, LLC
6	48-14-6A	FOOLS GOLD LLC
7	48-14-5	FOOLS GOLD LLC
8	48-14-4	FOOLS GOLD LLC
Adjacent Parcel Information		
Map Identifier	**Parcel Identifier**	**Owner Name**
9	39-A-34	DAVIS, WILLIAM E & ANNE C
10	39-13-51	KECK ROSEWOOD MANOR LLC
11	39-A-55	WALKER, WESLEY RANDALL
12	49-A-2	BARKER, FRED E & HELEN B
13	48-A-18	SWALES, SUSAN E
14	49-A-6	GOODMAN, BOBBY JR & ASHLEY
15	48-A-33	WELLS TRUST WALLACE W WELLS
16	49-4-3	BRYANT, ROBERT
17	49-4-2	REEVES, CHARLES M & SUSAN R
18	49-4-1	BRUCE, ROSA B % RALPH D PINTO
19	48-A-31	WELLS, FRANKLIN D
20	49-A-9C	NOKO, LLC C/O DAVID FISHER
21	49-A-7	FINLEY, FLORENCE
22	48-A-30	WELLS, FRANKLIN D
23	48-14-1	FANNON, MARY BETH M & MANN, KAREN M
24	48-14-2	HOPPER, SHERYL
25	48-14-3	ROYSTON, CLYDE E & MARIANNE R
26	48-A-43	SCHMIDT, CHRISTOPH ALFRED
27	48-A-36	BURGOS, ANTHONY & DURDEN, KIMBERLY
28	48-A-37	BURGOS, ANTHONY & DURDEN, KIMBERLY
29	48-A-38	MUNDY, CHRISTOPHER JOHN ET AL

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. ZONING AND PARCEL INFORMATION FROM FLUVANNA COUNTY GIS.
3. WORLD TOPOGRAPHIC BASEMAP FROM ESRI.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/16/2023
PROJECT NUMBER: 47661.004
PROJECT NAME: WHITE OAK SOLAR
DESIGNED BY / DRAWN BY: J. STICKLEY

REVISIONS

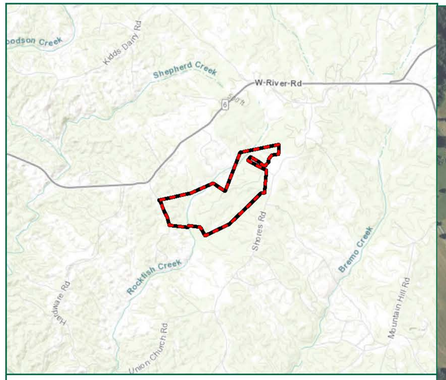
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
PARCEL AND ZONING MAP

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 400 '	C3.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Parcel Zoning Map.mxd

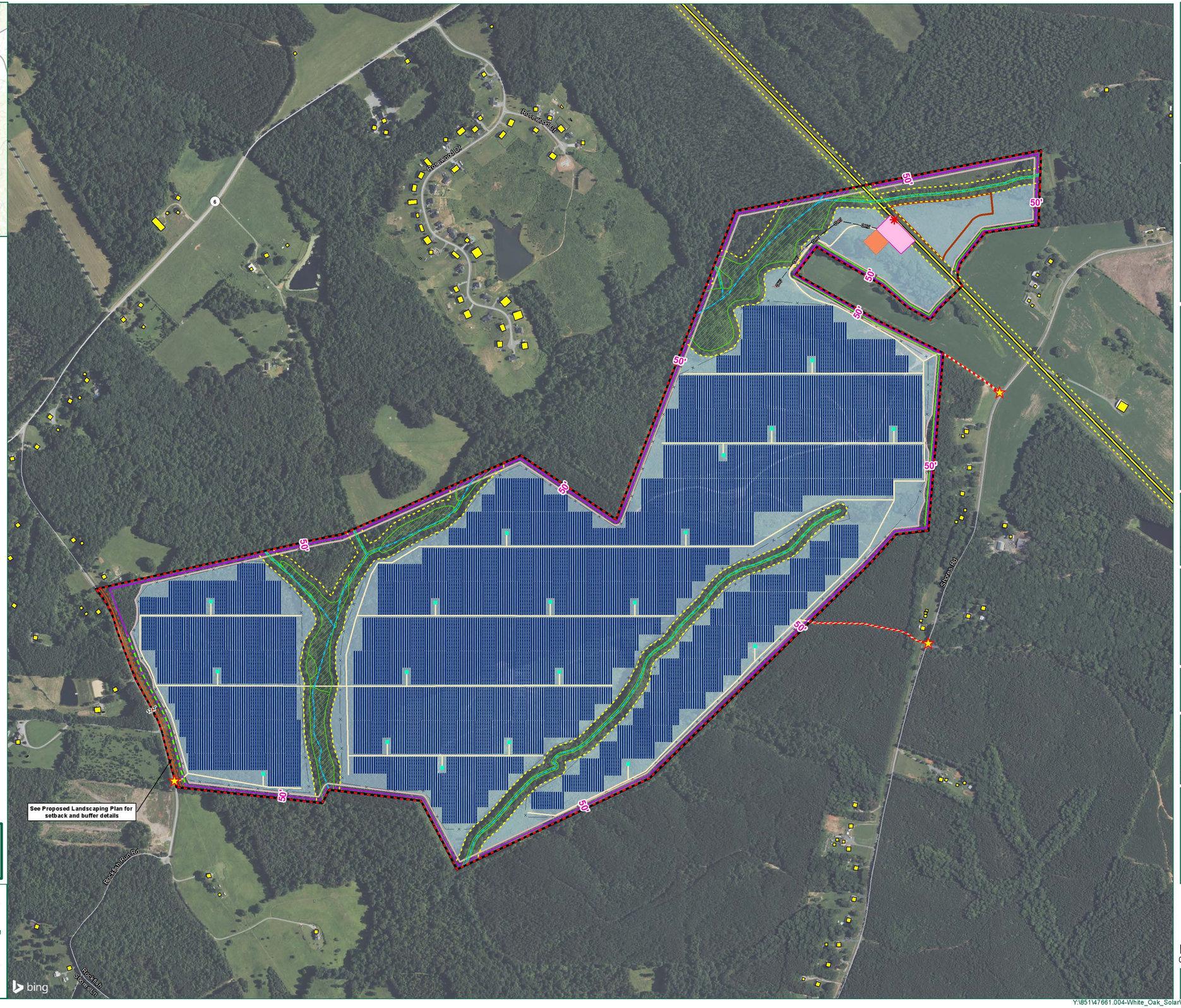


Legend

- Project Study Limits - 434.7 Acres
- Buildable Area - 342.0 Acres
- Setbacks (see notes for details)
- Project Entrance
- Point of Interconnection
- Electric Substations - Not Present
- Hybrid Inverters
- Proposed Utility Poles
- Setback Markers
- Width of Abutting Right-of-Way
- Distribution Line
- Transmission Line
- Retained Vegetative Buffer
- Typical Vegetative Buffer
- Rockfish Run Road Vegetative Buffer
- National Hydrography Dataset
- Access Easement
- Distribution Line Easement
- Transmission Line Easement
- Panels - 241.1 Acres Under Panel
- Fence - 307.4 Acres
- Battery Energy Storage System Area - 5.0 Acres
- Project Substation
- Utility Switchyard
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- FEMA Flood Zone - Not Present
- Existing Buildings

PANEL, INVERTER, POWER LINE, AND BATTERY ENERGY STORAGE SYSTEM LOCATIONS ARE SUBJECT TO CHANGE WITHIN THE BUILDABLE AREA.

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. SITE LAYOUT IS FOR DESIGN PURPOSES ONLY. NOT FOR CONSTRUCTION. LAYOUT SUBJECT TO CHANGE.
4. WETLAND DATA FROM NATIONAL WETLANDS INVENTORY.
5. STREAM DATA FROM NATIONAL HYDROGRAPHY DATASET.
6. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
7. FLOODPLAIN DATA IS PRELIMINARY DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER AND IS NOT YET EFFECTIVE.
9. HYBRID INVERTERS MAY INCLUDE BATTERY STORAGE TECHNOLOGY.
10. SETBACKS FROM FLUVANNA COUNTY ORDINANCE. SETBACKS ARE A MINIMUM OF 50' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
11. EXISTING BUILDING DATA FROM VGIN.
12. AERIAL IMAGERY FROM BING.



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/16/2023
PROJECT NUMBER: 47661.004
PROJECT NAME: WHITE OAK SOLAR
DESIGNED BY / DRAWN BY: J. STICKLEY

NOTES

REVISIONS

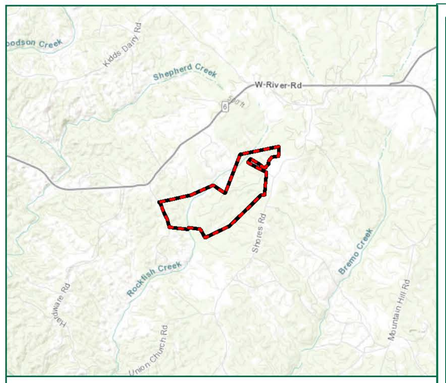
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
PRELIMINARY SITE PLAN

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

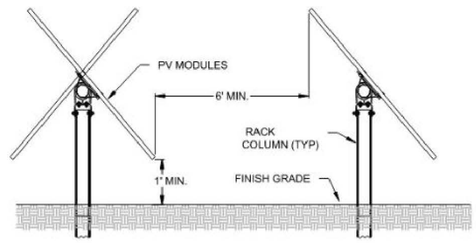
SCALE	SHEET NUMBER
H:1 " = 400 '	C4.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP2.mxd

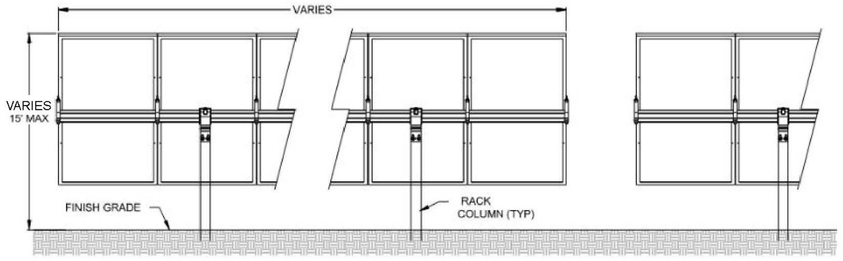


NOTES:

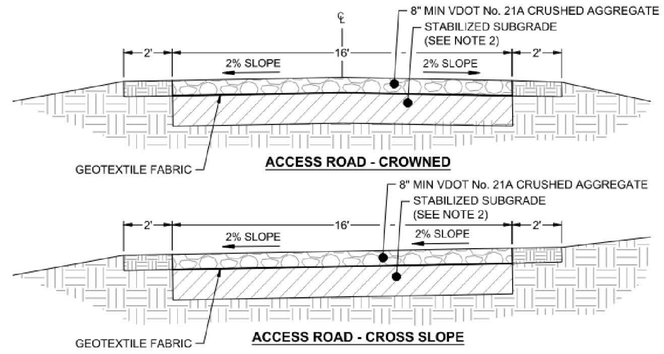
1. PROJECT LIMITS ARE APPROXIMATE.
2. SITE LAYOUT IS FOR DESIGN PURPOSES ONLY. NOT FOR CONSTRUCTION. LAYOUT SUBJECT TO CHANGE.
4. WETLAND DATA FROM NATIONAL WETLANDS INVENTORY.
5. STREAM DATA FROM NATIONAL HYDROGRAPHY DATASET.
6. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
7. FLOODPLAIN DATA IS PRELIMINARY DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER AND IS NOT YET EFFECTIVE.
9. HYBRID INVERTERS MAY INCLUDE BATTERY STORAGE TECHNOLOGY.
10. SETBACKS FROM FLUVANNA COUNTY ORDINANCE. SETBACKS ARE A MINIMUM 50' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
11. EXISTING BUILDING DATA FROM VGIN.
12. AERIAL IMAGERY FROM BING.



TYPICAL RACK NORTH/SOUTH END ELEVATION
NOT TO SCALE



TYPICAL TRACKER RACK EAST/WEST SIDE ELEVATION
NOT TO SCALE



NOTES:
1. GEOTEXTILE FABRIC SHALL BE MIRIFI HP370 OR SIMILAR.
2. SUBGRADE MATERIALS SHALL CONFORM TO VDOT "ROAD AND BRIDGE SPECIFICATIONS". SUBGRADE SHALL BE PLACED IN 12" MAXIMUM LIFTS AND COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. SOIL MOISTURE CONTENT DURING COMPACTION SHALL BE MAINTAINED WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT.
3. SHOULDERS SHALL BE COMPACTED NATIVE SOIL.

ACCESS ROAD TYPICAL SECTION
NTS

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/16/2023
PROJECT NUMBER: 47661.004
PROJECT NAME: WHITE OAK SOLAR
DESIGNED BY / DRAWN BY: J. STICKLEY
NOTES

REVISIONS

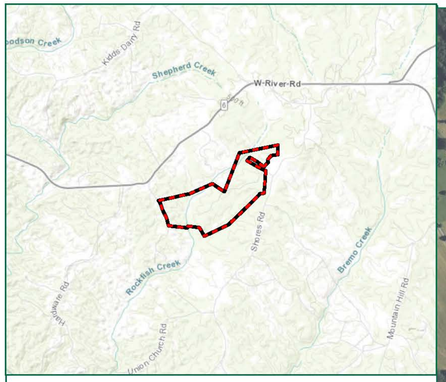
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
PRELIMINARY SITE PLAN NOTES AND DETAILS

PLANS PRINTED AS 11X17 ARE HALF SCALE

SHEET NUMBER
C4.1

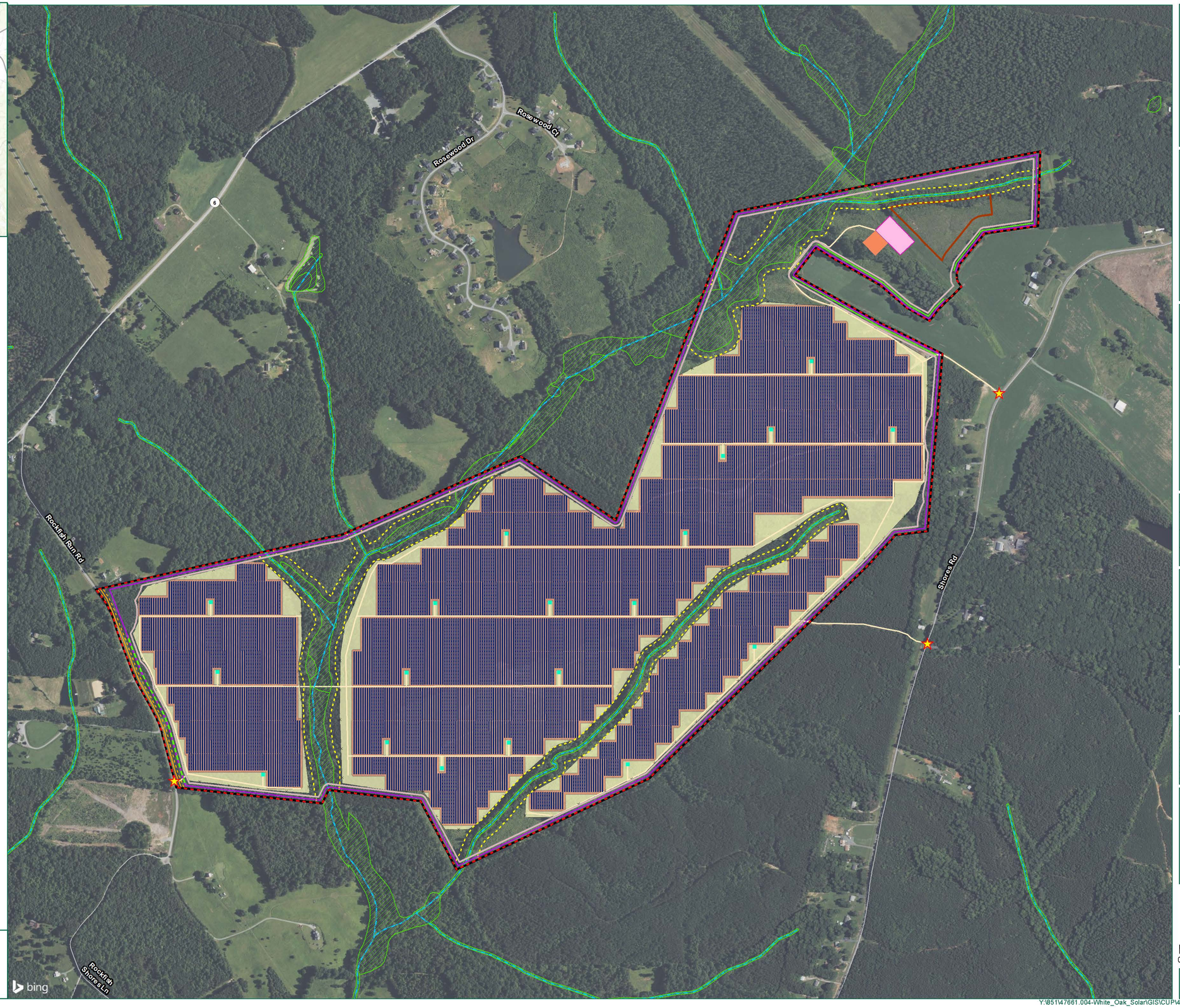
Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Schematic.mxd



Legend

- Project Study Limits - 434.7 Acres
- Setbacks (see notes for details)
- Hybrid Inverters
- Internal Roads
- National Hydrography Dataset
- Typical Vegetative Buffer
- Rockfish Run Road Vegetative Buffer
- Retained Vegetative Buffer
- Short Native Grass Seed Mix - 39.0 Acres
- Solar Farm Seed Mix - 268.4 Acres
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- Panels - 241.1 Acres Under Panel
- Fence - 307.4 Acres
- Project Substation
- Utility Switchyard
- Battery Energy Storage System Area - 5.0 Acres

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. BUFFERS AND SCREENING WILL FOLLOW FLUVANNA COUNTY ORDINANCE REQUIREMENTS. SEE SHEET 5.1 FOR DETAILS.
3. VEGETATION ON THE PERIMETER OF ADJACENT RESIDENTIAL PARCELS WILL BE RETAINED AS BUFFER WHERE IT EXISTS.
4. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
4. AERIAL IMAGERY FROM BING.



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/16/2023
PROJECT NUMBER: 47661.004
PROJECT NAME: WHITE OAK SOLAR
DESIGNED BY / DRAWN BY: J. STICKLEY

REVISIONS

#	MM/DD/YY	DESCRIPTION

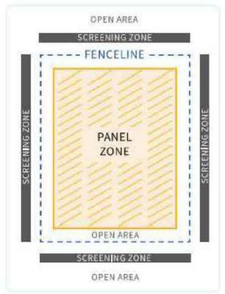
DRAWING DESCRIPTION
LANDSCAPING MAP

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 400 '	C5.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Veg Buffer.mxd

PROJECT AREA DIAGRAM



DEFINITIONS

Open Area: Any area beyond the panel zone, within the property boundary.

Panel Zone: The area underneath the solar arrays, including inter-row spacing.

Project Area: Open Area + Panel Zone + Screening Zone.

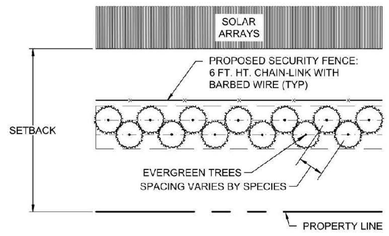
Screening Zone: A vegetated visual barrier.

SOURCE: VIRGINIA POLLINATOR-SMART COMPREHENSIVE PLAN

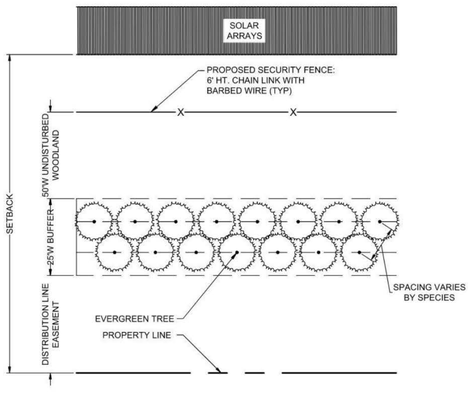
VEGETATIVE BUFFER NOTES

- PROVIDE A 25-FOOT WIDE LANDSCAPE BUFFER CONSISTING OF A STAGGERED ROW OF TWO SPECIES OF EVERGREEN TREES THAT ARE NON-INVASIVE, NATIVE, POLLINATOR, AND WILDLIFE FRIENDLY.THE TREES SHALL BE PLANTED TEN (10) FEET ON CENTER AND STAGGERED WITHIN THE PLANTING STRIP.
- PRESERVE EXISTING WETLANDS AND WOODLANDS TO SERVE AS VEGETATIVE BUFFER. IF EXISTING TREES AND VEGETATION ARE DISTURBED, PROVIDE NEW BUFFER PLANTINGS. WHERE INTERMITTENT EXISTING TREES OR SHRUBS EXIST WITHIN A PROPOSED BUFFER LOCATION, PROPOSED SCREENING MUST BE FIELD-LOCATED AND PLANTED AS NEEDED TO SUPPLEMENT THE EXISTING VEGETATIVE SCREENING.
- ENSURE THAT ALL PLANT MATERIAL MEETS REQUIREMENTS IN CHAPTER 22, ARTICLE 24 - LANDSCAPING AND TREE PROTECTION OF FLUVANNA COUNTY CODE OF ORDINANCES.
- TREES PLANTED IN THE BUFFER MUST BE AT LEAST FOUR (4) FEET TALL AT TIME OF PLANTING.
- FENCING MUST BE INSTALLED ON THE INTERIOR OF THE BUFFER.
- BUFFER MUST BE MAINTAINED IN GOOD CONDITION UNTIL THE FACILITY HAS BEEN DECOMMISSIONED AND REMOVED. IMPLEMENT A THREE-YEAR ESTABLISHMENT AND MAINTENANCE PERIOD TO FACILITY OPTIMAL SURVIVABILITY.

TYPICAL VEGETATIVE BUFFER PLANTING TEMPLATE



ROCKFISH RUN ROAD VEGETATIVE BUFFER PLANTING TEMPLATE



RECOMMENDED BUFFER PLANT LIST

EVERGREEN TREES (REQUIRED TO MITIGATE VISUAL IMPACT)

BOTANICAL NAME / COMMON NAME

ILEX OPACA / AMERICAN HOLLY

JUNIPERUS VIRGINIANA 'BRODIE' / EASTERN RED CEDAR

MAGNOLIA GRANDIFLORA 'LITTLE GEM' / SWEET BAY MAGNOLIA

MYRICA CERIFERA / SOUTHERN WAX MYRTLE

THUJA OCCIDENTALIS 'TECHNY' / ARBORVITAE

GROUNDCOVER PLANTING NOTES

- FOLLOWING INITIAL IMPLEMENTATION OF NOXIOUS WEED AND INVASIVE SPECIES MANAGEMENT PLAN, PREPARE SITE SOIL CONDITIONS FOR SEEDING.
- SEED DISTURBED AREAS WITHIN THE PROJECT AREA, DISTURBED AREAS WITHIN THE SETBACK, AND INSTALLED VEGETATIVE BUFFERS WITH APPROPRIATE POLLINATOR-FRIENDLY NATIVE PLANTS, SHRUBS, GRASSES, FORBES, AND WILDFLOWERS.
- SEED DISTURBED AREAS WITH A TEMPORARY MIXTURE AS NEEDED TO MEET STATE REGULATIONS FOR EROSION AND SEDIMENT CONTROL.
- DURING THE NEXT SUITABLE SEEDING PERIOD (SPRING OR FALL), SOW GROUNDCOVER TO ESTABLISH PERMANENT VEGETATIVE COVER. OPTIMAL SEED GERMINATION OCCURS AFTER OCTOBER 15 AND BEFORE APRIL 15. IF SEEDING IS CONDUCTED OUTSIDE OF OPTIMAL SEED GERMINATION PERIODS, PAIR A SEASONALLY-APPROPRIATE COVER CROP WITH PERMANENT SEED MIXTURE TO SUPPORT SOIL STABILIZATION AND EROSION AND SEDIMENT CONTROL DURING SEED ESTABLISHMENT PERIOD.
- USE RECOMMENDED SEEDING RATES (SPECIFIC TO MIXTURE) AND PROPER SEED PACKING FOR OPTIMAL GERMINATION AND SEED ESTABLISHMENT.

NOXIOUS WEED AND INVASIVE PLANT SPECIES MANAGEMENT PLAN

GENERAL NOTES

- ONGOING MONITORING IS REQUIRED TO MANAGE WEEDS AND INVASIVE SPECIES.
- USE PROPER EQUIPMENT FOR ALL CONTROL MEASURES:
  - TRACTOR MOUNTED BRUSH HOG FOR HEAVY MOWING (MINIMUM PLANT HEIGHT ≥3"-4") AND HIGH MOWING (MINIMUM PLANT HEIGHT ≥6"-8")
  - TRACTOR-MOUNTED, TRUCK-MOUNTED, OR ATV- MOUNTED SPRAYER FOR BROADCAST APPLICATIONS
  - BACKPACK STYLE SPRAYER OR OTHER DEVICE FOR SPOT SPRAYING APPROPRIATE TO THE CLASS OF PESTICIDE
  - AREAS UNDER AND DIRECTLY ADJACENT TO SOLAR ARRAYS MAY REQUIRE USE OF HAND-HELD EQUIPMENT
  - GRAZING BY RUMINANTS (USUALLY GOATS OR SHEEP) WHERE PRACTICAL AND APPROPRIATE TO PLANT SPECIES PRESENT
- REMOVE SHRUBS AND WOODY VINES BY THEIR ROOT SYSTEMS. ALTERNATIVELY, PRUNE THESE PLANTS AT GROUND LEVEL.
- REMOVE PROBLEMATIC PLANTS WITH FLOWERS OR SEEDS MANUALLY, PLACE HEAD FIRST IN HEAVY PLASTIC BAG, AND TRANSPORT TO A DESIGNATED DISPOSAL SITE. DO NOT DISPOSE OF AT LOCAL TRANSFER STATION, UNLESS THERE IS A DESIGNATED AREA FOR INVASIVE PLANT SPECIES DISPOSAL.
- PERFORM ALL CHEMICAL CONTROL TREATMENTS UNDER THE DIRECT SUPERVISION OF A VIRGINIA CERTIFIED PESTICIDE APPLICATOR OR REGISTERED TECHNICIAN.
- DO NOT APPLY HERBICIDE WHEN RAINFALL IS EXPECTED WITHIN 48 HOURS OR WIND SPEEDS EXCEED 10 MPH.

IDENTIFICATION AND CONTROL MEASURES PRE-CONSTRUCTION AND DURING CONSTRUCTION

- COMPLETE SITE INVENTORY OF NOXIOUS WEED SPECIES AND INVASIVE SPECIES.
- DEVELOP A MANAGEMENT PLAN THAT PRIORITIZES CONTROL OBJECTIVES.
- IMPLEMENT REMOVAL AND CONTROL MEASURES ACCORDING TO MANAGEMENT PLAN.
- REMOVAL AND CONTROL STRATEGIES SHOULD BE IMPLEMENTED TO BEGIN MANAGEMENT PRIOR TO SEEDING.

ESTABLISHMENT AND ONGOING MAINTENANCE SCHEDULE

- WINTER
  - REVIEW AND REVISE MANAGEMENT PLANS FOR THE UPCOMING YEAR BASED ON OBSERVATIONS FROM THE PRIOR YEAR.
  - PRUNE AS NECESSARY AND SEASONALLY APPROPRIATE.
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1, 2, AND 3: DURING LATE WINTER OR EARLY SPRING, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.5 FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES. AFTER THE ESTABLISHMENT PERIOD, THIS SHOULD BECOME THE ONCE-A-YEAR MOWING OR AN AS NEEDED MOWING.
- SPRING
  - WEED MANUALLY OR SPOT SPRAY TO TREAT WEEDS, IDEALLY ONCE PER MONTH.
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1, 2, AND 3: IF NOT DONE IN WINTER, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.5 FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES.
  - WATER AS NEEDED, ESPECIALLY DURING PERIODS OF DROUGHT.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGED PLANT MATERIAL, PARTICULARLY THOSE THAT CONTAIN OR COULD CONTAIN PESTS.
- SUMMER
  - WEED MANUALLY OR SPOT SPRAY TO TREAT WEEDS, IDEALLY ONCE PER MONTH.
  - WATER AS NEEDED, ESPECIALLY DURING PERIODS OF DROUGHT.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGED PLANT MATERIAL, PARTICULARLY THOSE THAT CONTAIN OR COULD CONTAIN PESTS.
- FALL
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1 AND 3: IF NOT DONE IN WINTER, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.R FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES. THE SECOND OR LAST MOWING SHOULD BE IN OCTOBER.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGE PLANT MATERIAL, PARTICULARLY THAT WHICH CONTAINS OR COULD CONTAIN PESTS.
  - LEAVE GROUNDCOVER ALONE FOR THE PURPOSE OF CREATING SEASONAL INTEREST IN THE LANDSCAPE AND WINTER HABITAT AND FOOD SOURCES FOR WILDLIFE. DO NOT DEADHEAD OR CUT DOWN STANDING VEGETATION, INCLUDING GRASSES AND FORBS. AN EXCEPTION IS ANY SPECIES THAT SEEDS AGGRESSIVELY; IN THAT CASE, DEADHEAD TO PREVENT THESE PLANTS FROM SELF-SOWING. IF A DECISION IS MADE TO CUT DOWN ANY VEGETATION, LAY THE CLIPPINGS ON THE GROUND TO SERVE AS MULCH (EXCEPT FOR AGGRESSIVE, NOXIOUS, OR INVASIVE PLANTS, WHICH SHOULD BE PROPERLY REMOVED FROM THE SITE).
  - IDENTIFY PROBLEM AREAS AND CHALLENGES FROM THE PRIOR GROWING SEASON TO INCORPORATE INTO MAINTENANCE AND MANAGEMENT PLANS FOR THE UPCOMING SEASON. PLAN OUT AND SCHEDULE SPECIFIC MAINTENANCE TASKS.

RECOMMENDED COVER CROPS (TEMPORARY SEEDING)

BOTANICAL NAME	COMMON NAME	SEEDS RATE: POUNDS PER ACRE
AVENA SATIVA	GRAIN OATS	50-100
SETARIA ITALICA	GERMAN MILLET	50
SECALE CEREALE	GRAIN RYE	50-100

RECOMMENDED GROUNDCOVER SEED MIXES

SOLAR FARM SEED MIX

FOR USE IN PANEL ZONE AND PROPOSED BUFFER

ERNST SOLAR FARM SEED MIX - ERNMX 186

Date: July 28, 2021

Ernst Solar Farm Seed Mix - ERNMX-186

	Botanical Name	Common Name	Price/lb
45.50 %	*Festuca rubra*	Creeping Red Fescue	3.30
15.00 %	*Festuca ovina var. duriuscula, 'Jetty'*	Hard Fescue, 'Jetty'	3.84
15.00 %	*Festuca ovina var. duriuscula, Gladiator*	Hard Fescue, Gladiator	3.84
10.00 %	*Festuca rubra ssp. commutata*	Chewings Fescue	3.30
5.00 %	*Poa pratensis, 'Selway'*	Kentucky Bluegrass, 'Selway'	3.36
5.00 %	*Poa pratensis, Appalachian*	Kentucky Bluegrass, Appalachian	3.36
4.50 %	*Trifolium repens, Dutch*	White Clover, Dutch	5.28
100.00 %		**Mix Price/lb Bulk:**	**$3.56**

Seeding Rate: 6 lb per 1,000 sq ft

Lawn & Turfgrass Sites; Solar Sites

Provide a 2' clearance between the ground and the solar panels. Mix formulations are subject to change without notice depending on the availability of existing and new products. While the formula may change, the guiding philosophy and function of the mix will not.

Price quotes guaranteed for 30 days.
All prices are FOB Meadville, PA.
Please check our web site at www.ernstseed.com for current pricing when placing orders.

SHORT NATIVE GRASS SEED MIX

FOR USE IN OPEN AREA WITHIN FENCE AND IN STAGING AREA (POST-CONSTRUCTION)

CUSTOM MIX BY ERNST

Ernst Conservation Seeds Inc
8884 Mercer Pike
Meadville, PA 16335-9275
Phone (814) 336-2404; (800) 873-3321; Fax (814) 336-5191
www.ernstseed.com; sales@ernstseed.com

QUOTE

Quote Number Q247897
Quote Date 7/30/2021
Page Number 1 of 1

BILL TO:
Timmons Group
1001 Boulder's Parkway
Suite 300
Richmond, VA 23225

Phone 804-200-6500
Fax 804-560-1648
Email ben.sagara@timmons.com

SHIP TO:
Timmons Group
1001 Boulder's Parkway
Suite 300
Richmond, VA 23225
Phone: 804-200-6500

Customer PO#	Customer ID	Shipping Method	UPS Shipper #	Terms	Salesperson ID
EM 073021 KK	TIMM002	UPS GROUND		Credit Card	

Bulk Qty	PLS Qty	UOM	Item Number	Description	Unit Price	Ext. Price
0.000		EACH	NATIVE SEED MIX		$0.00000	$0.00
2.343	2.178	LB PLS	PANSPH01	Roundseed Panicgrass	$32.00000	$69.70
1.493	1.227	LB PLS	BOUCUR02	Sideoats Grama, Butte	$14.00000	$17.18
5.259	4.356	LB PLS	SCHSCO01	Little Bluestem, 'Camper'	$16.00000	$69.70
0.000		EA	TOTAL	MIX NOTES	$0.00000	$0.00

$21.18 per PLS lb with a 5% custom mixing fee included
7.761 lb total

Prices quoted are firm for 30 days.

Subtotal	$156.58
Trade Discount	$0.00
Shipping/Handling	$0.00
Miscellaneous	$7.83
Tax	$9.86
Total US$	$174.27

Checks received may be converted to a one-time electronic funds transfer. Funds may be withdrawn from your account on the date payment is made.
Prices are F.O.B. Meadville. Items are subject to availability at time of delivery.
DISCLAIMER: Seeds are labeled as required by State and Federal laws.
RETURNS: Individual items and Ernst Mixes are subject to 10% restocking fee and must be made within 30 days of Invoice date. No returns on custom mixes. There is a 25% restocking fee on cancelled or returned bioengineering orders.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/16/2023

PROJECT NUMBER: 47661.004

PROJECT NAME: WHITE OAK SOLAR

DESIGNED BY / DRAWN BY: J. STICKLEY

NOTES

REVISIONS

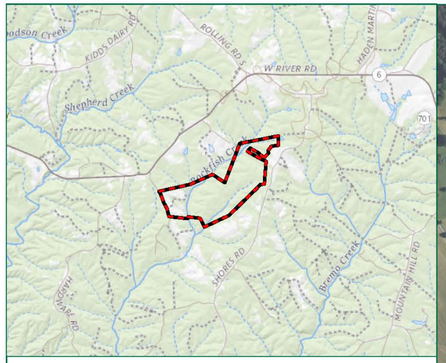
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION: PROPOSED LANDSCAPING NOTES AND DETAILS

PLANS PRINTED AS 11X17 ARE HALF SCALE

SHEET NUMBER: C5.1

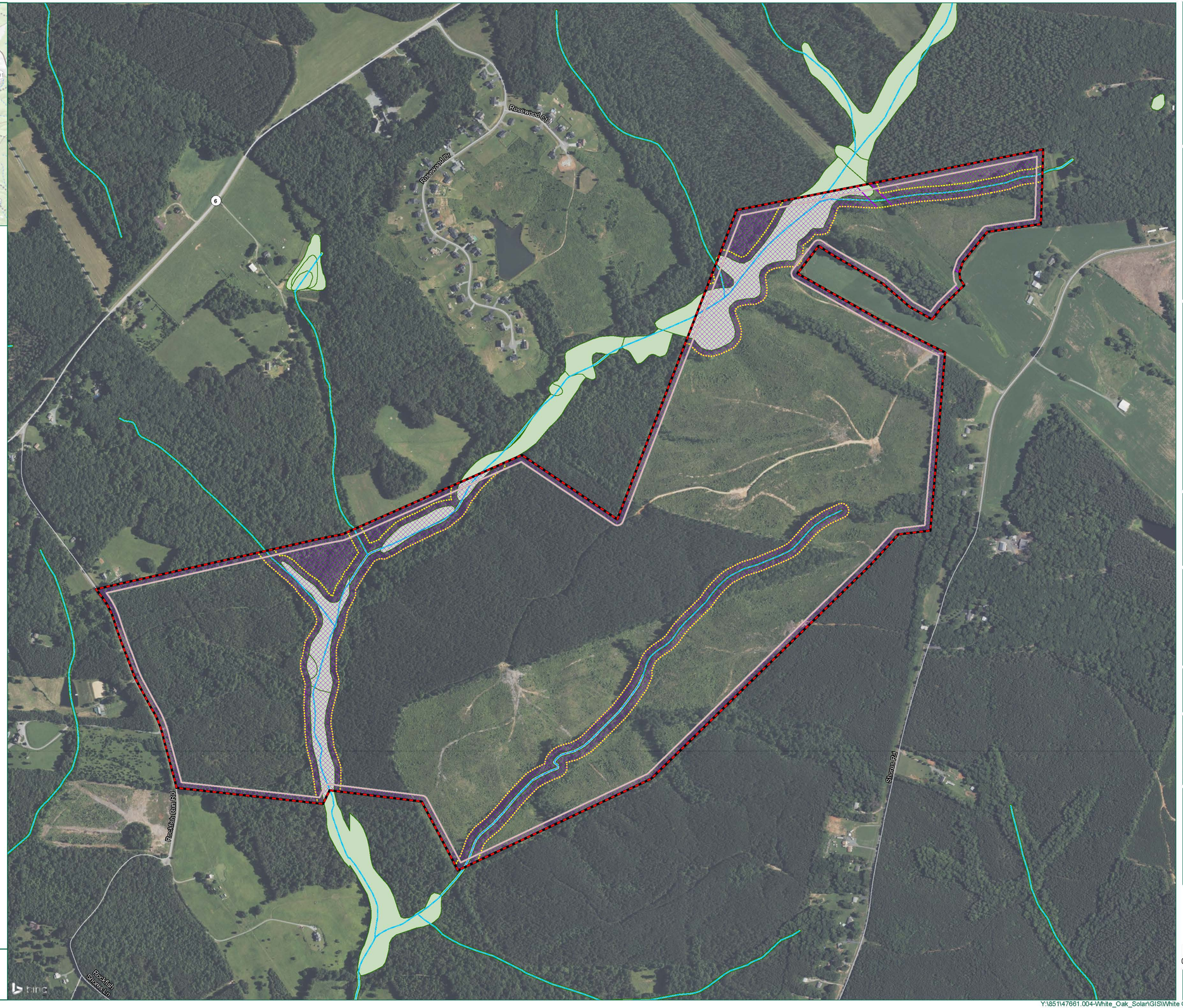
Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Landscaping Notes and Details.mxd



Legend

- Project Study Limits - 434.7 Acres
- Setbacks - 50'
- National Hydrography Dataset
- Preserverd Forests - 86.7 Acres
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- FEMA Flood Zone - Not Present

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. NWI FROM US FISH AND WILDLIFE SERVICE.
3. NATIONAL HYDROGRAPHY DATASET FROM USGS.
4. FLOOD ZONE DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER.
5. AERIAL IMAGERY FROM BING.



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/20/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

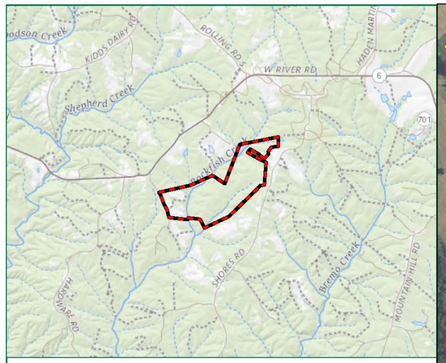
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
PRESERVED FORESTS MAP

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H: 1" = 400'	C6.0

Y:\851\47661.004-White_Oak_Solar\GIS\White Oak Slope\White Oak Slope.aprx



Legend

- Project Study Limits - 434.7 Acres
- Buildable Area - 343.1 Acres
- Setbacks (see notes for details)
- Distance Markers
- Virginia Building Footprints
- Fluvanna County Tax Parcels

Distance from Property Setbacks

- 200'
- 400'
- 600'

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. SETBACKS ARE 50' FROM ADJACENT PROPERTIES AND 300' FROM ADJACENT RESIDENCES.
3. SETBACKS ARE FROM FLUVANNA COUNTY ORDINANCE.
4. VIRGINIA BUILDING FOOTPRINT DATA FROM VGIN.
5. AERIAL IMAGERY FROM BING.

Rosewood Dr
Rosewood Ct
6
600'
400'
200'
Rockfish Run Rd
Shores Rd
Rockfish Shores Ln
bing

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/20/2023
PROJECT NUMBER: 47661.004
PROJECT NAME: WHITE OAK SOLAR
DESIGNED BY / DRAWN BY: M. HILL

REVISIONS

#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
EXISTING BUILDINGS MAP

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE: H: 1" = 400'
SHEET NUMBER: C7.0

Y:\851\47661.004-White_Oak_Solar\GIS\White Oak Slope\White Oak Slope.aprx

WHITE OAK SOLAR

SPECIAL EXCEPTION PERMIT

38 MW PV SOLAR ELECTRIC POWER GENERATION FACILITY

FLUVANNA COUNTY, VIRGINIA

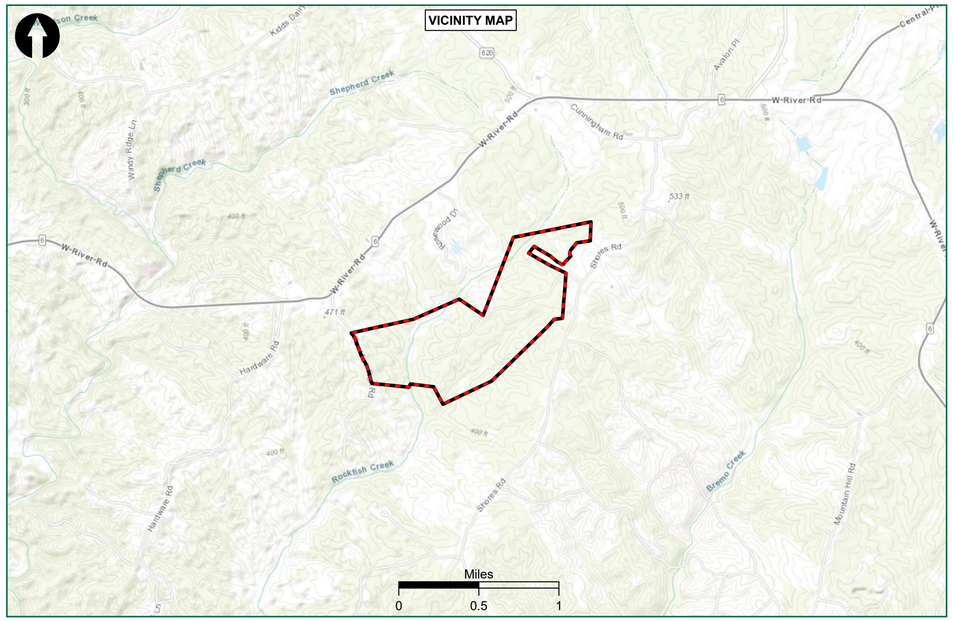


TABLE OF CONTENTS	
SHEET	**DESCRIPTION**
C1.0	COVER SHEET
C2.0	COUNTY MAP
C3.0	PARCEL AND ZONING MAP
C4.0	PRELIMINARY SITE PLAN
C4.1	PRELIMINARY SITE PLAN NOTES AND DETAILS
C5.0	PROPOSED LANDSCAPING MAP
C5.1	PROPOSED LANDSCAPING NOTES AND DETAILS
C6.0	PRESERVED FORESTS MAP
C7.0	EXISTING BUILDINGS MAP

WHITE OAK SOLAR

DEVELOPER

2201 W Broad Street, Suite 200
Richmond, VA 23220
TEL: 804.789.4040
Email: tyson.utt@cep-solar.com

TIMMONS GROUP

ENGINEER

1001 Boulders Parkway, Suite 300
Richmond, VA 23221
TEL 804.200.6446
www. timmons.com

PRELIMINARY SITE PLANS PREPARED BY TIMMONS GROUP

MARCH 16, 2023

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/16/2023
PROJECT NUMBER: 47661.004
PROJECT NAME: WHITE OAK SOLAR
DESIGNED BY / DRAWN BY: J. STICKLEY
PLAN SEAL/SIGNATURE:

REVISIONS

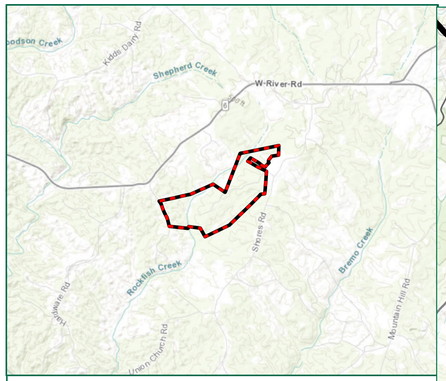
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION: COVER SHEET

PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
	C1.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Cover Sheet.mxd



Legend

Project Study Limits - 434.7 Acres

NOTES:

1. PROJECT LIMITS ARE APPROXIMATE.
2. COUNTY DATA FROM VDEM.
3. LATITUDE: 37.852248 | LONGITUDE: -78.094620
4. USGS QUADRANGLES: SCOTTSVILLE, PALMYRA | DATES: 2019, 2019
5. WATERSHED: MIDDLE JAMES-BUFFALO (JAMES RIVER BASIN)
6. HYDROLOGIC UNIT CODE: 02080203
7. WORLD TOPOGRAPHIC BASEMAP FROM ESRI.

Albemarle County
Fluvanna County
Louisa County
Fluvanna County
Louisa County
Goochland County
Fluvanna County
Goochland County
Albemarle County
Buckingham County
Buckingham County
Fluvanna County
Goochland County
Cumberland County
Fluvanna County
Cumberland County

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

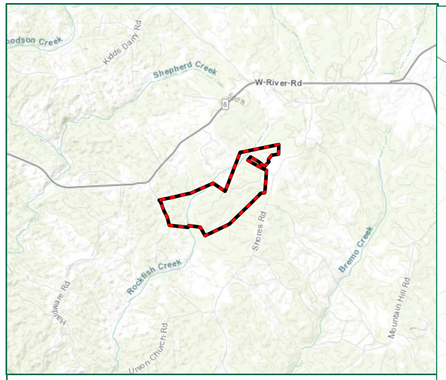
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
COUNTY MAP

SCALE (FEET)
0 6,000 12,000
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 6,000 '	C2.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-VIC.mxd



Legend

- Project Study Limits - 434.7 Acres
- Fluvanna County Parcels

Zoning Classification

- A-1 - Agricultural General District

Project Parcel Information		
Map Identifier	**Parcel Identifier**	**Owner Name**
1	49-A-1	ROCKFISH TRACT, LLC
2	49-A-5	ROCKFISH TRACT, LLC
3	48-A-35	FOOLS GOLD LLC
4	48-14-6	FOOLS GOLD LLC
5	49-A-8	ROCKFISH TRACT, LLC
6	48-14-6A	FOOLS GOLD LLC
7	48-14-5	FOOLS GOLD LLC
8	48-14-4	FOOLS GOLD LLC
Adjacent Parcel Information		
Map Identifier	**Parcel Identifier**	**Owner Name**
9	39-A-34	DAVIS, WILLIAM E & ANNE C
10	39-13-51	KECK ROSEWOOD MANOR LLC
11	39-A-55	WALKER, WESLEY RANDALL
12	49-A-2	BARKER, FRED E & HELEN B
13	48-A-18	SWALES, SUSAN E
14	49-A-6	GOODMAN, BOBBY JR & ASHLEY
15	48-A-33	WELLS TRUST WALLACE W WELLS
16	49-4-3	BRYANT, ROBERT
17	49-4-2	REEVES, CHARLES M & SUSAN R
18	49-4-1	BRUCE, ROSA B % RALPH D PINTO
19	48-A-31	WELLS, FRANKLIN D
20	49-A-9C	NOKO, LLC C/O DAVID FISHER
21	49-A-7	FINLEY, FLORENCE
22	48-A-30	WELLS, FRANKLIN D
23	48-14-1	FANNON, MARY BETH M & MANN, KAREN M
24	48-14-2	HOPPER, SHERYL
25	48-14-3	ROYSTON, CLYDE E & MARIANNE R
26	48-A-43	SCHMIDT, CHRISTOPH ALFRED
27	48-A-36	BURGOS, ANTHONY & DURDEN, KIMBERLY
28	48-A-37	BURGOS, ANTHONY & DURDEN, KIMBERLY
29	48-A-38	MUNDY, CHRISTOPHER JOHN ET AL

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. ZONING AND PARCEL INFORMATION FROM FLUVANNA COUNTY GIS.
3. WORLD TOPOGRAPHIC BASEMAP FROM ESRI.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

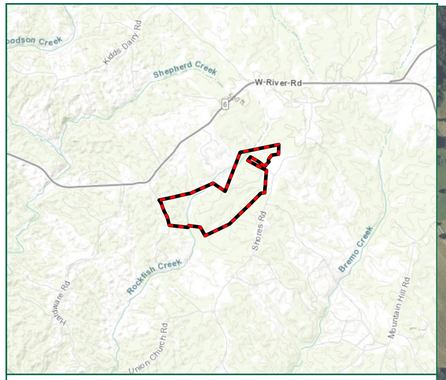
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
PARCEL AND ZONING MAP

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 400 '	C3.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Parcel Zoning Map.mxd

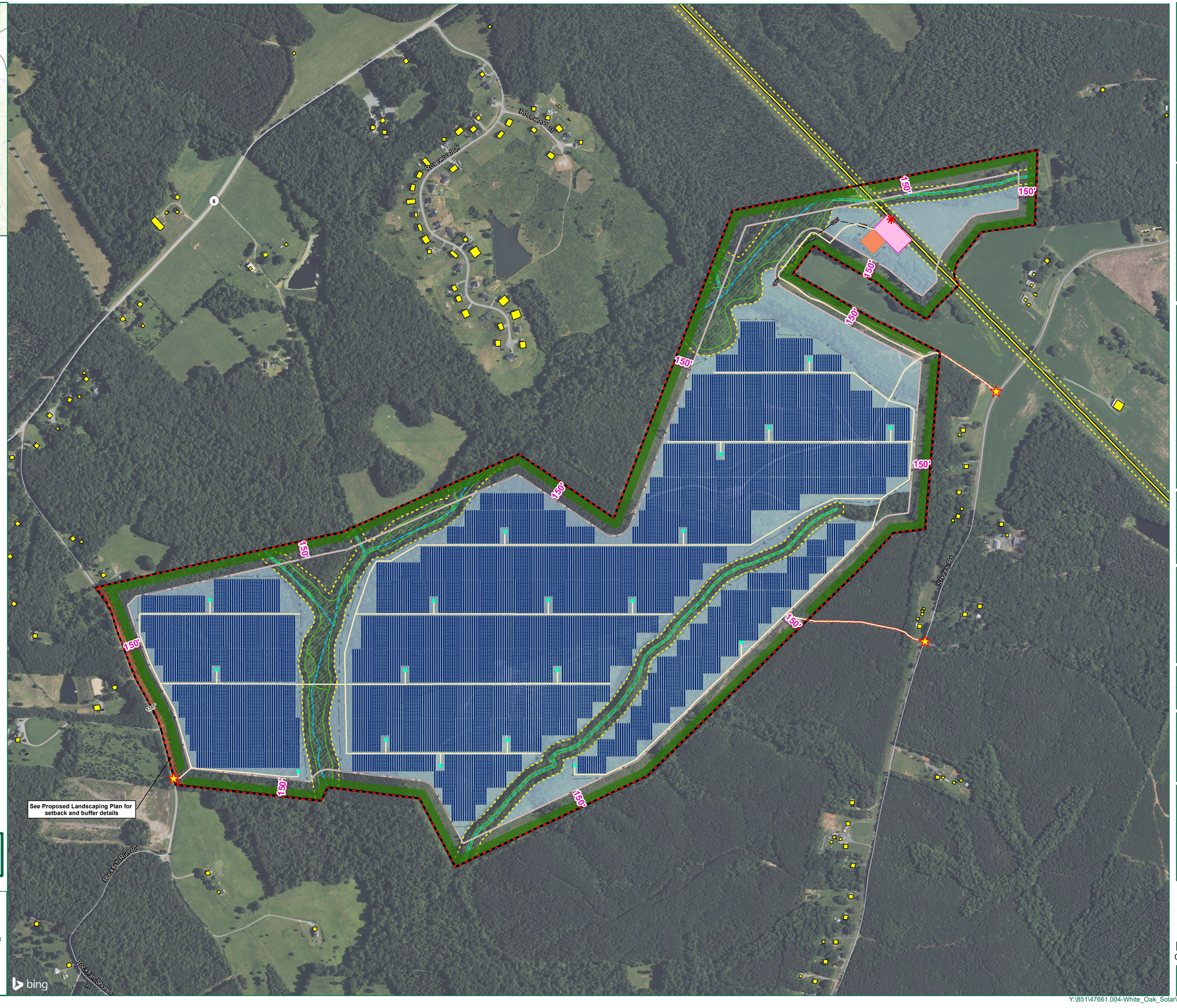


Legend

- Project Study Limits - 434.7 Acres
- Buildable Area - 301.6 Acres
- Setbacks (see notes for details)
- Project Entrance
- Point of Interconnection
- Electric Substations - Not Present
- Hybrid Inverters
- Proposed Utility Poles
- Setback Markers
- Width of Abutting Right-of-Way
- Distribution Line
- Transmission Line
- National Hydrography Dataset
- Access Easement
- Distribution Line Easement
- Transmission Line Easement
- Panels - 210.2 Acres Under Panel
- Fence - 270.0 Acres
- Project Substation
- Utility Switchyard
- Woodland Preservation Buffer - 75'
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- FEMA Flood Zone - Not Present
- Existing Buildings

PANEL, INVERTER, AND POWER LINE LOCATIONS ARE SUBJECT TO CHANGE WITHIN THE BUILDABLE AREA.

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. SITE LAYOUT IS FOR DESIGN PURPOSES ONLY. NOT FOR CONSTRUCTION. LAYOUT SUBJECT TO CHANGE.
4. WETLAND DATA FROM NATIONAL WETLANDS INVENTORY.
5. STREAM DATA FROM NATIONAL HYDROGRAPHY DATASET.
6. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
7. FLOODPLAIN DATA IS PRELIMINARY DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER AND IS NOT YET EFFECTIVE.
9. SETBACKS ARE A MINIMUM OF 150' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
10. EXISTING BUILDING DATA FROM VGIN.
11. AERIAL IMAGERY FROM BING.



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY

NOTES

REVISIONS

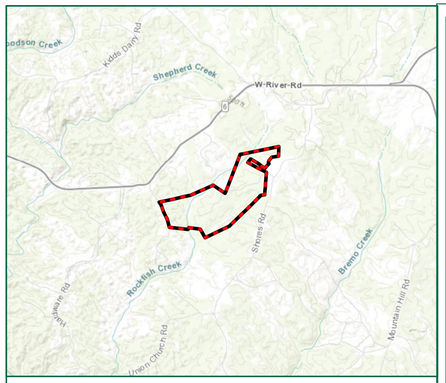
#	MM/DD/YY	DESCRIPTION
1	10/04/2023	SITE BASED ON COUNTY COMMENTS

DRAWING DESCRIPTION
PRELIMINARY SITE PLAN

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

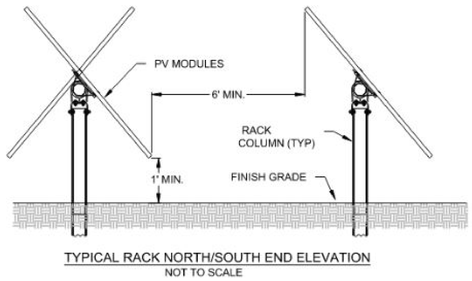
SCALE	SHEET NUMBER
H:1 " = 400 '	C4.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP2.mxd

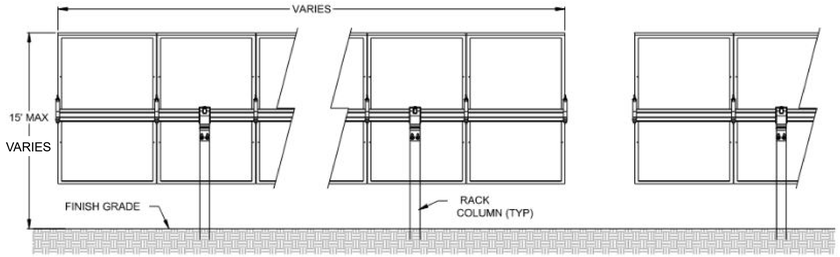


NOTES:

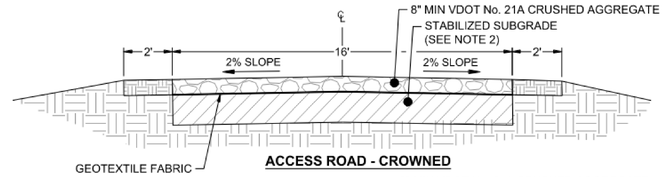
1. PROJECT LIMITS ARE APPROXIMATE.
2. SITE LAYOUT IS FOR DESIGN PURPOSES ONLY. NOT FOR CONSTRUCTION. LAYOUT SUBJECT TO CHANGE.
4. WETLAND DATA FROM NATIONAL WETLANDS INVENTORY.
5. STREAM DATA FROM NATIONAL HYDROGRAPHY DATASET.
6. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
7. FLOODPLAIN DATA IS PRELIMINARY DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER AND IS NOT YET EFFECTIVE.
9. SETBACKS ARE A MINIMUM 150' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
10. EXISTING BUILDING DATA FROM VGIN.
11. AERIAL IMAGERY FROM BING.



TYPICAL RACK NORTH/SOUTH END ELEVATION
NOT TO SCALE



TYPICAL TRACKER RACK EAST/WEST SIDE ELEVATION
NOT TO SCALE



NOTES:
1. GEOTEXTILE FABRIC SHALL BE MIRIFI HP370 OR SIMILAR.
2. SUBGRADE MATERIALS SHALL CONFORM TO VDOT "ROAD AND BRIDGE SPECIFICATIONS". SUBGRADE SHALL BE PLACED IN 12" MAXIMUM LIFTS AND COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. SOIL MOISTURE CONTENT DURING COMPACTION SHALL BE MAINTAINED WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT.
3. SHOULDERS SHALL BE COMPACTED NATIVE SOIL.

ACCESS ROAD TYPICAL SECTION
NTS

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE
03/16/2023

PROJECT NUMBER
47661.004

PROJECT NAME
WHITE OAK SOLAR

DESIGNED BY / DRAWN BY
J. STICKLEY

NOTES

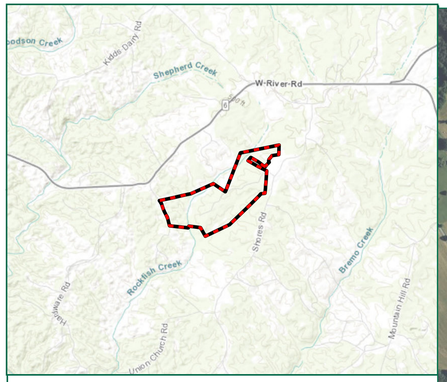
REVISIONS

#	MM/DD/YY	DESCRIPTION
1	10/04/2023	ADJUSTING SETBACK NOTE

DRAWING DESCRIPTION
PRELIMINARY SITE PLAN NOTES AND DETAILS

PLANS PRINTED AS 11X17 ARE HALF SCALE

SHEET NUMBER
C4.1



Legend

- Project Study Limits - 434.7 Acres
- Setbacks (see notes for details)
- Hybrid Inverters
- Internal Roads
- Distribution Line
- National Hydrography Dataset
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- Distribution Line Easement
- Panels - 241.1 Acres Under Panel
- Fence - 270.0 Acres
- Project Substation
- Utility Switchyard
- Woodland Preservation Buffer - 75'
- Native Pollinator Seed Mix - 31.6 Acres
- Solar Farm Seed Mix - 236.1 Acres

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. BUFFERS AND SCREENING WILL FOLLOW FLUVANNA COUNTY ORDINANCE REQUIREMENTS. SEE SHEET 5.1 FOR DETAILS.
3. VEGETATION ON THE PERIMETER OF ADJACENT RESIDENTIAL PARCELS WILL BE RETAINED AS BUFFER WHERE IT EXISITS.
4. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
5. SETBACKS ARE A MINIMUM OF 150' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
6. AERIAL IMAGERY FROM BING.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR

FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023

PROJECT NUMBER 47661.004

PROJECT NAME WHITE OAK SOLAR

DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

#	MM/DD/YY	DESCRIPTION
1	10/04/2023	EDITS BASED ON COUNTY COMMENTS

DRAWING DESCRIPTION

LANDSCAPING MAP

SCALE (FEET)

0 400 800

PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 400 '	C5.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Veg Buffer.mxd

PROJECT AREA DIAGRAM

DEFINITIONS

Open Area: Any area beyond the panel zone, within the property boundary.

Panel Zone: The area underneath the solar arrays, including inter-row spacing.

Project Area: Open Area + Panel Zone + Screening Zone.

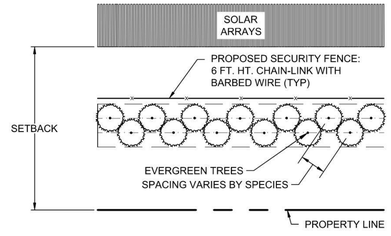
Screening Zone: A vegetated visual barrier.

SOURCE: VIRGINIA POLLINATOR-SMART COMPREHENSIVE PLAN

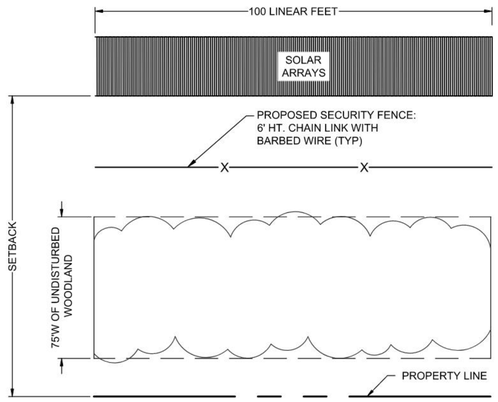
VEGETATIVE BUFFER NOTES

- PROVIDE A 25-FOOT WIDE LANDSCAPE BUFFER CONSISTING OF A STAGGERED ROW OF TWO SPECIES OF EVERGREEN TREES THAT ARE NON-INVASIVE, NATIVE, POLLINATOR, AND WILDLIFE FRIENDLY.THE TREES SHALL BE PLANTED TEN (10) FEET ON CENTER AND STAGGERED WITHIN THE PLANTING STRIP.
- PRESERVE EXISTING WETLANDS AND WOODLANDS TO SERVE AS VEGETATIVE BUFFER. IF EXISTING TREES AND VEGETATION ARE DISTURBED, PROVIDE NEW BUFFER PLANTINGS. WHERE INTERMITTENT EXISTING TREES OR SHRUBS EXIST WITHIN A PROPOSED BUFFER LOCATION, PROPOSED SCREENING MUST BE FIELD-LOCATED AND PLANTED AS NEEDED TO SUPPLEMENT THE EXISTING VEGETATIVE SCREENING.
- ENSURE THAT ALL PLANT MATERIAL MEETS REQUIREMENTS IN CHAPTER 22, ARTICLE 24 - LANDSCAPING AND TREE PROTECTION OF FLUVANNA COUNTY CODE OF ORDINANCES.
- TREES PLANTED IN THE BUFFER MUST BE AT LEAST FOUR (4) FEET TALL AT TIME OF PLANTING.
- FENCING MUST BE INSTALLED ON THE INTERIOR OF THE BUFFER.
- BUFFER MUST BE MAINTAINED IN GOOD CONDITION UNTIL THE FACILITY HAS BEEN DECOMMISSIONED AND REMOVED. IMPLEMENT A THREE-YEAR ESTABLISHMENT AND MAINTENANCE PERIOD TO FACILITY OPTIMAL SURVIVABILITY.

TYPICAL VEGETATIVE BUFFER PLANTING TEMPLATE



WOODLAND PRESERVATION BUFFER DETAIL



RECOMMENDED BUFFER PLANT LIST

EVERGREEN TREES (REQUIRED TO MITIGATE VISUAL IMPACT)

BOTANICAL NAME / COMMON NAME

ILEX OPACA / AMERICAN HOLLY

JUNIPERUS VIRGINIANA 'BRODIE' / EASTERN RED CEDAR

MAGNOLIA GRANDIFLORA 'LITTLE GEM' / SWEET BAY MAGNOLIA

MYRICA CERIFERA / SOUTHERN WAX MYRTLE

THUJA OCCIDENTALIS 'TECHNY' / ARBORVITAE

GROUNDCOVER PLANTING NOTES

- FOLLOWING INITIAL IMPLEMENTATION OF NOXIOUS WEED AND INVASIVE SPECIES MANAGEMENT PLAN, PREPARE SITE SOIL CONDITIONS FOR SEEDING.
- SEED DISTURBED AREAS WITHIN THE PROJECT AREA, DISTURBED AREAS WITHIN THE SETBACK, AND INSTALLED VEGETATIVE BUFFERS WITH APPROPRIATE POLLINATOR-FRIENDLY NATIVE PLANTS, SHRUBS, GRASSES, FORBES, AND WILDFLOWERS.
- SEED DISTURBED AREAS WITH A TEMPORARY MIXTURE AS NEEDED TO MEET STATE REGULATIONS FOR EROSION AND SEDIMENT CONTROL.
- DURING THE NEXT SUITABLE SEEDING PERIOD (SPRING OR FALL), SOW GROUNDCOVER TO ESTABLISH PERMANENT VEGETATIVE COVER. OPTIMAL SEED GERMINATION OCCURS AFTER OCTOBER 15 AND BEFORE APRIL 15. IF SEEDING IS CONDUCTED OUTSIDE OF OPTIMAL SEED GERMINATION PERIODS, PAIR A SEASONALLY-APPROPRIATE COVER CROP WITH PERMANENT SEED MIXTURE TO SUPPORT SOIL STABILIZATION AND EROSION AND SEDIMENT CONTROL DURING SEED ESTABLISHMENT PERIOD.
- USE RECOMMENDED SEEDING RATES (SPECIFIC TO MIXTURE) AND PROPER SEED PACKING FOR OPTIMAL GERMINATION AND SEED ESTABLISHMENT.

NOXIOUS WEED AND INVASIVE PLANT SPECIES MANAGEMENT PLAN

GENERAL NOTES

- ONGOING MONITORING IS REQUIRED TO MANAGE WEEDS AND INVASIVE SPECIES.
- USE PROPER EQUIPMENT FOR ALL CONTROL MEASURES:
  - TRACTOR MOUNTED BRUSH HOG FOR HEAVY MOWING (MINIMUM PLANT HEIGHT ≥3"-4") AND HIGH MOWING (MINIMUM PLANT HEIGHT ≥6"-8")
  - TRACTOR-MOUNTED, TRUCK-MOUNTED, OR ATV- MOUNTED SPRAYER FOR BROADCAST APPLICATIONS
  - BACKPACK STYLE SPRAYER OR OTHER DEVICE FOR SPOT SPRAYING APPROPRIATE TO THE CLASS OF PESTICIDE
  - AREAS UNDER AND DIRECTLY ADJACENT TO SOLAR ARRAYS MAY REQUIRE USE OF HAND-HELD EQUIPMENT
  - GRAZING BY RUMINANTS (USUALLY GOATS OR SHEEP) WHERE PRACTICAL AND APPROPRIATE TO PLANT SPECIES PRESENT
- REMOVE SHRUBS AND WOODY VINES BY THEIR ROOT SYSTEMS. ALTERNATIVELY, PRUNE THESE PLANTS AT GROUND LEVEL.
- REMOVE PROBLEMATIC PLANTS WITH FLOWERS OR SEEDS MANUALLY, PLACE HEAD FIRST IN HEAVY PLASTIC BAG, AND TRANSPORT TO A DESIGNATED DISPOSAL SITE. DO NOT DISPOSE OF AT LOCAL TRANSFER STATION, UNLESS THERE IS A DESIGNATED AREA FOR INVASIVE PLANT SPECIES DISPOSAL.
- PERFORM ALL CHEMICAL CONTROL TREATMENTS UNDER THE DIRECT SUPERVISION OF A VIRGINIA CERTIFIED PESTICIDE APPLICATOR OR REGISTERED TECHNICIAN.
- DO NOT APPLY HERBICIDE WHEN RAINFALL IS EXPECTED WITHIN 48 HOURS OR WIND SPEEDS EXCEED 10 MPH.

IDENTIFICATION AND CONTROL MEASURES PRE-CONSTRUCTION AND DURING CONSTRUCTION

- COMPLETE SITE INVENTORY OF NOXIOUS WEED SPECIES AND INVASIVE SPECIES.
- DEVELOP A MANAGEMENT PLAN THAT PRIORITIZES CONTROL OBJECTIVES.
- IMPLEMENT REMOVAL AND CONTROL MEASURES ACCORDING TO MANAGEMENT PLAN.
- REMOVAL AND CONTROL STRATEGIES SHOULD BE IMPLEMENTED TO BEGIN MANAGEMENT PRIOR TO SEEDING.

ESTABLISHMENT AND ONGOING MAINTENANCE SCHEDULE

- WINTER
  - REVIEW AND REVISE MANAGEMENT PLANS FOR THE UPCOMING YEAR BASED ON OBSERVATIONS FROM THE PRIOR YEAR.
  - PRUNE AS NECESSARY AND SEASONALLY APPROPRIATE.
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1, 2, AND 3: DURING LATE WINTER OR EARLY SPRING, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.5 FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES. AFTER THE ESTABLISHMENT PERIOD, THIS SHOULD BECOME THE ONCE-A-YEAR MOWING OR AN AS NEEDED MOWING.
- SPRING
  - WEED MANUALLY OR SPOT SPRAY TO TREAT WEEDS, IDEALLY ONCE PER MONTH.
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1, 2, AND 3: IF NOT DONE IN WINTER, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.5 FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES.
  - WATER AS NEEDED, ESPECIALLY DURING PERIODS OF DROUGHT.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGED PLANT MATERIAL, PARTICULARLY THOSE THAT CONTAIN OR COULD CONTAIN PESTS.
- SUMMER
  - WEED MANUALLY OR SPOT SPRAY TO TREAT WEEDS, IDEALLY ONCE PER MONTH.
  - WATER AS NEEDED, ESPECIALLY DURING PERIODS OF DROUGHT.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGED PLANT MATERIAL, PARTICULARLY THOSE THAT CONTAIN OR COULD CONTAIN PESTS.
- FALL
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1 AND 3: IF NOT DONE IN WINTER, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.R FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES. THE SECOND OR LAST MOWING SHOULD BE IN OCTOBER.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGE PLANT MATERIAL, PARTICULARLY THAT WHICH CONTAINS OR COULD CONTAIN PESTS.
  - LEAVE GROUNDCOVER ALONE FOR THE PURPOSE OF CREATING SEASONAL INTEREST IN THE LANDSCAPE AND WINTER HABITAT AND FOOD SOURCES FOR WILDLIFE. DO NOT DEADHEAD OR CUT DOWN STANDING VEGETATION, INCLUDING GRASSES AND FORBS. AN EXCEPTION IS ANY SPECIES THAT SEEDS AGGRESSIVELY; IN THAT CASE, DEADHEAD TO PREVENT THESE PLANTS FROM SELF-SOWING. IF A DECISION IS MADE TO CUT DOWN ANY VEGETATION, LAY THE CLIPPINGS ON THE GROUND TO SERVE AS MULCH (EXCEPT FOR AGGRESSIVE, NOXIOUS, OR INVASIVE PLANTS, WHICH SHOULD BE PROPERLY REMOVED FROM THE SITE).
  - IDENTIFY PROBLEM AREAS AND CHALLENGES FROM THE PRIOR GROWING SEASON TO INCORPORATE INTO MAINTENANCE AND MANAGEMENT PLANS FOR THE UPCOMING SEASON. PLAN OUT AND SCHEDULE SPECIFIC MAINTENANCE TASKS.

RECOMMENDED COVER CROPS (TEMPORARY SEEDING)

BOTANICAL NAME	COMMON NAME	SEEDS RATE: POUNDS PER ACRE
AVENA SATIVA	GRAIN OATS	50-100
SETARIA ITALICA	GERMAN MILLET	50
SECALE CEREALE	GRAIN RYE	50-100

RECOMMENDED GROUNDCOVER SEED MIXES

SOLAR FARM SEED MIX

FOR USE IN PANEL ZONE

ERNST SOLAR FARM SEED MIX - ERNMX 186

Date: July 28, 2021

Ernst Solar Farm Seed Mix - ERNMX-186

	Botanical Name	Common Name	Price/lb
45.50 %	*Festuca rubra*	Creeping Red Fescue	3.30
15.00 %	*Festuca ovina var. duriuscula, 'Jetty'*	Hard Fescue, 'Jetty'	3.84
15.00 %	*Festuca ovina var. duriuscula, Gladiator*	Hard Fescue, Gladiator	3.84
10.00 %	*Festuca rubra ssp. commutata*	Chewings Fescue	3.30
5.00 %	*Poa pratensis, 'Selway'*	Kentucky Bluegrass, 'Selway'	3.36
5.00 %	*Poa pratensis, Appalachian*	Kentucky Bluegrass, Appalachian	3.36
4.50 %	*Trifolium repens, Dutch*	White Clover, Dutch	5.28
100.00 %		**Mix Price/lb Bulk:**	**$3.56**

Seeding Rate: 6 lb per 1,000 sq ft

Lawn & Turfgrass Sites; Solar Sites

Provide a 2' clearance between the ground and the solar panels. Mix formulations are subject to change without notice depending on the availability of existing and new products. While the formula may change, the guiding philosophy and function of the mix will not.

Price quotes guaranteed for 30 days.
All prices are FOB Meadville, PA.
Please check our web site at www.ernstseed.com for current pricing when placing orders.

NATIVE POLLINATOR SEED MIX

FOR USE IN OPEN AREA WITHIN FENCE, PROPOSED BUFFER, AND IN STAGING AREA (POST-CONSTRUCTION)

CUSTOM MIX BY ERNST

ERNST SEEDS

Ernst Conservation Seeds
8884 Mercer Pike
Meadville, PA 16335
(800) 873-3321 Fax (814) 336-5191
www.ernstseed.com

Date: May 19, 2023

Mesic to Dry Native Pollinator Mix - ERNMX-105

	Botanical Name	Common Name	Price/Lb
29.40 %	*Schizachyrium scoparium, Fort Indiantown Gap-PA Ecotype*	Little Bluestem, Fort Indiantown Gap-PA Ecotype	15.13
18.50 %	*Elymus virginicus, PA Ecotype*	Virginia Wildrye, PA Ecotype	9.08
12.00 %	*Sorghastrum nutans, PA Ecotype*	Indiangrass, PA Ecotype	15.81
8.00 %	*Echinacea purpurea*	Purple Coneflower	43.20
5.00 %	*Panicum clandestinum, Tioga*	Deertongue, Tioga	22.50
3.00 %	*Chamaecrista fasciculata, PA Ecotype*	Partridge Pea, PA Ecotype	7.20
3.00 %	*Coreopsis lanceolata*	Lanceleaf Coreopsis	28.80
3.00 %	*Rudbeckia hirta*	Blackeyed Susan	31.20
2.50 %	*Verbena hastata, PA Ecotype*	Blue Vervain, PA Ecotype	38.40
2.00 %	*Helianthus helianthoides, PA Ecotype*	Oxeye Sunflower, PA Ecotype	33.60
2.00 %	*Zizia aurea, PA Ecotype*	Golden Alexanders, PA Ecotype	72.00
1.50 %	*Lespedeza capitata, RI Ecotype*	Roundhead Lespedeza, RI Ecotype	115.20
1.50 %	*Penstemon digitalis, PA Ecotype*	Tall White Beardtongue, PA Ecotype	168.00
1.00 %	*Asclepias tuberosa, PA Ecotype*	Butterfly Milkweed, PA Ecotype	312.00
1.00 %	*Pycnanthemum tenuifolium*	Narrowleaf Mountainmint	168.00
1.00 %	*Senna hebecarpa, VA & WV Ecotype*	Wild Senna, VA & WV Ecotype	28.80
0.90 %	*Aster pilosus, PA Ecotype*	Heath Aster, PA Ecotype	264.00
0.80 %	*Aster novae-angliae, PA Ecotype*	New England Aster, PA Ecotype	336.00
0.70 %	*Asclepias incarnata, PA Ecotype*	Swamp Milkweed, PA Ecotype	177.60
0.50 %	*Baptisia australis, Southern WV Ecotype*	Blue False Indigo, Southern WV Ecotype	96.00
0.50 %	*Geum canadense, PA Ecotype*	White Avens, PA Ecotype	192.00
0.50 %	*Rudbeckia triloba, WV Ecotype*	Browneyed Susan, WV Ecotype	57.60
0.40 %	*Monarda fistulosa, Fort Indiantown Gap-PA Ecotype*	Wild Bergamot, Fort Indiantown Gap-PA Ecotype	96.00
0.30 %	*Asclepias syriaca, PA Ecotype*	Common Milkweed, PA Ecotype	96.00
0.30 %	*Solidago nemoralis, PA Ecotype*	Gray Goldenrod, PA Ecotype	264.00
0.20 %	*Aster prenanthoides, PA Ecotype*	Zigzag Aster, PA Ecotype	432.00
0.20 %	*Eupatorium perfoliatum, PA Ecotype*	Boneset, PA Ecotype	192.00
0.20 %	*Solidago bicolor, PA Ecotype*	White Goldenrod, PA Ecotype	240.00
0.10 %	*Solidago juncea, PA Ecotype*	Early Goldenrod, PA Ecotype	336.00
100.00 %		**Mix Price/Lb Bulk:**	**$38.59**

Seeding Rate: 20 lbs/acre with 30 lbs/acre of a cover crop. For a cover crop use either grain oats (1 Jan to 31 Jul) or grain rye (1 Aug to 31 Dec).

Herbaceous Flowering Species - Herbaceous Perennial; Pollinator Favorites; Uplands & Meadows

The native wildflowers and grasses in this mix provide an attractive display of color from spring to fall. Designed for mesic to upland sites and full sun to lightly shaded areas. This mix will attract a variety of pollinators and songbirds. Mix formulations are subject to change without notice depending on the availability of existing and new products. While the formula may change, the guiding philosophy and function of the mix will not.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CESOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023

PROJECT NUMBER 47661.004

PROJECT NAME WHITE OAK SOLAR

DESIGNED BY / DRAWN BY J. STICKLEY

NOTES

REVISIONS

#	MM/DD/YY	DESCRIPTION

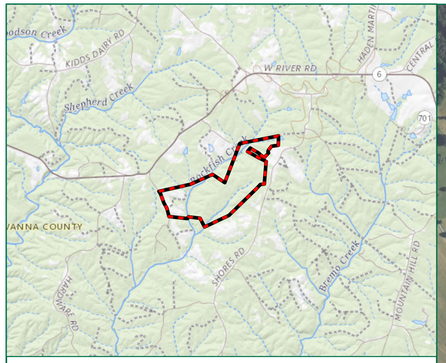
DRAWING DESCRIPTION

PROPOSED LANDSCAPING NOTES AND DETAILS

PLANS PRINTED AS 11X17 ARE HALF SCALE

SHEET NUMBER C5.1

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Landscaping Notes and Details.mxd



Legend

- Project Study Limits - 434.7 Acres
- National Hydrography Dataset
- Preserverd Forests - 131.6 Acres
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- FEMA Flood Zone - Not Present

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. NWI FROM US FISH AND WILDLIFE SERVICE.
3. NATIONAL HYDROGRAPHY DATASET FROM USGS.
4. FLOOD ZONE DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER.
5. SETBACKS ARE A MINIMUM OF 150' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
6. AERIAL IMAGERY FROM BING.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/20/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

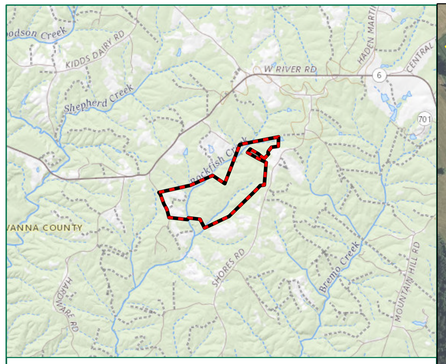
#	MM/DD/YY	DESCRIPTION
1	10/04/2023	*ADDING PRESERVED FOREST AREA*

DRAWING DESCRIPTION
PRESERVED FORESTS MAP

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H: 1" = 400'	C6.0

Y:\851\47661.004-White_Oak_Solar\GIS\White Oak Slope\White Oak Slope.aprx



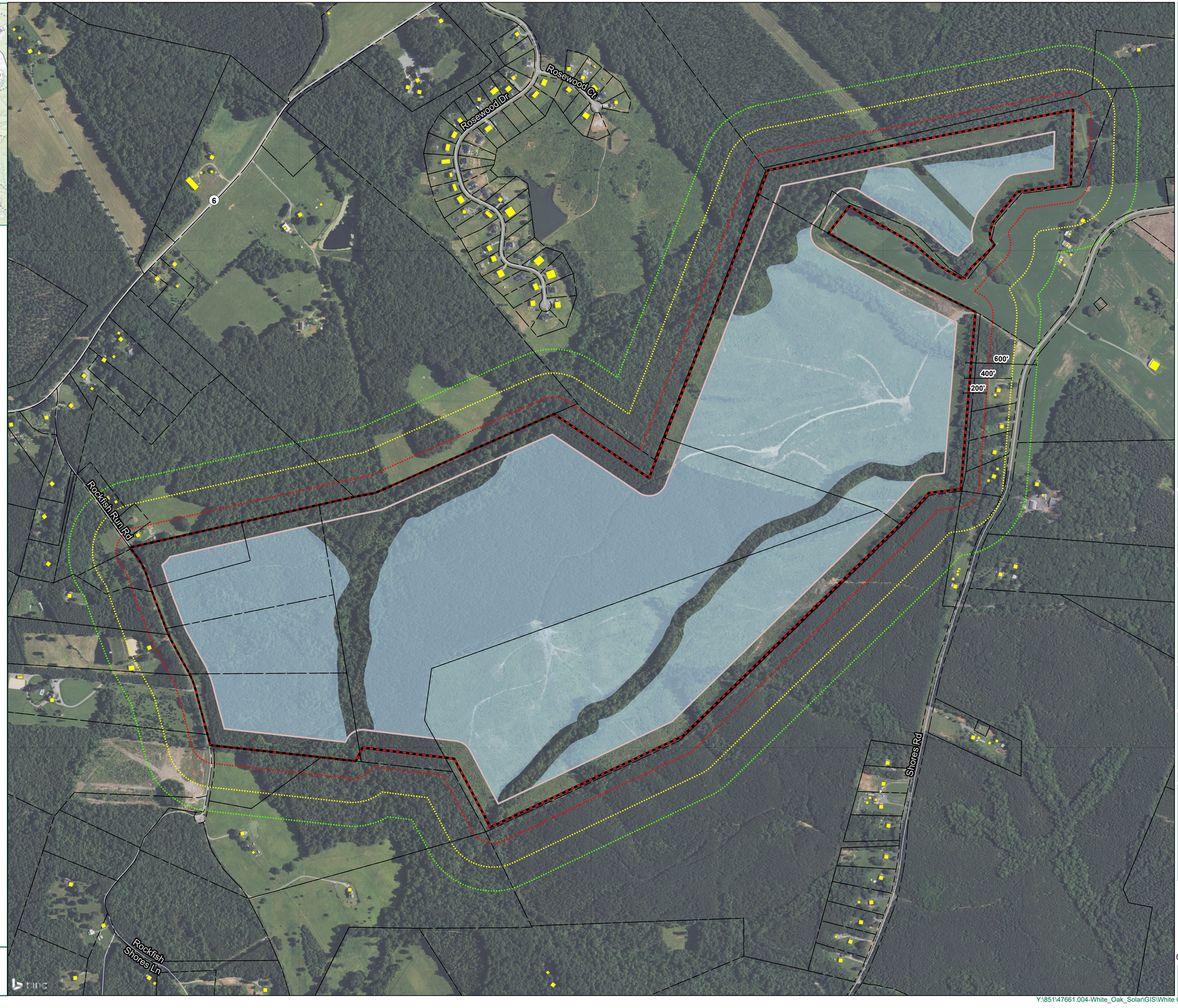
Legend

- Project Study Limits - 434.7 Acres
- Property Setbacks (see notes for details)
- Buildable Area - 301.6 Acres
- Distance Markers
- Virginia Building Footprints
- Fluvanna County Tax Parcels

Distance from Property Setbacks

- 200'
- 400'
- 600'

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. SETBACKS AREA MINIMUM OF 150' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
3. VIRGINIA BUILDING FOOTPRINT DATA FROM VGIN.
4. AERIAL IMAGERY FROM BING.



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/20/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY M. HILL

REVISIONS

#	MM/DD/YY	DESCRIPTION
1	11/04/2023	*ADJUSTING SETBACKS*

DRAWING DESCRIPTION
EXISTING BUILDINGS MAP

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H: 1" = 400'	C7.0

Y:\851\47661.004-White_Oak_Solar\GIS\White Oak Slope\White Oak Slope.aprx

Date: 12/8/22

Rockfish Tract, LLC
2425 Grenoble Rd.
Richmond, VA 23294

Fluvanna County
132 Main Street
Palmyra, VA 22963
Telephone: 434-591-1910
Fax: 434-591-1911

RE: Special Use Permit Application of White Oak Tree Solar, LLC
Fluvanna County parcels 49-A-1, 49-A-5, and 49-A-8

To Whom It May Concern:

As owner of record of the parcels of real property that are the subject of the application referenced above, I hereby designate White Oak Tree Solar, LLC, a wholly owned subsidiary of Pruitt Properties, Inc., as owner's authorized agent for all matters concerning the application for the Special Use Permit on Fluvanna County parcels 49-A-1, 49-A-5, and 49-A-8.

Oliver J. Pruitt, III.
Manager of Rockfish Tract, LLC

Date: 12/8/12

Fools Gold, LLC
2425 Grenoble Rd.
Richmond, VA 23294

Fluvanna County
132 Main Street
Palmyra, VA 22963
Telephone: 434-591-1910
Fax: 434-591-1911

RE: Special Use Permit Application of White Oak Tree Solar, LLC
Fluvanna County parcels 48-14-4, 48-14-5, 48-14-6, 48-14-6A, and 48-A-35

To Whom It May Concern:

As owner of record of the parcels of real property that are the subject of the application referenced above, I hereby designate White Oak Tree Solar, LLC, a wholly owned subsidiary of Pruitt Properties, Inc., as owner's authorized agent for all matters concerning the application for the Special Use Permit on Fluvanna County parcels 48-14-4, 48-14-5, 48-14-6, 48-14-6A, and 48-A-35.

Oliver J. Pruitt, Jr.
Manager of Fools Gold, LLC

WHITE OAK SOLAR

SPECIAL EXCEPTION PERMIT

38 MW PV SOLAR ELECTRIC POWER GENERATION FACILITY

FLUVANNA COUNTY, VIRGINIA

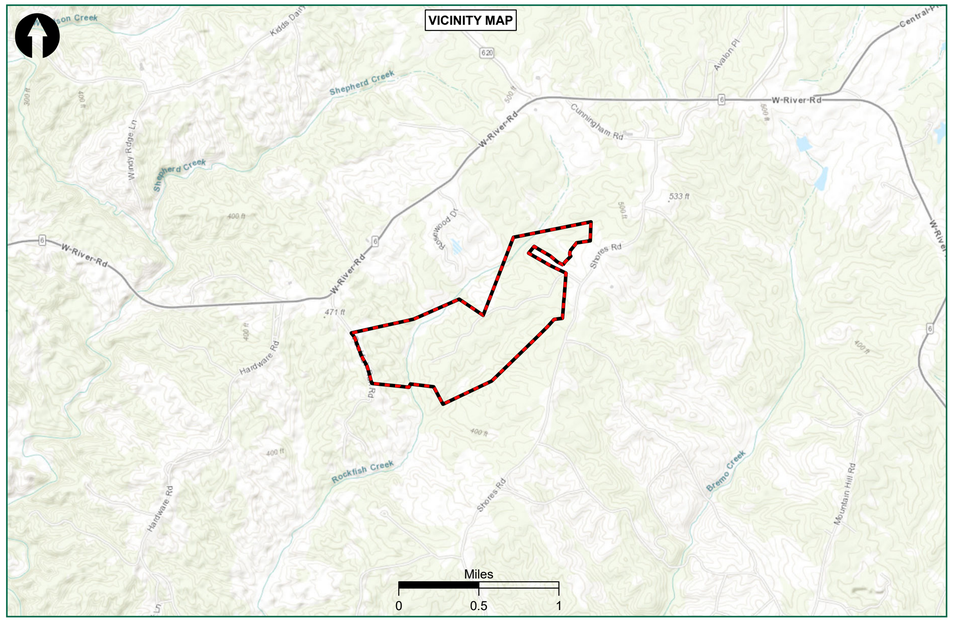


TABLE OF CONTENTS	
SHEET	**DESCRIPTION**
C1.0	COVER SHEET
C2.0	COUNTY MAP
C3.0	PARCEL AND ZONING MAP
C4.0	PRELIMINARY SITE PLAN
C4.1	PRELIMINARY SITE PLAN NOTES AND DETAILS
C5.0	PROPOSED LANDSCAPING MAP
C5.1	PROPOSED LANDSCAPING NOTES AND DETAILS
C6.0	PRESERVED FORESTS MAP
C7.0	EXISTING BUILDINGS MAP

WHITE OAK SOLAR

DEVELOPER

2201 W Broad Street, Suite 200
Richmond, VA 23220
TEL: 804.789.4040
Email: tyson.utt@cep-solar.com

TIMMONS GROUP

ENGINEER

1001 Boulders Parkway, Suite 300
Richmond, VA 23221
TEL 804.200.6446
www. timmons.com

PRELIMINARY SITE PLANS PREPARED BY TIMMONS GROUP

MARCH 16, 2023

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE: 03/16/2023
PROJECT NUMBER: 47661.004
PROJECT NAME: WHITE OAK SOLAR
DESIGNED BY / DRAWN BY: J. STICKLEY
PLAN SEAL/SIGNATURE:

REVISIONS

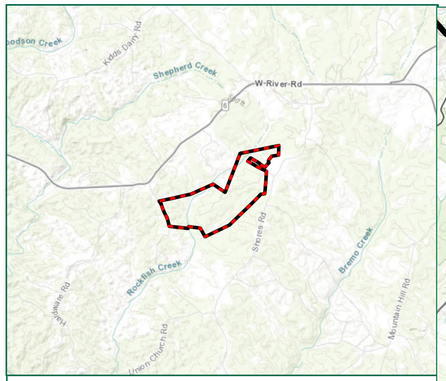
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION: COVER SHEET

PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
	C1.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Cover Sheet.mxd



Legend

Project Study Limits - 434.7 Acres

NOTES:

1. PROJECT LIMITS ARE APPROXIMATE.
2. COUNTY DATA FROM VDEM.
3. LATITUDE: 37.852248 | LONGITUDE: -78.094620
4. USGS QUADRANGLES: SCOTTSVILLE, PALMYRA | DATES: 2019, 2019
5. WATERSHED: MIDDLE JAMES-BUFFALO (JAMES RIVER BASIN)
6. HYDROLOGIC UNIT CODE: 02080203
7. WORLD TOPOGRAPHIC BASEMAP FROM ESRI.

Albemarle County
Fluvanna County
Louisa County
Fluvanna County
Louisa County
Goochland County
Fluvanna County
Goochland County
Albemarle County
Buckingham County
Buckingham County
Fluvanna County
Goochland County
Cumberland County
Fluvanna County
Cumberland County

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

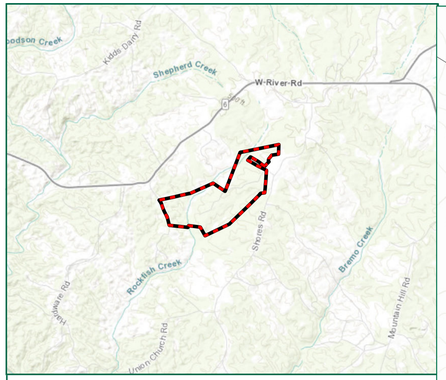
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
COUNTY MAP

SCALE (FEET)
0 6,000 12,000
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 6,000 '	C2.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-VIC.mxd



Legend

- Project Study Limits - 434.7 Acres
- Fluvanna County Parcels

Zoning Classification

- A-1 - Agricultural General District

Project Parcel Information		
Map Identifier	**Parcel Identifier**	**Owner Name**
1	49-A-1	ROCKFISH TRACT, LLC
2	49-A-5	ROCKFISH TRACT, LLC
3	48-A-35	FOOLS GOLD LLC
4	48-14-6	FOOLS GOLD LLC
5	49-A-8	ROCKFISH TRACT, LLC
6	48-14-6A	FOOLS GOLD LLC
7	48-14-5	FOOLS GOLD LLC
8	48-14-4	FOOLS GOLD LLC
Adjacent Parcel Information		
Map Identifier	**Parcel Identifier**	**Owner Name**
9	39-A-34	DAVIS, WILLIAM E & ANNE C
10	39-13-51	KECK ROSEWOOD MANOR LLC
11	39-A-55	WALKER, WESLEY RANDALL
12	49-A-2	BARKER, FRED E & HELEN B
13	48-A-18	SWALES, SUSAN E
14	49-A-6	GOODMAN, BOBBY JR & ASHLEY
15	48-A-33	WELLS TRUST WALLACE W WELLS
16	49-4-3	BRYANT, ROBERT
17	49-4-2	REEVES, CHARLES M & SUSAN R
18	49-4-1	BRUCE, ROSA B % RALPH D PINTO
19	48-A-31	WELLS, FRANKLIN D
20	49-A-9C	NOKO, LLC C/O DAVID FISHER
21	49-A-7	FINLEY, FLORENCE
22	48-A-30	WELLS, FRANKLIN D
23	48-14-1	FANNON, MARY BETH M & MANN, KAREN M
24	48-14-2	HOPPER, SHERYL
25	48-14-3	ROYSTON, CLYDE E & MARIANNE R
26	48-A-43	SCHMIDT, CHRISTOPH ALFRED
27	48-A-36	BURGOS, ANTHONY & DURDEN, KIMBERLY
28	48-A-37	BURGOS, ANTHONY & DURDEN, KIMBERLY
29	48-A-38	MUNDY, CHRISTOPHER JOHN ET AL

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. ZONING AND PARCEL INFORMATION FROM FLUVANNA COUNTY GIS.
3. WORLD TOPOGRAPHIC BASEMAP FROM ESRI.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

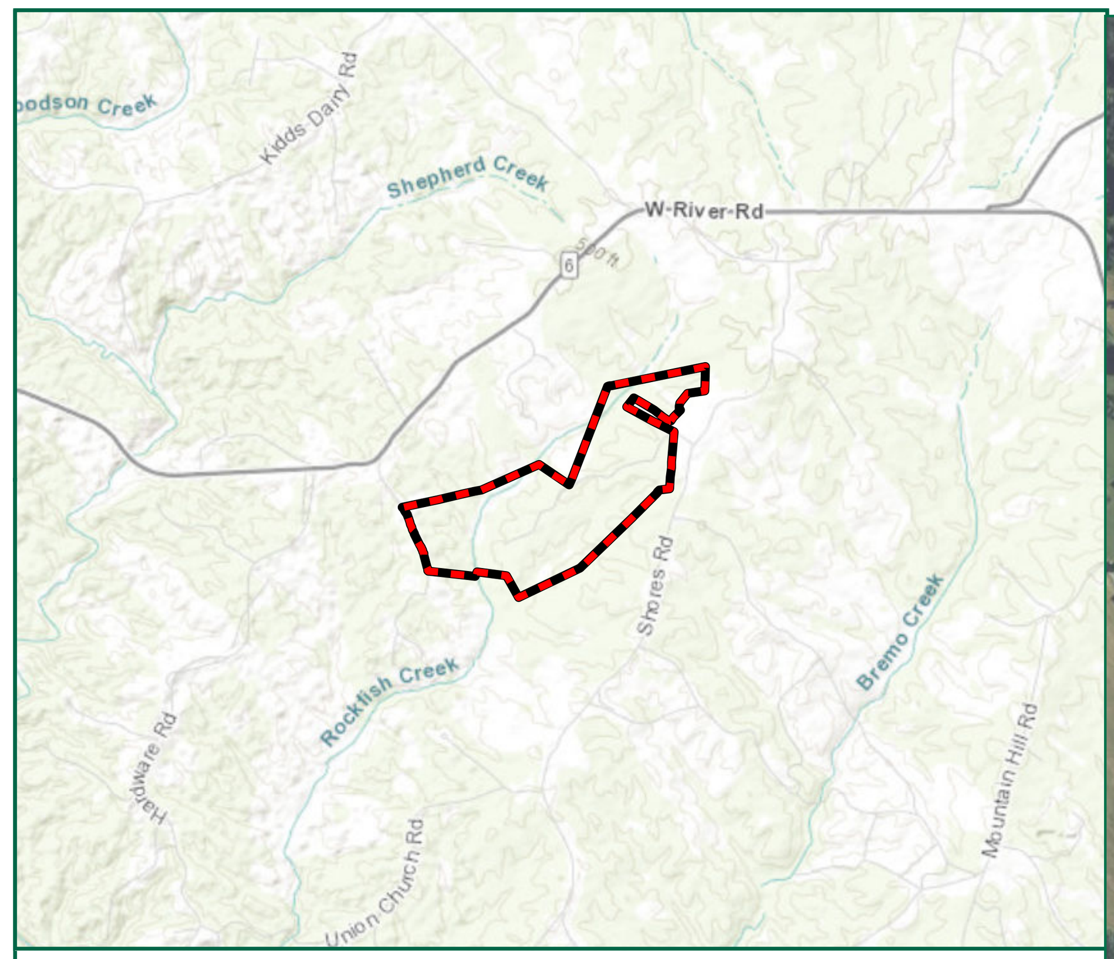
#	MM/DD/YY	DESCRIPTION

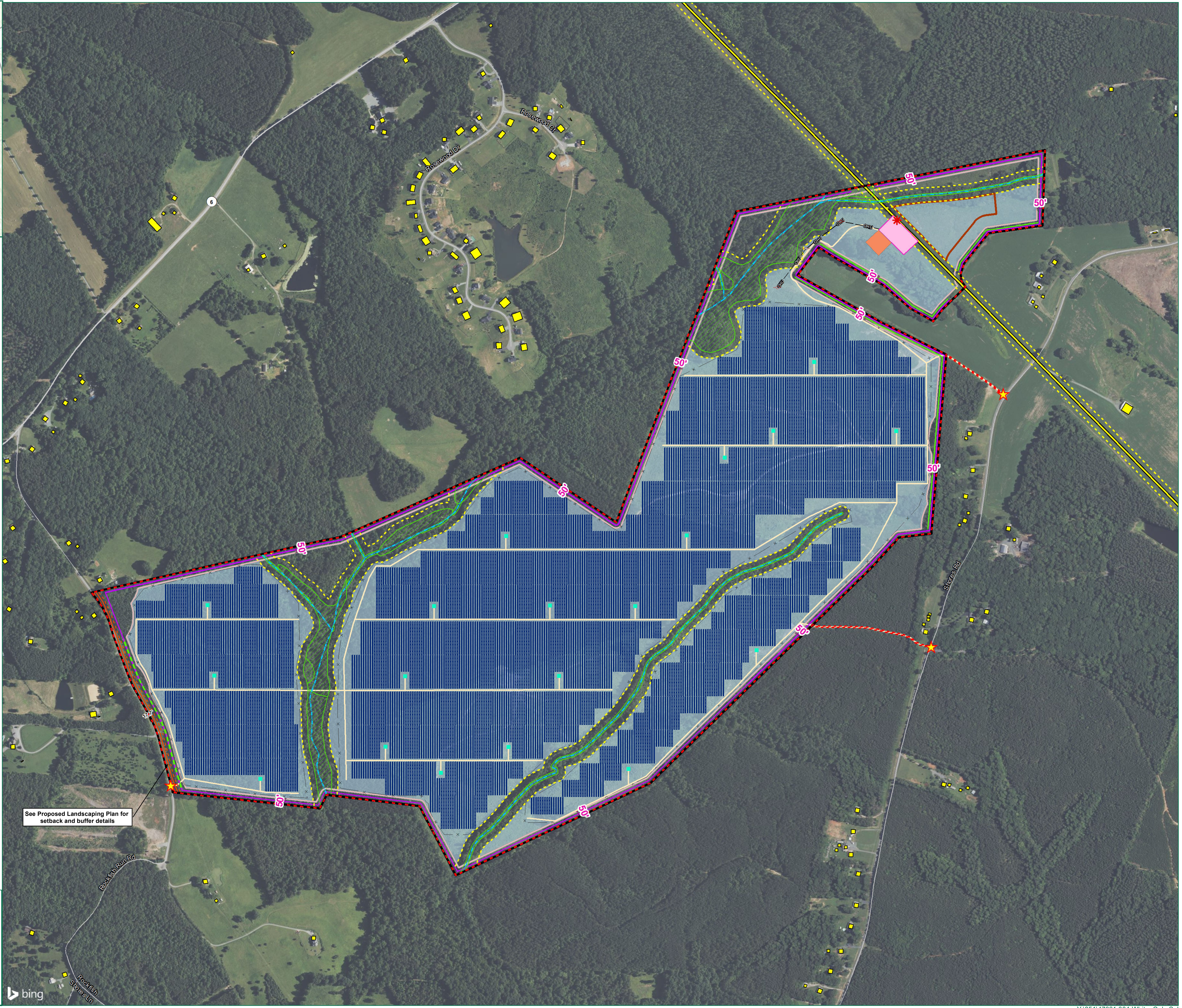
DRAWING DESCRIPTION
PARCEL AND ZONING MAP

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 400 '	C3.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Parcel Zoning Map.mxd





Legend

- Project Study Limits - 434.7 Acres
- Buildable Area - 342.0 Acres
- Setbacks (see notes for details)
- Project Entrance
- Point of Interconnection
- Electric Substations - Not Present
- Hybrid Inverters
- Proposed Utility Poles
- Setback Markers
- Width of Abutting Right-of-Way
- Distribution Line
- Transmission Line
- Retained Vegetative Buffer
- Typical Vegetative Buffer
- Rockfish Run Road Vegetative Buffer
- National Hydrography Dataset
- Access Easement
- Distribution Line Easement
- Transmission Line Easement
- Panels - 241.1 Acres Under Panel
- Fence - 307.4 Acres
- Battery Energy Storage System Area - 5.0 Acres
- Project Substation
- Utility Switchyard
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- FEMA Flood Zone - Not Present
- Existing Buildings

PANEL, INVERTER, POWER LINE, AND BATTERY ENERGY STORAGE SYSTEM LOCATIONS ARE SUBJECT TO CHANGE WITHIN THE BUILDABLE AREA.

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. SITE LAYOUT IS FOR DESIGN PURPOSES ONLY. NOT FOR CONSTRUCTION. LAYOUT SUBJECT TO CHANGE.
4. WETLAND DATA FROM NATIONAL WETLANDS INVENTORY.
5. STREAM DATA FROM NATIONAL HYDROGRAPHY DATASET.
6. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
7. FLOODPLAIN DATA IS PRELIMINARY DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER AND IS NOT YET EFFECTIVE.
9. HYBRID INVERTERS MAY INCLUDE BATTERY STORAGE TECHNOLOGY.
10. SETBACKS FROM FLUVANNA COUNTY ORDINANCE. SETBACKS ARE A MINIMUM OF 50' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
11. EXISTING BUILDING DATA FROM VGIN.
12. AERIAL IMAGERY FROM BING.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE	03/16/2023
PROJECT NUMBER	47661.004
PROJECT NAME	WHITE OAK SOLAR
DESIGNED BY / DRAWN BY	J. STICKLEY

NOTES

REVISIONS

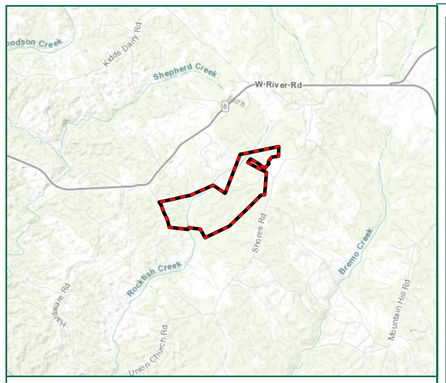
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
PRELIMINARY SITE PLAN

SCALE (FEET)
0 400 800
PLANS PRINTED AS 11X17 ARE HALF SCALE

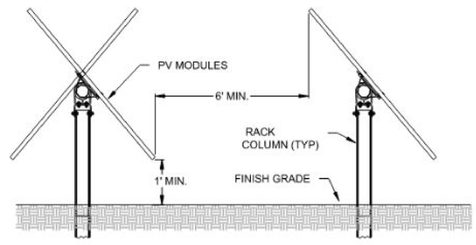
SCALE	SHEET NUMBER
H:1 " = 400 '	C4.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP2.mxd

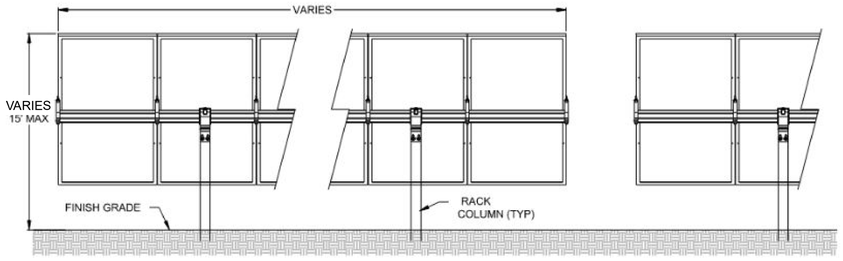


NOTES:

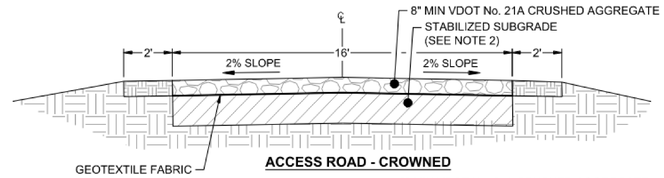
1. PROJECT LIMITS ARE APPROXIMATE.
2. SITE LAYOUT IS FOR DESIGN PURPOSES ONLY. NOT FOR CONSTRUCTION. LAYOUT SUBJECT TO CHANGE.
4. WETLAND DATA FROM NATIONAL WETLANDS INVENTORY.
5. STREAM DATA FROM NATIONAL HYDROGRAPHY DATASET.
6. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
7. FLOODPLAIN DATA IS PRELIMINARY DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER AND IS NOT YET EFFECTIVE.
9. HYBRID INVERTERS MAY INCLUDE BATTERY STORAGE TECHNOLOGY.
10. SETBACKS FROM FLUVANNA COUNTY ORDINANCE. SETBACKS ARE A MINIMUM 50' FROM ALL PROPERTY LINES AND 300' FROM ADJACENT RESIDENCES.
11. EXISTING BUILDING DATA FROM VGIN.
12. AERIAL IMAGERY FROM BING.



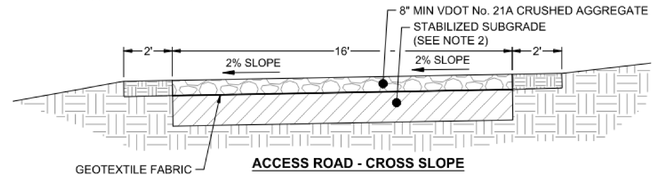
TYPICAL RACK NORTH/SOUTH END ELEVATION
NOT TO SCALE



TYPICAL TRACKER RACK EAST/WEST SIDE ELEVATION
NOT TO SCALE



ACCESS ROAD - CROWNED



ACCESS ROAD - CROSS SLOPE

NOTES:
1. GEOTEXTILE FABRIC SHALL BE MIRIFI HP370 OR SIMILAR.
2. SUBGRADE MATERIALS SHALL CONFORM TO VDOT "ROAD AND BRIDGE SPECIFICATIONS". SUBGRADE SHALL BE PLACED IN 12" MAXIMUM LIFTS AND COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. SOIL MOISTURE CONTENT DURING COMPACTION SHALL BE MAINTAINED WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT.
3. SHOULDERS SHALL BE COMPACTED NATIVE SOIL.

ACCESS ROAD TYPICAL SECTION
NTS

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY
NOTES

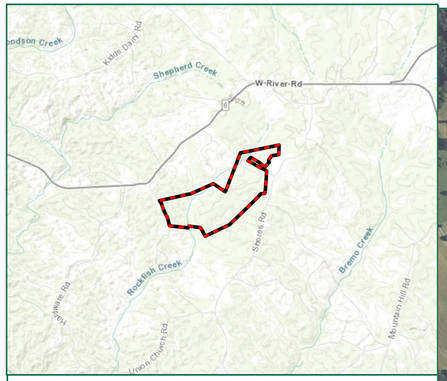
REVISIONS

#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
PRELIMINARY SITE PLAN NOTES AND DETAILS

PLANS PRINTED AS 11X17 ARE HALF SCALE

SHEET NUMBER C4.1



Legend

- Project Study Limits - 434.7 Acres
- Setbacks (see notes for details)
- Hybrid Inverters
- Internal Roads
- National Hydrography Dataset
- Typical Vegetative Buffer
- Rockfish Run Road Vegetative Buffer
- Retained Vegetative Buffer
- Short Native Grass Seed Mix - 39.0 Acres
- Solar Farm Seed Mix - 268.4 Acres
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- Panels - 241.1 Acres Under Panel
- Fence - 307.4 Acres
- Project Substation
- Utility Switchyard
- Battery Energy Storage System Area - 5.0 Acres

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. BUFFERS AND SCREENING WILL FOLLOW FLUVANNA COUNTY ORDINANCE REQUIREMENTS. SEE SHEET 5.1 FOR DETAILS.
3. VEGETATION ON THE PERIMETER OF ADJACENT RESIDENTIAL PARCELS WILL BE RETAINED AS BUFFER WHERE IT EXISITS.
4. WETLAND AND STREAM BUFFER IS 50' FROM INTERMITTENT STREAMS AND 75' FROM PERENNIAL STREAMS.
4. AERIAL IMAGERY FROM BING.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR

FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023

PROJECT NUMBER 47661.004

PROJECT NAME WHITE OAK SOLAR

DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION

LANDSCAPING MAP

SCALE (FEET)

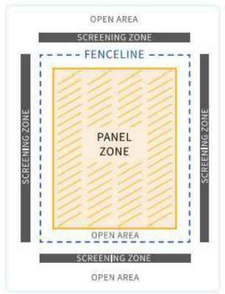
0 400 800

PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H:1 " = 400 '	C5.0

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Veg Buffer.mxd

PROJECT AREA DIAGRAM



DEFINITIONS

Open Area: Any area beyond the panel zone, within the property boundary.

Panel Zone: The area underneath the solar arrays, including inter-row spacing.

Project Area: Open Area + Panel Zone + Screening Zone.

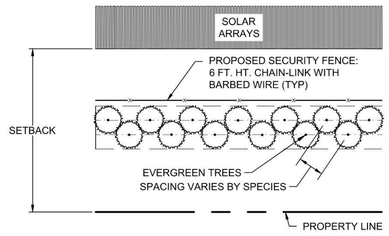
Screening Zone: A vegetated visual barrier.

SOURCE: VIRGINIA POLLINATOR-SMART COMPREHENSIVE PLAN

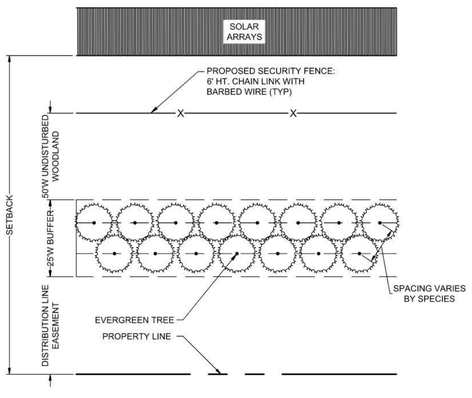
VEGETATIVE BUFFER NOTES

- PROVIDE A 25-FOOT WIDE LANDSCAPE BUFFER CONSISTING OF A STAGGERED ROW OF TWO SPECIES OF EVERGREEN TREES THAT ARE NON-INVASIVE, NATIVE, POLLINATOR, AND WILDLIFE FRIENDLY.THE TREES SHALL BE PLANTED TEN (10) FEET ON CENTER AND STAGGERED WITHIN THE PLANTING STRIP.
- PRESERVE EXISTING WETLANDS AND WOODLANDS TO SERVE AS VEGETATIVE BUFFER. IF EXISTING TREES AND VEGETATION ARE DISTURBED, PROVIDE NEW BUFFER PLANTINGS. WHERE INTERMITTENT EXISTING TREES OR SHRUBS EXIST WITHIN A PROPOSED BUFFER LOCATION, PROPOSED SCREENING MUST BE FIELD-LOCATED AND PLANTED AS NEEDED TO SUPPLEMENT THE EXISTING VEGETATIVE SCREENING.
- ENSURE THAT ALL PLANT MATERIAL MEETS REQUIREMENTS IN CHAPTER 22, ARTICLE 24 - LANDSCAPING AND TREE PROTECTION OF FLUVANNA COUNTY CODE OF ORDINANCES.
- TREES PLANTED IN THE BUFFER MUST BE AT LEAST FOUR (4) FEET TALL AT TIME OF PLANTING.
- FENCING MUST BE INSTALLED ON THE INTERIOR OF THE BUFFER.
- BUFFER MUST BE MAINTAINED IN GOOD CONDITION UNTIL THE FACILITY HAS BEEN DECOMMISSIONED AND REMOVED. IMPLEMENT A THREE-YEAR ESTABLISHMENT AND MAINTENANCE PERIOD TO FACILITY OPTIMAL SURVIVABILITY.

TYPICAL VEGETATIVE BUFFER PLANTING TEMPLATE



ROCKFISH RUN ROAD VEGETATIVE BUFFER PLANTING TEMPLATE



RECOMMENDED BUFFER PLANT LIST

EVERGREEN TREES (REQUIRED TO MITIGATE VISUAL IMPACT)

BOTANICAL NAME / COMMON NAME

ILEX OPACA / AMERICAN HOLLY

JUNIPERUS VIRGINIANA 'BRODIE' / EASTERN RED CEDAR

MAGNOLIA GRANDIFLORA 'LITTLE GEM' / SWEET BAY MAGNOLIA

MYRICA CERIFERA / SOUTHERN WAX MYRTLE

THUJA OCCIDENTALIS 'TECHNY' / ARBORVITAE

GROUNDCOVER PLANTING NOTES

- FOLLOWING INITIAL IMPLEMENTATION OF NOXIOUS WEED AND INVASIVE SPECIES MANAGEMENT PLAN, PREPARE SITE SOIL CONDITIONS FOR SEEDING.
- SEED DISTURBED AREAS WITHIN THE PROJECT AREA, DISTURBED AREAS WITHIN THE SETBACK, AND INSTALLED VEGETATIVE BUFFERS WITH APPROPRIATE POLLINATOR-FRIENDLY NATIVE PLANTS, SHRUBS, GRASSES, FORBES, AND WILDFLOWERS.
- SEED DISTURBED AREAS WITH A TEMPORARY MIXTURE AS NEEDED TO MEET STATE REGULATIONS FOR EROSION AND SEDIMENT CONTROL.
- DURING THE NEXT SUITABLE SEEDING PERIOD (SPRING OR FALL), SOW GROUNDCOVER TO ESTABLISH PERMANENT VEGETATIVE COVER. OPTIMAL SEED GERMINATION OCCURS AFTER OCTOBER 15 AND BEFORE APRIL 15. IF SEEDING IS CONDUCTED OUTSIDE OF OPTIMAL SEED GERMINATION PERIODS, PAIR A SEASONALLY-APPROPRIATE COVER CROP WITH PERMANENT SEED MIXTURE TO SUPPORT SOIL STABILIZATION AND EROSION AND SEDIMENT CONTROL DURING SEED ESTABLISHMENT PERIOD.
- USE RECOMMENDED SEEDING RATES (SPECIFIC TO MIXTURE) AND PROPER SEED PACKING FOR OPTIMAL GERMINATION AND SEED ESTABLISHMENT.

NOXIOUS WEED AND INVASIVE PLANT SPECIES MANAGEMENT PLAN

GENERAL NOTES

- ONGOING MONITORING IS REQUIRED TO MANAGE WEEDS AND INVASIVE SPECIES.
- USE PROPER EQUIPMENT FOR ALL CONTROL MEASURES:
  - TRACTOR MOUNTED BRUSH HOG FOR HEAVY MOWING (MINIMUM PLANT HEIGHT ≥3"-4") AND HIGH MOWING (MINIMUM PLANT HEIGHT ≥6"-8")
  - TRACTOR-MOUNTED, TRUCK-MOUNTED, OR ATV- MOUNTED SPRAYER FOR BROADCAST APPLICATIONS
  - BACKPACK STYLE SPRAYER OR OTHER DEVICE FOR SPOT SPRAYING APPROPRIATE TO THE CLASS OF PESTICIDE
  - AREAS UNDER AND DIRECTLY ADJACENT TO SOLAR ARRAYS MAY REQUIRE USE OF HAND-HELD EQUIPMENT
  - GRAZING BY RUMINANTS (USUALLY GOATS OR SHEEP) WHERE PRACTICAL AND APPROPRIATE TO PLANT SPECIES PRESENT
- REMOVE SHRUBS AND WOODY VINES BY THEIR ROOT SYSTEMS. ALTERNATIVELY, PRUNE THESE PLANTS AT GROUND LEVEL.
- REMOVE PROBLEMATIC PLANTS WITH FLOWERS OR SEEDS MANUALLY, PLACE HEAD FIRST IN HEAVY PLASTIC BAG, AND TRANSPORT TO A DESIGNATED DISPOSAL SITE. DO NOT DISPOSE OF AT LOCAL TRANSFER STATION, UNLESS THERE IS A DESIGNATED AREA FOR INVASIVE PLANT SPECIES DISPOSAL.
- PERFORM ALL CHEMICAL CONTROL TREATMENTS UNDER THE DIRECT SUPERVISION OF A VIRGINIA CERTIFIED PESTICIDE APPLICATOR OR REGISTERED TECHNICIAN.
- DO NOT APPLY HERBICIDE WHEN RAINFALL IS EXPECTED WITHIN 48 HOURS OR WIND SPEEDS EXCEED 10 MPH.

IDENTIFICATION AND CONTROL MEASURES PRE-CONSTRUCTION AND DURING CONSTRUCTION

- COMPLETE SITE INVENTORY OF NOXIOUS WEED SPECIES AND INVASIVE SPECIES.
- DEVELOP A MANAGEMENT PLAN THAT PRIORITIZES CONTROL OBJECTIVES.
- IMPLEMENT REMOVAL AND CONTROL MEASURES ACCORDING TO MANAGEMENT PLAN.
- REMOVAL AND CONTROL STRATEGIES SHOULD BE IMPLEMENTED TO BEGIN MANAGEMENT PRIOR TO SEEDING.

ESTABLISHMENT AND ONGOING MAINTENANCE SCHEDULE

- WINTER
  - REVIEW AND REVISE MANAGEMENT PLANS FOR THE UPCOMING YEAR BASED ON OBSERVATIONS FROM THE PRIOR YEAR.
  - PRUNE AS NECESSARY AND SEASONALLY APPROPRIATE.
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1, 2, AND 3: DURING LATE WINTER OR EARLY SPRING, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.5 FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES. AFTER THE ESTABLISHMENT PERIOD, THIS SHOULD BECOME THE ONCE-A-YEAR MOWING OR AN AS NEEDED MOWING.
- SPRING
  - WEED MANUALLY OR SPOT SPRAY TO TREAT WEEDS, IDEALLY ONCE PER MONTH.
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1, 2, AND 3: IF NOT DONE IN WINTER, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.5 FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES.
  - WATER AS NEEDED, ESPECIALLY DURING PERIODS OF DROUGHT.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGED PLANT MATERIAL, PARTICULARLY THOSE THAT CONTAIN OR COULD CONTAIN PESTS.
- SUMMER
  - WEED MANUALLY OR SPOT SPRAY TO TREAT WEEDS, IDEALLY ONCE PER MONTH.
  - WATER AS NEEDED, ESPECIALLY DURING PERIODS OF DROUGHT.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGED PLANT MATERIAL, PARTICULARLY THOSE THAT CONTAIN OR COULD CONTAIN PESTS.
- FALL
  - DURING THE ESTABLISHMENT PERIOD, YEARS 1 AND 3: IF NOT DONE IN WINTER, MOW SEEDED AREAS WHEN VEGETATION GROWS TO 18 INCHES BENEATH THE PANELS OR 2 TO 2.R FEET ELSEWHERE. MOW TO A HEIGHT OF 12 INCHES. THE SECOND OR LAST MOWING SHOULD BE IN OCTOBER.
  - REMOVE AND DISPOSE OF DISEASED AND DAMAGE PLANT MATERIAL, PARTICULARLY THAT WHICH CONTAINS OR COULD CONTAIN PESTS.
  - LEAVE GROUNDCOVER ALONE FOR THE PURPOSE OF CREATING SEASONAL INTEREST IN THE LANDSCAPE AND WINTER HABITAT AND FOOD SOURCES FOR WILDLIFE. DO NOT DEADHEAD OR CUT DOWN STANDING VEGETATION, INCLUDING GRASSES AND FORBS. AN EXCEPTION IS ANY SPECIES THAT SEEDS AGGRESSIVELY; IN THAT CASE, DEADHEAD TO PREVENT THESE PLANTS FROM SELF-SOWING. IF A DECISION IS MADE TO CUT DOWN ANY VEGETATION, LAY THE CLIPPINGS ON THE GROUND TO SERVE AS MULCH (EXCEPT FOR AGGRESSIVE, NOXIOUS, OR INVASIVE PLANTS, WHICH SHOULD BE PROPERLY REMOVED FROM THE SITE).
  - IDENTIFY PROBLEM AREAS AND CHALLENGES FROM THE PRIOR GROWING SEASON TO INCORPORATE INTO MAINTENANCE AND MANAGEMENT PLANS FOR THE UPCOMING SEASON. PLAN OUT AND SCHEDULE SPECIFIC MAINTENANCE TASKS.

RECOMMENDED COVER CROPS (TEMPORARY SEEDING)

BOTANICAL NAME	COMMON NAME	SEEDS RATE: POUNDS PER ACRE
AVENA SATIVA	GRAIN OATS	50-100
SETARIA ITALICA	GERMAN MILLET	50
SECALE CEREALE	GRAIN RYE	50-100

RECOMMENDED GROUNDCOVER SEED MIXES

SOLAR FARM SEED MIX

FOR USE IN PANEL ZONE AND PROPOSED BUFFER

ERNST SOLAR FARM SEED MIX - ERNMX 186

Date: July 28, 2021

Ernst Solar Farm Seed Mix - ERNMX-186

	Botanical Name	Common Name	Price/lb
45.50 %	*Festuca rubra*	Creeping Red Fescue	3.30
15.00 %	*Festuca ovina var. duriuscula, 'Jetty'*	Hard Fescue, 'Jetty'	3.84
15.00 %	*Festuca ovina var. duriuscula, Gladiator*	Hard Fescue, Gladiator	3.84
10.00 %	*Festuca rubra ssp. commutata*	Chewings Fescue	3.30
5.00 %	*Poa pratensis, 'Selway'*	Kentucky Bluegrass, 'Selway'	3.36
5.00 %	*Poa pratensis, Appalachian*	Kentucky Bluegrass, Appalachian	3.36
4.50 %	*Trifolium repens, Dutch*	White Clover, Dutch	5.28
100.00 %		**Mix Price/lb Bulk:**	**$3.56**

Seeding Rate: 6 lb per 1,000 sq ft

Lawn & Turfgrass Sites; Solar Sites

Provide a 2' clearance between the ground and the solar panels. Mix formulations are subject to change without notice depending on the availability of existing and new products. While the formula may change, the guiding philosophy and function of the mix will not.

Price quotes guaranteed for 30 days.
All prices are FOB Meadville, PA.
Please check our web site at www.ernstseed.com for current pricing when placing orders.

SHORT NATIVE GRASS SEED MIX

FOR USE IN OPEN AREA WITHIN FENCE AND IN STAGING AREA (POST-CONSTRUCTION)

CUSTOM MIX BY ERNST

Ernst Conservation Seeds Inc
8884 Mercer Pike
Meadville, PA 16335-9275
Phone (814) 336-2404; (800) 873-3321; Fax (814) 336-5191
www.ernstseed.com; sales@ernstseed.com

QUOTE

Quote Number Q247897
Quote Date 7/30/2021
Page Number 1 of 1

BILL TO:
Timmons Group
1001 Boulder's Parkway
Suite 300
Richmond, VA 23225

Phone 804-200-6500
Fax 804-560-1648
Email ben.sagara@timmons.com

SHIP TO:
Timmons Group
1001 Boulder's Parkway
Suite 300
Richmond, VA 23225
Phone: 804-200-6500

Customer PO#	Customer ID	Shipping Method	UPS Shipper #	Terms	Salesperson ID
EM 073021 KK	TIMM002	UPS GROUND		Credit Card	

Bulk Qty	PLS Qty	UOM	Item Number	Description	Unit Price	Ext. Price
0.000		EACH	NATIVE SEED MIX		$0.00000	$0.00
2.343	2.178	LB PLS	PANSPH01	Roundseed Panicgrass	$32.00000	$69.70
1.493	1.227	LB PLS	BOUCUR02	Sideoats Grama, Butte	$14.00000	$17.18
5.259	4.356	LB PLS	SCHSCO01	Little Bluestem, 'Camper'	$16.00000	$69.70
0.000		EA	TOTAL	MIX NOTES	$0.00000	$0.00

$21.18 per PLS lb with a 5% custom mixing fee included
7.761 lb total

Prices quoted are firm for 30 days.

Subtotal	$156.58
Trade Discount	$0.00
Shipping/Handling	$0.00
Miscellaneous	$7.83
Tax	$9.86
Total US$	$174.27

Checks received may be converted to a one-time electronic funds transfer. Funds may be withdrawn from your account on the date payment is made.
Prices are F.O.B. Meadville. Items are subject to availability at time of delivery.
DISCLAIMER: Seeds are labeled as required by State and Federal laws.
RETURNS: Individual items and Ernst Mixes are subject to 10% restocking fee and must be made within 30 days of Invoice date. No returns on custom mixes. There is a 25% restocking fee on cancelled or returned bioengineering orders.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION
WHITE OAK SOLAR
FLUVANNA COUNTY, VIRGINIA

DATE 03/16/2023
PROJECT NUMBER 47661.004
PROJECT NAME WHITE OAK SOLAR
DESIGNED BY / DRAWN BY J. STICKLEY
NOTES

REVISIONS

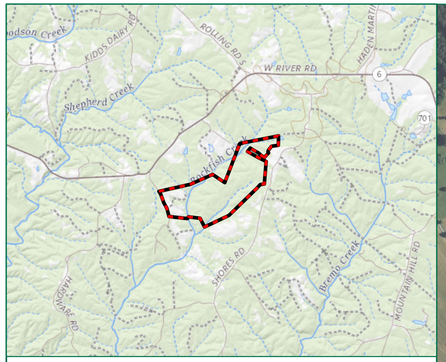
#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION
PROPOSED LANDSCAPING NOTES AND DETAILS

PLANS PRINTED AS 11X17 ARE HALF SCALE

SHEET NUMBER C5.1

Y:\851\47661.004-White_Oak_Solar\GIS\CUP\47661.004-CUP - Landscaping Notes and Details.mxd



Legend

- Project Study Limits - 434.7 Acres
- Setbacks - 50'
- National Hydrography Dataset
- Preserverd Forests - 86.7 Acres
- National Wetlands Inventory
- Wetland and Stream Buffer - 50' / 75'
- FEMA Flood Zone - Not Present

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. NWI FROM US FISH AND WILDLIFE SERVICE.
3. NATIONAL HYDROGRAPHY DATASET FROM USGS.
4. FLOOD ZONE DATA FROM FEMA'S NATIONAL FLOOD HAZARD LAYER.
5. AERIAL IMAGERY FROM BING.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR

FLUVANNA COUNTY, VIRGINIA

DATE 03/20/2023

PROJECT NUMBER 47661.004

PROJECT NAME WHITE OAK SOLAR

DESIGNED BY / DRAWN BY J. STICKLEY

REVISIONS

#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION

PRESERVED FORESTS MAP

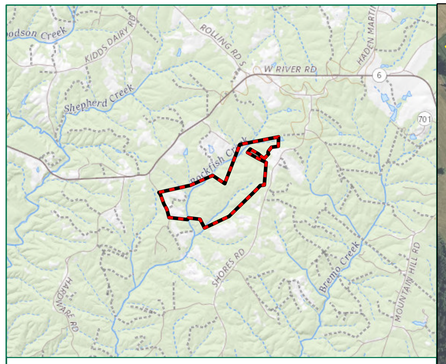
SCALE (FEET)

0 400 800

PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H: 1" = 400'	C6.0

Y:\851\47661.004-White_Oak_Solar\GIS\White Oak Slope\White Oak Slope.aprx



Legend

- Project Study Limits - 434.7 Acres
- Buildable Area - 343.1 Acres
- Setbacks (see notes for details)
- Distance Markers
- Virginia Building Footprints
- Fluvanna County Tax Parcels

Distance from Property Setbacks

- 200'
- 400'
- 600'

NOTES:
1. PROJECT LIMITS ARE APPROXIMATE.
2. SETBACKS ARE 50' FROM ADJACENT PROPERTIES AND 300' FROM ADJACENT RESIDENCES.
3. SETBACKS ARE FROM FLUVANNA COUNTY ORDINANCE.
4. VIRGINIA BUILDING FOOTPRINT DATA FROM VGIN.
5. AERIAL IMAGERY FROM BING.

Rosewood Dr
Rosewood Ct
6
Rockfish Run Rd
600'
400'
200'
Shores Rd
Rockfish Shores Ln
bing

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
TEL 804.200.6500
www.timmons.com

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS
2201 W Broad Street, Suite 200
Richmond, VA 23220

PROJECT NAME & LOCATION

WHITE OAK SOLAR

FLUVANNA COUNTY, VIRGINIA

DATE	03/20/2023
PROJECT NUMBER	47661.004
PROJECT NAME	WHITE OAK SOLAR
DESIGNED BY / DRAWN BY	M. HILL

REVISIONS

#	MM/DD/YY	DESCRIPTION

DRAWING DESCRIPTION

EXISTING BUILDINGS MAP

SCALE (FEET)

0 400 800

PLANS PRINTED AS 11X17 ARE HALF SCALE

SCALE	SHEET NUMBER
H: 1" = 400'	C7.0

Y:\851\47661.004-White_Oak_Solar\GIS\White Oak Slope\White Oak Slope.aprx

Fidelity National Title Insurance Company
Schedule B – Commitment No. GT–1147

(Referenced by corresponding number in Commitment)

AS TO PARCEL 1: TM#49–A–1 – 46.9 acres

(12) Rights of others in and to the use of a right of way granted in Deed Book 51, page 291.
Plotted and shown hereon.

(13) Matters shown on plat recorded in Deed Book 56, page 351.
Plotted and shown hereon.

(14) Easements granted to Virginia Electric and Power Company, dated August 28, 1956, recorded September 15, 1956 in Deed Book 51 at page 37. Granted 150' in width to construct and maintain poles, towers, etc., and attachments, etc., together with ingress, egress and clearage, etc. See instrument for particulars.
Plotted and shown hereon.

AS TO PARCEL 2: TM# 49–A–5 – 104.00 acres

(15a) Rights of others in and to the use of a right of way granted in Deed Book 51, page 490.
Plotted and shown hereon.

(16a) Matters shown on plat recorded in Deed Book 51, page 491.
Plotted and shown hereon.

AS TO PARCEL 3: TM# 49–A–8 – 94.65 acres

(15b) Rights of others in and to the use of a right of way granted in Deed Book 51, page 291.
Plotted and shown hereon.

(16b) Matters shown on plat recorded in Deed Book 51, page 493.
Plotted and shown hereon.

AS TO EASEMENTS:

TM# 49–A–2 – 62.4 acres

(17) Matters shown on plat recorded in Deed Book 60, page 189.
Plotted and shown hereon.

(18) Rights of others in and to the use of an old road granted by deed recorded in Deed Book 56, page 350.
Plotted and shown hereon.

(19) Easement granted VEPCO in Deed Book 51, page 37.
Plotted and shown hereon.

(20) Easement to Central Virginia Electric Co–op.
Does not affect – located east of Parcel #1.

(21) Deed to Commonwealth of Virginia recorded in Deed Book 47, page 403.
Does not affect – located along State Route No. 640 (Shores Road).

TM# 49–A–6 – 8.1 acres

(22) Matters shown on plat recorded in Deed Book 31, page 157.
Plotted and shown hereon.

(23a) Deed to Commonwealth of Virginia recorded in Deed Book 47, page 403.
Does not affect – located along State Route No. 640 (Shores Road).

(24a) DEED OF TRUST from Ashley Goodman and Bobby Goodman, Jr. to RES/Title, Inc., Trustee, dated December 23, 2019, recorded December 23, 2019, as Instrument No. 190003976. TO SECURE: Residential Mortgage Services, Inc. in the amount of $176,767.00
Right of Way Easement is plotted and shown hereon.

TM# 49–A–7 – 3.5 acres

(23b) Rights of others in and to the use of an access easement recorded in Deed Book 51, page 291.
Plotted and shown hereon.

(24b) Easements granted Virginia Telephone and Telegraph recorded in Deed Book 60, page 51 and Deed Book 85, page 125.
Does not affect – located east of Parcel #2.

(25) Easement granted Central Virginia Electric Co–op recorded in Deed Book 288, page 41.
Does not affect – located east of Parcel #2.

TM# 49–A–9C

(26) Easement granted Commonwealth of Virginia recorded in Deed Book 47, Page 403. Road take includes agreement to grant easements adjacent to Rt. 640 to any public utility which has an easement within bounds of road.
Does not affect – located east of Parcel #3.

(27) Right of Way Agreement recorded in Deed Book 51, Page 291. Grants easement for ingress and egress along old road bed to land in name J.E. Seay.
Plotted and shown hereon.

(28) Easement granted Virginia Telephone and Telegraph Company, recorded in Deed Book 60, Page 141.
Does not affect – located east of Parcel #3.

(29) Easement granted Virginia Telephone and Telegraph Company recorded in Deed Book 95, Page 138.
Does not affect – located east of Parcel #3.

(30) Rights of others in and to the unrestricted use of said ingress and egress easement.
Not a survey related matter.

(31) Any rights, interest of claim that may exist, arise or be asserted against the title under or pursuant to the Perishable Agricultural Commodities Act of 1930, as amended, Packers and Stockyard Act of 1921, as amended or any similar state laws.
Not a survey related matter.

(32) Matters shown on plat recorded in Plat Book 3, page 270.
Existing Right of Way (DB. 51, PG.291) is plotted and shown hereon.

(33) Rights of upper and lower riparian owners in and to the use of the waters and natural now thereof.
Not a survey related matter.

(34) Rights of others in and to the unrestricted use of said ingress/egress R/W & 4 wheeler path as shown on boundary survey.
Ingress/Egress R/W is plotted and shown hereon.
No remaining evidence of 4 wheeler path found along property line.

Legal Descriptions:

(Per Title)

PARCEL 1: TM#49–A–1 – 46.9 acres

ALL that certain tract or parcel of land lying, being and situate in Fluvanna County, Virginia, containing 46.9 acres, more or less, and designated on a plat entitled: "Continental Can Co., Inc., J.B. Bryan Tract, State – Virginia, County– Fluvanna, District– Cunningham, 46.9 Acres", made by T. W. Saunders, C.L.S., a copy of which is attached to and made a part of that certain deed recorded in the Clerk's Office, Circuit Court, Fluvanna County in Deed Book 56, page 350, and more particularly described as follows:

BEGINNING at an iron in an old road on the southern boundary of the property hereby conveyed; thence in a northeasterly direction N 42 ½° E. 4.29 ch. to an iron; thence in a southeasterly direction S 52 1/4° E 2.14 ch. to an iron; thence S 55 ½° E 7.36 ch. to an iron; thence S 44–3/4° E 4.55 ch. to an iron; thence S 56° E 3.27 ch. to a small maple; thence in a northeasterly direction along the lien of property now or formerly owned by J. B. Bryan N 42 ½° E 2.0 ch. to a post; thence N 50 ½° E 4.0 ch. to a post; thence N 30° W 0.94 ch. to a point; thence N 1° W 0.86 ch. to a point; thence N 23° E 1.35 ch. to a pine; thence N. 43 ½° E 5.05 ch. to an iron; thence N 86 ½° E 6.92 ch. to an iron; thence N 6 ½° E 9.56 ch. to a small white oak; thence S 83 ½° W 39.91 ch. to an iron; thence along the line of property of W.O. Snead S 26° W 13.97 ch. to a walnut on the south side of a branch; thence up said branch in a northeasterly direction N 80 ½° E 1.62 ch. to a point; N. 58 ½° E 7.13 ch. to a point; N 46° E 3.0 ch. to a point where an old road intersects said branch; thence leaving said branch in a southeasterly direction along the old road S 28° E 0.59 ch. to a point; S 68 1/4° E 2.38 ch. to a point; S 52° E 1.20 ch. to an iron, being the point of beginning, together with an easement of right–of–way along an old road leading from the property hereby conveyed to State Route #640, and more particularly described on the aforementioned plat.

TOGETHER WITH the non–exclusive right of way leading from said tract to Highway No. 640, which right of way is evidenced by Plat made by Carroll Gillispie which is attached to a Deed recorded in Deed Book 56, Page 350 dated August 21, 1959, and of record in the aforesaid Clerk's Office on October 10, 1959.

PARCEL 2: TM# 49–A–5 – 104.00 acres

ALL that certain tract or parcel of land lying and being situate in Cunningham Magisterial District, Fluvanna County, Virginia, on the West side of, but not adjoining, the road leading from Central Plains to Shores, containing One Hundred and Four (104) acres, more or less, according to a plat of survey made by Carroll Gillispie, S.F.C., dated September 2 and October 6, 1956, which plat is attached to and made a part of that certain deed recorded in the Clerk's Office, Circuit Court, Fluvanna County in Deed Book 51, page 490, Reference is here made to said plat for a further description of the land conveyed, including the location of the outlet road over which an easement of right of way is conveyed.

TOGETHER WITH the non–exclusive right of way leading from said tract to Highway No. 640, which right of way is evidenced by Plat made by Carroll Gillispie which is attached to a Deed recorded in Deed Book 51, Page 490 dated September 2, October 6, 1956, and of record in the aforesaid Clerk's Office on January 24, 1957.

PARCEL 3: TM# 49–A–8 – 94.65 acres

ALL that certain tract or parcel of land lying and being situate in Cunningham Magisterial District, Fluvanna County, Virginia, containing 94.65 acres according to a plat of survey made by Carroll Gillispie, CLS, SFC, dated December 19–21, 1956, which plat is attached to and made a part of that deed recorded in the Clerk's Office, Circuit Court, Fluvanna County, Deed Book 51, page 492.

TOGETHER WITH the non–exclusive right of way leading from said tract to Highway No. 640, which right of way is evidenced by an agreement between Dorothy Lee Porter, et. als., and J.E. Seay, dated July 16, 1956, and of record in the aforesaid Clerk's Office in Deed Book 51, page 291. The right of way hereby conveyed is the same as shown on the aforesaid plat made by Carroll Gillispie.

BEING PORTIONS of the same property conveyed to US Delta Timberlands, LLC, a Delaware limited liability company, by deed from Simorg South Forests LLC, a Delaware limited liability company, dated November 20, 2020, and recorded November 24, 2020, in the Clerk's Office, Circuit Court, Fluvanna County, Virginia, as Instrument No. 200004838.

(As–Surveyed)

PARCEL 1: TM#49–A–1

COMMENCING at a point on the western boundary of the right of way line of Shores Road (State Route 640) said point being 1.5± Miles south of the point of intersection of the southern boundary of the right of way line of State Route 697 and the western boundary of the right of way line of Shores Road; thence leaving the western boundary of the right of way line of Shores Road and proceeding in a northwesterly direction the following sixteen (16) courses and distances:

1) N 83°42'46" W 111.43 feet to a point;
2) Thence N 13°53'01" E 976.68 feet to a point;
3) Thence N 09°29'24" E 43.72 feet to a point;
4) Thence N 09°09'46" E 515.76 feet to a point;
5) Thence N 09°09'46" E 939.24 feet to a point;
6) Thence N 57°29'58" W 35.86 feet to a point;
7) Thence N 51°41'59" W 50.50 feet to a point;
8) Thence N 53°08'18" W 129.61 feet to a point;
9) Thence N 54°52'14" W 109.25 feet to a point;
10) Thence N 57°54'19" W 271.05 feet to a point;
11) Thence N 58°41'27" W 635.65 feet to a point;
12) Thence N 58°06'28" W 184.22 feet to a point, said point being the Actual Point and Place of Beginning of Parcel 1;

Thence proceeding in a northwesterly direction the following four (4) courses and distances:

1) N 50°30'58" W 58.20 feet to a point;
2) Thence N 59°14'26" E 76.63 feet to a point;
3) Thence N 65°35'48" W 97.27 feet to a point;
4) Thence N 28°17'38" W 42± feet to a point in the centerline of an 8'± Creek;

Thence proceeding along the centerline of the 8'± Creek in a southwesterly direction 917± feet to a point;

Thence leaving the centerline of the 8'± Creek and proceeding in a northeasterly direction the following fifteen (15) courses and distances:

1) N 25°31'57" E 925± feet to a point;
2) Thence N 83°12'22" E 2633.39 feet to a point;
3) Thence S 06°12'22" W 630.96 feet to a point;
4) Thence S 86°12'22" W 456.72 feet to a point;
5) Thence S 43°12'22" W 330.00 feet to a point;
6) Thence S 22°42'22" W 89.10 feet to a point;
7) Thence S 01°17'38" E 56.76 feet to a point;
8) Thence S 30°17'38" E 62.04 feet to a point;
9) Thence S 50°12'22" W 264.00 feet to a point;
10) Thence S 42°12'22" W 132.00 feet to a point;
11) Thence N 56°17'38" W 215.82 feet to a point;
12) Thence N 45°02'38" W 300.30 feet to a point;
13) Thence N 55°47'38" W 485.76 feet to a point;
14) Thence N 52°47'38" W 141.24 feet to a point;
15) Thence S 42°12'22" W 297.30 feet to a point, said point being the Point and Place of Beginning of Parcel 1, containing 46.29± Acres, more or less.

PARCEL 2: TM# 49–A–5

COMMENCING at a point on the western boundary of the right of way line of Shores Road (State Route 640) said point being 1.5± Miles south of the point of intersection of the southern boundary of the right of way line of State Route 697 and the western boundary of the right of way line of Shores Road; thence leaving the western boundary of the right of way line of Shores Road and proceeding in a northwesterly direction the following two (2) courses and distances:

1) N 83°42'46" W 111.43 feet to a point;
2) Thence N 13°53'01" E 976.68 feet to a point, said point being the Actual Point and Place of Beginning of Parcel 2;

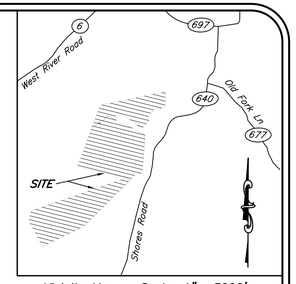
Thence proceeding in a southwesterly direction the following six (6) courses and distances:

1) S 87°36'57" W 272.63 feet to a point;
2) Thence S 44°45'37" W 62.98 feet to a point;
3) Thence S 46°59'27" W 279.15 feet to a point;
4) Thence N 52°12'24" W 173.32 feet to a point;
5) Thence N 71°46'42" W 1977.83 feet to a point;
6) Thence N 25°31'47" E 1668± feet to a point in the centerline of an 8'± Creek;

Thence proceeding along the centerline of the 8'± Creek in a northeasterly direction 917'± to a point;

Thence leaving the centerline of the 8'± Creek and proceeding in a southwesterly direction the following fourteen (14) courses and distances:

1) S 28°17'38" E 42± feet to a point;
2) Thence S 65°35'48" E 97.27 feet to a point;
3) Thence S 59°14'26" E 76.63 feet to a point;
4) Thence S 50°30'58" E 58.20 feet to a point;
5) Thence S 58°06'28" E 184.22 feet to a point;
6) Thence S 58°41'27" E 635.65 feet to a point;
7) Thence S 57°54'19" E 271.05 feet to a point;
8) Thence S 54°52'14" E 109.25 feet to a point;
9) Thence S 53°08'18" E 129.61 feet to a point;
10) Thence S 51°41'59" E 50.50 feet to a point;
11) Thence S 57°29'58" E 35.86 feet to a point;
12) Thence S 09°09'46" W 939.24 feet to a point;
13) Thence S 09°09'46" W 515.76 feet to a point;
14) Thence S 09°29'24" W 43.72 feet to a point, said point being the Point and Place of Beginning of Parcel 2, containing 105.19± Acres, more or less.



Vicinity Map – Scale: 1"= 3000'

(As–Surveyed) (Continued)

PARCEL 3: TM# 49–A–8 – 94.65 acres

COMMENCING at a point on the western boundary of the right of way line of Shores Road (State Route 640) said point being 1.5± Miles south of the point of intersection of the southern boundary of the right of way line of State Route 697 and the western boundary of the right of way line of Shores Road; thence leaving the western boundary of the right of way line of Shores Road and proceeding in a northwesterly direction the following five (5) courses and distances:

1) N 83°42'46" W 111.43 feet to a point;
2) Thence N 13°53'01" E 976.68 feet to a point;
3) S 87°36'57" W 272.63 feet to a point;
4) Thence S 44°45'37" W 62.98 feet to a point;
5) Thence S 46°59'27" W 279.15 feet to a point, said point being the Actual Point and Place of Beginning of Parcel 3;

Thence proceeding in a southwesterly direction the following six (6) courses and distances:

1) S 50°09'26" W 2586.91 feet to a point;
2) Thence S 69°03'40" W 1800.66 feet to a point;
3) Thence N 23°21'43" W 1126.43 feet to a point;
4) Thence N 16°23'15" E 424.46 feet to a point;
5) Thence N 75°56'43" E 3977.00 feet to a point;
6) Thence S 52°12'24" E 173.32 feet to a point, said point being the Point and Place of Beginning of Parcel 3, containing 96.240 Acres, more or less.

Surveyor's Certificate

This survey is certified to and prepared for the sole and exclusive benefit of the entities and/or individuals listed below as of DECEMBER 20, 2021 and shall not be relied upon by any other entity or individual whomsoever.

To: ROCK FISH TRACT, LLC
To: FIDELITY NATIONAL TITLE INSURANCE COMPANY

The undersigned further certifies that this map or plat and the survey on which it is based were made in accordance with the 2021 Minimum Standard Detail Requirements for ALTA/NSPS Land Title Surveys, jointly established and adopted by ALTA and NSPS and includes items 1–4, 6(a), 6(b), 7(a), 7(c), 8, 9, 11, 13, 14, 16 – 19 of Table A thereof.
The fieldwork was completed on December 1, 2021.

COMMONWEALTH OF VIRGINIA
PRELIMINARY
RODNEY B. SHADRACH
Lic. No. 2274
LAND SURVEYOR

Rodney B. Shadrach
Shadrach & Associates, LLC
Va. Registered Surveyor No. 2274

I hereby certify that this ALTA/NSPS survey, to the best of my professional knowledge and belief, is correct and complies with the minimum procedures and standards established by the Virginia State Board of Architects, Professional Engineers, Land Surveyors and Certified Landscape Architects.

ALTA/NSPS LAND TITLE SURVEY
OF THREE PARCELS OF LAND
SITUATED WEST OF STATE ROUTE NO. 640
CUNNINGHAM DIST., FLUVANNA CO., VIRGINIA
Date: December 20, 2021

250 0 250 500 750
Scale: 1"= 250'

Shadrach & Associates LLC
LAND SURVEYING
430 Southlake Blvd., Suite 10–B ⊕ Richmond, Virginia 23236
Phone: (804)379–9300 ⊕ Fax: (804)379–9301

21085–PA.JOB –– 21085–ALTA.DWG

Legend

- Fire Hydrant
- Handicap Parking Spaces
- Painted Parking Space Number
- Water Meter
- Water Valve
- Lamp Post (Metal Post w/light)
- Drainage Manhole
- Sanitary Manhole
- Monitoring Well
- Telephone Pedestal
- Gas Meter (GM)
- Gas Valve (GV)
- Vepco Pole
- Vepco Transformer
- Misc Frame Sign
- Handi-cap Parking Sign
- Bollard
- Yard Inlet (Drainage)
- Sanitary Cleanout
- Concrete Surface
- RCP Reinforced Concrete Pipe
- CMP Corrugated Metal Pipe
- D.I. Drainage Inlet
- F.F.E Finish Floor Elevation
- P.O.B. Point of Beginning
- P.O.C. Point of Commencement

*5/8" Rods or P-K Nails Set At Corners Unless Otherwise Shown Hereon

PLAT BOOK 2, PAGE 47

N/F FOOLS GOLD LLC
Deed Book 881, Page 189
Map PIN: 48-A-35
Zoned: A-1

N/F Anthony Burgos & Kimberly Durden
Deed Book 837, Page 253
Map PIN: 48-A-37
#745 Rockfish Run Road
Zoned: A-1

N/F Christopher John Mundy, et al
Deed Book 837, Page 274
Map PIN: 48-A-38
#751 Rockfish Run Road
Zoned: A-1

N/F NOKO, LLC
Instrument No. 180002702
Map PIN: 49-A-9C
Zoned: A-1

N/F Keck Rosewood Manor LLC
Instrument No. 200005441
Map PIN: 39-1,3-51
Zoned: A-1

N/F FOOLS GOLD LLC
Deed Book 881, Page 189
Map PIN: 48-A-35
Zoned: A-1

N/F William E. & Anne C. Davis
Deed Book 512, Page 988
Map PIN: 39-A-34
Zoned: A-1

N/F Wesley Randall Walker
Instrument No. 200001600
Map PIN: 39-A-55
#434 Shores Road
Zoned: A-1

N/F Fred E. & Helen B. Barker
Deed Book 187, Page 854
Map PIN: 49-A-2
#912 Shores Road
Zoned: A-1

N/F LOFT REALTY & INVESTMENTS LLC
Instrument No. 190003975
Map PIN: 49-A-6
#1184 Shores Road
Zoned: A-1

N/F Florence Finley
Will Book 63, Page 833
Map PIN: 49-A-7
#1504 Shores Road
Zoned: A-1

N/F Rosa B. Bruce
Deed Book 177, Page 106
Map PIN: 49-A-1
#1336 Shores Road
Zoned: A-1

N/F Thompson Land Trust
Deed Book 777, Page 968
Map PIN: 49-A-2
#1292 Shores Road
Zoned: A-1

N/F Federal Home Loan Mortgage Corporation
Deed Book 843, Page 150
Map PIN: 49-A-3
#1248 Shores Road
Zoned: A-1

[No Improvements]
Parcel 3
96.240 Acres

[No Improvements]
Parcel 2
105.19± Acres
(Area of overlap included in Parcel 2)

[No Improvements]
Parcel 1
46.29± Acres

Area of Overlap=0.548 Ac.

P.O.B. Parcel 3

P.O.B. Parcel 2

P.O.B. Parcel 1

P.O.C. Shores Road State Route 640 (40' Public R/W)

1.5± Mi. to P/I S/L SR 697

N25°21'43"W 1126.43'

N16°23'15"E 424.46'

N35°56'43"E 3977.00'

S69°03'40"W 1800.66'

S50°09'26"W 2586.91'

N71°46'42"W 1977.83'

N25°31'57"E (1668'±)

2592.96'(T) (925'±)

N76°07'59"E 351.33'

S87°36'57"W 212.63'

S46°59'27"W 279.15'

S09°09'46"W 939.24'

S09°09'46"W 515.76'

N13°53'01"E 976.68'

N83°42'46"W 111.43'

S42°12'22"W 297.30'

S58°06'28"E 184.22'

N52°47'38"W 141.24'

N55°47'38"W 485.76'

S55°41'27"E 635.65'

N83°12'22"E 2653.39'

S54°52'14"E 109.36'

S57°54'19"E 271.50'

N45°02'38"W 300.30'

N56°17'38"W 215.82'

S43°12'22"W 330.00'

S50°12'22"W 284.00'

S86°12'22"W 456.72'

S06°12'22"W 630.96'

S57°29'19"E 1910'

Walnut Stump Found 18.9' South of Corner

Blazed 28" Oak Fnd @ Corner

Pipe Fnd

5/8" Rod Set

5/8" Rod Fnd

Pipe Fnd 2.45' North of Corner

12" Dead Oak @ Corner

24" Oak @ Corner

14" Oak @ Corner

30" Oak

Wooded

Cutover

Field

10'± Creek

3'± Creek

8'± Creek

10'± Gravel Road

15'± Gravel Road

10' Dirt Road

Remnants Old 10' Dirt Road

Transmission Poles & Guys

Pointed 30" Poplar Fnd On Line

Overhead Transmission Lines

Stone Fnd

Edge Pavement

10' Gravel Drive

Vepco Pole

Tele.

Ped.

12" CMP

4' Wire Fence

4' Wire Fence Meanders Along ℄

No Evidence of Old Road, ℄ Along 4' Wire Fence

4' Wire Fence Along ℄

Gate

Obj.

(12)(15b)(16b)(23b)(27) RIGHT OF WAY EASEMENT DB. 51, PAGE 291

(32)(34) RIGHT OF WAY EASEMENT PB. 3, PAGE 270

(15a)(16a) RIGHT OF WAY EASEMENT DB. 51, PAGE 490 & 491

(17) DB. 60, PAGE 189

(13)(18) DB. 56, PAGE 350 & 351

(22) DB. 31, PAGE 157 & 351

(24a) INST. 190003976

(13) 100' VEPCO EASEMENT, DB. 51, PAGE 351

(14)(19) 150' VEPCO EASEMENT DB. 51, PAGE 37

LINE TABLE

LINE	BEARING	DISTANCE
L1	S22°42'22"W	89.10'
L2	S01°17'38"E	56.76'
L3	S30°17'38"E	62.04'
L4	S42°12'22"W	132.00'
L5	S28°17'38"E	42'±
L6	S65°35'48"E	97.27'
L7	S59°14'26"E	76.63'
L8	S50°30'58"E	58.20'
L9	S51°41'59"E	50.50'
L10	S57°29'58"E	35.86'
L11	S09°29'24"W	43.72'
L12	S44°45'37"W	62.98'
L13	N52°12'24"W	173.32'

Statement of Encroachments

1 248' Length of 4' Wire Fence 15.4'(Max) Inside Subject ℄

2 450' Length of 4' Wire Fence 61.0'(Max) Inside Subject ℄

Flood Certification

I have examined the Flood Insurance Rate Map for the County of Fluvanna, Virginia, Community Panel No. 51065C-0175-C effective date May 5, 2016, and hereby certify to the best of my professional knowledge and belief that the property is not located within the limits of the 100 Year Flood Plain Boundary as defined by National Flood Insurance Program, Federal Emergency Management Agency, Department of Housing and Urban Development.

General Notes

1. This survey plat represents a current and accurate field transit survey of the premises shown hereon. Date of last physical survey: December 1, 2021
2. This survey is of the same property as described in Title Report issued by Fidelity National Title Insurance Company dated August 25, 2021, Commitment No. GT-1147.
3. Observed utilities are plotted and shown hereon. Subsurface utility delineation was not performed.
4. State Route No. 640 (Shores Road) is a Public Roadway.
5. Parcels has direct vehicular access from State Route No. 640 through recorded Ingress/Egress R/W's as plotted and shown hereon.
6. No delineated wetlands were found by Surveyor.
7. No evidence of cemeteries on subject property found by Surveyor.
8. The surveyor observed no evidence of current earth moving work or evidence of building construction or building additions.
9. Surveyor is not aware of any proposed changes in the street right of ways and observed no evidence of recent street or sidewalk construction or repairs.
10. The legal description does form a mathematically closed figure with no gaps, gores or overlaps except as shown hereon.

Zoning

Current Zoning: A-1 (General Agricultural District)

Setbacks:

Minimum Front Yard: Public Roadway - 125 feet
Minimum Front Yard: Private Roadway - 100 feet
Minimum Side Yard: 50 feet
Minimum Rear Yard: 75 feet

Maximum Height: 35 feet

*ZONING TO BE VERIFIED BY ZONING CONFIRMATION LETTER

Existing Parking

No Delineated Spaces

For further clarification of Zoning Requirements - Contact:
Fluvanna County Planning and Zoning Department
132 Main Street
Palmyra, VA 22963
(434) 591-1910

Legal References:

Parcel 1, Parcel 2, Parcel 3:

US Delta Timberlands LLC
Part of Instrument No. 200004838
Tax Parcel: 49-A-1 (Parcel 1)
Tax Parcel: 49-A-5 (Parcel 2)
Tax Parcel: 49-A-8 (Parcel 3)

Sheet 2 of 2

ALTA/NSPS LAND TITLE SURVEY
OF THREE PARCELS OF LAND
SITUATED WEST OF STATE ROUTE NO. 640
CUNNINGHAM DIST., FLUVANNA CO., VIRGINIA

Date: December 20, 2021

250 0 250 500 750

Scale: 1"= 250'

Shadrach & Associates LLC
LAND SURVEYING
430 Southlake Blvd., Suite 10-B ⊕ Richmond, Virginia 23236
Phone: (804)379-9300 ⊕ Fax: (804)379-9301

Kirkland Appraisals, LLC

Richard C. Kirkland, Jr., MAI
9408 Northfield Court
Raleigh, North Carolina 27603
Phone (919) 414-8142
rkirkland2@gmail.com
www.kirklandappraisals.com

November 19, 2022

Mr. Harry Kingery
CEP Solar, LLC
2201 W. Broad Street, Suite 200
Richmond, VA 23220

RE: White Oak Solar Project, Kidds Store, Fluvanna County, VA

Mr. Kingery

In November 2022, Kirkland Appraisals, LLC studied the impact of a 38 MW solar energy generation facility proposed to be constructed on approximately 347 acres out of a parent tract of 434.70 acres of land in Fluvanna County, Virginia. Specifically, the study was designed to determine what level of impact the proposed solar facility will have on adjoining property value and whether "the location and character of the use, if developed according to the plan as submitted and approved, will be in harmony with the area in which it is to be located."

As a basis for the study, industry-standard Paired Sales Analysis was employed, which posits that when two properties are in all other respects equivalent, a single difference (such as an additional bedroom, a view of a golf course, or in this case the proximity of a solar facility) can be measured to indicate the difference in price between them. Existing and proposed solar facilities were visited and researched in Virginia and other states. Additionally, articles through the Appraisal Institute and other studies were researched, and multiple real estate professionals were interviewed in developing this study. I have not been asked to assign any value to any specific property.

This study is a limited report of a real property appraisal consulting assignment and subject to the limiting conditions attached to this letter. My client is CEP Solar, LLC, represented to me by Mr. Harry Kingery. My findings support the Application. The effective date of this consultation is November 19, 2022.

Conclusion

The adjoining properties are appropriately set back from the proposed solar panels and most of the site has sufficient existing landscaping for screening the proposed solar farm.

The matched pair analysis supports a finding of no impact on home values due to abutting or adjoining a solar farm as well as no impact to abutting or adjacent vacant residential or agricultural land where the solar farm is properly screened and buffered. The criteria that typically correlates with downward adjustments on property values such as noise, odor, and traffic all indicate that a solar farm is a compatible use for rural/residential transition areas and that it would function in a harmonious manner with this area.

The data points include a mix of negative and positive results, but the large majority of the findings fall within typical market variation of +/-5%. The aggregate of the findings support a mild positive impact, but within that typical market variation. As real estate is considered an imperfect market

this +/-5% range is typical for any property type and supports a finding of no impact on property value.

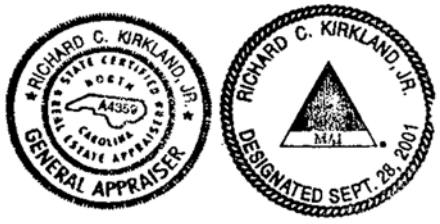
Data from the university studies, broker commentary, and other appraisal studies support the same finding.

Comparable solar facilities in have been found by hundreds of towns and counties not to have a substantial negative effect to abutting or adjoining properties, and many of those findings of no impact have been upheld by appellate courts. Comparable solar facilities have been approved with adjoining agricultural uses, schools, churches, and residential developments.

Based on the data and analysis in this report, it is my professional opinion that the proposed White Oak Solar facility will have negligible impact on the value of adjoining or abutting properties and the proposed use is in harmony with the area in which it is located. As an aside, there are positive implications of a solar facility on nearby properties including protection from future residential development or other more intrusive uses, reduced dust, odor and chemicals from former farming operations, protection from light pollution at night, minimal noises, and minimal traffic.

If you have any questions, please let me know.

Sincerely,



Richard C. Kirkland, Jr., MAI
NC Certified General Appraiser #A4359
VA Certified General Appraiser # 4001017291

Table of Contents

I. Proposed Project and Adjoining Uses

Proposed Use Description

This 38 MW solar farm is proposed to be constructed on a 347-acre portion of a 434.70-acre parent tract of land off Rockfish Run Road, Kidds Store, Fluvanna County, Virginia.

Adjoining Properties

I have considered adjoining uses and included a map to identify each parcel's location. The closest adjoining home will be 200 feet from the closest solar panel and the average distance to adjoining homes will be 724 feet to the nearest solar panel.

Adjoining land is primarily a mix of residential and agricultural uses.

The breakdown of those uses by acreage and number of parcels is summarized below.

Adjoining Use Breakdown

	Acreage	**Parcels**
Residential	7.32%	55.00%
Agricultural	63.04%	20.00%
Agri/Res	29.65%	25.00%
Total	**100.00%**	**100.00%**

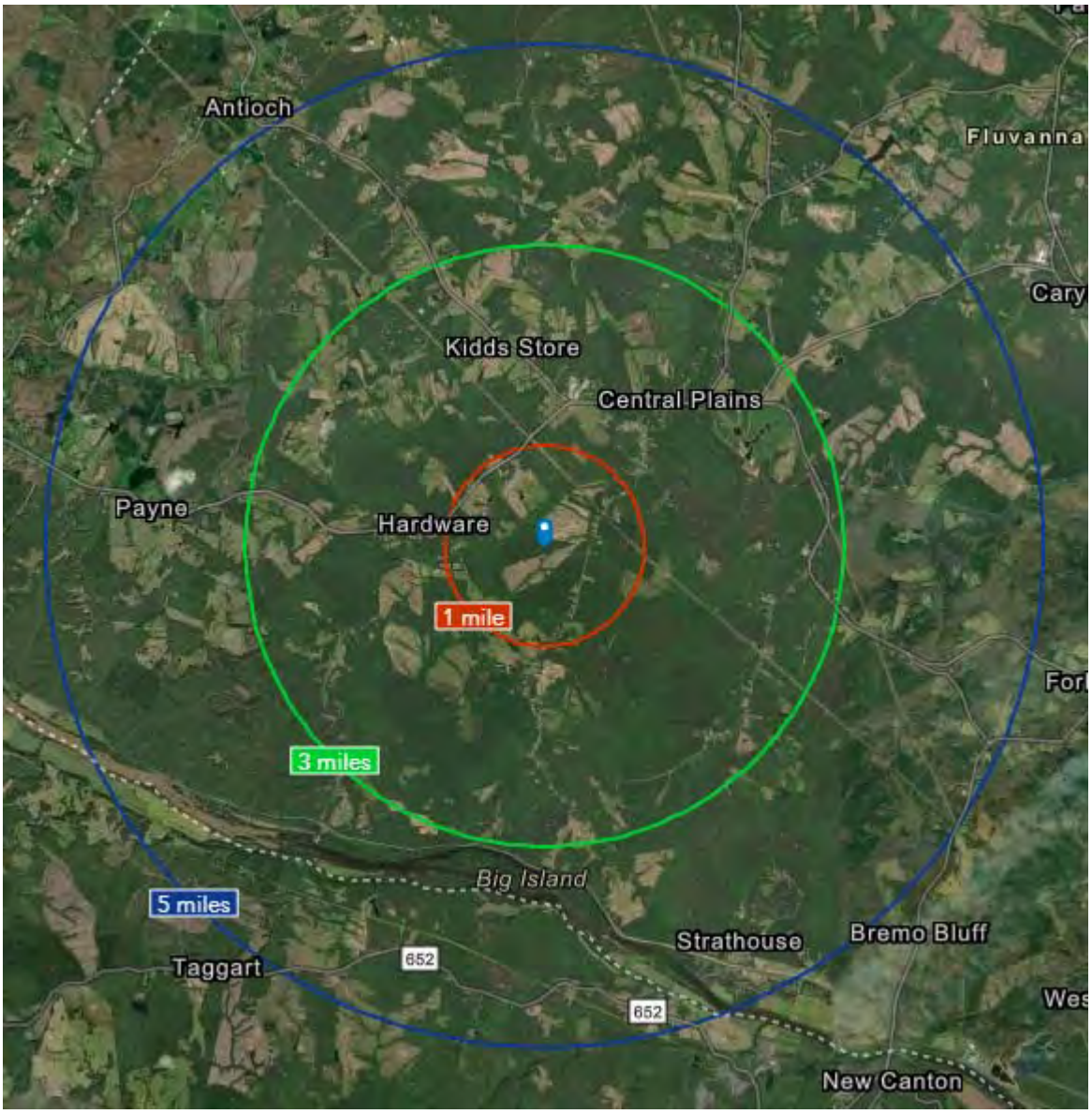
Parcel 3 noted above is the excess land for Rosewood Manor Open Space. There is a creek that runs in the woods on that tract that make it very unlikely it would be developed with any homes closer than the southernmost home at the end of Rosewood Drive if this land was determined to have additional development potential. That closest home is almost 900 feet from the property line of the subject parent tract and most of that distance is wooded.

Surrounding Uses

#	MAP ID	Owner	GIS Data Acres	Present Use	Adjoin Acres	Adjoin Parcels	Distance (ft) Home/Panel
1	48-A-33	Wells	46.50	Agri/Res	4.46%	5.00%	200
2	48-A-18	Swales	127.76	Agri/Res	12.25%	5.00%	1,595
3	39-13-51	Keck	151.61	Agricultural	14.54%	5.00%	N/A
4	39-A-34	Davis	327.29	Agricultural	31.39%	5.00%	N/A
5	49-A-2	Barker	62.40	Agri/Res	5.99%	5.00%	1,660
6	49-A-6	Goodman	8.10	Residential	0.78%	5.00%	350
7	49-4-3	Bryant	2.00	Residential	0.19%	5.00%	365
8	49-4-2	Reeves	2.00	Residential	0.19%	5.00%	315
9	49-4-1	Bruce	2.00	Residential	0.19%	5.00%	315
10	49-A-7	Finley	3.50	Residential	0.34%	5.00%	430
11	49-A-9C	Noko	147.30	Agricultural	14.13%	5.00%	N/A
12	48-A-38	Mundy	39.65	Agri/Res	3.80%	5.00%	1,160
13	48-A-37	Burgos	32.77	Agri/Res	3.14%	5.00%	740
14	48-A-36	Burgos	6.88	Residential	0.66%	5.00%	N/A
15	48-A-43	Schmidt	31.00	Agricultural	2.97%	5.00%	N/A
16	48-14-3	Royston	20.00	Residential	1.92%	5.00%	1,235
17	48-14-2	Hopper	14.54	Residential	1.39%	5.00%	335
18	48-14-1	Fannon	10.00	Residential	0.96%	5.00%	715
19	48-A-30	Wells	2.25	Residential	0.22%	5.00%	N/A
20	48-A-30	Wells	5.00	Residential	0.48%	5.00%	N/A
		Total	**1042.550**		**100.00%**	**100.00%**	724

Demographics Around Subject Property

I have pulled demographic data around a 1-mile, 3-mile and 5-mile radius from the middle of the project as shown on the following pages.



Housing Profile

22963, Palmyra, Virginia
Ring: 1 mile radius

Prepared by Esri
Latitude: 37.78318
Longitude: -78.36578

Population		Households	
2010 Total Population	40	2022 Median Household Income	$62,386
2020 Total Population	43	2027 Median Household Income	$66,774
2022 Total Population	42	2022-2027 Annual Rate	1.37%
2027 Total Population	42		
2022-2027 Annual Rate	0.00%		

	Census 2010		2022		2027	
Housing Units by Occupancy Status and Tenure	Number	Percent	Number	Percent	Number	Percent
Total Housing Units	20	100.0%	21	100.0%	21	100.0%
Occupied	19	95.0%	20	95.2%	21	100.0%
Owner	15	75.0%	15	71.4%	16	76.2%
Renter	4	20.0%	5	23.8%	5	23.8%
Vacant	1	5.0%	0	0.0%	1	4.8%

	2022		2027	
Owner Occupied Housing Units by Value	Number	Percent	Number	Percent
Total	14	100.0%	16	100.0%
<$50,000	0	0.0%	0	0.0%
$50,000-$99,999	0	0.0%	0	0.0%
$100,000-$149,999	2	14.3%	1	6.2%
$150,000-$199,999	2	14.3%	1	6.2%
$200,000-$249,999	2	14.3%	2	12.5%
$250,000-$299,999	3	21.4%	3	18.8%
$300,000-$399,999	1	7.1%	1	6.2%
$400,000-$499,999	1	7.1%	2	12.5%
$500,000-$749,999	3	21.4%	6	37.5%
$750,000-$999,999	0	0.0%	0	0.0%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	0	0.0%	0	0.0%
$2,000,000+	0	0.0%	0	0.0%
Median Value	$266,667		$400,000	
Average Value	$325,000		$410,938	

Census 2010 Housing Units	Number	Percent
Total	20	100.0%
In Urbanized Areas	0	0.0%
In Urban Clusters	0	0.0%
Rural Housing Units	20	100.0%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2022 and 2027. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

November 19, 2022

Housing Profile

22963, Palmyra, Virginia
Ring: 3 mile radius

Prepared by Esri
Latitude: 37.78318
Longitude: -78.36578

Population		Households	
2010 Total Population	1,161	2022 Median Household Income	$69,304
2020 Total Population	1,254	2027 Median Household Income	$78,040
2022 Total Population	1,243	2022-2027 Annual Rate	2.40%
2027 Total Population	1,238		
2022-2027 Annual Rate	-0.08%		

	Census 2010		2022		2027	
Housing Units by Occupancy Status and Tenure	Number	Percent	Number	Percent	Number	Percent
Total Housing Units	505	100.0%	539	100.0%	542	100.0%
Occupied	438	86.7%	486	90.2%	484	89.3%
Owner	355	70.3%	375	69.6%	384	70.8%
Renter	83	16.4%	111	20.6%	100	18.5%
Vacant	68	13.5%	53	9.8%	58	10.7%

	2022		2027	
Owner Occupied Housing Units by Value	Number	Percent	Number	Percent
Total	375	100.0%	384	100.0%
<$50,000	6	1.6%	4	1.0%
$50,000-$99,999	6	1.6%	3	0.8%
$100,000-$149,999	36	9.6%	15	3.9%
$150,000-$199,999	37	9.9%	19	4.9%
$200,000-$249,999	55	14.7%	37	9.6%
$250,000-$299,999	63	16.8%	53	13.8%
$300,000-$399,999	39	10.4%	40	10.4%
$400,000-$499,999	54	14.4%	71	18.5%
$500,000-$749,999	74	19.7%	133	34.6%
$750,000-$999,999	4	1.1%	8	2.1%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	0	0.0%	0	0.0%
$2,000,000+	1	0.3%	1	0.3%
Median Value	$287,698		$429,577	
Average Value	$349,933		$434,245	

Census 2010 Housing Units	Number	Percent
Total	505	100.0%
In Urbanized Areas	0	0.0%
In Urban Clusters	0	0.0%
Rural Housing Units	505	100.0%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2022 and 2027. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

November 19, 2022

Housing Profile

22963, Palmyra, Virginia
Ring: 5 mile radius

Prepared by Esri
Latitude: 37.78318
Longitude: -78.36578

Population		Households	
2010 Total Population	3,100	2022 Median Household Income	$70,217
2020 Total Population	3,248	2027 Median Household Income	$78,742
2022 Total Population	3,221	2022-2027 Annual Rate	2.32%
2027 Total Population	3,204		
2022-2027 Annual Rate	-0.11%		

	Census 2010		2022		2027	
Housing Units by Occupancy Status and Tenure	Number	Percent	Number	Percent	Number	Percent
Total Housing Units	1,333	100.0%	1,398	100.0%	1,405	100.0%
Occupied	1,161	87.1%	1,229	87.9%	1,226	87.3%
Owner	923	69.2%	931	66.6%	951	67.7%
Renter	238	17.9%	298	21.3%	275	19.6%
Vacant	172	12.9%	170	12.2%	179	12.7%

	2022		2027	
Owner Occupied Housing Units by Value	Number	Percent	Number	Percent
Total	931	100.0%	950	100.0%
<$50,000	21	2.3%	15	1.6%
$50,000-$99,999	36	3.9%	19	2.0%
$100,000-$149,999	84	9.0%	36	3.8%
$150,000-$199,999	111	11.9%	62	6.5%
$200,000-$249,999	116	12.5%	79	8.3%
$250,000-$299,999	130	14.0%	111	11.7%
$300,000-$399,999	128	13.7%	143	15.1%
$400,000-$499,999	157	16.9%	220	23.2%
$500,000-$749,999	137	14.7%	244	25.7%
$750,000-$999,999	9	1.0%	18	1.9%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	0	0.0%	0	0.0%
$2,000,000+	2	0.2%	3	0.3%
Median Value	$287,500		$404,545	
Average Value	$331,310		$410,000	

Census 2010 Housing Units	Number	Percent
Total	1,333	100.0%
In Urbanized Areas	0	0.0%
In Urban Clusters	0	0.0%
Rural Housing Units	1,333	100.0%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2022 and 2027. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

November 19, 2022

II. Methodology and Discussion of Issues

Standards and Methodology

I conducted this analysis using the standards and practices established by the Appraisal Institute and that conform to the Uniform Standards of Professional Appraisal Practice. The analyses and methodologies contained in this report are accepted by all major lending institutions, and they are used in Virginia and across the country as the industry standard by certified appraisers conducting appraisals, market analyses, or impact studies and are considered adequate to form an opinion of the impact of a land use on neighboring properties. These standards and practices have also been accepted by the courts at the trial and appellate levels and by federal courts throughout the country as adequate to reach conclusions about the likely impact a use will have on adjoining or abutting properties.

The aforementioned standards compare property uses in the same market and generally within the same calendar year so that fluctuating markets do not alter study results. Although these standards do not require a linear study that examines adjoining property values before and after a new use (e.g. a solar farm) is developed, some of these studies do in fact employ this type of analysis. Comparative studies, as used in this report, are considered an industry standard.

The type of analysis employed is a Matched Pair Analysis or Paired Sales Analysis. This methodology is outlined in **The Appraisal of Real Estate**, Twelfth Edition by the Appraisal Institute pages 438-439. It is further detailed in **Real Estate Damages**, Third Edition, pages 33-36 by Randall Bell PhD, MAI. Paired sales analysis is used to support adjustments in appraisal work for factors ranging from the impact of having a garage, golf course view, or additional bedrooms. It is an appropriate methodology for addressing the question of impact of an adjoining solar farm. The paired sales analysis is based on the theory that when two properties are in all other respects equivalent, a single difference can be measured to indicate the difference in price between them. Dr. Bell describes it as comparing a test area to control areas. In the example provided by Dr. Bell he shows five paired sales in the test area compared to 1 to 3 sales in the control areas to determine a difference. I have used 3 sales in the control areas in my analysis for each sale developed into a matched pair.

Determining what is an External Obsolescence

An external obsolescence is a use of property that, because of its characteristics, might have a negative impact on the value of adjacent or nearby properties because of identifiable impacts. Determining whether a use would be considered an external obsolescence requires a study that isolates that use, eliminates any other causing factors, and then studies the sales of nearby versus distant comparable properties. The presence of one or a combination of key factors does not mean the use will be an external obsolescence, but a combination of these factors tends to be present when market data reflects that a use is an external obsolescence.

External obsolescence is evaluated by appraisers based on several factors. These factors include but are not limited to:

1) Traffic. Solar Farms are not traffic generators.

2) Odor. Solar farms do not produce odor.

3) Noise. Solar farms generate no noise concerns and are silent at night.

4) Environmental. Solar farms do not produce toxic or hazardous waste. Grass is maintained underneath the panels so there is minimal impervious surface area.

5) Appearance/Viewshed. This is the one area that potentially applies to solar farms. However, solar farms are generally required to provide significant setbacks and landscaping buffers to address that concern. Furthermore, any consideration of appearance of viewshed impacts has to be considered in comparison with currently allowed uses on that site. For example if a residential subdivision is already an allowed use, the question becomes in what way does the appearance impact adjoining property owners above and beyond the appearance of that allowed subdivision or other similar allowed uses.

6) Other factors. I have observed and studied many solar farms and have never observed any characteristic about such facilities that prevents or impedes neighbors from fully using their homes or farms or businesses for the use intended.

Relative Solar Farm Sizes

Solar farms have been increasing in size in recent years. Much of the data collected is from existing, older solar farms of smaller size, but there are numerous examples of sales adjoining 75 to 80 MW facilities that show a similar trend as the smaller solar farms. This is understandable given that the primary concern relative to a solar farm is the appearance or view of the solar farm, which is typically addressed through setbacks and landscaping buffers. The relevance of data from smaller solar farms to larger solar farms is due to the primary question being one of appearance. If the solar farm is properly screened, then little of the solar farm would be seen from adjoining property regardless of how many acres are involved.

Larger solar farms are often set up in sections where any adjoining owner would only be able to see a small section of the project even if there were no landscaping screen. Once a landscaping screen is in place, the primary view is effectively the same whether adjoining a 5 MW, 20 MW or 100 MW facility.

I have split out the data for the matched pairs adjoining larger solar farms only to illustrate the similarities later in this report.

Steps Involved in the Analysis

The paired sales analysis employed in this report follows the following process:

1. Identify sales of property adjoining existing solar farms.
2. Compare those sales to similar property that does not adjoin an existing solar farm.
3. Confirmation of sales are noted in the analysis write ups.
4. Distances from the homes to panels are included as a measure of the setbacks.
5. Topographic differences across the solar farms themselves are likewise noted along with demographic data for comparing similar areas.

There are a number of Sale/Resale comparables included in the write ups, but most of the data shown is for sales of homes after a solar farm has been announced (where noted) or after a solar farm has been constructed.

III. Research on Solar Farms

A. Appraisal Market Studies

I have also considered a number of impact studies completed by other appraisers as detailed below.

CohnReznick – Property Value Impact Study: Adjacent Property Values Solar Impact Study: A Study of Eight Existing Solar Facilities

Patricia McGarr, MAI, CRE, FRICS, CRA and Andrew R. Lines, MAI with CohnReznick completed an impact study for a proposed solar farm in Cheboygan County, Michigan completed on June 10, 2020. I am familiar with this study as well as a number of similar such studies completed by CohnReznick. I have not included all of these studies but I submit this one as representative of those studies.

This study addresses impacts on value from eight different solar farms in Michigan, Minnesota, Indiana, Illinois, Virginia and North Carolina. These solar farms are 19.6 MW, 100 MW, 11.9 MW, 23 MW, 71 MW, 61 MW, 40 MW, and 19 MW for a range from 11.9 MW to 100 MW with an average of 31 MW and a median of 31.5 MW. They analyzed a total of 24 adjoining property sales in the Test Area and 81 comparable sales in the Control Area over a five-year period.

The conclusion of this study is that there is no evidence of any negative impact on adjoining property values based on sales prices, conditions of sales, overall marketability, potential for new development or rate of appreciation.

Christian P. Kaila & Associates – Property Impact Analysis – Proposed Solar Power Plant Guthrie Road, Stuarts Draft, Augusta County, Virginia

Christian P. Kaila, MAI, SRA and George J. Finley, MAI developed an impact study as referenced above dated June 16, 2020. This was for a proposed 83 MW facility on 886 acres.

Mr. Kaila interviewed appraisers who had conducted studies and reviewed university studies and discussed the comparable impacts of other development that was allowed in the area for a comparative analysis of other impacts that could impact viewshed based on existing allowed uses for the site. He also discussed in detail the various other impacts that could cause a negative impact and how solar farms do not have such characteristics.

Mr. Kaila also interviewed county planners and real estate assessors in eight different Virginia counties with none of the assessor's identifying any negative impacts observed for existing solar projects.

Mr. Kaila concludes on a finding of no impact on property values adjoining the indicated solar farm.

Fred Beck, MAI, CCIM – Impact Analysis in Lincoln County 2013

Mr. Fred Beck, MAI, CCIM completed an impact analysis in 2013 for a proposed solar farm that concluded on a negative impact on value. That report relied on a single cancelled contract for an adjoining parcel where the contracted buyers indicated that the solar farm was the reason for the cancellation. It also relied on the activities of an assessment impact that was applied in a nearby county.

Mr. Beck was interviewed as part of the Christian Kalia study noted above. From that I quote "Mr. Beck concluded on no effect on moderate priced homes, and only a 5% change in his limited research of higher priced homes. His one sale that fell through is hardly a reliable sample. It also

was misleading on Mr. Beck's part to report the lower re-assessments since the primary cause of the re-assesments were based on the County Official, who lived adjacent to the solar farm, appeal to the assessor for reductions with his own home." In that Clay County Case study the noted lack of lot sales after announcement of the solar farm also coincided with the recession in 2008/2009 and lack of lot sales effectively defined that area during that time.

I further note, that I was present at the hearing where Mr. Beck presented these findings and the predominance of his argument before the Lincoln County Board of Commissioner's was based on the one cancelled sale as well as a matched pair analysis of high-end homes adjoining a four-story call center. He hypothesized that a similar impact from that example could be compared to being adjacent solar farm without explaining the significant difference in view, setbacks, landscaping, traffic, light, and noise. Furthermore, Mr. Beck did have matched pairs adjoining a solar farm in his study that he put in the back of his report and then ignored as they showed no impact on property value.

Also noted in the Christian Kalia interview notes is a response from Mr. Beck indicating that in his opinion "the homes were higher priced homes and had full view of the solar farm." Based on a description of screening so that "the solar farm would not be in full view to adjoining property owners. Mr. Beck said in that case, he would not see any drop in property value."

NorthStar Appraisal Company – Impact Analysis for Nichomus Run Solar, Pilesgrove, NJ, September 16, 2020

Mr. William J. Sapio, MAI with NorthStar Appraisal Company considered a matched pair analysis for the potential impact on adjoining property values to this proposed 150 MW solar farm. Mr. Sapio considered sales activity in a subdivision known as Point of Woods in South Brunswick Township and identified two recent new homes that were constructed and sold adjoining a 13 MW solar farm and compared them to similar homes in that subdivision that did not adjoin the solar farm. These homes sold in the $1,290,450 to $1,336,613 price range and these homes were roughly 200 feet from the closest solar panel.

Based on this analysis, he concluded that the adjoining solar farm had no impact on adjoining property value.

MR Valuation Consulting, LLC – The Kuhl Farm Solar Development and The Fischer Farm Solar Development – June 7, 2012

Mr. Mark Pomykacaz, MAI MRICS with MR Valuation Consulting, LLC considered a matched pair analysis for sales near these solar farms. The sales data presented supported a finding of no impact on property value for nearby and adjoining homes and concludes that there is no impact on marketing time and no additional risk involved with owning, building, or selling properties next to the solar farms.

Mary McClinton Clay, MAI – McCracken County Solar Project Value Impact Report, July 10, 2021

Ms. Mary Clay, MAI reviewed a report by Kirkland Appraisals in this case and also provided a differing opinion of impact. She cites a number of other appraisal studies and interestingly finds fault with heavily researched opinions, while praising the results of poorly researched studies that found the opposing view.

Her analysis includes details from solar farms that show no impact on value, but she dismisses those.

She cites the University of Texas study noted later in this report, but she cites only isolated portions of that study to conclude the opposite of what that study specifically concludes.

She cites the University of Rhode Island study noted alter in this report, but specifically excludes the conclusion of that study that in rural areas they found no impact on property value.

She cites lot sales near Spotsylvania Solar without confirming the purchase prices with brokers as indicative of market impact and has made no attempt to compare lot prices that are contemporaneous. In her 5 lot sales that she identifies, all of the lot prices decline with time from 2015 through 2019. This includes the 3 lot sales prior to the approval of the solar farm. The decrease in lot values shown in this chart are more indicative of the trend in the market, than of any impact related to the solar farm. Otherwise, how does she explain the drop in price from 2015 to 2017 prior to the solar farm approval.

She considers data at McBride Place Solar Farm and does a sale/resale analysis based on Zillow Home Value Index, which is not a reliable indication for appreciation in the market. She then adjusted her initial sales prior to the solar farm over 7 years to determine what she believes the home should have appreciated by and then compares that to an actual sale. She has run no tests or any analysis to show that the appreciation rates she is using are consistent with the market but more importantly she has not attempted to confirm any of these sales with market participants. I have spoken with brokers active in the sales that she cites and they have all indicated that the solar farm was not a negative factor in marketing or selling those homes.

She has considered lot sales at Sunshine Farms in Grandy, NC. She indicates that the lots next to the solar farm are selling for less than lots not near the solar farm, but she is actually using lot sales next to the solar farm prior to the solar farm being approved. She also ignores recent home sales adjoining this solar farm after it was built that show no impact on property value.

She also notes a couple of situations where solar developers have purchased adjoining homes and resold them or where a neighbor agreement was paid as proof of a negative impact on property value. Given that there are over 2,500 solar farms in the USA as of 2018 according to the U.S. Energy Information Administration and there are only a handful of such examples, this is clearly not an industry standard but a business decision. Furthermore, solar developers are not in the business of flipping homes and are in a position very similar to a bank that acquires a home as OREO (Other Real Estate Owned), where homes are frequently sold at discounted prices, not because of any drop in value, but because they are not a typically motivated seller. Market value requires an analysis of a typically motivated buyer and seller. So these are not good indicators of market value impacts.

The comments throughout this study are heavy in adjectives, avoids stating facts contrary to the conclusion and shows a strong selection bias.

Conclusion of Impact Studies

Of the five studies noted two included actual sales data to derive an opinion of no impact on value. The two studies to conclude on a negative impact includes the Fred Beck study based on no actual sales data, and he has since indicated that with landscaping screens he would not conclude on a negative impact. The other study by Mary Clay shows improper adjustments for time, a lack of confirmation of sales comparables, and exclusion of data that does not support her position.

I have relied on these studies as additional support for the findings in this impact analysis.

B. Articles

I have also considered a number of articles on this subject as well as conclusions and analysis as noted below.

Farm Journal Guest Editor, March 22, 2021 – Solar's Impact on Rural Property Values

Andy Ames, ASFMRA (American Society of Farm Managers and Rural Appraisers) published this article that includes a discussion of his survey of appraisers and studies on the question of property value related to solar farms. He discusses the university studies that I have cited as well as Patricia McGarr, MAI.

He also discusses the findings of Donald A. Fisher, ARA, who served six years at the Chair of the ASFMRA's National Appraisal Review Committee. He is also the Executive Vice President of the CNY Pomeroy Appraiser and has conducted several market studies on solar farms and property impact. He is quoted in the article as saying, "Most of the locations were in either suburban or rural areas, and all of those studies found either a neutral impact, or ironically, a positive impact, where values on properties after installation of solar farms went up higher than time trends."

Howard Halderman, AFM, President and CEO of Halderman Real Estate and Farm Management attended the ASFMRA solar talk hosted by the Indiana Chapter of the ASFMRA and he concludes that other rural properties would likely see no impact and farmers and landowners shown even consider possible benefits. "In some cases, farmers who rent land to a solar company will insure the viability of their farming operation for a longer time period. This makes them better long-term tenants or land buyers so one can argue that higher rents and land values will follow due to the positive impact the solar leases offer."

More recently in August 2022, Donald Fisher, ARA, MAI and myself led a webinar on this topic for the ASFMRA discussing the issues, the university studies and specific examples of solar farms having no impact on adjoining property values.

National Renewable Energy Laboratory – Top Five Large-Scale Solar Myths, February 3, 2016

Megan Day reports form NREL regarding a number of concerns neighbors often express. Myth #4 regarding property value impacts addresses specifically the numerous studies on wind farms that show no impact on property value and that solar farms have a significantly reduced visual impact from wind farms. She highlights that the appearance can be addressed through mitigation measures to reduce visual impacts of solar farms through vegetative screening. Such mitigations are not available to wind farms given the height of the windmills and again, those studies show no impact on value adjoining wind farms.

North Carolina State University: NC Clean Energy Technology Center White Paper: Balancing Agricultural Productivity with Ground-Based Solar Photovoltaic (PV) Development (Version 2), May 2019

Tommy Cleveland and David Sarkisian wrote a white paper for NCSU NC Clean Energy Technology Center regarding the potential impacts to agricultural productivity from a solar farm use. I have interviewed Tommy Cleveland on numerous occasions and I have also heard him speak on these issues at length as well. He addresses many of the common questions regarding how solar farms work and a detailed explanation of how solar farms do not cause significant impacts on the soils, erosion and other such concerns. This is a heavily researched paper with the references included.

North Carolina State University: NC Clean Energy Technology Center White Paper: Health and Safety Impacts of Solar Photovoltaics, May 2017

Tommy Cleveland wrote a white paper for NCSU NC Clean Energy Technology Center regarding the health and safety impacts to address common questions and concerns related to solar farms. This is a heavily researched white paper addressing questions ranging from EMFs, fire safety, as well as vegetation control and the breakdown of how a solar farm works.

C. Broker Commentary

In the process of working up the matched pairs used later in this report, I have collected comments from brokers who have actually sold homes adjoining solar farms indicating that the solar farm had no impact on the marketing, timing, or sales price for the adjoining homes. I have included comments from brokers within this report where they discussed specific solar projects including brokers from Kentucky, Virginia, Tennessee, and North Carolina.

I have additional commentary from other states including New Jersey and Michigan that provide the same conclusion.

IV. University Studies

I have also considered the following studies completed by four different universities related to solar farms and impacts on property values.

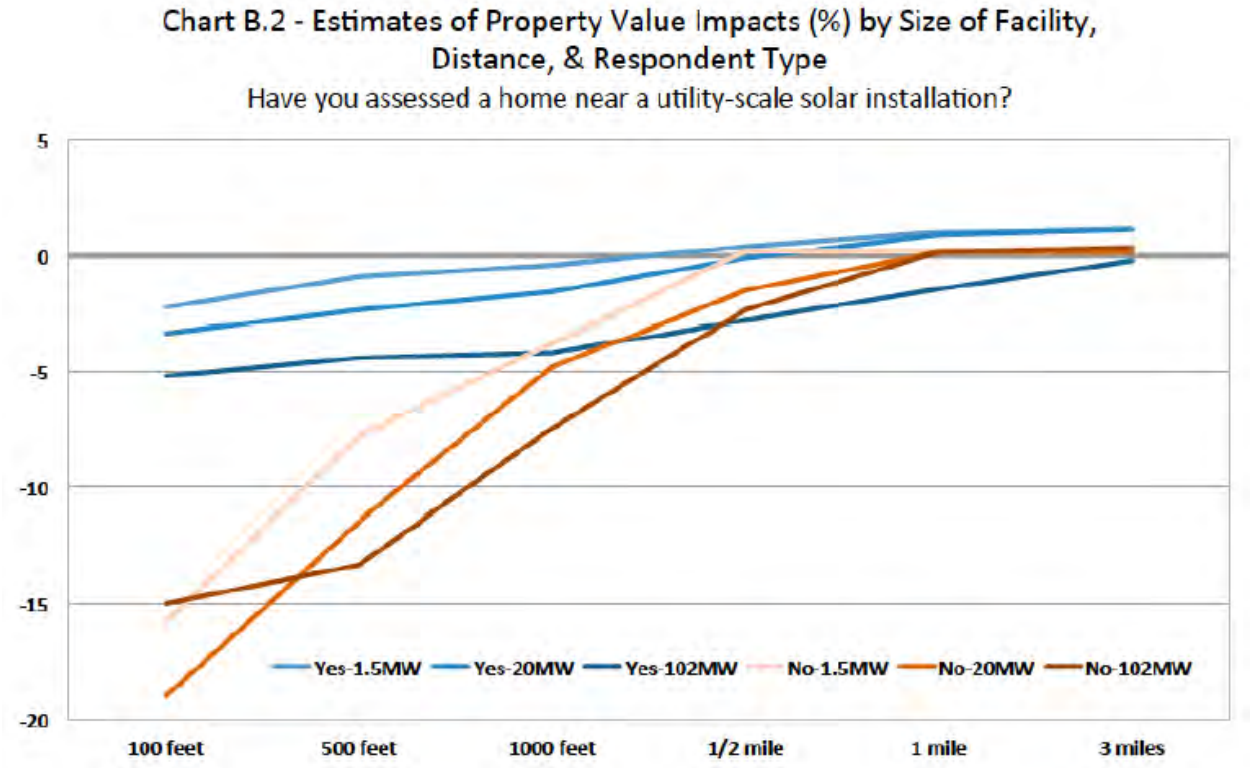
A. University of Texas at Austin, May 2018

An Exploration of Property-Value Impacts Near Utility-Scale Solar Installations

This study considers solar farms from two angles. First it looks at where solar farms are being located and concludes that they are being located primarily in low density residential areas where there are fewer homes than in urban or suburban areas.

The second part is more applicable in that they conducted a survey of appraisers/assessors on their opinions of the possible impacts of proximity to a solar farm. They consider the question in terms of size of the adjoining solar farm and how close the adjoining home is to the solar farm. I am very familiar with this part of the study as I was interviewed by the researchers multiple times as they were developing this. One very important question that they ask within the survey is very illustrative. They asked if the appraiser being surveyed had ever appraised a property next to a solar farm. There is a very noticeable divide in the answers provided by appraisers who have experience appraising property next to a solar farm versus appraisers who self-identify as having no experience or knowledge related to that use.

On Page 16 of that study they have a chart showing the responses from appraisers related to proximity to a facility and size of the facility, but they separate the answers as shown below with appraisers with experience in appraising properties next to a solar farm shown in blue and those inexperienced shown in brown. Even within 100 feet of a 102 MW facility the response from experienced appraisers were -5% at most on impact. While inexperienced appraisers came up with significantly higher impacts. This chart clearly shows that an uninformed response widely diverges from the sales data available on this subject.



Furthermore, the question cited above does not consider any mitigating factors such as landscaping buffers or screens which would presumably reduce the minor impacts noted by experienced appraisers on this subject.

The conclusion of the researchers is shown on Page 23 indicated that "Results from our survey of residential home assessors show that the majority of respondents believe that proximity to a solar installation has either no impact or a positive impact on home values."

This analysis supports the conclusion of this report that the data supports no impact on adjoining property values.

B. University of Rhode Island, September 2020

Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island

The University of Rhode Island published a study entitled **Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island** on September 29, 2020 with lead researchers being Vasundhara Gaur and Corey Lang. I have read that study and interviewed Mr. Corey Lang related to that study. This study is often cited by opponents of solar farms but the findings of that study have some very specific caveats according to the report itself as well as Mr. Lang from the interview.

While that study does state in the Abstract that they found depreciation of homes within 1-mile of a solar farm, that impact is limited to non-rural locations. On Pages 16-18 of that study under Section 5.3 Heterogeneity in treatment effect they indicate that the impact that they found was limited to non-rural locations with the impact in rural locations effectively being zero. For the study they defined "rural" as a municipality/township with less than 850 population per square mile.

They further tested the robustness of that finding and even in areas up to 2,000 population per square mile they found no statistically significant data to suggest a negative impact. They have not specifically defined a point at which they found negative impacts to begin, as the sensitivity study stopped checking at the 2,000-population dataset.

Where they did find negative impacts was in high population density areas that was largely a factor of running the study in Massachusetts and Rhode Island which the study specifically cites as being the 2nd and 3rd most population dense states in the USA. Mr. Lang in conversation as well as in recorded presentations has indicated that the impact in these heavily populated areas may reflect a loss in value due to the scarce greenery in those areas and not specifically related to the solar farm itself. In other words, any development of that site might have a similar impact on property value.

Based on this study I have checked the population for Fork Union District of Fluvanna County, which has a population of 4,861 population for 2022 based on HomeTownLocator.com and a total area of 118.56 square miles. This indicates a population density of 41 people per square mile which puts this well below the threshold indicated by the Rhode Island Study.

I therefore conclude that the Rhode Island Study supports a finding of no impact on adjoining properties for the proposed solar farm.

Fork Union District Data & Demographics (As of July 1, 2022)

POPULATION	
Total Population	4,861 (100%)
Population in Households	4,708 (96.9%)
Population in Families	3,961 (81.5%)
Population in Group Quarters[1]	153 (3.1%)
Population Density	41
Diversity Index[2]	51

HOUSING	
Total HU (Housing Units)	2,071 (100%)
Owner Occupied HU	1,447 (69.9%)
Renter Occupied HU	393 (19.0%)
Vacant Housing Units	231 (11.2%)
Median Home Value	$289,612
Average Home Value	$333,449
Housing Affordability Index[3]	127

INCOME	
Median Household Income	$73,957
Average Household Income	$110,268
% of Income for Mortgage[4]	21%
Per Capita Income	$41,597
Wealth Index[5]	128

HOUSEHOLDS	
Total Households	1,840
Average Household Size	2.56
Family Households	1,325
Average Family Size	3

C. Georgia Institute of Technology, October 2020

Utility-Scale Solar Farms and Agricultural Land Values

This study was completed by Nino Abashidze as Post-Doctoral Research Associate of Health Economics and Analytics Labe (HEAL), School of Economics, Georgia Institute of Technology. This research was started at North Carolina State University and analyzes properties near 451 utility-scale ground-mount solar installations in NC that generate at least 1 MW of electric power. A total of 1,676 land sales within 5-miles of solar farms were considered in the analysis.

This analysis concludes on Page 21 of the study "Although there are no direct effects of solar farms on nearby agricultural land values, we do find evidence that suggests construction of a solar farm may create a small, positive, option -value for land owners that is capitalized into land prices. Specifically, after construction of a nearby solar farm, we find that agricultural land that is also located near transmission infrastructure may increase modestly in value."

This study supports a finding of no impact on adjoining agricultural property values and in some cases could support a modest increase in value.

D. Master's Thesis: ECU by Zachary Dickerson July 2018

A Solar Farm in *My* Backyard? Resident Perspectives of Utility-Scale Solar in Eastern North Carolina

This study was completed as part of a Master of Science in Geography Master's Thesis by Zachary Dickerson in July 2018. This study sets out to address three questions:

1. Are there different aspects that affect resident satisfaction regarding solar farms?

2. Are there variations in satisfaction for residents among different geographic settings, e.g. neighborhoods adjacent to the solar farms or distances from the solar farms?

3. How can insight from both the utility and planning sectors, combined with knowledge gained from residents, fill gaps in communication and policy writing in regard to solar farms?

This was done through survey and interview with adjacent and nearby neighbors of existing solar farms. The positive to neutral comments regarding the solar farms were significantly higher than negative. The researcher specifically indicates on Page 46 "The results show that respondents generally do not believe the solar farms pose a threat to their property values."

The most negative comments regarding the solar farms were about the lack of information about the approval process and the solar farm project prior to construction.

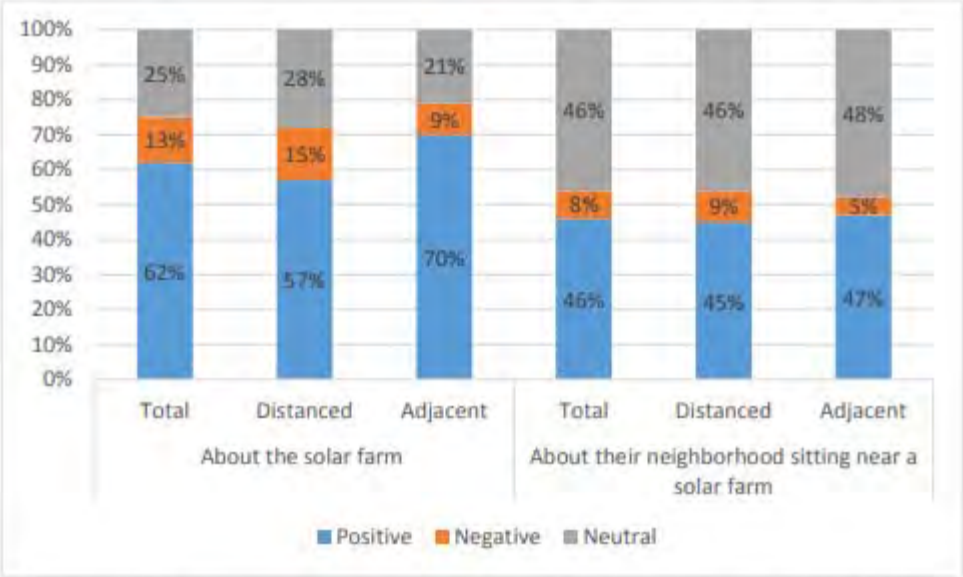


Figure 11: Residents' positive/negative word choices by geographic setting for both questions

V. Assessor Surveys

I have attempted to contact all of the assessor departments in North Carolina to determine how local assessors are handling solar farms and adjoining property values. I have spoken personally with a number of assessors, but much of this data was obtained via email. I have 39 counties in NC that have both responded to these questions on property value and also have solar farms in that county. I have excluded responses from assessors from counties where there are no current solar farms.

As can be seen in the chart below, of the 39 responses all of the responses have indicated that they make no adjustment to properties adjoining solar farms. Several assessors indicated that it would require an adjoining property owner to appeal their property value with data showing a negative impact before they would make any adjustment and to date they have not had that happen.

I also point out specifically Clay County. I spoke with the assessor there specifically about adjustments that were applied to some properties near a solar farm back in 2008. She was unaware of the details of that event as she was not in this position at that time. As discussed earlier in this report the lower re-assessments at that solar farm were based on a County Official, who owned property adjacent to the solar farm, who made an appeal to the assessor for reductions for his own property. The noted lack of lot sales after announcement of the solar farm however coincided with the recession in 2008/2009 and lack of lot sales effectively defined that area during that time, but without relying on any data the assessor made that change in that time frame based on conversations with the assessor. Since then, Clay County has confirmed that they do not currently make any changes to adjoining property values and the current county assessor was not even aware that they had in the past done so.

NC Assessor Survey on Solar Farm Property Value Impacts

County	Assessor's Name	Number of Farms	Change in Adjacent Property Value
Alexander	Doug Fox	3	No
Buncombe	Lisa Kirbo	1	No
Burke	Daniel Isenhour	3, 2 on 1 parcel, 1 on 3 parcels	No
Cabarrus	Justin	less than 10, more in the works	No
Caldwell	Monty Woods	3 small	No, but will look at data in 2025
Catawba	Lori Ray	14	No
Chatham	Jenny Williams	13	No
Cherokee	Kathy Killian	9	No
Chowan	Melissa Radke	3, I almost operational	No
Clay	Bonnie L. Lyvers		No
Davidson	Libby	1	No
Duplin	Gary Rose	34, 2 more in planning	No
Franklin	Marion Cascone	11	No
Gaston	Traci Hovis	3	No
Gates	Chris Hill	3	No
Granville	Jenny Griffin	8	No
Halifax	C. Shane Lynch	Multiple	No
Hoke	Mandi Davis	4	No
Hyde	Donnie Shumate	1 to supplement egg processing plant	No
Iredell	Wes Long	2, 3 others approved	No
Lee	Lisa Faulkner	8	No
Lincoln	Susan Sain	2	No
Moore	Michael Howery	10	No
New Hanover	Rhonda Garner	35	No
Orange	Chad Phillip	2 or 7 depending on breakdown	No
Pender	Kayla Bolick Futrell	6	No
Person	Russell Jones	9	No
Pitt	Russell D. Hill	8, 1 in planning	No
Randolph	Mark Frick	19	No
Rockingham	Mark C McClintock	6	No
Rutherford	Kim Aldridge	20	No
Sampson	Jim Johnson	9, 1 in construction	No
Scotland	James Brown	15, 1 in process	No
Stokes	Richard Brim	2	No
Surry	Penny Harrison	4, 2 more in process	No
Union	Robin E. Merry	6	No
Vance	Cathy E. Renn	13	No
Warren	John Preston	7	No
Wayne	Alan Lumpkin	32	No
Wilson	William (Witt) Putney	~16	No, mass appraisal standards applied

Responses: 39
Negative Impact on Adjoining Value = Yes: 0
Negative Impact on Adjoining Value = No: 39

I have also been working on a survey of Virginia Assessors regarding property values related to solar farms and whether or not the local assessors have found any data to support any changes to value on property adjoining solar farms. In this process I have contacted every assessor's office by email and I have received responses by email and by phone from a number of these counties. Many of the counties in Virginia rely on outside firms to assist in gathering data for the assessments and where that is the case, we have contacted the outside firms regarding the question of whether or not the assessors are currently making any adjustments to properties adjoining solar farms.

I currently have response from 16 counties that have solar farms in them and of those 16 responses none of the assessors are currently applying a negative impact on property value. One response suggested that adjoining values may go up.

I did speak with Randy Willis with Pearson Assessors. His company assists in the assessments in many of the counties south of Richmond. He indicated that they had found no data to suggest a negative impact on property value and they have looked as they were concerned about that issue.

He indicated that they would make no negative impact adjustments and that he recognizes that there are a number of agricultural adjoining uses that have a greater impact on adjoining properties in terms of noise, dust and odor than a solar farm would have. He did indicate that there could be situations where an individual home might have a greater visual impact and those should be looked at on a case-by-case basis, but he also agreed that many allowed agricultural uses could have similar visual impacts on such properties as well.

VIRGINIA Commissioner of the Revenue

County	Assessor Name	Number of Farms in Operation	Change in adjacent property value
Appomattox	Sara Henderson	1, plus one in process	No
Augusta	W. Jean Shrewsbury	no operational	No
Buckingham	Stephanie D. Love	1	No
Charlotte	Naisha Pridgen Carter	1, several others in the works	No
Clarke	Donna Peake	1	No
Frederick	Seth T. Thatcher	none, 2 appoved for 2022	No, assuming compatible with rural area
Goochland	Mary Ann Davis		No
Hanover	Ed Burnett	1	No
Louisa	Stacey C. Fletcher	2 operational by end of year	No, only if supported by market data
Mecklenburg	Joseph E. "Ed" Taylor		No
Nottoway	Randy Willis with Pearson Assessors		No
Powhatan	Charles Everest	2 approved, 1 built	Likely increase in value
Rockingham	Dan Cullers	no operational	Likely no
Southampton	Amy B. Carr	1	Not normally
Surry	Jonathan F. Judkins	1	None at this time
Westmoreland	William K. Hoover	4	No

Responses: 16
Negative Impact on Adjoining Value = Yes: 0
Negative Impact on Adjoining Value = No: 16

VI. Summary of Solar Projects In Virginia

I have researched the solar projects in Virginia. I identified the solar farms through the Solar Energy Industries Association (SEIA) Major Projects List and then excluded the roof mounted facilities. I focused on larger solar farms over 10 MW though I have included a couple of smaller solar farms as shown in the chart below.

I was able to identify and research 50 solar farms in Virginia as shown below. These are primarily over 20 MW in size with adjoining homes as close as 100 feet and the mix of adjoining uses is primarily agricultural and residential.

Parcel #	Name	County	City	Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre Res	Agri	Agri/Res	Com
115	Buckingham I	Buckingham	Cumberland	19.8	481.18		N/A	N/A	8%	73%	18%	0%
121	Scott	Powhatan	Amelia Court Hou	20	898.4		1,421	730	29%	28%	44%	0%
204	Walker-Correctional	New Kent	Barhamsville	20	484.65	484.65	516	103	13%	68%	20%	0%
205	Sappony	Sussex	Stony Creek	20	322.68	322.68			2%	98%	0%	0%
216	Beetle	Southampton	Boykins	40	422.19	422.19	1,169	310	0%	10%	90%	0%
222	Grasshopper	Mecklenburg	Chase City	80	946.25	946.25			6%	87%	5%	1%
226	Belcher	Louisa	Louisa	88	1238.11	1238.11		150	19%	53%	28%	0%
228	Bluestone Farm	Mecklenburg	Chase City	4.99	332.5	332.5			0%	100%	0%	0%
257	Nokesville	Prince Willia	Nokesville		331.01	331.01			12%	49%	17%	23%
261	Buckingham II	Buckingham	Buckingham	19.8	460.05	460.05			6%	79%	15%	0%
262	Mount Jackson	Shenandoah	Mount Jackson	15.65	652.47	652.47			21%	51%	14%	13%
263	Gloucester	Gloucester	Gloucester	20	203.55	203.55	508	190	17%	55%	28%	0%
267	Scott II	Powhatan	Powhatan		701	701			41%	25%	34%	0%
272	Churchview	Middlesex	Church View	20	567.91	567.91			9%	64%	27%	0%
303	Turner	Henrico	Henrico	20	463.12	463.12	N/A	N/A	21%	37%	0%	42%
311	Sunnybrook Farm	Halifax	Scottsburg		527.88	527.88	N/A	N/A	15%	59%	26%	0%
312	Powell Creek	Halifax	Alton		513	513	N/A	N/A	7%	71%	22%	0%
339	Crystal Hill	Halifax	Crystal Hill		628.67	628.67	1,570	140	6%	41%	35%	18%
354	Amazon East	Accomack	Oak Hall	80	1000	1000	645	135	8%	75%	17%	0%
355	Alton Post	Halifax	Alton		501.96	501.96	749	100	2%	58%	40%	0%
364	Remington	Fauquier	Remington	20	277.2	277.2	2,755	1,280	10%	41%	31%	18%
365	Greenwood	Culpepper	Stevensburg	100	2266.58	2266.58	788	200	8%	62%	29%	0%
367	Culpeper Sr	Culpeper	Culpeper		12.53	12.53	N/A	N/A	15%	0%	86%	0%
370	Cherrydale	Northampton	Kendall Grove	20	180.17	180.17	N/A	N/A	5%	0%	92%	3%
373	Woodland,VA	Isle of Wight	Smithfield	19.7	211.12	211.12	606	190	9%	0%	91%	0%
374	Whitehouse	Louisa	Louisa	20	499.52	499.52	1,195	110	24%	55%	18%	4%
402	Cedar Park	Henrico	Richmond		13.93	13.93			57%	0%	0%	43%
407	Foxhound	Halifax	Clover	91	1311.78	1311.78	885	185	5%	61%	17%	18%
415	Stagecoach II	Halifax	Nathalie	16.625	327.87	327.87	1,073	255	5%	66%	29%	0%
484	Essex Solar Center	Essex	Center Cross	20	106.12	106.12	693	360	3%	70%	27%	0%
485	Southampton	Southampton	Newsoms	100	3243.92	3243.92	-	-	3%	78%	17%	3%
487	Augusta	Augusta	Stuarts Draft	125	3197.4	1147	588	165	16%	61%	16%	7%
490	Cartersville	Powhatan	Powhatan		2945	1358	1,467	105	6%	14%	80%	0%
495	Walnut	King and Que	Shacklefords	110	1700	1173	641	165	14%	72%	13%	1%
497	Piney Creek	Halifax	Clover	80	776.18	422	523	195	15%	62%	24%	0%
511	UVA Puller	Middlesex	Topping	15	120	120	1,095	185	59%	32%	0%	10%
519	Fountain Creek	Greensville	Emporia	80	798.3	798.3	-	-	6%	23%	71%	0%
557	Winterpock 1	Chesterfield	Chesterfield		518	308	2,106	350	4%	78%	18%	0%
577	Windsor	Isle of Wight	Windsor	85	564.1	564.1	572	160	9%	67%	24%	0%
579	Spotsylvania	Spotsylvania	Paytes	500	6412	3500			9%	52%	11%	27%
586	Sweet Sue	King William	Aylett	77	1262	576	1,617	680	7%	68%	25%	0%
591	Warwick	Prince Georg	Disputanta	26.5	967.62	442.05	555	115	12%	68%	20%	0%
621	Loblolly	Surry	Spring Grove	150	2181.92	1000	1,860	110	7%	62%	31%	0%
622	Woodridge	Albemarle	Scottsville	138	2260.87	1000	1,094	170	9%	63%	28%	0%
633	Brunswick	Greensville	Emporia	150.2	2076.36	1387.3	1,091	240	4%	85%	11%	0%
642	Belcher 3	Louisa	Louisa		749.36	658.56	598	180	14%	71%	14%	1%
649	Endless Caverns	Rockingham	New Market	31.5	355	323.6	624	190	15%	27%	51%	7%
664	Watlington	Halifax	South Boston	20	240.09	137	536	215	24%	48%	28%	0%
671	Spout Spring	Appomattox	Appomattox	60	881.12	673.37	836	335	16%	30%	46%	8%
703	Lily Pond	Dinwiddie	Carson	80	2197.74	1930	723	115	13%	60%	27%	0%
		Total Number of Solar Farms		50								
			Average	66.76	1006.61	755.54	1003.2	253.5	13%	53%	29%	5%
			Median	31.50	566.01	520.44	788.0	185.0	9%	60%	24%	0%
			High	500.00	6412.00	3500.00	2755.0	1280.0	59%	100%	92%	43%
			Low	4.99	12.53	12.53	508.0	100.0	0%	0%	0%	0%

On the following pages I have included summary data on the constructed solar farms indicated above. Similar information is available for the larger set of solar farms in the adjoining states in my files if requested.

115: Buckingham Solar, E. James Anderson Hwy, Buckingham, VA

This project was proposed in 2017 and located on 460 acres with the closest home proposed to be 150 feet from the closest solar panel.

Adjoining Use Breakdown

	Acreage	Parcels
Residential	5.95%	71.79%
Agricultural	78.81%	20.51%
Agri/Res	15.24%	7.69%
Total	**100.00%**	**100.00%**

121: Scott Solar Project, 1580 Goodes Bridge Rd, Powhatan, VA

This project was built in 2016 and located on 165 acres out of 898 acres for a 17 MW with the closest home proposed to be 730 feet from the closest solar panel.

Adjoining Use Breakdown

	Acreage	Parcels
Residential	28.83%	78.57%
Agri/Res	43.52%	3.57%
Agricultural	27.65%	17.86%
Total	**100.00%**	**100.00%**

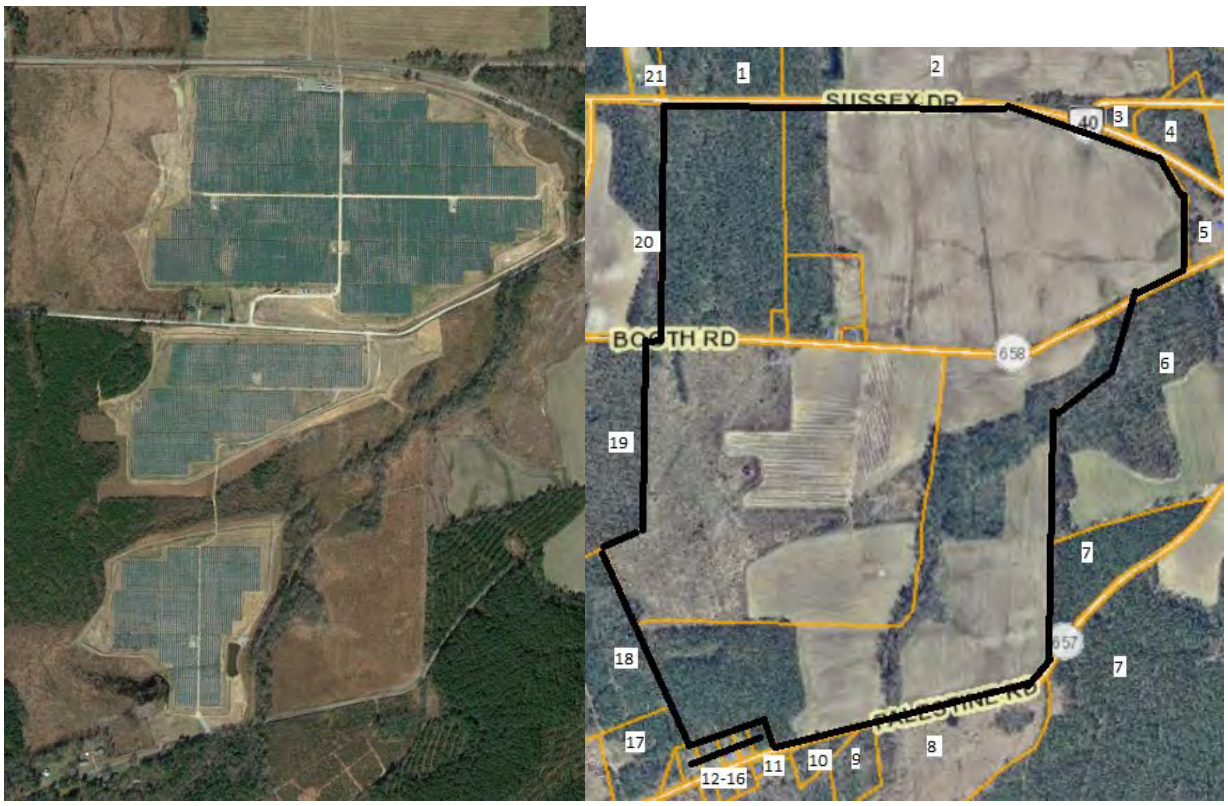
204: Walker-Correctional Solar, Barham Road, Barhamsville, VA

This project was built in 2017 and located on 484.65 acres for a 20 MW with the closest home at 110 feet from the closest solar panel with an average distance of 500 feet.

Adjoining Use Breakdown

	Acreage	Parcels
Residential	12.59%	76.92%
Agricultural	67.71%	15.38%
Agri/Res	19.70%	7.69%
Total	**100.00%**	**100.00%**

205: Sappony Solar, Sussex Drive, Stony Creek, VA



This project was built in 2017 and located on 484.65 acres for a 20 MW with the closest home at 110 feet from the closest solar panel with an average distance of 500 feet.

Adjoining Use Breakdown

	Acreage	**Parcels**
Residential	12.59%	76.92%
Agricultural	67.71%	15.38%
Agri/Res	19.70%	7.69%
Total	**100.00%**	**100.00%**

354: Amazon Solar project East (Eastern Shore), Accomack, VA

This project was built in 2016 for a solar project on a 1,000-acre assemblage for an 80 MW facility. The closest home is 135 feet from the closest panel.

Adjoining Use Breakdown

	Acreage	**Parcels**
Residential	8.18%	63.74%
Agricultural	75.16%	30.77%
Agri/Res	16.56%	3.30%
Substation	0.08%	1.10%
Church	0.01%	1.10%
Total	**100.00%**	**100.00%**

364: Remington Solar, 12080 Lucky Hill Rd, Remington, VA

This project was built in 2017 for a solar project on a 125-acre tract for a 20 MW facility. There were some recent home sales adjoining this project, but it was difficult to do any matched pairs. One sale was an older home in very poor condition according to the broker and required crossing railroad tracks on a private road to get access to the home and located across from a large industrial building. The other sale is a renovated historic home on a large tract of land just one parcel north of the large industrial building. These sales essentially have too much static around them to isolate any impacts separate from these other factors. I did find a new home sale to the north that is discussed later in this report.

Adjoining Use Breakdown

	Acreage	**Parcels**
Residential	10.24%	65.38%
Agricultural	40.79%	19.23%
Agri/Res	30.87%	7.69%
Warehouse	0.82%	3.85%
Substation	17.28%	3.85%
Total	**100.00%**	**100.00%**

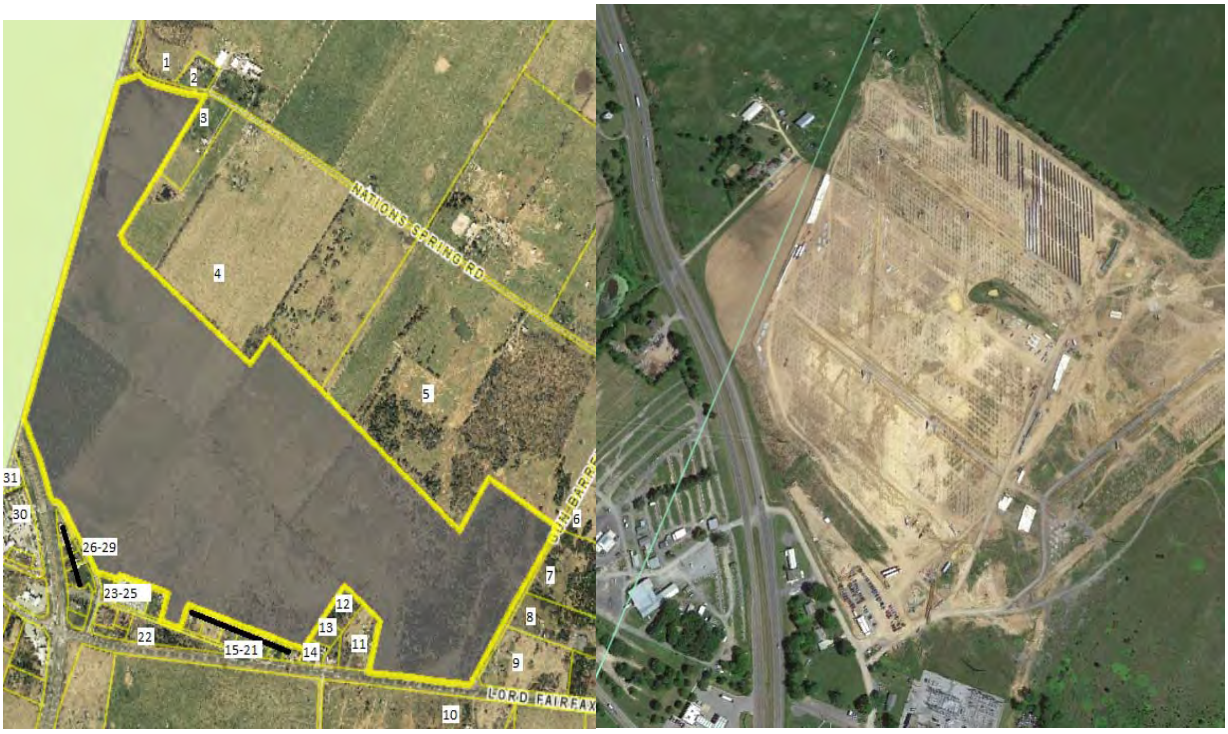
370: Cherrydale Solar, Seaside Road, Kendall Grove, VA

This project was built in 2017 and located on 180.17 acres for a 20 MW facility.

Adjoining Use Breakdown

	Acreage	Parcels
Residential	5.44%	80.77%
Agricultural	92.01%	15.38%
Warehouse	2.55%	3.85%
Total	**100.00%**	**100.00%**

371: Clarke County Solar, Double Tollgate Road, White Post, VA

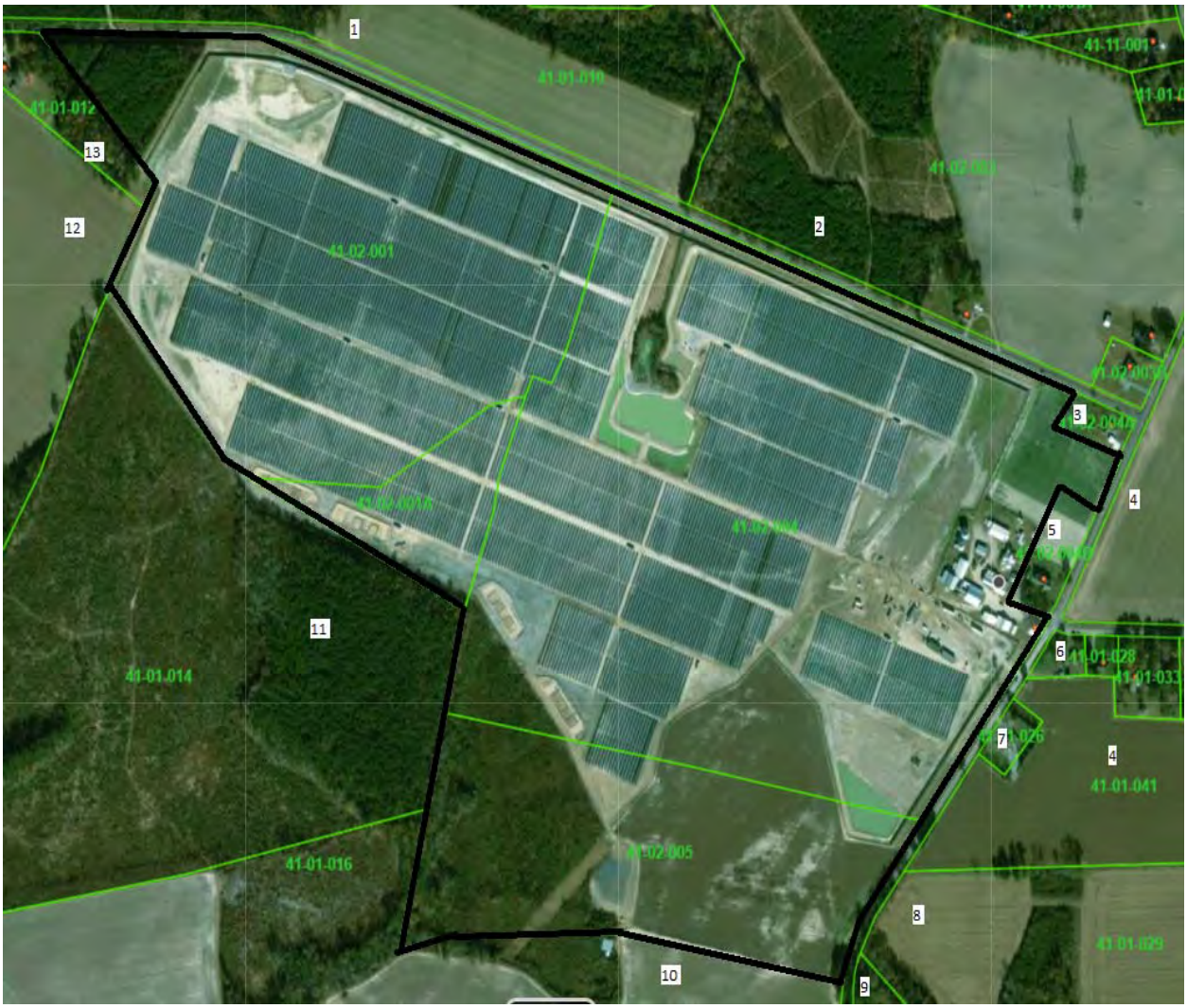


This project was built in 2017 and located on a portion of a 234.84-acre tract for a 20 MW facility.

Adjoining Use Breakdown

	Acreage	Parcels
Residential	13.70%	74.19%
Agricultural	38.89%	6.45%
Agri/Res	46.07%	6.45%
Commercial	0.19%	6.45%
Warehouse	0.85%	3.23%
Substation	0.30%	3.23%
Total	**100.00%**	**100.00%**

373: Woodland Solar, Longview Drive, Smithfield, VA



This project was built in 2016 for a solar project on a 211.12-acre tract for a 19.7 MW facility. The closest single-family home is 190 feet away from the closest solar panel. The average distance is 606 feet.

Adjoining Use Breakdown

	Acreage	Parcels
Residential	8.85%	46.15%
Agricultural	91.08%	46.15%
Cell Tower	0.07%	7.69%
Total	**100.00%**	**100.00%**

374: Whitehouse Solar, Chalklevel Road, Louisa, VA

This project was built in 2016 for a solar project on a 499.52-acre tract for a 20 MW facility. The closest single-family home is 110 feet away from the closest solar panel. The average distance is 1,195 feet.

Adjoining Use Breakdown

	Acreage	**Parcels**
Residential	23.55%	70.27%
Agricultural	54.51%	10.81%
Agri/Res	18.22%	2.70%
Commercial	2.49%	13.51%
Industrial	1.22%	2.70%
Total	**100.00%**	**100.00%**

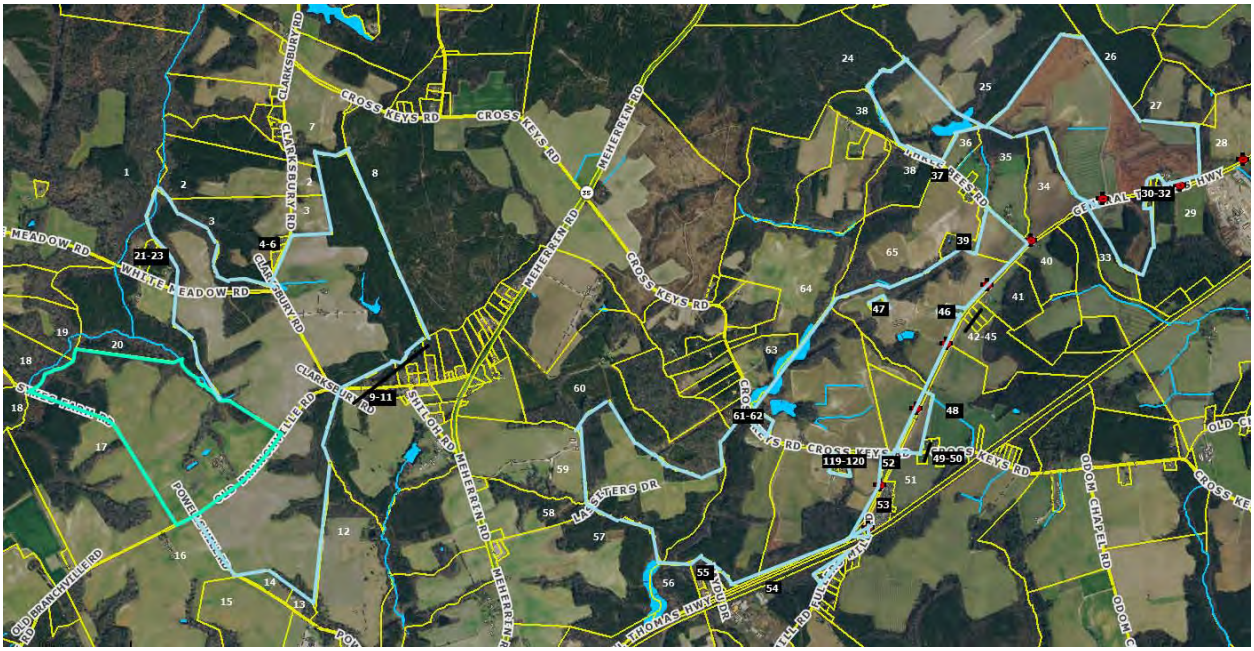
484: Essex Solar, Tidewater Trail, Center Cross, VA

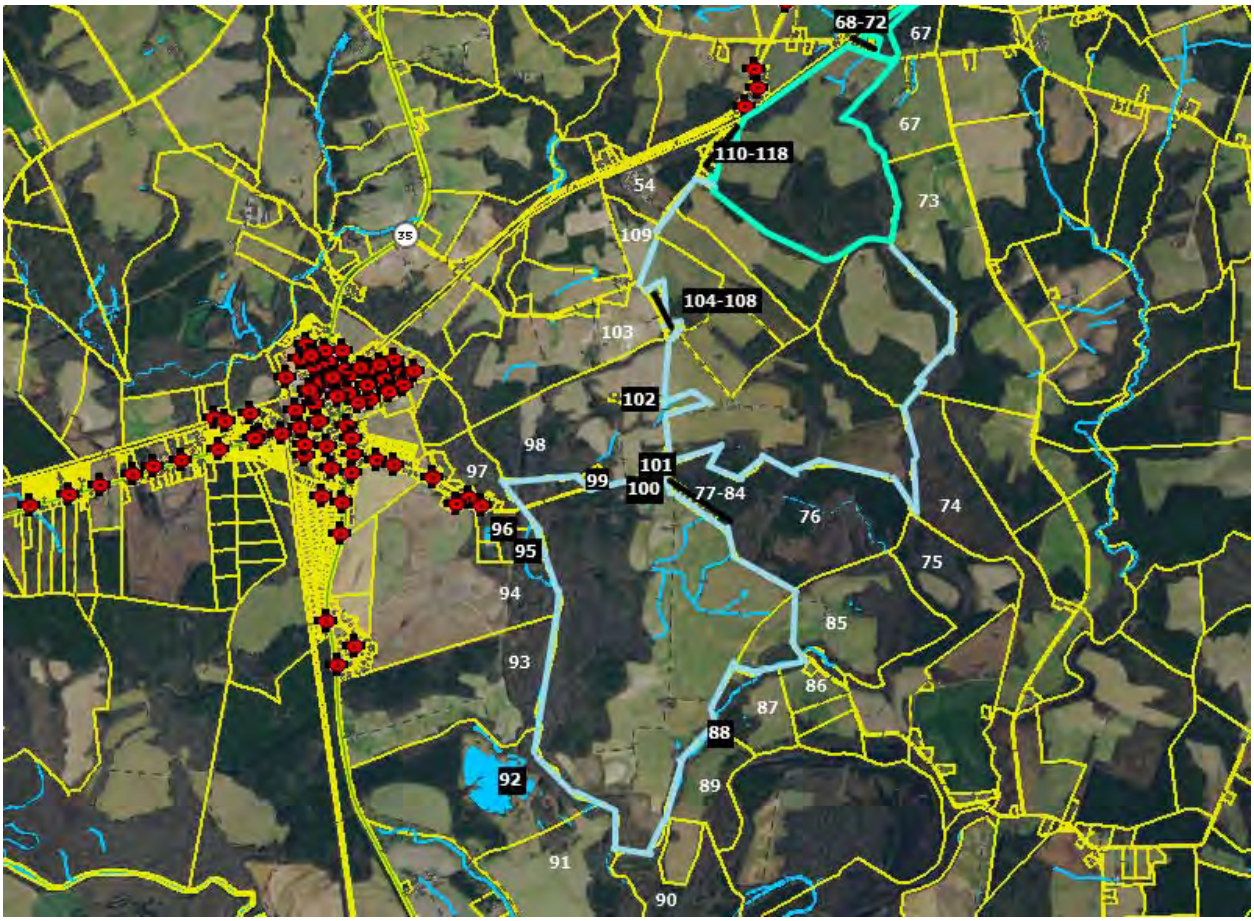
This project was built in 2017 for a solar project on a 106.12-acre tract for a 20 MW facility. The closest single-family home is 360 feet away from the closest solar panel. The average distance is 693 feet.

Adjoining Use Breakdown

	Acreage	**Parcels**
Residential	3.13%	57.89%
Agricultural	69.65%	26.32%
Agri/Res	26.99%	10.53%
Religious	0.23%	5.26%
Total	**100.00%**	**100.00%**

485: Southampton Solar, General Thomas Hwy, Newsoms, VA



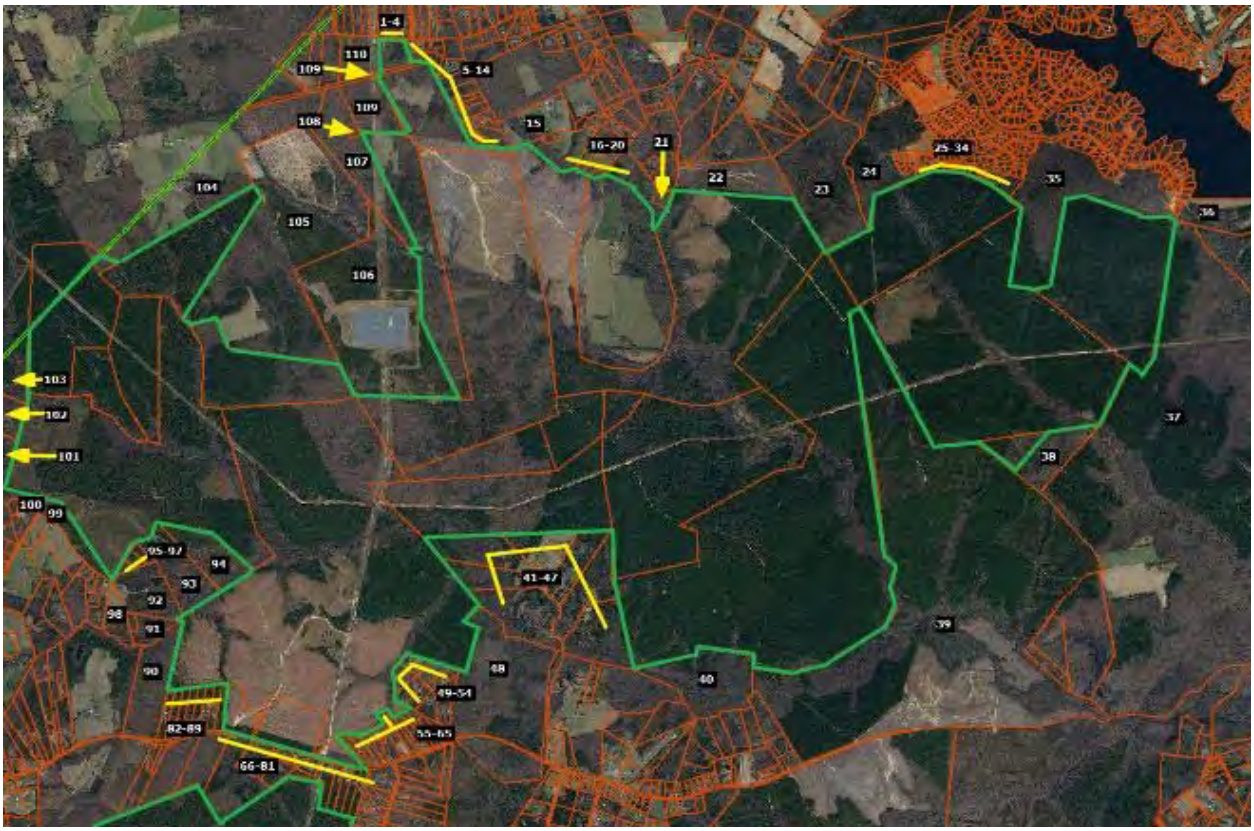


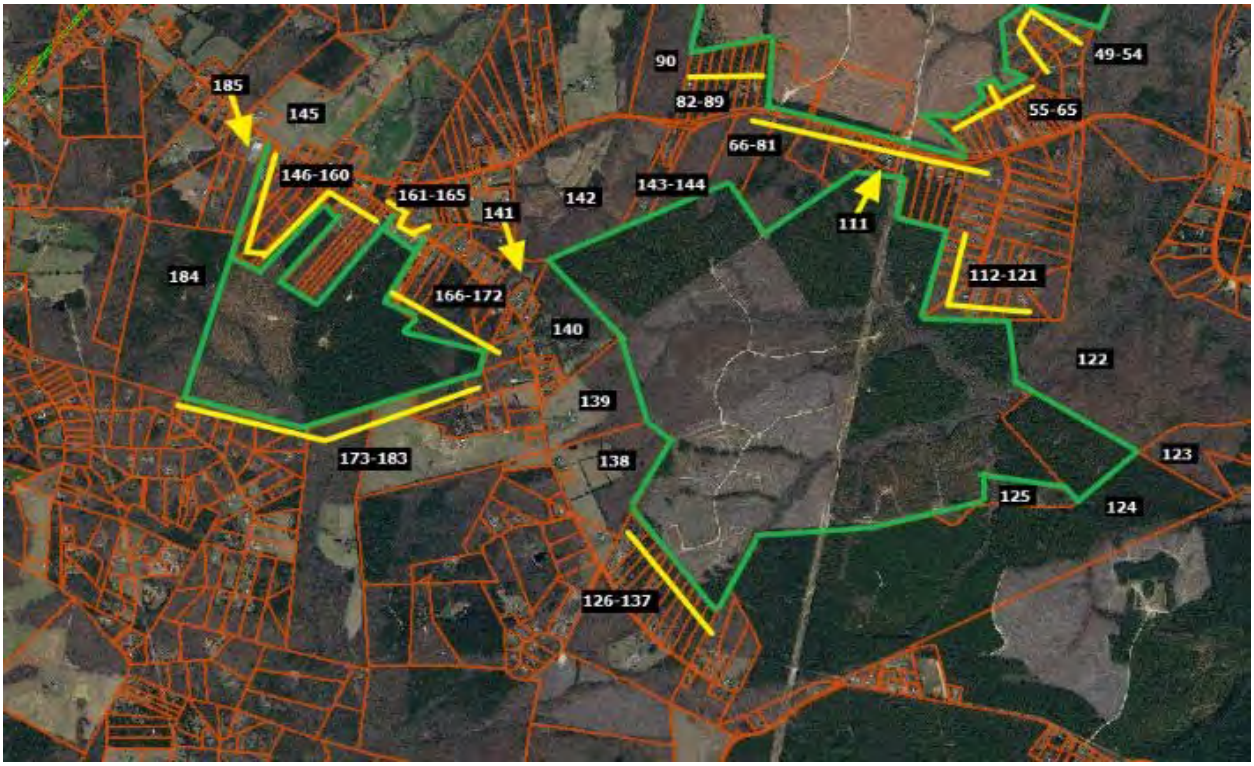
This project was built in 2017 for a solar project on an assemblage of 3,244 acres for a 100 MW facility.

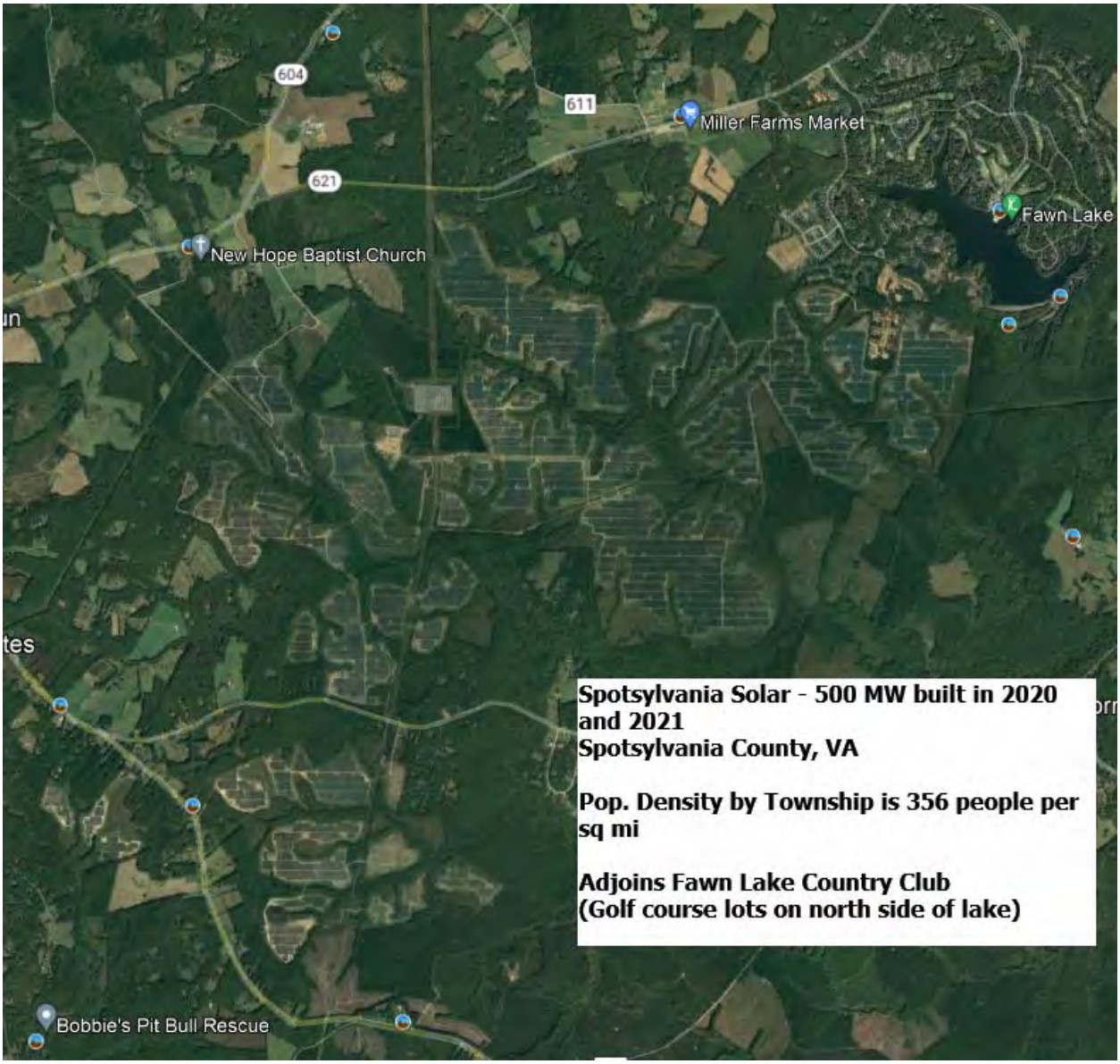
Adjoining Use Breakdown

	Acreage	Parcels
Residential	2.56%	53.33%
Agricultural	77.99%	36.67%
Agri/Res	16.56%	8.33%
Industrial	2.89%	1.67%
Total	**100.00%**	**100.00%**

579: Spotsylvania Solar, Paytes, VA






604
611
621
Miller Farms Market
Fawn Lake
New Hope Baptist Church
Bobbie's Pit Bull Rescue
Spotsylvania Solar - 500 MW built in 2020 and 2021
Spotsylvania County, VA
Pop. Density by Township is 356 people per sq mi
Adjoins Fawn Lake Country Club
(Golf course lots on north side of lake)

VII. Market Analysis of the Impact on Value from Solar Farms

I have researched hundreds of solar farms in numerous states to determine the impact of these facilities on the value of adjoining property. This research has primarily been in North Carolina, but I have also conducted market impact analyses in Virginia, South Carolina, Tennessee, Texas, Oregon, Mississippi, Maryland, New York, California, Missouri, Florida, Montana, Georgia, Louisiana, and New Jersey.

Wherever I have looked at solar farms, I have derived a breakdown of the adjoining uses to show what adjoining uses are typical for solar farms and what uses would likely be considered consistent with a solar farm use similar to the breakdown that I've shown for the subject property on the previous page. A summary showing the results of compiling that data over hundreds of solar farms is shown later in the Scope of Research section of this report.

I also consider whether the properties adjoining a solar farm in one location have characteristics similar to the properties abutting or adjoining the proposed site so that I can make an assessment of market impact on each proposed site. Notably, in most cases solar farms are placed in areas very similar to the site in question, which is surrounded by low density residential and agricultural uses. In my over 700 studies, I have found a striking repetition of that same typical adjoining use mix in over 90% of the solar farms I have looked at. Matched pair results in multiple states are strikingly similar, and all indicate that solar farms – which generate very little traffic, and do not generate noise, dust or have other harmful effects – do not negatively impact the value of adjoining or abutting properties.

On the following pages I have considered matched pair data specific to Virginia and Kentucky.

In the next section I have considered matched pair data throughout the Southeast of the United States as being the most similar states that would most readily compare to Virginia. This includes data from Florida, Georgia, South Carolina, North Carolina, Tennessee, Virginia and Maryland. I focused on projects of 5 MW and larger though I have significant supplemental data on solar farms just smaller than that in North Carolina that show similar results. This data is available in my files.

I have additional supporting information from other states in my files that show a consistent pattern across the United States, but again, I have focused on the Southeast in this analysis.

A. Virginia Data

I have identified matched pairs adjoining 3 of the 27 solar farms noted above. I have also included data from a solar farm in Kentucky that does a good job of illustrating distant views of solar panels in relation to adjoining housing.

The following pages detail the matched pairs and how they were derived.

1. Matched Pair – Clarke County Solar, Clarke County, VA

This project is a 20 MW facility located on a 234-acre tract that was built in 2017.

I have considered two recent sales of Parcel 3. The home on this parcel is 1,230 feet from the closest panel as measured in the second map from Google Earth, which shows the solar farm under construction. This home sold in January 2017 for $295,000 and again in August 2019 for $385,000. I show each sale below and compare those to similar home sales in each time frame. The significant increase in price between 2017 and 2019 is due to a major kitchen remodel, new roof, and related upgrades as well as improvement in the market in general. The sale and later resale of the home with updates and improvements speaks to pride of ownership and increasing overall value as properties perceived as diminished are less likely to be renovated and sold for profit.

I note that 102 Tilthammer includes a number of barns that I did not attribute any value in the analysis. The market would typically give some value for those barns but even without that adjustment there is an indication of a positive impact on value due to the solar farm. The landscaping buffer from this home is considered light.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
3	Adjoins	833 Nations Spr	5.13	8/18/2019	$385,000	1979	1,392	$276.58	3/2	Det Gar	Ranch	UnBsmt
	Not	167 Leslie	5.00	8/19/2020	$429,000	1980	1,665	$257.66	3/2	Det2Gar	Ranch	
	Not	2393 Old Chapel	2.47	8/10/2020	$330,000	1974	1,500	$220.00	3/1.5	Det Gar	Ranch	
	Not	102 Tilthammer	6.70	5/7/2019	$372,000	1970	1,548	$240.31	3/1.5	Det Gar	Ranch	UnBsmt

Adjoining Sales Adjusted

Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
							$385,000			1230
-$13,268		-$2,145	-$56,272		-$5,000	$50,000	$402,315	-4%		
-$9,956	$25,000	$8,250	-$19,008	$5,000		$50,000	$389,286	-1%		
$3,229		$16,740	-$29,991	$5,000			$366,978	5%		
									0%	

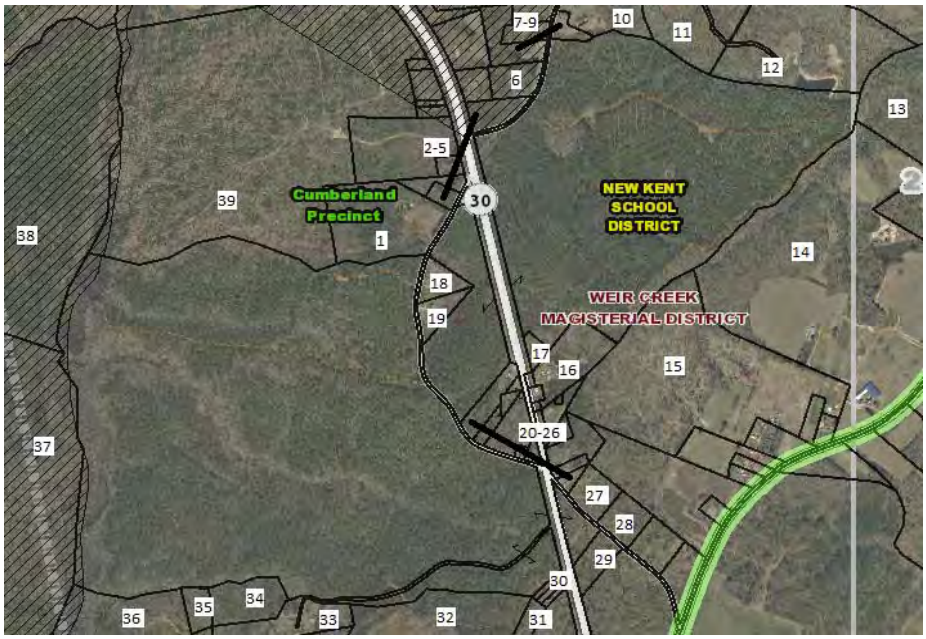
Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
3	Adjoins	833 Nations Spr	5.13	1/9/2017	$295,000	1979	1,392	$211.93	3/2	Det Gar	Ranch	UnBsmt
	Not	6801 Middle	2.00	12/12/2017	$249,999	1981	1,584	$157.83	3/2	Open	Ranch	
	Not	4174 Rockland	5.06	1/2/2017	$300,000	1990	1,688	$177.73	3/2	2 Gar	2-story	
	Not	400 Sugar Hill	1.00	6/7/2018	$180,000	1975	1,008	$178.57	3/1	Open	Ranch	

Adjoining Sales Adjusted

Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
							$295,000			1230
-$7,100	$25,000	-$2,500	-$24,242		$5,000	$50,000	$296,157	0%		
$177		-$16,500	-$42,085		-$10,000	$50,000	$281,592	5%		
-$7,797		$3,600	$54,857	$10,000	$5,000	$50,000	$295,661	0%		
									1%	

2. Matched Pair – Walker-Correctional Solar, Barham Road, Barhamsville, VA



This project was built in 2017 and located on 484.65 acres for a 20 MW with the closest home at 110 feet from the closest solar panel with an average distance of 500 feet.

I considered the recent sale identified on the map above as Parcel 19, which is directly across the street and based on the map shown on the following page is 250 feet from the closest panel. A

limited buffering remains along the road with natural growth being encouraged, but currently the panels are visible from the road. Alex Uminski, SRA with MGMiller Valuations in Richmond VA confirmed this sale with the buying and selling broker. The selling broker indicated that the solar farm was not a negative influence on this sale and in fact the buyer noticed the solar farm and then discovered the listing. The privacy being afforded by the solar farm was considered a benefit by the buyer. I used a matched pair analysis with a similar sale nearby as shown below and found no negative impact on the sales price. Property actually closed for more than the asking price. The landscaping buffer is considered light.

Adjoining Residential Sales After Solar Farm Approved

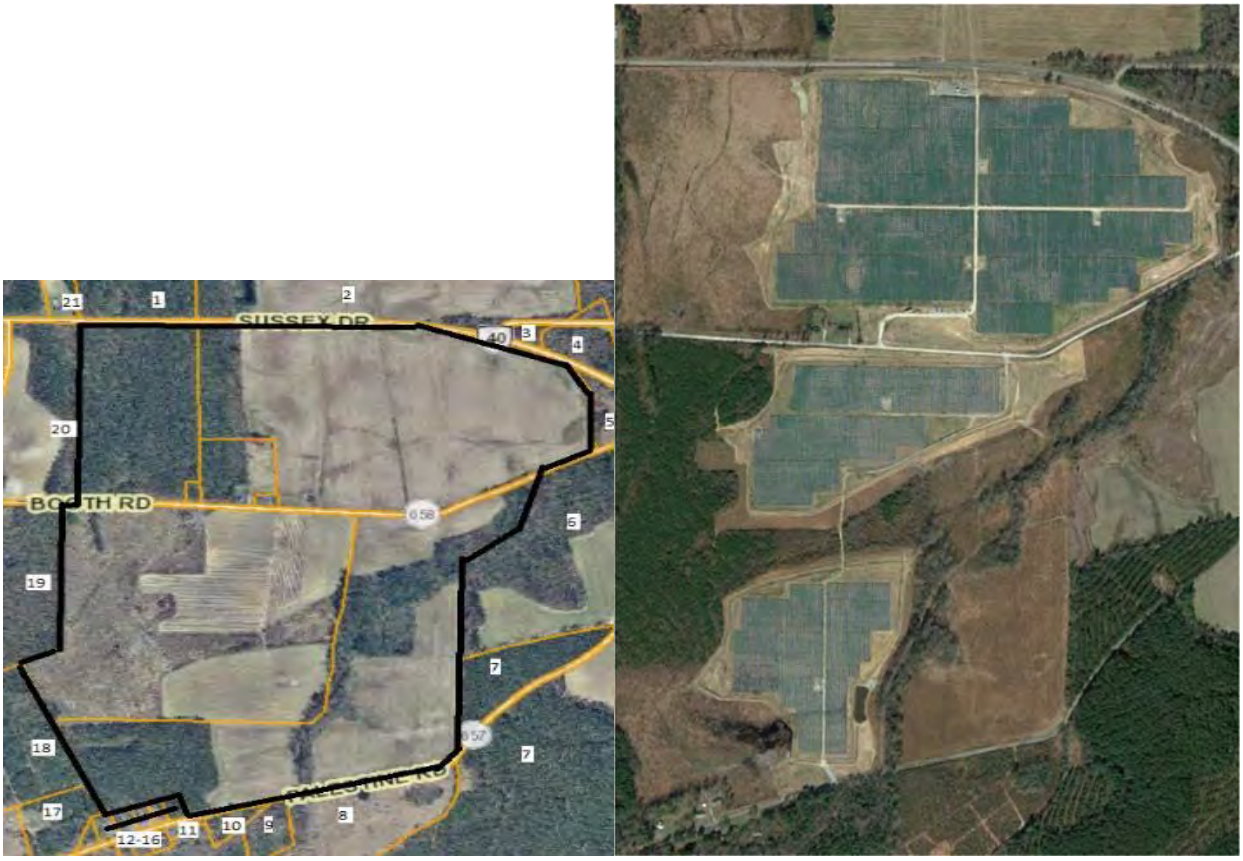
Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	5241 Barham	2.65	10/18/2018	$264,000	2007	1,660	$159.04	3/2	Drive	Ranch	Modular
Not	17950 New Kent	5.00	9/5/2018	$290,000	1987	1,756	$165.15	3/2.5	3 Gar	Ranch	
Not	9252 Ordinary	4.00	6/13/2019	$277,000	2001	1,610	$172.05	3/2	1.5-Gar	Ranch	
Not	2416 W Miller	1.04	9/24/2018	$299,000	1999	1,864	$160.41	3/2.5	Gar	Ranch	

Adjoining Sales Adjusted

Solar	Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
Adjoins	5241 Barham								$264,000		250
Not	17950 New Kent		-$8,000	$29,000	-$4,756	-$5,000	-$20,000	-$15,000	$266,244	-1%	
Not	9252 Ordinary	-$8,310	-$8,000	$8,310	$2,581		-$10,000	-$15,000	$246,581	7%	
Not	2416 W Miller		$8,000	$11,960	-$9,817	-$5,000	-$10,000	-$15,000	$279,143	-6%	
								Average Diff		0%	

I also spoke with Patrick W. McCrerey of Virginia Estates who was marketing a property that sold at 5300 Barham Road adjoining the Walker-Correctional Solar Farm. He indicated that this property was unique with a home built in 1882 and heavily renovated and updated on 16.02 acres. The solar farm was through the woods and couldn't be seen by this property and it had no impact on marketing this property. This home sold on April 26, 2017 for $358,000. I did not set up any matched pairs for this property since it is a unique property that any such comparison would be difficult to rely on. The broker's comments do support the assertion that the adjoining solar farm had no impact on value. The home in this case was 510 feet from the closest panel.

3. Matched Pair – Sappony Solar, Sussex County, VA



This project is a 30 MW facility located on a 322.68-acre tract that was built in the fourth quarter of 2017.

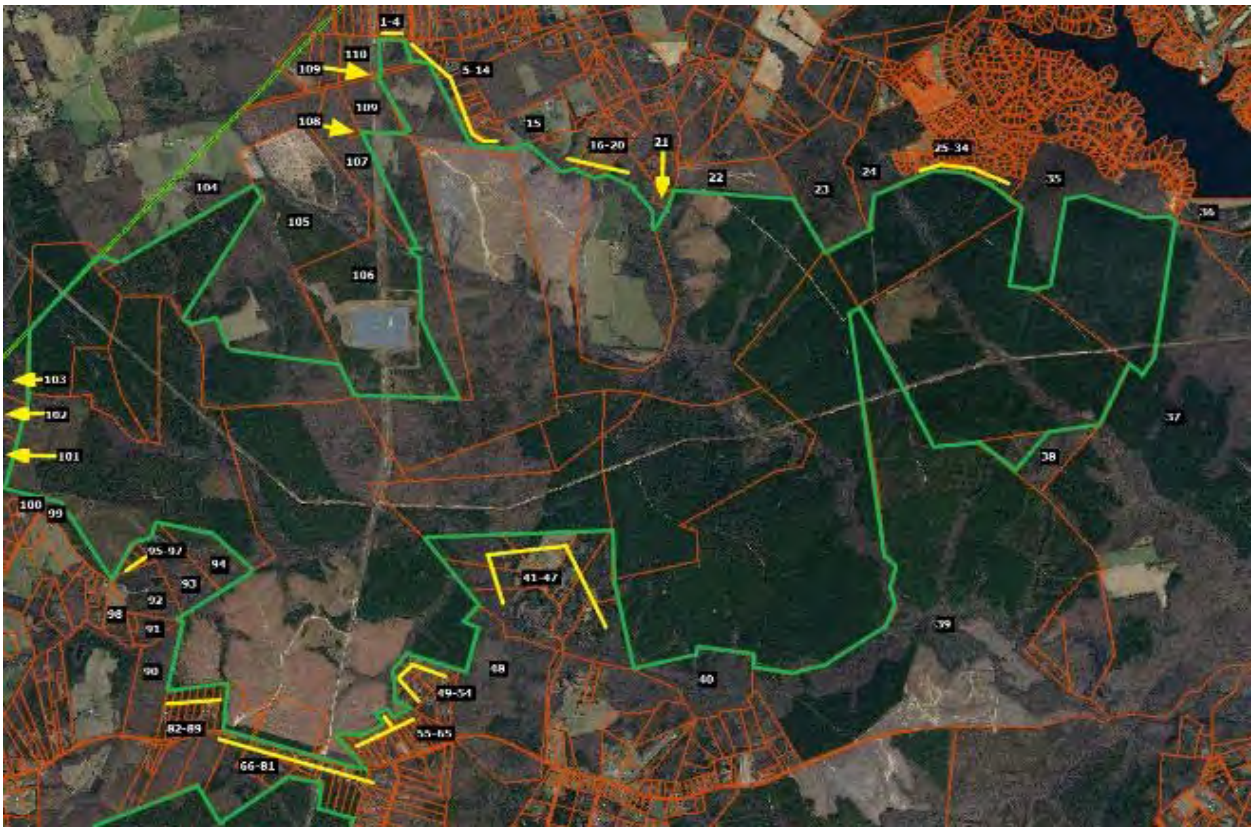
I have considered the 2018 sale of Parcel 17 as shown below. This was a 1,900 s.f. manufactured home on a 6.00-acre lot that sold in 2018. I have compared that to three other nearby manufactured homes as shown below. The range of impacts is within typical market variation with an average of -1%, which supports a conclusion of no impact on property value. The landscaping buffer is considered medium.

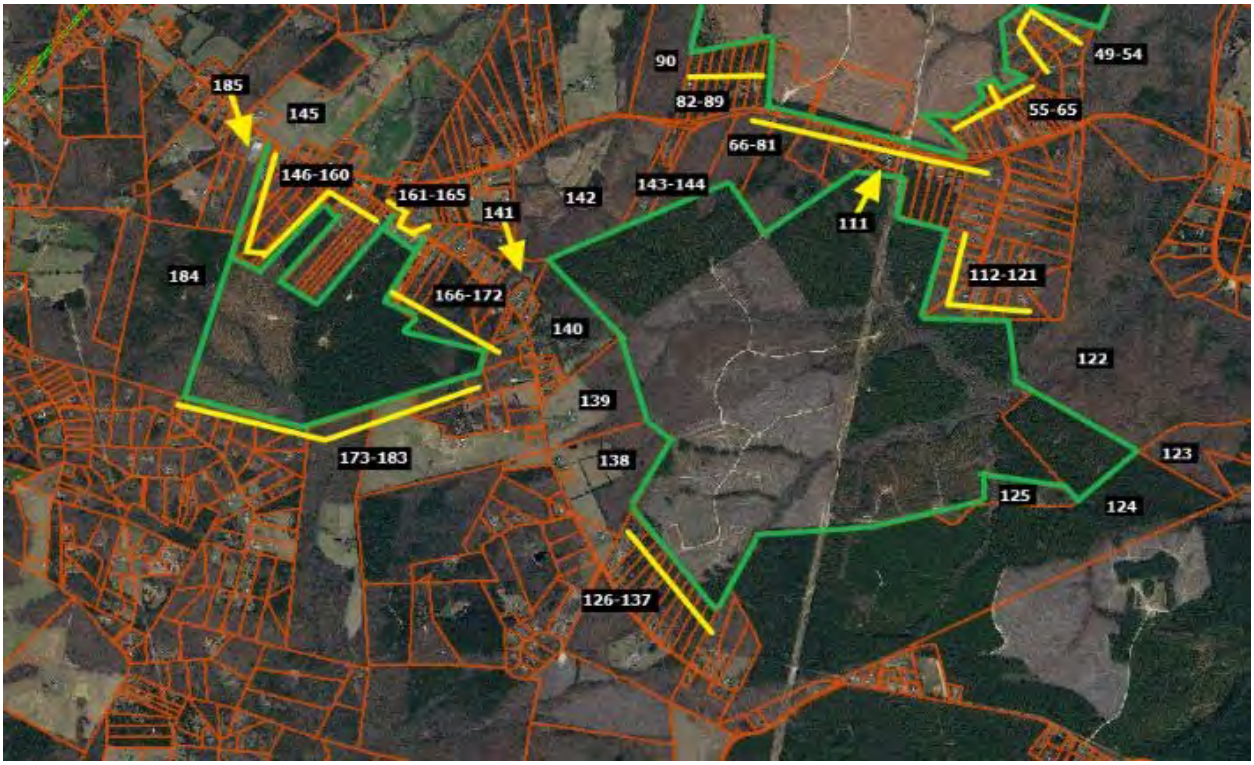
Adjoining Residential Sales After Solar Farm Approved

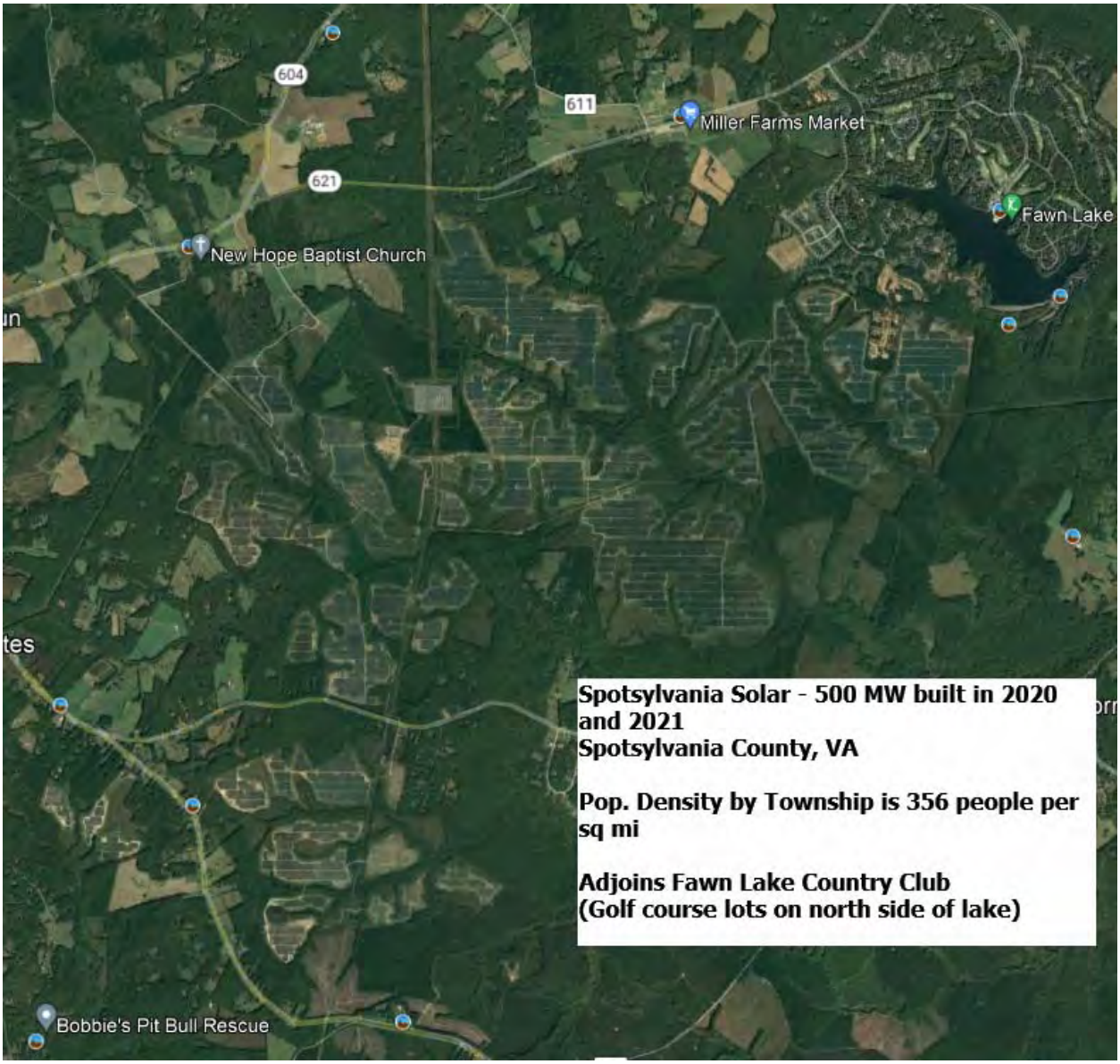
Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
	Adjoins	12511 Palestine	6.00	7/31/2018	$128,400	2013	1,900	$67.58	4/2.5	Open	Manuf	
	Not	15698 Concord	3.92	7/31/2018	$150,000	2010	2,310	$64.94	4/2	Open	Manuf	Fence
	Not	23209 Sussex	1.03	7/7/2020	$95,000	2005	1,675	$56.72	3/2	Det Crpt	Manuf	
	Not	6494 Rocky Br	4.07	11/8/2018	$100,000	2004	1,405	$71.17	3/2	Open	Manuf	

Adjoining Sales Adjusted									Avg	
Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	% Diff	Distance
							$128,400			1425
$0		$2,250	-$21,299	$5,000			$135,951	-6%		
-$5,660	$13,000	$3,800	$10,209	$5,000	$1,500		$122,849	4%		
-$843		$4,500	$28,185				$131,842	-3%		
									-1%	

4. Matched Pair – Spotsylvania Solar, Paytes, VA







This solar farm is being built in four phases with the area known as Site C having completed construction in November 2020 after the entire project was approved in April 2019. Site C, also known as Pleinmont 1 Solar, includes 99.6 MW located in the southeast corner of the project and shown on the maps above with adjoining parcels 111 through 144. The entire Spotsylvania project totals 500 MW on 3500 acres out of a parent tract assemblage of 6,412 acres.

I have identified three adjoining home sales that occurred during construction and development of the site in 2020.

The first is located on the north side of Site A on Orange Plank Road. The second is located on Nottoway Lane just north of Catharpin Road on the south side of Site A and east of Site C. The third is located on Post Oak Road for a home that backs up to Site C that sold in September 2020 near the completion of construction for Site C.

Spotsylvania Solar Farm

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	12901 Orng Plnk	5.20	8/27/2020	$319,900	1984	1,714	$186.64	3/2	Drive	1.5	Un Bsmt
Not	8353 Gold Dale	3.00	1/27/2021	$415,000	2004	2,064	$201.07	3/2	3 Gar	Ranch	
Not	6488 Southfork	7.26	9/9/2020	$375,000	2017	1,680	$223.21	3/2	2 Gar	1.5	Barn/Patio
Not	12717 Flintlock	0.47	12/2/2020	$290,000	1990	1,592	$182.16	3/2.5	Det Gar	Ranch	

Adjoining Sales Adjusted

Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
12901 Orng Plnk								$319,900		1270
8353 Gold Dale	-$5,219	$20,000	-$41,500	-$56,298		-$20,000		$311,983	2%	
6488 Southfork	-$401	-$20,000	-$61,875	$6,071		-$15,000		$283,796	11%	
12717 Flintlock	-$2,312	$40,000	-$8,700	$17,779	-$5,000	-$5,000		$326,767	-2%	
							Average Diff		4%	

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	9641 Nottoway	11.00	5/12/2020	$449,900	2004	3,186	$141.21	4/2.5	Garage	2-Story	Un Bsmt
Not	26123 Lafayette	1.00	8/3/2020	$390,000	2006	3,142	$124.12	3/3.5	Gar/DtG	2-Story	
Not	11626 Forest	5.00	8/10/2020	$489,900	2017	3,350	$146.24	4/3.5	2 Gar	2-Story	
Not	10304 Pny Brnch	6.00	7/27/2020	$485,000	1998	3,076	$157.67	4/4	2Gar/Dt2	Ranch	Fn Bsmt

Adjoining Sales Adjusted

Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
9641 Nottoway								$449,900		1950
26123 Lafayette	-$2,661	$45,000	-$3,900	$4,369	-$10,000	-$5,000		$417,809	7%	
11626 Forest	-$3,624		-$31,844	-$19,187		-$5,000		$430,246	4%	
10304 Pny Brnch	-$3,030		$14,550	$13,875	-$15,000	-$15,000	-$10,000	$470,396	-5%	
							Average Diff		2%	

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	13353 Post Oak	5.20	9/21/2020	$300,000	1992	2,400	$125.00	4/3	Drive	2-Story	Fn Bsmt
Not	9609 Logan Hgt	5.86	7/4/2019	$330,000	2004	2,352	$140.31	3/2	2Gar	2-Story	
Not	12810 Catharpian	6.18	1/30/2020	$280,000	2008	2,240	$125.00	4/2.5	Drive	2-Story	Bsmt/Nd Pnt
Not	10725 Rbrt Lee	5.01	10/26/2020	$295,000	1995	2,166	$136.20	4/3	Gar	2-Story	Fn Bsmt

Adjoining Sales Adjusted

Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
13353 Post Oak								$300,000		1171
9609 Logan Hgt	$12,070		-$19,800	$5,388		-$15,000	$15,000	$327,658	-9%	
12810 Catharpian	$5,408		-$22,400	$16,000	$5,000		$15,000	$299,008	0%	
10725 Rbrt Lee	-$849		-$4,425	$25,496		-$10,000		$305,222	-2%	
							Average Diff		-4%	

All three of these homes are well set back from the solar panels at distances over 1,000 feet and are well screened from the project. All three show no indication of any impact on property value.

There are a couple of recent lot sales located along Southview Court that have sold since the solar farm was approved. The most recent lot sales include 11700 Southview Court that sold on December 29, 2021 for $140,000 for a 0.76-acre lot. This property was on the market for less than 2 months before closing within 6% of the asking price. This lot sold earlier in September 2019 for $55,000 based on a liquidation sale from NTS to an investor.

A similar 0.68-acre lot at 11507 Stonewood Court within the same subdivision located away from the solar farm sold on March 9, 2021 for $109,000. This lot sold for 18% over the asking price within 1 month of listing suggesting that this was priced too low. Adjusting this lot value upward by 12% for very strong growth in the market over 2021, the adjusted indicated value is $122,080 for this lot. This is still showing a 15% premium for the lot backing up to the solar farm.

The lot at 11009 Southview Court sold on August 5, 2019 for $65,000, which is significantly lower than the more recent sales. This lot was sold by NTS the original developer of this subdivision, who was in the process of liquidating lots in this subdivision with multiple lot sales in this time period throughout the subdivision being sold at discounted prices. The home was later improved by the buyer with a home built in 2020 with 2,430 square feet ranch, 3.5 bathrooms, with a full basement, and a current assessed value of $492,300.

I spoke with Chris Kalia, MAI, Mark Doherty, local real estate investor, and Alex Doherty, broker, who are all three familiar with this subdivision and activity in this neighborhood. All three indicated that there was a deep sell off of lots in the neighborhood by NTS at discounted prices under $100,000 each. Those lots since that time are being sold for up to $140,000. The prices paid for the lots below $100,000 were liquidation values and not indicative of market value. Homes are being built in the neighborhood on those lots with home prices ranging from $600,000 to $800,000 with no sign of impact on pricing due to the solar farm according to all three sources.

Fawn Lake Lot Sales

Parcel	Solar?	Address	Acres	Sale Date	Sale Price	Ad. For Time	% Diff
A	Adjoins	11700 Southview Ct	0.76	12/29/2021	$140,000		
1	1 parcel away	11603 Southview Ct	0.44	3/31/2022	$140,000	$141,960	-1.4%
2	Not adjoin	11507 Stonewood Ct	0.68	3/9/2021	$109,000	$118,374	15.4%
3	Not adjoin	11312 Westgate Wy	0.83	10/15/2020	$125,000	$142,000	-1.4%
4	Not adjoin	11409 Darkstone Pl	0.589	9/23/2021	$118,000	$118,000	15.7%

Average	7.1%
Median	7.0%

Least Adjusted	15.7%
2nd Least Adjusted (Parcel 1 off solar farm)	-1.4%

Time Adjustments are based on the FHFA Housing Price Index

5. Matched Pair – Crittenden Solar, Crittenden, KY

This solar farm was built in December 2017 on a 181.70-acre tract but utilizing only 34.10 acres. This is a 2.7 MW facility with residential subdivisions to the north and south.

I have identified five home sales to the north of this solar farm on Clairborne Drive and one home sale to the south on Eagle Ridge Drive since the completion of this solar farm. The home sale on Eagle Drive is for a $75,000 home and all of the homes along that street are similar in size and price range. According to local broker Steve Glacken with Cutler Real Estate these are the lowest price range/style home in the market. I have not analyzed that sale as it would unlikely provide significant data to other homes in the area.

Mr. Glacken has been selling lots at the west end of Clairborne for new home construction. He indicated in 2020 that the solar farm near the entrance of the development has been a complete non-factor and none of the home sales are showing any concern over the solar farm. Most of the homes are in the $250,000 to $280,000 price range. The vacant residential lots are being marketed for $28,000 to $29,000. The landscaping buffer is considered light, but the rolling terrain allows for distant views of the panels from the adjoining homes along Clairborne Drive.

The first home considered is a bit of an anomaly for this subdivision in that it is the only manufactured home that was allowed in the community. It sold on January 3, 2019. I compared that sale to three other manufactured home sales in the area making minor adjustments as shown on the next page to account for the differences. After all other factors are considered the adjustments show a -1% to +13% impact due to the adjacency of the solar farm. The best indicator is 1250 Cason, which shows a 3% impact. A 3% impact is within the normal static of real estate transactions and therefore not considered indicative of a positive impact on the property, but it strongly supports an indication of no negative impact.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
	Adjoins	250 Claiborne	0.96	1/3/2019	$120,000	2000	2,016	$59.52	3/2	Drive	Manuf	
	Not	1250 Cason	1.40	4/18/2018	$95,000	1994	1,500	$63.33	3/2	2-Det	Manuf	Carport
	Not	410 Reeves	1.02	11/27/2018	$80,000	2000	1,456	$54.95	3/2	Drive	Manuf	
	Not	315 N Fork	1.09	5/4/2019	$107,000	1992	1,792	$59.71	3/2	Drive	Manuf	

Adjustments

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	250 Claiborne								$120,000			373
Not	1250 Cason	$2,081		$2,850	$26,144		-$5,000	-$5,000	$116,075	3%		
Not	410 Reeves	$249		$0	$24,615				$104,865	13%		
Not	315 N Fork	-$1,091		$4,280	$10,700				$120,889	-1%		
											5%	

I also looked at three other home sales on this street as shown below. These are stick-built homes and show a higher price range.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
	Adjoins	300 Claiborne	1.08	9/20/2018	$212,720	2003	1,568	$135.66	3/3	2-Car	Ranch	Brick
	Not	460 Claiborne	0.31	1/3/2019	$229,000	2007	1,446	$158.37	3/2	2-Car	Ranch	Brick
	Not	2160 Sherman	1.46	6/1/2019	$265,000	2005	1,735	$152.74	3/3	2-Car	Ranch	Brick
	Not	215 Lexington	1.00	7/27/2018	$231,200	2000	1,590	$145.41	5/4	2-Car	Ranch	Brick

Adjustments

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	300 Claiborne								$213,000			488
Not	460 Claiborne	-$2,026		-$4,580	$15,457	$5,000			$242,850	-14%		
Not	2160 Sherman	-$5,672		-$2,650	-$20,406				$236,272	-11%		
Not	215 Lexington	$1,072		$3,468	-$2,559	-$5,000			$228,180	-7%		
											-11%	

This set of matched pairs shows a minor negative impact for this property. I was unable to confirm the sales price or conditions of this sale. The best indication of value is based on 215 Lexington, which required the least adjusting and supports a -7% impact.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
	Adjoins	350 Claiborne	1.00	7/20/2018	$245,000	2002	1,688	$145.14	3/3	2-Car	Ranch	Brick
	Not	460 Claiborne	0.31	1/3/2019	$229,000	2007	1,446	$158.37	3/2	2-Car	Ranch	Brick
	Not	2160 Sherman	1.46	6/1/2019	$265,000	2005	1,735	$152.74	3/3	2-Car	R/FBsmt	Brick
	Not	215 Lexington	1.00	7/27/2018	$231,200	2000	1,590	$145.41	5/4	2-Car	Ranch	Brick

Adjustments

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	350 Claiborne								$245,000			720
Not	460 Claiborne	-$3,223		-$5,725	$30,660	$5,000			$255,712	-4%		
Not	2160 Sherman	-$7,057		-$3,975	-$5,743				$248,225	-1%		
Not	215 Lexington	-$136		$2,312	$11,400	-$5,000			$239,776	2%		
											-1%	

The following photograph shows the light landscaping buffer and the distant view of panels that was included as part of the marketing package for this property. The panels are visible somewhat on the left and somewhat through the trees in the center of the photograph. The first photograph is from the home, with the second photograph showing the view near the rear of the lot.

This set of matched pairs shows a no negative impact for this property. The range of adjusted impacts is -4% to +2%. The best indication is -1%, which as described above is within the typical market static and supports no impact on adjoining property value.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
	Adjoins	370 Claiborne	1.06	8/22/2019	$273,000	2005	1,570	$173.89	4/3	2-Car	2-Story	Brick
	Not	2160 Sherman	1.46	6/1/2019	$265,000	2005	1,735	$152.74	3/3	2-Car	R/FBsmt	Brick
	Not	2290 Dry	1.53	5/2/2019	$239,400	1988	1,400	$171.00	3/2.5	2-Car	R/FBsmt	Brick
	Not	125 Lexington	1.20	4/17/2018	$240,000	2001	1,569	$152.96	3/3	2-Car	Split	Brick

Adjustments

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	370 Claiborne								$273,000			930
Not	2160 Sherman	$1,831		$0	-$20,161				$246,670	10%		
Not	2290 Dry	$2,260		$20,349	$23,256	$2,500			$287,765	-5%		
Not	125 Lexington	$9,951		$4,800					$254,751	7%		
											4%	

This set of matched pairs shows a general positive impact for this property. The range of adjusted impacts is -5% to +10%. The best indication is +7%. I typically consider measurements of +/-5% to be within the typical variation in real estate transactions. This indication is higher than that and suggests a positive relationship.

The photograph from the listing shows panels visible between the home and the trampoline shown in the picture.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	330 Claiborne	1.00	12/10/2019	$282,500	2003	1,768	$159.79	3/3	2-Car	Ranch	Brick/pool
Not	895 Osborne	1.70	9/16/2019	$249,900	2002	1,705	$146.57	3/2	2-Car	Ranch	Brick/pool
Not	2160 Sherman	1.46	6/1/2019	$265,000	2005	1,735	$152.74	3/3	2-Car	R/FBsmt	Brick
Not	215 Lexington	1.00	7/27/2018	$231,200	2000	1,590	$145.41	5/4	2-Car	Ranch	Brick

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	330 Claiborne								$282,500			665
Not	895 Osborne	$1,790		$1,250	$7,387	$5,000		$0	$265,327	6%		
Not	2160 Sherman	$4,288		-$2,650	$4,032			$20,000	$290,670	-3%		
Not	215 Lexington	$9,761		$3,468	$20,706	-$5,000		$20,000	$280,135	1%		
											1%	

This set of matched pairs shows a general positive impact for this property. The range of adjusted impacts is -3% to +6%. The best indication is +6%. I typically consider measurements of +/-5% to be within the typical variation in real estate transactions. This indication is higher than that and suggests a positive relationship. The landscaping buffer on these is considered light with a fair visibility of the panels from most of these comparables and only thin landscaping buffers separating the homes from the solar panels.

I also looked at four sales that were during a rapid increase in home values around 2021, which required significant time adjustments based on the FHFA Housing Price Index. Sales in this time frame are less reliable for impact considerations as the peak buyer demand allowed for homes to sell with less worry over typical issues such as repairs.

The home at 250 Claiborne Drive sold with no impact from the solar farm according to the buyer's broker Lisa Ann Lay with Keller Williams Realty Service. As noted earlier, this is the only manufactured home in the community and is a bit of an anomaly. There was an impact on this sale due to an appraisal that came in low likely related to the manufactured nature of the home. Ms. Lay indicated that there was significant back and forth between both brokers and the appraiser to address the low appraisal, but ultimately, the buyers had to pay $20,000 out of pocket to cover the difference in appraised value and the purchase price. The low appraisal was not attributed to the solar farm, but the difficulty in finding comparable sales and likely the manufactured housing.

Adjoining Residential Sales After Solar Farm Built

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	250 Claiborne	1.05	1/5/2022	$210,000	2002	1,592	$131.91	4/2	Drive	Ranch	Manuf
Not	255 Spillman	0.64	3/4/2022	$166,000	1991	1,196	$138.80	3/1	Drive	Ranch	Remodel
Not	546 Waterworks	0.28	4/29/2021	$179,500	2007	1,046	$171.61	4/2	Drive	Ranch	3/4 Fin B
Not	240 Shawnee	1.18	6/7/2021	$180,000	1977	1,352	$133.14	3/2	Gar	Ranch	N/A

Solar	Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	250 Claiborne							$210,000			365
Not	255 Spillman	-$379	$9,130	$43,971	$10,000		-$20,000	$208,722	1%		
Not	546 Waterworks	$1,772	-$4,488	$74,958			-$67,313	$184,429	12%		
Not	240 Shawnee	$1,501	$22,500	$25,562		-$10,000		$219,563	-5%		
										3%	

The photograph of the rear view from the listing is shown below.

The home at 260 Claiborne Drive sold with no impact from the solar farm according to the buyer's broker Jim Dalton with Ashcraft Real Estate Services. He noted that there was significant wood rot and a heavy smoker smell about the house, but even that had no impact on the price due to high demand in the market.

Adjoining Residential Sales After Solar Farm Built

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	260 Claiborne	1.00	10/13/2021	$175,000	2001	1,456	$120.19	3/2	Drive	Ranch	N/A
Not	355 Oakwood	0.58	10/27/2020	$186,000	2002	1,088	$170.96	3/2	Gar	Ranch	3/4 Fin B
Not	30 Ellen Kay	0.50	1/30/2020	$183,000	1988	1,950	$93.85	3/2	Gar	2-Story	N/A
Not	546 Waterworks	0.28	4/29/2021	$179,500	2007	1,046	$171.61	4/2	Drive	Ranch	3/4 Fin B

Solar	Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	260 Claiborne							$175,000			390
Not	355 Oakwood	$18,339	-$930	$50,329		-$10,000	-$69,750	$173,988	1%		
Not	30 Ellen Kay	$31,974	$11,895	-$37,088		-$10,000		$179,781	-3%		
Not	546 Waterworks	$8,420	-$5,385	$56,287			-$67,313	$171,510	2%		
										0%	

The photograph of the rear view from the listing is shown below.

These next two were brick and with unfinished basements which made them easier to compare and therefore more reliable. For 300 Claiborne I considered the sale of a home across the street that did not back up to the solar farm and it adjusted to well below the range of the other comparables. I have included it, but would not rely on that which means this next comparable strongly supports a range of 0 to +3% and not up to +19%.

djoining Residential Sales After Solar Farm Built

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	300 Claiborne	0.89	12/18/2021	$290,000	2002	1,568	$184.95	3/3	2-Car	Br Rnch	Bsmt
Not	405 Claiborne	0.41	2/1/2022	$267,750	2004	1,787	$149.83	3/2	2-Car	Br Rnch	Bsmt
Not	39 Pinhook	0.68	3/31/2022	$299,000	1992	1,680	$177.98	3/2	2-Car	Br Rnch	Bsmt
Not	5 Pinhook	0.70	4/7/2022	$309,900	1992	1,680	$184.46	3/2	2-Car	Br Rnch	Bsmt

Solar	Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	300 Claiborne							$290,000			570
Not	405 Claiborne	-$3,384	-$2,678	-$26,251				$235,437	19%		
Not	39 Pinhook	-$8,651	$14,950	-$15,947				$289,352	0%		
Not	5 Pinhook	-$9,576	$15,495	-$16,528				$299,291	-3%		
										5%	

The photograph of the rear view from the listing is shown below.

The home at 410 Claiborne included an inground pool with significant landscaping around it that was a challenge. Furthermore, two of the comparables had finished basements. I made no adjustment for the pool on those two comparables and considered the two factors to cancel out

Adjoining Residential Sales After Solar Farm Built

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	410 Claiborne	0.31	2/10/2021	$275,000	2006	1,595	$172.41	3/2	2-Car	Br Rnch	Bsmt/Pool
Not	114 Austin	1.40	12/23/2020	$248,000	1994	1,650	$150.30	3/2	2-Car	Br Rnch	Bsmt
Not	125 Liza	0.29	6/25/2021	$315,000	2005	1,913	$164.66	4/3	2-Car	Br Rnch	Ktchn Bsmt
Not	130 Hannahs	0.42	2/9/2021	$295,000	2007	1,918	$153.81	3/3	2-Car	Br Rnch	Fin Bsmt

Solar	Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
Adjoins	410 Claiborne							$275,000			1080
Not	114 Austin	$3,413	$14,880	-$6,613			$20,000	$279,680	-2%		
Not	125 Liza	-$11,945	$1,575	-$41,890	-$10,000			$252,740	8%		
Not	130 Hannahs	$83	-$1,475	-$39,743	-$10,000			$243,864	11%		
										6%	

The nine matched pairs considered in this analysis includes five that show no impact on value, one that shows a negative impact on value, and three that show a positive impact. The negative indication supported by one matched pair is -7% and the positive impacts are +6% and +7%. The two neutral indications show impacts of -5% to +5%. The average indicated impact is +2% when all nine of these indicators are blended.

Furthermore, the comments of the local real estate brokers strongly support the data that shows no negative impact on value due to the proximity to the solar farm.

6. Matched Pair – White House Solar, Louisa, VA

This project was built in 2016 for a solar project on a 499.52-acre tract for a 20 MW facility. The closest single-family home is 110 feet away from the closest solar panel. The average distance is 1,195 feet.

I have identified one recent adjoining home sale to the north of this project that sold in 2020. I spoke with the broker, Stacie Chandler, who represented the buyer in that transaction. She indicated that the solar farm had no impact on the price that they negotiated on that home. That is supported by the matched pair shown below.

The adjustments shown below make no adjustment for the difference in acreage for the smaller parcels. One of these is on a smaller lot, but located in a golf course community with rear exposure to the golf course. The other is in Mineral and while the lots are not the same size, they are similarly valued. I also adjusted this property upward by $50,000 for the condition/lack of renovation. This adjustment is based on the fact that this home was renovated following the 2020 purchase and then resold in 2021 for $75,000 more than the 2020 value. Comparing the 2021 renovated price at $144/s.f. to the subject property and adjusting on the same rates would require a downward adjustment to the comparable of $10,400 for time, upward by $8,325 for year built, and downward by $5,000 for the extra half bathroom for an indicated adjusted value of $252,925 which suggests a 5% reduction in value due to the solar farm. Either way this comparable requires significant adjustments and suggests a range of -5% to 0% impact. The Woodger comparable required less

adjustment and suggests an 11% enhancement due to proximity to the solar farm and that is without any consideration of this home having a superior exposure to a golf course.

Whitehouse Solar

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	127 Walnut Wds	4.09	3/27/2020	$240,000	1984	1,824	$131.58	3/2	2 Gar	Br Rnch	Reno
Not	126 Woodger	0.63	4/29/2019	$240,000	1992	1,956	$122.70	3/2+2	2 Gar	Br Rnch	Golf
Not	808 Virginia	0.51	3/16/2020	$185,000	1975	1,806	$102.44	3/2.5	2 Gar	Br Rnch	
Not	273 Carsons	3.94	9/29/2018	$248,500	1985	2,224	$111.74	4/3	Drive	Ranch	Not Brck

Adjoining Sales Adjusted

Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
127 Walnut Wds								$240,000		1400
126 Woodger	$6,569		-$9,600	-$12,957	-$10,000			$214,012	11%	
808 Virginia	$167		$8,325	$1,475	-$5,000		$50,000	$239,967	0%	
273 Carsons	$11,131		-$1,243	-$35,755	-$10,000	$15,000	$12,425	$240,059	0%	
							Average Diff		4%	

These matched pairs are generally challenging in that one is shown before and after a renovation suggesting impacts of -5% to 0%. The comparable requiring the least adjustment is on a golf course but it also was not recently renovated which makes it less reliable. Finally, the Carsons property was similar, but older and is not brick. While I adjusted for those factors it really does not make for a great matched pair.

The best indication by the matched pairs is -5% to 0%. The broker involved in the transaction indicated that the solar farm had no impact on property value. Given those comments and the range of impacts shown, I conclude that this home sale near the White House solar project indicates no impact on property value.

7. Matched Pair – Remington Solar, Bealeton, Fauquier County, VA

This project was built in 2017 for a solar project on a 277-acre tract for a 20 MW facility.

The triangular lot with the red circle on it sold on July 18, 2022 with a home built in 2021 by a semi-custom builder for $549,654 for a 2,198 square foot home with 4 BR, 2.5 BA with 2 car garage, screened porch, and full unfinished basement with rough-ins for plumbing for future bathroom. This is a 1.5-acre lot with the homesite approximately 700 feet from the closest solar panel. This home sits between the solar farm and the Luck Stone Quarry. I reached out to the listing broker Jim Cheatle with Century 21 to discuss this. Given the nearby quarry, substation, and solar farm, I did not attempt a paired sales analysis. If an impact were found, it would be challenging to determine if it was from the quarry, the substation, or the solar farm, which makes it a bit unreliable in any case. I do note that the sales price was $250.00 per square foot for the finished area and that the home was built as a spec home by a local builder who clearly did not anticipate negative impacts from any sources. A similar at 11206 Callie Jo Ct, Bealeton sold on July 27, 2022 for $535,000 for a 2,000 s.f. home built in 2021 with 3 BR, 2 BA, unfinished basement and a 2 car garage, or $267.50 per square foot. This home backs up to the Southcoate Village HOA land with a preserved wooded backyard and access to a greenway, clubhouse, and basketball court for the HOA. Adjusting this sales price downward by 5% for superior amenities, the adjusted sales price is $254.13 per square foot. This is very similar to the test property next to the solar farm sales price and suggests that none of the nearby uses are having a significant impact as this is only a 1.6% difference in value and easily attributable to market imperfection.

Conclusion

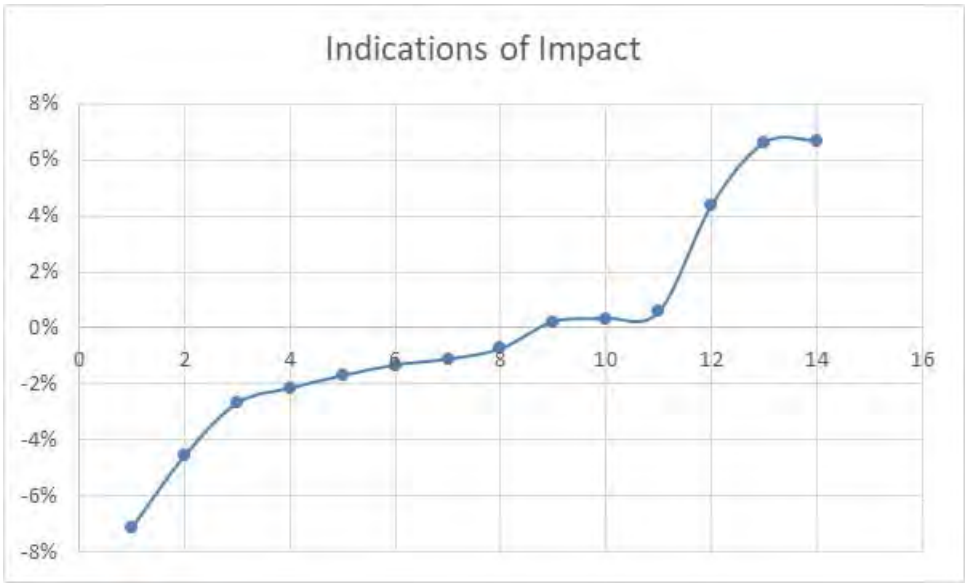
The solar farm matched pairs shown above have similar characteristics to each other in terms of population, but with several outliers showing solar farms in far more urban areas. The median income for the population within 1 mile of a solar farm among this subset of matched pairs is $70,486 with a median housing unit value of $264,681. Most of the comparables are under $500,000 in the home price, with $483,333 being the high end of the set, though I have matched pairs in other states over $1,000,000 in price adjoining large solar farms. The predominate adjoining uses are residential and agricultural. These figures are in line with the larger set of solar farms that I have looked at with the predominant adjoining uses being residential and agricultural and similar to the solar farm breakdown shown for Virginia and adjoining states as well as the proposed subject property.

Based on the similarity of adjoining uses and demographic data between these sites and the subject property, I consider it reasonable to compare these sites to the subject property.

Matched Pair Summary						Adj. Uses By Acreage				1 mile Radius (2010-2020 Data)			
	Name	City	State	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com/Ind	Population	Med. Income	Avg. Housing Unit	Veg. Buffer
1	Clarke Cnty	White Post	VA	234	20.00	70	14%	39%	46%	1%	578	$81,022	$374,453	Light
2	Walker	Barhamsville	VA	485	20.00	N/A	12%	68%	20%	0%	203	$80,773	$320,076	Light
3	Sappony	Stony Crk	VA	322	20.00	N/A	2%	98%	0%	0%	74	$51,410	$155,208	Medium
4	Spotyslvania	Paytes	VA	3,500	500.00	160	37%	52%	11%	0%	74	$120,861	$483,333	Med to Hvy
5	Crittenden	Crittenden	KY	34	2.70	40	22%	51%	27%	0%	1,419	$60,198	$178,643	Light
6	White House	Louisa	VA	500	20.00	N/A	24%	55%	18%	3%	409	$57,104	$209,286	Medium
	Average			846	97.12	90	19%	61%	20%	1%	460	$75,228	$286,833	
	Median			404	20.00	70	18%	54%	19%	0%	306	$70,486	$264,681	
	High			3,500	500.00	160	37%	98%	46%	3%	1,419	$120,861	$483,333	
	Low			34	2.70	40	2%	39%	0%	0%	74	$51,410	$155,208	
	White Oak Solar													
	1 Mile Radius			347	43.00	50	7%	63%	30%	0%	42	$62,386	$325,000	
	3 Mile Radius			347	43.00	50	7%	63%	30%	0%	1,243	$69,304	$349,933	
	5 Mile Radius			347	43.00	50	7%	63%	30%	0%	3,221	$70,217	$331,310	

The test for the home adjoining Remington Solar in Fauquier County suggests no impact on property value due to the adjoining solar farm as well.

On the following page is a summary of the matched pairs for all of the solar farms noted above. They show a pattern of results from -7% to +7% with an average of 0% and a median finding of -1%. As can be seen in the chart of those results below, most of the data points are between -3% and +2%. This variability is common with real estate and consistent with market "static." I therefore conclude that these results strongly support an indication of no impact on property value due to the adjacent solar farm. Only 2 of the 14 data points show a negative impact greater than the typical variability due to market imperfection, while 3 of the 14 data points show a positive impact. This leaves 9 of the 14 indications showing no impact and within the typical market variability/imperfection that would be expected for any property.



Residential Dwelling Matched Pairs Adjoining Solar Farms

Pair	Solar Farm	City	State	Area	MW	Approx Distance	Tax ID/Address	Sale Date	Sale Price	Adj. Price	% Diff	Notes
1	Spotsylvania	Paytes	VA	Rural	617	1270	12901 Orange Plnk	Aug-20	$319,900			Medium
							12717 Flintlock	Dec-20	$290,000	$326,767	-2%	
2	Spotsylvania	Paytes	VA	Rural	617	1950	9641 Nottoway	May-20	$449,900			Medium
							11626 Forest	Aug-20	$489,900	$430,246	4%	
3	Spotsylvania	Paytes	VA	Rural	617	1171	13353 Post Oak	Sep-20	$300,000			Heavy
							12810 Catharpin	Jan-20	$280,000	$299,008	0%	
4	Walker	Barhamsville	VA	Rural	20	250	5241 Barham	Oct-18	$264,000			Light
							9252 Ordinary	Jun-19	$277,000	$246,581	7%	
5	Clarke Cnty	White Post	VA	Rural	20	1230	833 Nations Spr	Aug-19	$385,000			Light
							2393 Old Chapel	Aug-20	$330,000	$389,286	-1%	
6	Sappony	Stony Creek	VA	Rural	20	1425	12511 Palestine	Jul-18	$128,400			Medium
							6494 Rocky Branch	Nov-18	$100,000	$131,842	-3%	
7	Crittenden	Crittenden	KY	Suburban	2.7	373	250 Claiborne	Jan-19	$120,000			Light
							315 N Fork	May-19	$107,000	$120,889	-1%	
8	Crittenden	Crittenden	KY	Suburban	2.7	488	300 Claiborne	Sep-18	$213,000			Light
							1795 Bay Valley	Dec-17	$231,200	$228,180	-7%	
9	Crittenden	Crittenden	KY	Suburban	2.7	720	350 Claiborne	Jul-18	$245,000			Light
							2160 Sherman	Jun-19	$265,000	$248,225	-1%	
10	Crittenden	Crittenden	KY	Suburban	2.7	930	370 Claiborne	Aug-19	$273,000			Light
							125 Lexington	Apr-18	$240,000	$254,751	7%	
11	Crittenden	Crittenden	KY	Suburban	2.7	365	250 Claiborne	Jan-22	$210,000			Light
							240 Shawnee	Jun-21	$166,000	$219,563	-5%	
12	Crittenden	Crittenden	KY	Suburban	2.7	390	260 Claiborne	Oct-21	$175,000			Light
							355 Oakwood	Oct-20	$186,000	$173,988	1%	
13	Crittenden	Crittenden	KY	Suburban	2.7	570	300 Claiborne	Dec-21	$290,000			Light
							39 Pinhook	Mar-22	$299,000	$289,352	0%	
14	Crittenden	Crittenden	KY	Suburban	2.7	1080	410 Claiborne	Feb-21	$275,000			Light
							114 Austin	Dec-20	$248,000	$279,680	-2%	

	MW	Avg. Distance
Average	138.04	872
Median	2.70	825
High	617.00	1,950
Low	2.70	250

	% Dif
Average	0%
Median	-1%
High	7%
Low	-7%

The matched pairs from White House Solar are not included in the breakdown above, but the best indication of impact is between 0 and -5%, which is in keeping with the other noted comparables.

Furthermore, the broker for the buyer indicated that the solar farm had no impact on the value and therefore strongly supports the o% impact end of that range.

I have further broken down these results based on the MWs, Landscaping, and distance from panel to show the following range of findings for these different categories.

This breakdown shows no homes between 100-200 homes. Solar farms up to 75 MW show homes between 201 and 500 feet with no impact on value. Most of the findings are for homes between 201 and 500 feet.

Light landscaping screens are showing no impact on value at any distances, though solar farms over 75.1 MW only show Medium and Heavy landscaping screens in the 3 examples identified.

MW Range 4.4 to 10 Landscaping Distance	**Light 100-200**	**Light 201-500**	**Light 500+**	**Medium 100-200**	**Medium 201-500**	**Medium 500+**	**Heavy 100-200**	**Heavy 201-500**	**Heavy 500+**
Average	N/A	-4%	3%	N/A	N/A	N/A	N/A	N/A	N/A
Median	N/A	-4%	3%	N/A	N/A	N/A	N/A	N/A	N/A
High	N/A	-1%	7%	N/A	N/A	N/A	N/A	N/A	N/A
Low	N/A	-7%	-1%	N/A	N/A	N/A	N/A	N/A	N/A

10.1 to 30 Landscaping Distance	**Light 100-200**	**Light 201-500**	**Light 500+**	**Medium 100-200**	**Medium 201-500**	**Medium 500+**	**Heavy 100-200**	**Heavy 201-500**	**Heavy 500+**
Average	N/A	7%	-1%	N/A	N/A	-3%	N/A	N/A	N/A
Median	N/A	7%	-1%	N/A	N/A	-3%	N/A	N/A	N/A
High	N/A	7%	0%	N/A	N/A	-3%	N/A	N/A	N/A
Low	N/A	7%	-1%	N/A	N/A	-3%	N/A	N/A	N/A

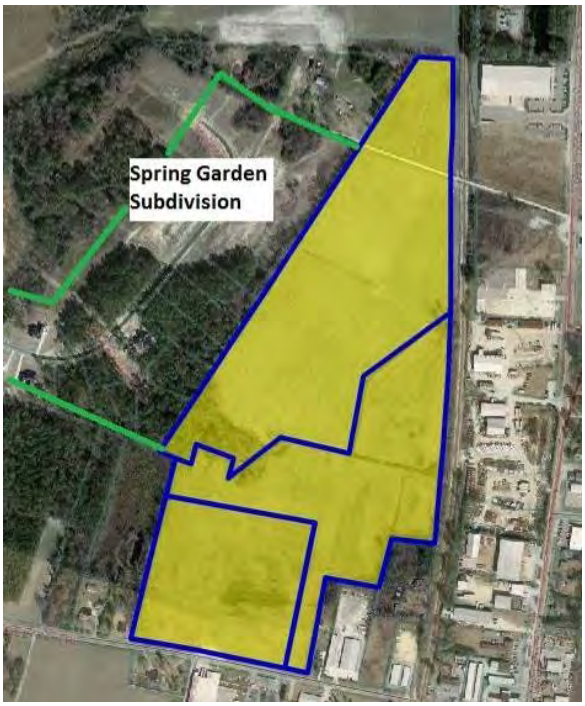
30.1 to 75 Landscaping Distance	**Light 100-200**	**Light 201-500**	**Light 500+**	**Medium 100-200**	**Medium 201-500**	**Medium 500+**	**Heavy 100-200**	**Heavy 201-500**	**Heavy 500+**
Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Median	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

75.1+ Landscaping Distance	**Light 100-200**	**Light 201-500**	**Light 500+**	**Medium 100-200**	**Medium 201-500**	**Medium 500+**	**Heavy 100-200**	**Heavy 201-500**	**Heavy 500+**
Average	N/A	N/A	N/A	N/A	N/A	1%	N/A	N/A	N/A
Median	N/A	N/A	N/A	N/A	N/A	1%	N/A	N/A	N/A
High	N/A	N/A	N/A	N/A	N/A	4%	N/A	N/A	N/A
Low	N/A	N/A	N/A	N/A	N/A	-2%	N/A	N/A	N/A

B. Southeastern USA Data – Over 5 MW

1. Matched Pair – AM Best Solar Farm, Goldsboro, NC

This 5 MW solar farm adjoins Spring Garden Subdivision which had new homes and lots available for new construction during the approval and construction of the solar farm. The recent home sales have ranged from $200,000 to $250,000. This subdivision sold out the last homes in late 2014. The solar farm is clearly visible particularly along the north end of this street where there is only a thin line of trees separating the solar farm from the single-family homes.

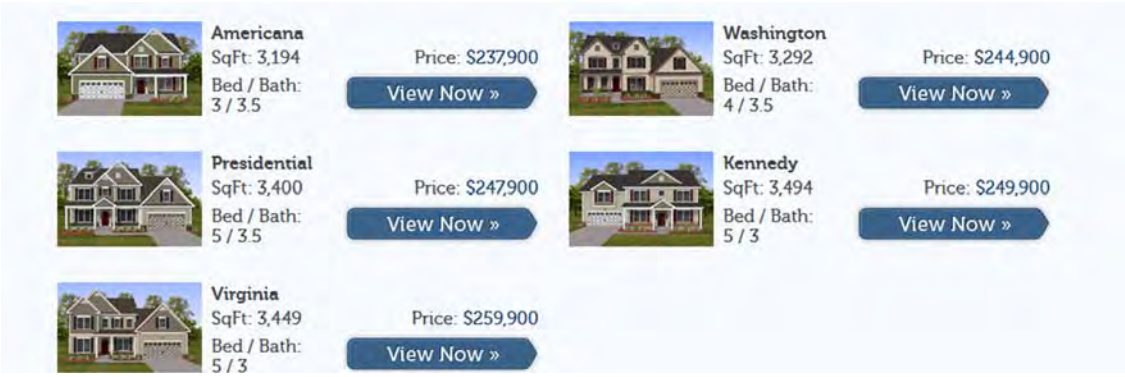


Homes backing up to the solar farm are selling at the same price for the same floor plan as the homes that do not back up to the solar farm in this subdivision. According to the builder, the solar farm has been a complete non-factor. Not only do the sales show no difference in the price paid for the various homes adjoining the solar farm versus not adjoining the solar farm, but there are actually more recent sales along the solar farm than not. There is no impact on the sellout rate, or time to sell for the homes adjoining the solar farm.

I spoke with a number of owners who adjoin the solar farm and none of them expressed any concern over the solar farm impacting their property value.

The data presented on the following page shows multiple homes that have sold in 2013 and 2014 adjoining the solar farm at prices similar to those not along the solar farm. These series of sales indicate that the solar farm has no impact on the adjoining residential use.

The homes that were marketed at Spring Garden are shown below.



The homes adjoining the solar farm are considered to have a light landscaping screen as it is a narrow row of existing pine trees supplemented with evergreen plantings.

Matched Pairs
As of Date: 9/3/2014

Adjoining Sales After Solar Farm Completed

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600195570	Helm	0.76	Sep-13	$250,000	2013	3,292	$75.94	2 Story
3600195361	Leak	1.49	Sep-13	$260,000	2013	3,652	$71.19	2 Story
3600199891	McBrayer	2.24	Jul-14	$250,000	2014	3,292	$75.94	2 Story
3600198632	Foresman	1.13	Aug-14	$253,000	2014	3,400	$74.41	2 Story
3600196656	Hinson	0.75	Dec-13	$255,000	2013	3,453	$73.85	2 Story
	Average	1.27		$253,600	2013.4	3,418	$74.27	
	Median	1.13		$253,000	2013	3,400	$74.41	

Adjoining Sales After Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
0	Feddersen	1.56	Feb-13	$247,000	2012	3,427	$72.07	Ranch
0	Gentry	1.42	Apr-13	$245,000	2013	3,400	$72.06	2 Story
	Average	1.49		$246,000	2012.5	3,414	$72.07	
	Median	1.49		$246,000	2012.5	3,414	$72.07	

Adjoining Sales Before Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600183905	Carter	1.57	Dec-12	$240,000	2012	3,347	$71.71	1.5 Story
3600193097	Kelly	1.61	Sep-12	$198,000	2012	2,532	$78.20	2 Story
3600194189	Hadwan	1.55	Nov-12	$240,000	2012	3,433	$69.91	1.5 Story
	Average	1.59		$219,000	2012	2,940	$74.95	
	Median	1.59		$219,000	2012	2,940	$74.95	

Nearby Sales After Solar Farm Completed

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600193710	Barnes	1.12	Oct-13	$248,000	2013	3,400	$72.94	2 Story
3601105180	Nackley	0.95	Dec-13	$253,000	2013	3,400	$74.41	2 Story
3600192528	Mattheis	1.12	Oct-13	$238,000	2013	3,194	$74.51	2 Story
3600198928	Beckman	0.93	Mar-14	$250,000	2014	3,292	$75.94	2 Story
3600196965	Hough	0.81	Jun-14	$224,000	2014	2,434	$92.03	2 Story
3600193914	Preskitt	0.67	Jun-14	$242,000	2014	2,825	$85.66	2 Story
3600194813	Bordner	0.91	Apr-14	$258,000	2014	3,511	$73.48	2 Story
3601104147	Shaffer	0.73	Apr-14	$255,000	2014	3,453	$73.85	2 Story
	Average	0.91		$246,000	2013.625	3,189	$77.85	
	Median	0.92		$249,000	2014	3,346	$74.46	

Nearby Sales Before Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600191437	Thomas	1.12	Sep-12	$225,000	2012	3,276	$68.68	2 Story
3600087968	Lilley	1.15	Jan-13	$238,000	2012	3,421	$69.57	1.5 Story
3600087654	Burke	1.26	Sep-12	$240,000	2012	3,543	$67.74	2 Story
3600088796	Hobbs	0.73	Sep-12	$228,000	2012	3,254	$70.07	2 Story
	Average	1.07		$232,750	2012	3,374	$69.01	
	Median	1.14		$233,000	2012	3,349	$69.13	

Matched Pair Summary

	Adjoins Solar Farm		Nearby Solar Farm	
	Average	**Median**	**Average**	**Median**
Sales Price	$253,600	$253,000	$246,000	$249,000
Year Built	2013	2013	2014	2014
Size	3,418	3,400	3,189	3,346
Price/SF	$74.27	$74.41	$77.85	$74.46

Percentage Differences

Median Price	-2%
Median Size	-2%
Median Price/SF	0%

I note that 2308 Granville Drive sold again in November 2015 for $267,500, or $7,500 more than when it was purchased new from the builder two years earlier (Tax ID 3600195361, Owner: Leak). The neighborhood is clearly showing appreciation for homes adjoining the solar farm.

The Median Price is the best indicator to follow in any analysis as it avoids outlying samples that would otherwise skew the results. The median sizes and median prices are all consistent throughout the sales both before and after the solar farm whether you look at sites adjoining or nearby to the solar farm. The average size for the homes nearby the solar farm shows a smaller building size and a higher price per square foot. This reflects a common occurrence in real estate where the price per square foot goes up as the size goes down. So even comparing averages the indication is for no impact, but I rely on the median rates as the most reliable indication for any such analysis.

I have also considered four more recent resales of homes in this community as shown on the following page. These comparable sales adjoin the solar farm at distances ranging from 315 to 400 feet. The matched pairs show a range from -9% to +6%. The range of the average difference is -2% to +1% with an average of 0% and a median of +0.5%. These comparable sales support a finding of no impact on property value.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	103 Granville Pl	1.42	7/27/2018	$265,000	2013	3,292	$80.50	4/3.5	2-Car	2-Story		385
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	103 Granville Pl								$265,000		-2%
	Not	2219 Granville	$4,382		$1,300	$0				$265,682	0%	
	Not	634 Friendly	-$8,303		-$6,675	$16,721	-$10,000			$258,744	2%	
	Not	2403 Granville	-$6,029		-$1,325	$31,356				$289,001	-9%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	104 Erin	2.24	6/19/2017	$280,000	2014	3,549	$78.90	5/3.5	2-Car	2-Story		315
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	104 Erin								$280,000		0%
	Not	2219 Granville	-$4,448		$2,600	$16,238				$274,390	2%	
	Not	634 Friendly	-$17,370		-$5,340	$34,702	-$10,000			$268,992	4%	
	Not	2403 Granville	-$15,029		$0	$48,285				$298,256	-7%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	2312 Granville	0.75	5/1/2018	$284,900	2013	3,453	$82.51	5/3.5	2-Car	2-Story		400
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	2312 Granville								$284,900		1%
	Not	2219 Granville	$2,476		$1,300	$10,173				$273,948	4%	
	Not	634 Friendly	-$10,260		-$6,675	$27,986	-$10,000			$268,051	6%	
	Not	2403 Granville	-$7,972		-$1,325	$47,956				$303,659	-7%	

Adjoining Residential Sales After Solar Farm Approved

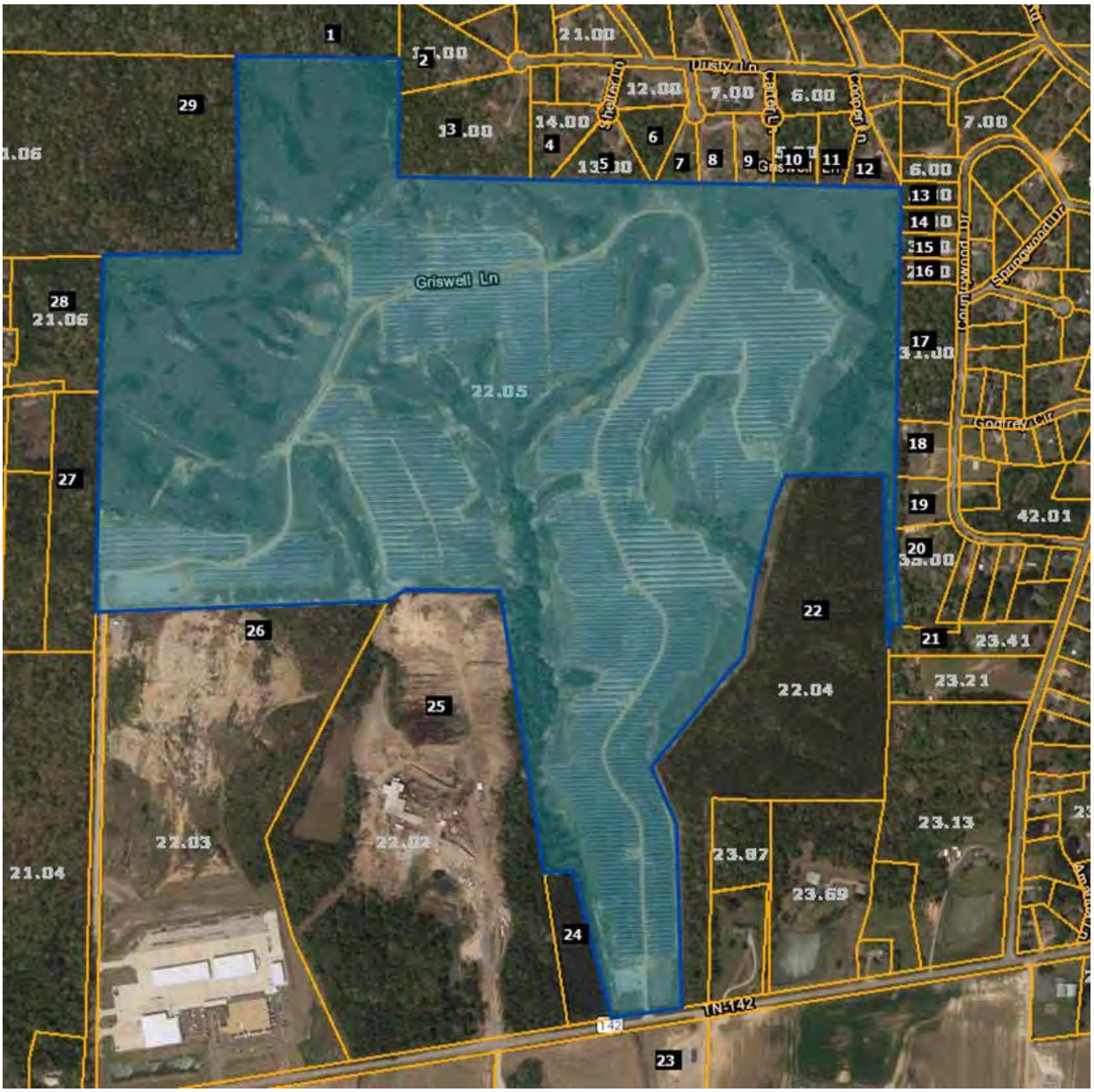
Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	2310 Granville	0.76	5/14/2019	$280,000	2013	3,292	$85.05	5/3.5	2-Car	2-Story		400
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	2310 Granville								$280,000		1%
	Not	2219 Granville	$10,758		$1,300	$0				$272,058	3%	
	Not	634 Friendly	-$1,755		-$6,675	$16,721	-$10,000			$265,291	5%	
	Not	2403 Granville	$469		-$1,325	$31,356				$295,500	-6%	

I have also considered the original sales prices in this subdivision relative to the recent resale values as shown in the chart below. This rate of appreciation is right at 2.5% over the last 6 years. Zillow indicates that the average home value within the 27530-zip code as of January 2014 was $101,300 and as of January 2020 that average is $118,100. This indicates an average increase in the market of 2.37%. I conclude that the appreciation of the homes adjoining the solar farm are not impacted by the presence of the solar farm based on this data.

	Address	Initial Sale Date	Price	Second Sale Date	Price	Year Diff	Apprec.	% Apprec.	Apprec. %/Year
1	103 Granville Pl	4/1/2013	$245,000	7/27/2018	$265,000	5.32	$20,000	8.16%	1.53%
2	105 Erin	7/1/2014	$250,000	6/19/2017	$280,000	2.97	$30,000	12.00%	4.04%
3	2312 Granville	12/1/2013	$255,000	5/1/2015	$262,000	1.41	$7,000	2.75%	1.94%
4	2312 Granville	5/1/2015	$262,000	5/1/2018	$284,900	3.00	$22,900	8.74%	2.91%
5	2310 Granville	8/1/2013	$250,000	5/14/2019	$280,000	5.79	$30,000	12.00%	2.07%
6	2308 Granville	9/1/2013	$260,000	11/12/2015	$267,500	2.20	$7,500	2.88%	1.31%
7	2304 Granville	9/1/2012	$198,000	6/1/2017	$225,000	4.75	$27,000	13.64%	2.87%
8	102 Erin	8/1/2014	$253,000	11/1/2016	$270,000	2.25	$17,000	6.72%	2.98%
								Average	2.46%
								Median	2.47%

2. Matched Pair – Mulberry, Selmer, TN



This 16 MW solar farm was built in 2014 on 208.89 acres with the closest home being 480 feet.

This solar farm adjoins two subdivisions with Central Hills having a mix of existing and new construction homes. Lots in this development have been marketed for $15,000 each with discounts offered for multiple lots being used for a single home site. I spoke with the agent with Rhonda Wheeler and Becky Hearnsberger with United County Farm & Home Realty who noted that they have seen no impact on lot or home sales due to the solar farm in this community.

I have included a map below as well as data on recent sales activity on lots that adjoin the solar farm or are near the solar farm in this subdivision both before and after the announced plan for this solar farm facility. I note that using the same method I used to breakdown the adjoining uses at the subject property I show that the predominant adjoining uses are residential and agricultural, which is consistent with the location of most solar farms.

Adjoining Use Breakdown

	Acreage	Parcels
Commercial	3.40%	0.034
Residential	12.84%	79.31%
Agri/Res	10.39%	3.45%
Agricultural	73.37%	13.79%
Total	**100.00%**	**100.00%**

I have run a number of direct matched comparisons on the sales adjoining this solar farm as shown below. These direct matched pairs include some of those shown above as well as additional more recent sales in this community. In each of these I have compared the one sale adjoining the solar farm to multiple similar homes nearby that do not adjoin a solar farm to look for any potential impact from the solar farm.

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
3	Adjoins	491 Dusty	6.86	10/28/2016	$176,000	2009	1,801	$97.72	3/2	2-Gar	Ranch	
	Not	820 Lake Trail	1.00	6/8/2018	$168,000	2013	1,869	$89.89	4/2	2-Gar	Ranch	
	Not	262 Country	1.00	1/17/2018	$145,000	2000	1,860	$77.96	3/2	2-Gar	Ranch	
	Not	35 April	1.15	8/16/2016	$185,000	2016	1,980	$93.43	3/2	2-Gar	Ranch	

Adjoining Sales Adjusted

Parcel	Solar	Address	Time	Site	YB	GLA	Park	Other	Total	% Diff	Distance
3	Adjoins	491 Dusty							$176,000		480
	Not	820 Lake Trail	-$8,324	$12,000	-$3,360	-$4,890			$163,426	7%	
	Not	262 Country	-$5,450	$12,000	$6,525	-$3,680			$154,396	12%	
	Not	35 April	$1,138	$12,000	-$6,475	-$13,380			$178,283	-1%	
									Average	6%	

The best matched pair is 35 April Loop, which required the least adjustment and indicates a -1% increase in value due to the solar farm adjacency.

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
12	Adjoins	57 Cooper	1.20	2/26/2019	$163,000	2011	1,586	$102.77	3/2	2-Gar	1.5 Story	Pool
	Not	191 Amelia	1.00	8/3/2018	$132,000	2005	1,534	$86.05	3/2	Drive	Ranch	
	Not	75 April	0.85	3/17/2017	$134,000	2012	1,588	$84.38	3/2	2-Crprt	Ranch	
	Not	345 Woodland	1.15	12/29/2016	$131,000	2002	1,410	$92.91	3/2	1-Gar	Ranch	

Adjoining Sales Adjusted

Parcel	Solar	Address	Sales Price	Time	Site	YB	GLA	Park	Other	Total	% Diff	Distance
12	Adjoins	57 Cooper	$163,000							$163,000		685
	Not	191 Amelia	$132,000	$2,303		$3,960	$2,685	$10,000	$5,000	$155,947	4%	
	Not	75 April	$134,000	$8,029	$4,000	-$670	-$135	$5,000	$5,000	$155,224	5%	
	Not	345 Woodland	$131,000	$8,710		$5,895	$9,811		$5,000	$160,416	2%	
										Average	4%	

The best matched pair is 191 Amelia, which was most similar in time frame of sale and indicates a +4% increase in value due to the solar farm adjacency.

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
15	Adjoins	297 Country	1.00	9/30/2016	$150,000	2002	1,596	$93.98	3/2	4-Gar	Ranch	
	Not	185 Dusty	1.85	8/17/2015	$126,040	2009	1,463	$86.15	3/2	2-Gar	Ranch	
	Not	53 Glen	1.13	3/9/2017	$126,000	1999	1,475	$85.42	3/2	2-Gar	Ranch	Brick

Adjoining Sales Adjusted

Parcel	Solar	Address	Sales Price	Time	Site	YB	GLA	Park	Other	Total	% Diff	Distance
15	Adjoins	297 Country	$150,000							$150,000		650
	Not	185 Dusty	$126,040	$4,355		-$4,411	$9,167	$10,000		$145,150	3%	
	Not	53 Glen	$126,000	-$1,699		$1,890	$8,269	$10,000		$144,460	4%	
										Average	3%	

The best matched pair is 53 Glen, which was most similar in time frame of sale and required less adjustment. It indicates a +4% increase in value due to the solar farm adjacency.

The average indicated impact from these three sets of matched pairs is +4%, which suggests a mild positive relationship due to adjacency to the solar farm. The landscaping buffer for this project is mostly natural tree growth that was retained as part of the development but much of the trees separating the panels from homes are actually on the lots for the homes themselves. I therefore consider the landscaping buffer to be thin to moderate for these adjoining homes.

I have also looked at several lot sales in this subdivision as shown below.

These are all lots within the same community and the highest prices paid are for lots one parcel off from the existing solar farm. These prices are fairly inconsistent, though they do suggest about a $3,000 loss in the lots adjoining the solar farm. This is an atypical finding and additional details suggest there is more going on in these sales than the data crunching shows. First of all Parcel 4 was purchased by the owner of the adjoining home and therefore an atypical buyer seeking to expand a lot and the site is not being purchased for home development. Moreover, using the SiteToDoBusiness demographic tools, I found that the 1-mile radius around this development is expecting a total population increase over the next 5 years of 3 people. This lack of growing demand for lots is largely explained in that context. Furthermore, the fact that finished home sales as shown above are showing no sign of a negative impact on property value makes this data unreliable and inconsistent with the data shown in sales to an end user. I therefore place little weight on this outlier data.

Parcel	Solar	Address	Acres	Date Sold	Sales Price	4/18/2019 Adj for Time	$/AC	4/18/2019 Adj for Time
4	Adjoins	Shelter	2.05	10/25/2017	$16,000	$16,728	$7,805	$8,160
10	Adjoins	Carter	1.70	8/2/2018	$14,000	$14,306	$8,235	$8,415
11	Adjoins	Cooper	1.28	9/17/2018	$12,000	$12,215	$9,375	$9,543
	Not	75 Dusty	1.67	4/18/2019	$20,000	$20,000	$11,976	$11,976
	Not	Lake Trl	1.47	11/7/2018	$13,000	$13,177	$8,844	$8,964
	Not	Lake Trl	1.67	4/18/2019	$20,000	$20,000	$11,976	$11,976

	Adjoins	Per Acre	Not Adjoins	Per Acre	% DIF/Lot	% DIF/AC
Average	$14,416	$8,706	$17,726	$10,972	19%	21%
Median	$14,306	$8,415	$20,000	$11,976	28%	30%
High	$16,728	$9,543	$20,000	$11,976	16%	20%
Low	$12,215	$8,160	$13,177	$8,964	7%	9%

3. Matched Pair – Leonard Road Solar Farm, Hughesville, MD

This 5 MW solar farm is located on 47 acres and mostly adjoins agricultural and residential uses to the west, south and east as shown above. The property also adjoins retail uses and a church. I looked at a 2016 sale of an adjoining home with a positive impact on value adjoining the solar farm of 2.90%. This is within typical market friction and supports an indication of no impact on property value.

I have shown this data below. The landscaping buffer is considered heavy.

Leonardtown Road Solar Farm, Hughesville, MD

Nearby Residential Sale After Solar Farm Construction

Address	Solar Farm	Acres	Date Sold	Sales Price*	Built	GBA	$/GBA	Style	BR/BA	Bsmt	Park	Upgrades	Other
14595 Box Elder Ct	Adjoins	3.00	2/12/2016	$291,000	1991	2,174	$133.85	Colonial	5/2.5	No	2 Car Att	N/A	Deck
15313 Bassford Rd	Not	3.32	7/20/2016	$329,800	1990	2,520	$130.87	Colonial	3/2.5	Finished	2 Car Att	Custom	Scr Por/Patio

*$9,000 concession deducted from sale price for Box Elder and $10,200 deducted from Bassford

Adjoining Sales Adjusted			Adjustments					
Address	Date Sold	Sales Price	Time	GLA	Bsmt	Upgrades	Other	Total
14595 Box Elder Ct	2/12/2016	$291,000						$291,000
15313 Bassford Rd	7/20/2016	$329,800	-$3,400	-$13,840	-$10,000	-$15,000	-$5,000	$282,560

Difference Attributable to Location $8,440
2.90%

This is within typical market friction and supports an indication of no impact on property value.

4. Matched Pair – Gastonia SC Solar, Gastonia, NC

This 5 MW project is located on the south side of Neal Hawkins Road just outside of Gastonia. The property identified above as Parcel 4 was listed for sale while this solar farm project was going

through the approval process. The property was put under contract during the permitting process with the permit being approved while the due diligence period was still ongoing. After the permit was approved the property closed with no concerns from the buyer. I spoke with Jennifer Bouvier, the broker listing the property and she indicated that the solar farm had no impact at all on the sales price. She considered some nearby sales to set the price and the closing price was very similar to the asking price within the typical range for the market. The buyer was aware that the solar farm was coming and they had no concerns.

This two-story brick dwelling was sold on March 20, 2017 for $270,000 for a 3,437 square foot dwelling built in 1934 in average condition on 1.42 acres. The property has four bedrooms and two bathrooms. The landscaping screen is light for this adjoining home due to it being a new planted landscaping buffer.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	609 Neal Hawkins	1.42	3/20/2017	$270,000	1934	3,427	$78.79	4/2	Open	2-Brick	
Not	1418 N Modena	4.81	4/17/2018	$225,000	1930	2,906	$77.43	3/3	2-Crprt	2-Brick	
Not	363 Dallas Bess	2.90	11/29/2018	$265,500	1968	2,964	$89.57	3/3	Open	FinBsmt	
Not	1612 Dallas Chry	2.74	9/17/2018	$245,000	1951	3,443	$71.16	3/2	Open	2-Brick	Unfin bath

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
609 Neal Hawkins								$270,000			225
1418 N Modena	$7,319		$2,700	$32,271		-$10,000		$257,290	5%		
363 Dallas Bess	$746		-$27,081	$33,179	-$10,000		$53,100	$262,456	3%		
1612 Dallas Chry	$4,110		-$12,495	-$911			$10,000	$235,704	13%		
										7%	

I also considered the newer adjoining home identified as Parcel 5 that sold later in 2017 and it likewise shows no negative impact on property value. This is also considered a light landscaping buffer.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style
Adjoins	611 Neal Hawkins	0.78	7/6/2017	$288,000	1991	2,256	$127.66	5/3	2-Gar	1.5 Brick
Not	1211 Still Frst	0.51	7/30/2018	$280,000	1989	2,249	$124.50	3/3	2-Gar	Br Rnch
Not	2867 Colony Wds	0.52	8/14/2018	$242,000	1990	2,006	$120.64	3/3	2-Gar	Br Rnch
Not	1010 Strawberry	1.00	10/4/2018	$315,000	2002	2,330	$135.19	3/2.5	2-Gar	1.5 Brick

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
611 Neal Hawkins								$288,000			145
1211 Still Frst	$1,341		$2,800	$697				$284,838	1%		
2867 Colony Wds	$7,714		$1,210	$24,128				$275,052	4%		
1010 Strawberry	-$4,555		-$17,325	-$8,003	$5,000			$290,116	-1%		
										2%	

5. Matched Pair – Summit/Ranchlands Solar, Moyock, NC

This project is located at 1374 Caritoke Highway, Moyock, NC. This is an 80 MW facility on a parent tract of 2,034 acres. Parcels Number 48 and 53 as shown in the map above were sold in 2016. The project was under construction during the time period of the first of the matched pair sales and the permit was approved well prior to that in 2015.

I looked at multiple sales of adjoining and nearby homes and compared each to multiple comparables to show a range of impacts from -10% up to +11% with an average of +2% and a median of +3%. These ranges are well within typical real estate variation and supports an indication of no impact on property value.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
48	Adjoins	129 Pinto	4.29	4/15/2016	$170,000	1985	1,559	$109.04	3/2	Drive	MFG		1,060
	Not	102 Timber	1.30	4/1/2016	$175,500	2009	1,352	$129.81	3/2	Drive	MFG		
	Not	120 Ranchland	0.99	10/1/2014	$170,000	2002	1,501	$113.26	3/2	Drive	MFG		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	129 Pinto								$170,000		-3%
Not	102 Timber	$276	$10,000	-$29,484	$18,809				$175,101	-3%	
Not	120 Ranchland	$10,735	$10,000	-$20,230	$4,598				$175,103	-3%	

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	105 Pinto	4.99	12/16/2016	$206,000	1978	1,484	$138.81	3/2	Det G	Ranch	
Not	111 Spur	1.15	2/1/2016	$193,000	1985	2,013	$95.88	4/2	Gar	Ranch	
Not	103 Marshall	1.07	3/29/2017	$196,000	2003	1,620	$120.99	3/2	Drive	Ranch	
Not	127 Ranchland	0.00	6/9/2015	$219,900	1988	1,910	$115.13	3/2	Gar/3Det	Ranch	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
105 Pinto								$206,000			980
111 Spur	$6,747	$10,000	-$6,755	-$25,359				$177,633	14%		
103 Marshall	-$2,212	$10,000	-$24,500	-$8,227		$5,000		$176,212	14%		
127 Ranchland	$13,399	$10,000	-$10,995	-$24,523		-$10,000		$197,781	4%		
										11%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
15	Adjoins	318 Green View	0.44	9/15/2019	$357,000	2005	3,460	$103.18	4/4	2-Car	1.5 Brick		570
	Not	195 St Andrews	0.55	6/17/2018	$314,000	2002	3,561	$88.18	5/3	2-Car	2.0 Brick		
	Not	336 Green View	0.64	1/13/2019	$365,000	2006	3,790	$96.31	6/4	3-Car	2.0 Brick		
	Not	275 Green View	0.36	8/15/2019	$312,000	2003	3,100	$100.65	5/3	2-Car	2.0 Brick		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	318 Green View								$357,000		4%
Not	195 St Andrews	$12,040		$4,710	-$7,125	$10,000			$333,625	7%	
Not	336 Green View	$7,536		-$1,825	-$25,425			-$5,000	$340,286	5%	
Not	275 Green View	$815		$3,120	$28,986	$10,000			$354,921	1%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
29	Adjoins	164 Ranchland	1.01	4/30/2019	$169,000	1999	2,052	$82.36	4/2	Gar	MFG		440
	Not	150 Pinto	0.94	3/27/2018	$168,000	2017	1,920	$87.50	4/2	Drive	MFG		
	Not	105 Longhorn	1.90	10/10/2017	$184,500	2002	1,944	$94.91	3/2	Drive	MFG		
	Not	112 Pinto	1.00	7/27/2018	$180,000	2002	1,836	$98.04	3/2	Drive	MFG	Fenced	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	164 Ranchland								$169,000		-10%
Not	150 Pinto	$5,649		-$21,168	$8,085			$5,000	$165,566	2%	
Not	105 Longhorn	$8,816	-$10,000	-$3,875	$7,175			$5,000	$191,616	-13%	
Not	112 Pinto	$4,202		-$3,780	$14,824			$5,000	$200,245	-18%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	358 Oxford	10.03	9/16/2019	$478,000	2008	2,726	$175.35	3/3	2 Gar	Ranch		635
	Not	276 Summit	10.01	12/20/2017	$355,000	2006	1,985	$178.84	3/2	2 Gar	Ranch		
	Not	176 Providence	6.19	5/6/2019	$425,000	1990	2,549	$166.73	3/3	4 Gar	Ranch	Brick	
	Not	1601 B Caratoke	12.20	9/26/2019	$440,000	2016	3,100	$141.94	4/3.5	5 Gar	Ranch	Pool	

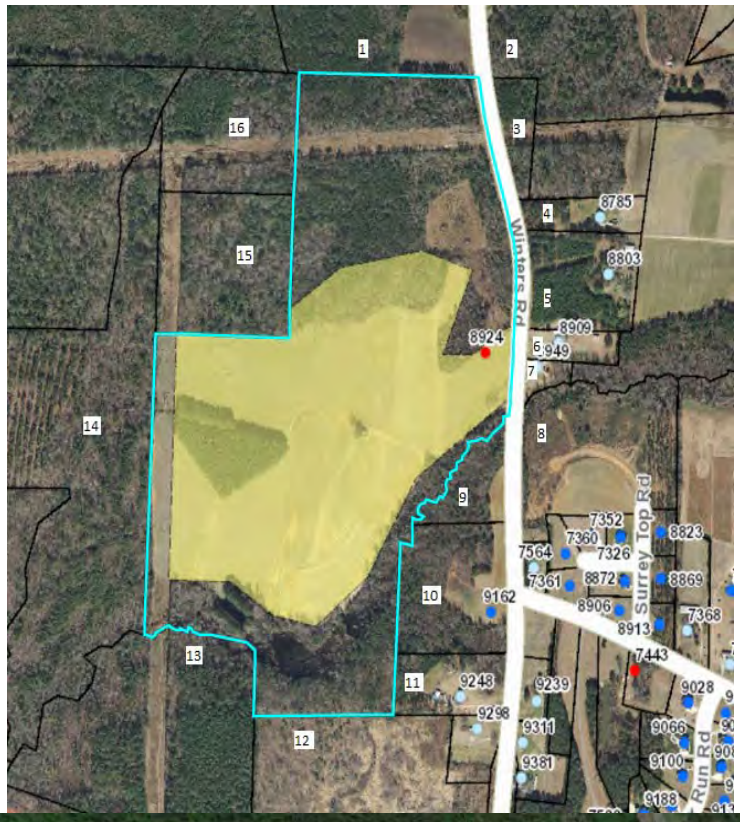
Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	358 Oxford								$478,000		5%
Not	276 Summit	$18,996		$3,550	$106,017	$10,000			$493,564	-3%	
Not	176 Providence	$4,763		$38,250	$23,609		-$10,000	-$25,000	$456,623	4%	
Not	1601 B Caratoke	-$371	$50,000	-$17,600	-$42,467	-$5,000	-$10,000		$414,562	13%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Nearby	343 Oxford	10.01	3/9/2017	$490,000	2016	3,753	$130.56	3/3	2 Gar	1.5 Story	Pool	970
	Not	287 Oxford	10.01	9/4/2017	$600,000	2013	4,341	$138.22	5/4.5	8-Gar	1.5 Story	Pool	
	Not	301 Oxford	10.00	4/23/2018	$434,000	2013	3,393	$127.91	5/3	2 Gar	1.5 Story		
	Not	218 Oxford	10.01	4/4/2017	$525,000	2006	4,215	$124.56	4/3	4 Gar	1.5 Story	VG Barn	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	343 Oxford								$490,000		3%
Not	287 Oxford	-$9,051		$9,000	-$65,017	-$15,000	-$25,000		$494,932	-1%	
Not	301 Oxford	-$14,995	-$10,000	$6,510	$36,838				$452,353	8%	
Not	218 Oxford	-$1,150		$26,250	-$46,036		-$10,000	-$10,000	$484,064	1%	

6. Matched Pair – Tracy Solar, Bailey, NC



This project is located in rural Nash County on Winters Road with a 5 MW facility that was built in 2016 on 50 acres. A local builder acquired parcels 9 and 10 following construction as shown below

at rates comparable to other tracts in the area. They then built a custom home for an owner and sold that at a price similar to other nearby homes as shown in the matched pair data below. The retained woods provide a heavy landscaped buffer for this homesite.

Adjoining Land Sales After Solar Farm Completed

#	Solar Farm	TAX ID	Grantor	Grantee	Address	Acres	Date Sold	Sales Price	$/AC	Other
9 &10	Adjoins	316003 & 316004	Cozart	Kingsmill	9162 Winters	13.22	7/21/2016	$70,000	$5,295	
	Not	6056	Billingsly		427 Young	41	10/21/2016	$164,000	$4,000	
	Not	33211	Fulcher	Weikel	10533 Cone	23.46	7/18/2017	$137,000	$5,840	Doublewide, structures
	Not	106807	Perry	Gardner	Claude Lewis	11.22	8/10/2017	$79,000	$7,041	Gravel drive for sub, cleared
	Not	3437	Vaughan	N/A	11354 Old Lewis Sch	18.73	Listing	$79,900	$4,266	Small cemetery,wooded

Adjoining Sales Adjusted

Time	Acres	Location	Other	Adj $/Ac	% Diff
				$5,295	
$0	$400	$0	$0	$4,400	17%
-$292	$292	$0	-$500	$5,340	-1%
-$352	$0	$0	-$1,000	$5,689	-7%
-$213	$0	$0	$213	$4,266	19%
				Average	7%

Adjoining Residential Sales After Solar Farm Completed

#	Solar Farm	n	Address	Acres	Date Sold	Sales Price	Built	GLA	$/GLA	BR/BA	Style	Other
9 &10	Adjoins	gs	9162 Winters	13.22	1/5/2017	$255,000	2016	1,616	$157.80	3/2	Ranch	1296 sf wrkshp
	Not	w	7352 Red Fox	0.93	6/30/2016	$176,000	2010	1,529	$115.11	3/2	2-story	

Adjoining Sales Adjusted

Time	Acres	YB	GLA	Style	Other	Total	% Diff
						$255,000	
$0	$44,000	$7,392	$5,007	$5,000	$15,000	$252,399	1%

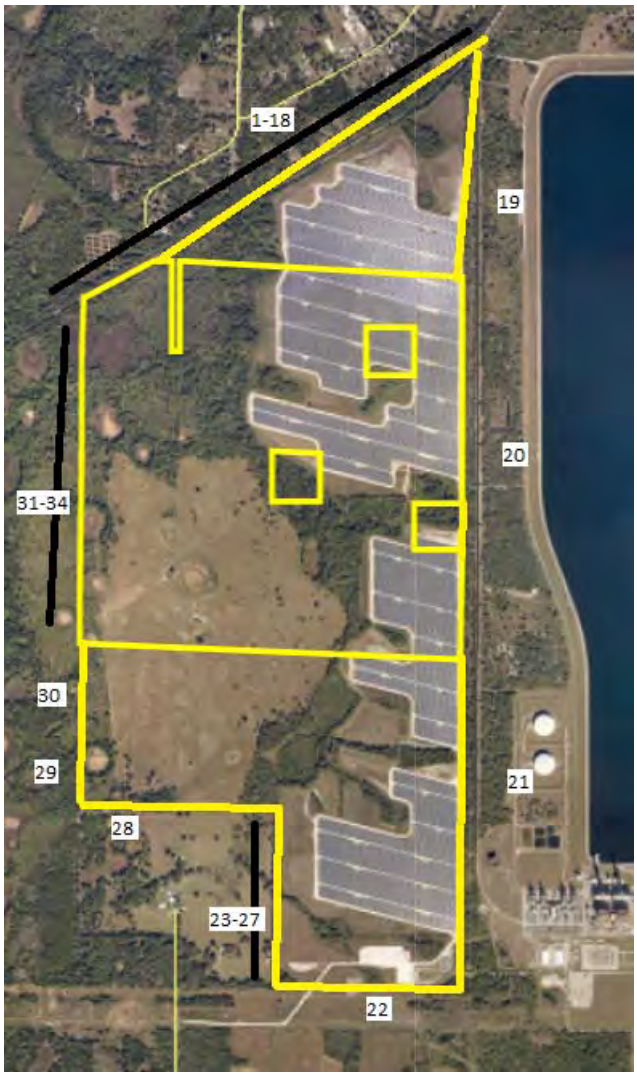
The comparables for the land show either a significant positive relationship or a mild negative relationship to having and adjoining solar farm, but when averaged together they show no negative impact. The wild divergence is due to the difficulty in comping out this tract of land and the wide variety of comparables used. The two comparables that show mild negative influences include a property that was partly developed as a residential subdivision and the other included a doublewide with some value and accessory agricultural structures. The tax assessed value on the improvements were valued at $60,000. So both of those comparables have some limitations for comparison. The two that show significant enhancement due to adjacency includes a property with a cemetery located in the middle and the other is a tract almost twice as large. Still that larger tract after adjustment provides the best matched pair as it required the least adjustment. I therefore conclude that there is no negative impact due to adjacency to the solar farm shown by this matched pair.

The dwelling that was built on the site was a build-to-suit and was compared to a nearby homesale of a property on a smaller parcel of land. I adjusted for that differenced based on a $25,000 value for a 1-acre home site versus the $70,000 purchase price of the larger subject tract. The other adjustments are typical and show no impact due to the adjacency to the solar farm.

The closest solar panel to the home is 780 feet away.

I note that the representative for Kingsmill Homes indicated that the solar farm was never a concern in purchasing the land or selling the home. He also indicated that they had built a number of nearby homes across the street and it had never come up as an issue.

7. Matched Pair – Manatee Solar Farm, Parrish, FL



This solar farm is located near Seminole Trail, Parrish, FL. The solar farm has a 74.50 MW output and is located on a 1,180.38-acre tract and was built in 2016. The tract is owned by Florida Power & Light Company.

I have considered the recent sale of 13670 Highland Road, Wimauma, Florida. This one-story, concrete block home is located just north of the solar farm and separated from the solar farm by a railroad corridor. This home is a 3 BR, 3 BA 1,512 s.f. home with a carport and workshop. The property includes new custom cabinets, granite counter tops, brand-new stainless-steel appliances, updated bathrooms and new carpet in the bedrooms. The home is sitting on 5 acres. The home was built in 1997.

I have compared this sale to several nearby homesales as part of this matched pair analysis as shown below. The landscaping separating the home from the solar farm is considered heavy.

Solar	TAX ID/Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Note
Adjoins	13670 Highland	5.00	8/21/2017	$255,000	1997	1,512	$168.65	3/3	Carport/Wrkshp	Ranch	Renov.
Not	2901 Arrowsmith	1.91	1/31/2018	$225,000	1979	1,636	$137.53	3/2	2 Garage/Wrkshp	Ranch	
Not	602 Butch Cassidy	1.00	5/5/2017	$220,000	2001	1,560	$141.03	3/2	N/A	Ranch	Renov.
Not	2908 Wild West	1.23	7/12/2017	$254,000	2003	1,554	$163.45	3/2	2 Garage/Wrkshp	Ranch	Renov.
Not	13851 Highland	5.00	9/13/2017	$240,000	1978	1,636	$146.70	4/2	3 Garage	Ranch	Renov.

		Adjoining Sales Adjusted								
Solar	**TAX ID/Address**	**Time**	**Acres**	**YB**	**GLA**	**BR/BA**	**Park**	**Note**	**Total**	**% Diff**
Adjoins	13670 Highland								$255,000	
Not	2901 Arrowsmith	$2,250	$10,000	$28,350	-$8,527	$5,000	-$10,000	$10,000	$262,073	-3%
Not	602 Butch Cassidy	-$2,200	$10,000	-$6,160	-$3,385	$5,000	$2,000		$225,255	12%
Not	2908 Wild West	$0	$10,000	-$10,668	-$3,432	$5,000	-$10,000		$244,900	4%
Not	13851 Highland	$0	$0	$31,920	-$9,095	$3,000	-$10,000		$255,825	0%
									Average	3%

The sales prices of the comparables before adjustments range from $220,000 to $254,000. After adjustments they range from $225,255 to $262,073. The comparables range from no impact to a strong positive impact. The comparables showing -3% and +4% impact on value is considered within a typical range of value and therefore not indicative of any impact on property value.

This set of matched pair data falls in line with the data seen in other states. The closest solar panel to the home at 13670 Highland is 1,180 feet. There is a wooded buffer between these two properties.

I have included a map showing the relative location of these properties below.

8. Matched Pair – McBride Place Solar Farm, Midland, NC

This project is located on Mount Pleasant Road, Midland, North Carolina. The property is on 627 acres on an assemblage of 974.59 acres. The solar farm was approved in early 2017 for a 74.9 MW facility.

I have considered the sale of 4380 Joyner Road which adjoins the proposed solar farm near the northwest section. This property was appraised in April of 2017 for a value of $317,000 with no consideration of any impact due to the solar farm in that figure. The property sold in November

2018 for $325,000 with the buyer fully aware of the proposed solar farm. The landscaping buffer relative to Joyner Road, Hayden Way, Chanel Court and Kristi Lane is considered medium, while the landscaping for the home at the north end of Chanel Court is considered very light.

I have considered the following matched pairs to the subject property.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	4380 Joyner	12.00	11/22/2017	$325,000	1979	1,598	$203.38	3/2	2xGar	Ranch	Outbldg
Not	3870 Elkwood	5.50	8/24/2016	$250,000	1986	1,551	$161.19	3/2.5	Det 2xGar	Craft	
Not	8121 Lower Rocky	18.00	2/8/2017	$355,000	1977	1,274	$278.65	2/2	2xCarprt	Ranch	Eq. Fac.
Not	13531 Cabarrus	7.89	5/20/2016	$267,750	1981	2,300	$116.41	3/2	2xGar	Ranch	

Adjoining Sales Adjusted

Time	Acres	YB	Condition	GLA	BR/BA	Park	Other	Total	% Diff
								$325,000	
$7,500	$52,000	-$12,250	$10,000	$2,273	-$2,000	$2,500	$7,500	$317,523	2%
$7,100	-$48,000	$4,970		$23,156	$0	$3,000	-$15,000	$330,226	-2%
$8,033	$33,000	-$3,749	$20,000	-$35,832	$0	$0	$7,500	$296,702	9%
								Average	3%

The home at 4380 Joyner Road is 275 feet from the closest solar panel.

I also considered the recent sale of a lot at 5800 Kristi Lane that is on the east side of the proposed solar farm. This 4.22-acre lot sold in December 2017 for $94,000. A home was built on this lot in 2019 with the closest point from home to panel at 689 feet. The home site is heavily wooded and their remains a wooded buffer between the solar panels and the home. I spoke with the broker, Margaret Dabbs, who indicated that the solar farm was considered a positive by both buyer and seller as it ensures no subdivision will be happening in that area. Buyers in this market are looking for privacy and seclusion.

The breakdown of recent lot sales on Kristi are shown below with the lowest price paid for the lot with no solar farm exposure, though that lot has exposure to Mt Pleasant Road South. Still the older lot sales have exposure to the solar farm and sold for higher prices than the front lot and adjusting for time would only increase that difference.

Adjoining Lot Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	$/AC	$/Lot
	Adjoins	5811 Kristi	3.74	5/1/2018	$100,000	$26,738	$100,000
	Adjoins	5800 Kristi	4.22	12/1/2017	$94,000	$22,275	$94,000
	Not	5822 Kristi	3.43	2/24/2020	$90,000	$26,239	$90,000

The lot at 5811 Kristi Lane sold in May 2018 for $100,000 for a 3.74-acre lot. The home that was built later in 2018 is 505 feet to the closest solar panel. This home then sold to a homeowner for $530,000 in April 2020. I have compared this home sale to other properties in the area as shown below.

Adjoining Residential Sales After Solar Farm Built

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	5811 Kristi	3.74	3/31/2020	$530,000	2018	3,858	$137.38	5/3.5	2 Gar	2-story	Cement Ext
Not	3915 Tania	1.68	12/9/2019	$495,000	2007	3,919	$126.31	3/3.5	2 Gar	2-story	3Det Gar
Not	6782 Manatee	1.33	3/8/2020	$460,000	1998	3,776	$121.82	4/2/2h	2 Gar	2-story	Water
Not	314 Old Hickory	1.24	9/20/2019	$492,500	2017	3,903	$126.18	6/4.5	2 Gar	2-story	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	5811 Kristi								$530,000		5%
Not	3915 Tania	$6,285		$27,225	-$3,852		-$20,000		$504,657	5%	
Not	6782 Manatee	$1,189		$46,000	$4,995	$5,000			$517,183	2%	
Not	314 Old Hickory	$10,680		$2,463	-$2,839	-$10,000			$492,803	7%	

After adjusting the comparables, I found that the average adjusted value shows a slight increase in value for the subject property adjoining a solar farm. As in the other cases, this is a mild positive impact on value but within the typical range of real estate transactions.

I also looked at 5833 Kristi Lane that sold on 9/14/2020 for $625,000. This home is 470 feet from the closest panel.

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Nearby	5833 Kristi	4.05	9/14/2020	$625,000	2008	4,373	$142.92	5/4	3-Car	2-Brick	
Not	4055 Dakeita	4.90	12/30/2020	$629,000	2005	4,427	$142.08	4/4	4-Car	2-Brick	4DetGar/Stable
Not	9615 Bales	2.16	6/30/2020	$620,000	2007	4,139	$149.79	4/5	3-Car	2-Stone	2DetGar
Not	9522 Bales	1.47	6/18/2020	$600,000	2007	4,014	$149.48	4/4.5	3-Car	2-Stone	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
5833 Kristi								$625,000			470
4055 Dakeita	-$9,220		$5,661	-$6,138		-$25,000		$594,303	5%		
9615 Bales	$6,455		$1,860	$28,042	-$10,000	-$15,000		$631,356	-1%		
9522 Bales	$7,233		$1,800	$42,930	-$5,000			$646,963	-4%		
										0%	

The average difference is 0% impact and the differences are all within a close range with this set of comparables and supports a finding of no impact on property value.

I have also looked at 4504 Chanel Court. This home sold on January 1, 2020 for $393,500 for this 3,010 square foot home built in 2004 with 3 bedrooms, 3.5 bathrooms, and a 3-car garage. This home includes a full partially finished basement that significantly complicates comparing this to other sales. This home previously sold on January 23, 2017 for $399,000. This was during the time that the solar farm was a known factor as the solar farm was approved in early 2017 and public discussions had already commenced. I spoke with Rachelle Killman with Real Estate Realty, LLC the buyer's agent for this transaction and she indicated that the solar farm was not a factor or consideration for the buyer. She noted that you could see the panels sort of through the trees, but it wasn't a concern for the buyer. She was not familiar with the earlier 2017 sale, but indicated that it was likely too high. This again goes back to the partially finished basement issue. The basement has a fireplace, and an installed 3/4 bathroom but otherwise bare studs and concrete floors with different buyers assigning varying value to that partly finished space. I also reached out to Don Gomez with Don Anthony Realty, LLC as he was the listing agent.

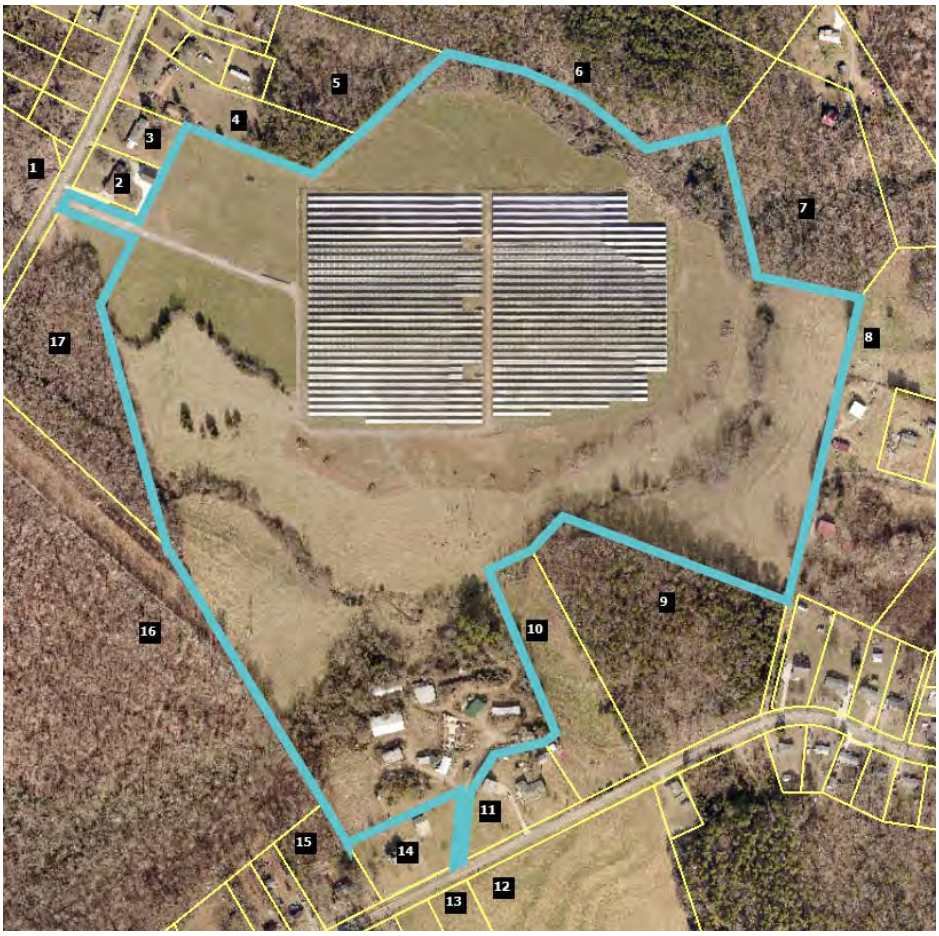
I also looked at the recent sale of 4599 Chanel Court. This home is within 310 feet of solar panels but notably does not have a good landscaping screen in place as shown in the photo below. The plantings appear to be less than 3-feet in height and only a narrow, limited screen of existing hardwoods were kept. The photograph is from the listing.

According to Scott David with Better Homes and Gardens Paracle Realty, this property was under contract for $550,000 contingent on the buyer being able to sell their former home. The former home was apparently overpriced and did not sell and the contract stretched out over 2.5 months.

The seller was in a bind as they had a home they were trying to buy contingent on this closing and were about to lose that opportunity. A cash buyer offered them a quick close at $500,000 and the seller accepted that offer in order to not lose the home they were trying to buy. According to Mr. David, the original contracted buyer and the actual cash buyer never considered the solar farm as a negative. In fact Mr. David noted that the actual buyer saw it as a great opportunity to purchase a home where a new subdivision could not be built behind his house. I therefore conclude that this property supports a finding of no impact on adjoining property, even where the landscaping screen still requires time to grow in for a year-round screen.

I also considered a sale/resale analysis on this property. This same home sold on September 15, 2015 for $462,000. Adjusting this upward by 5% per year for the five years between these sales dates suggests a value of $577,500. Comparing that to the $550,000 contract that suggests a 5% downward impact, which is within a typical market variation. Given that the broker noted no negative impact from the solar farm and the analysis above, I conclude this sale supports a finding of no impact on value.

9. Matched Pair – Mariposa Solar, Gaston County, NC



This project is a 5 MW facility located on 35.80 acres out of a parent tract of 87.61 acres at 517 Blacksnake Road, Stanley that was built in 2016.

I have considered a number of recent sales around this facility as shown below.

The first is identified in the map above as Parcel 1, which is 215 Mariposa Road. This is an older dwelling on large acreage with only one bathroom. I've compared it to similar nearby homes as shown below. The landscaping buffer for this home is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style
Adjoins	215 Mariposa	17.74	12/12/2017	$249,000	1958	1,551	$160.54	3/1	Garage	Br/Rnch
Not	249 Mariposa	0.48	3/1/2019	$153,000	1974	1,792	$85.38	4/2	Garage	Br/Rnch
Not	110 Airport	0.83	5/10/2016	$166,000	1962	2,165	$76.67	3/2	Crprt	Br/Rnch
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	1980	2,156	$112.48	3/2	Drive	1.5
Not	1201 Abernathy	27.00	5/3/2018	$390,000	1970	2,190	$178.08	3/2	Crprt	Br/Rnch

Adjoining Residential Sales After Solar Farm Approved **Adjoining Sales Adjusted**

Solar	Address	Acres	Date Sold	Sales Price	Time	YB	Acres	GLA	BR/BA	Park	Other	Total	% Diff
Adjoins	215 Mariposa	17.74	12/12/2017	$249,000								$249,000	
Not	249 Mariposa	0.48	3/1/2019	$153,000	-$5,583	-$17,136	$129,450	-$20,576	-$10,000			$229,154	8%
Not	110 Airport	0.83	5/10/2016	$166,000	$7,927	-$4,648	$126,825	-$47,078	-$10,000			$239,026	4%
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	-$5,621	-$37,345	$95,475	-$68,048	-$10,000	$5,000		$221,961	11%
Not	1201 Abernathy	27.00	5/3/2018	$390,000	-$4,552	-$32,760	-$69,450	-$60,705	-$10,000			$212,533	15%
												Average	9%

The average difference after adjusting for all factors is +9% on average, which suggests an enhancement due to the solar farm across the street. Given the large adjustments for acreage and size, I will focus on the low end of the adjusted range at 4%, which is within the typical deviation and therefore suggests no impact on value.

I have also considered Parcel 4 that sold after the solar farm was approved but before it had been constructed in 2016. The landscaping buffer for this parcel is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	242 Mariposa	2.91	9/21/2015	$180,000	1962	1,880	$95.74	3/2	Carport	Br/Rnch	Det Wrkshop
Not	249 Mariposa	0.48	3/1/2019	$153,000	1974	1,792	$85.38	4/2	Garage	Br/Rnch	
Not	110 Airport	0.83	5/10/2016	$166,000	1962	2,165	$76.67	3/2	Crprt	Br/Rnch	
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	1980	2,156	$112.48	3/2	Drive	1.5	

Adjoining Residential Sales After Solar Farm Approved **Adjoining Sales Adjusted**

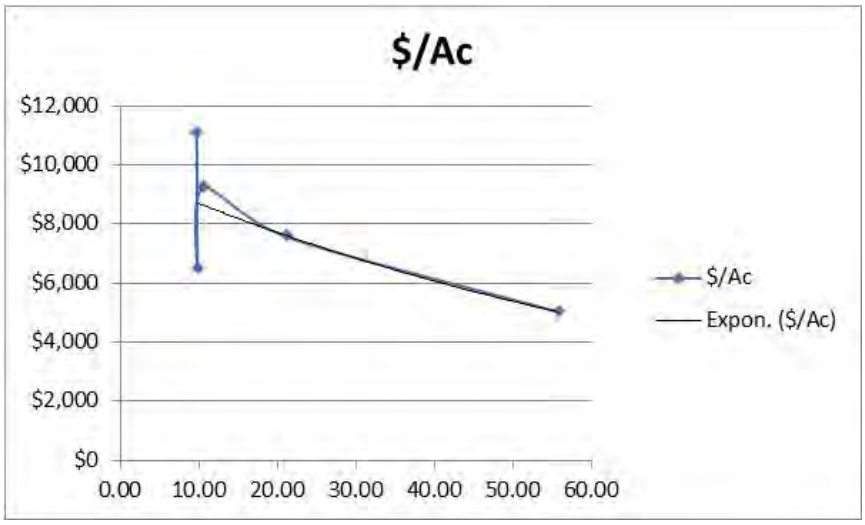
Solar	Address	Acres	Date Sold	Sales Price	Time	YB	Acres	GLA	BR/BA	Park	Other	Total	% Diff
Adjoins	242 Mariposa	2.91	9/21/2015	$180,000								$180,000	
Not	249 Mariposa	0.48	3/1/2019	$153,000	-$15,807	-$12,852	$18,468	$7,513		-$3,000	$25,000	$172,322	4%
Not	110 Airport	0.83	5/10/2016	$166,000	-$3,165	$0	$15,808	-$28,600			$25,000	$175,043	3%
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	-$21,825	-$30,555	-$15,960	-$40,942		$2,000	$25,000	$160,218	11%
												Average	6%

The average difference after adjusting for all factors is +6%, which is again suggests a mild increase in value due to the adjoining solar farm use. The median is a 4% adjustment, which is within a standard deviation and suggests no impact on property value.

I have also considered the recent sale of Parcel 13 that is located on Blacksnake Road south of the project. I was unable to find good land sales in the same 20-acre range, so I have considered sales of larger and smaller acreage. I adjusted each of those land sales for time. I then applied the price per acre to a trendline to show where the expected price per acre would be for 20 acres. As can be seen in the chart below, this lines up exactly with the purchase of the subject property. I therefore conclude that there is no impact on Parcel 13 due to proximity to the solar farm.

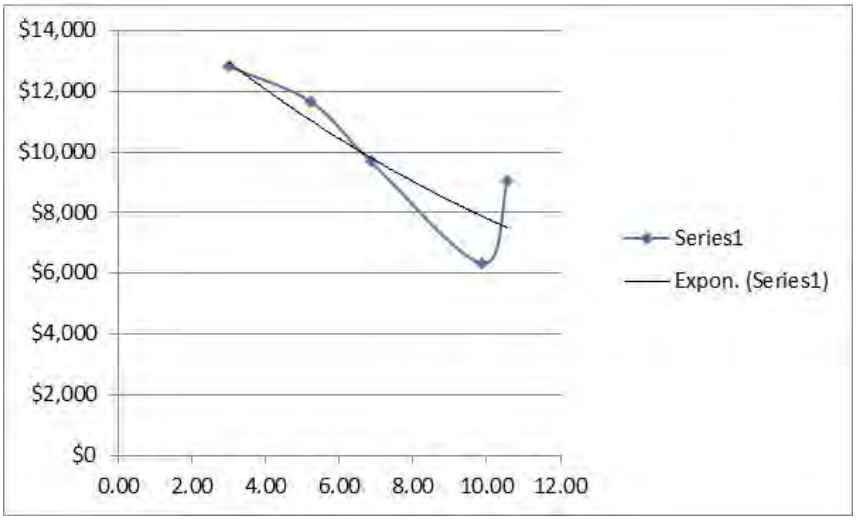
Adjoining Residential Land Sales After Solar Farm Approved **Adjoining Sales Adjusted**

Solar	Tax/Street	Acres	Date Sold	Sales Price	$/Ac	Time	$/Ac
Adjoins	174339/Blacksnake	21.15	6/29/2018	$160,000	$7,565		$7,565
Not	227852/Abernathy	10.57	5/9/2018	$97,000	$9,177	$38	$9,215
Not	17443/Legion	9.87	9/7/2018	$64,000	$6,484	-$37	$6,447
Not	164243/Alexis	9.75	2/1/2019	$110,000	$11,282	-$201	$11,081
Not	176884/Bowden	55.77	6/13/2018	$280,000	$5,021	$7	$5,027



Finally, I have considered the recent sale of Parcel 17 that sold as vacant land. I was unable to find good land sales in the same 7-acre range, so I have considered sales of larger and smaller acreage. I adjusted each of those land sales for time. I then applied the price per acre to a trendline to show where the expected price per acre would be for 7 acres. As can be seen in the chart below, this lines up with the trendline running right through the purchase price for the subject property. I therefore conclude that there is no impact on Parcel 13 due to proximity to the solar farm. I note that this property was improved with a 3,196 square foot ranch built in 2018 following the land purchase, which shows that development near the solar farm was unimpeded.

Adjoining Residential Land Sales After Solar Farm Approved						**Adjoining Sales Adjusted**		
Solar	**Tax/Street**	**Acres**	**Date Sold**	**Sales Price**	**$/Ac**	**Time**	**Location**	**$/Ac**
Adjoins	227039/Mariposa	6.86	12/6/2017	$66,500	$9,694			$9,694
Not	227852/Abernathy	10.57	5/9/2018	$97,000	$9,177	-$116		$9,061
Not	17443/Legion	9.87	9/7/2018	$64,000	$6,484	-$147		$6,338
Not	177322/Robinson	5.23	5/12/2017	$66,500	$12,715	$217	-$1,272	$11,661
Not	203386/Carousel	2.99	7/13/2018	$43,500	$14,548	-$262	-$1,455	$12,832



10. Matched Pair – Clarke County Solar, Clarke County, VA

This project is a 20 MW facility located on a 234-acre tract that was built in 2017.

I have considered two recent sales of Parcel 3. The home on this parcel is 1,230 feet from the closest panel as measured in the second map from Google Earth, which shows the solar farm under construction. This home sold in January 2017 for $295,000 and again in August 2019 for $385,000. I show each sale below and compare those to similar home sales in each time frame. The significant increase in price between 2017 and 2019 is due to a major kitchen remodel, new roof, and related upgrades as well as improvement in the market in general. The sale and later resale of the home with updates and improvements speaks to pride of ownership and increasing overall value as properties perceived as diminished are less likely to be renovated and sold for profit.

I note that 102 Tilthammer includes a number of barns that I did not attribute any value in the analysis. The market would typically give some value for those barns but even without that adjustment there is an indication of a positive impact on value due to the solar farm. The landscaping buffer from this home is considered light.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
3	Adjoins	833 Nations Spr	5.13	8/18/2019	$385,000	1979	1,392	$276.58	3/2	Det Gar	Ranch	UnBsmt
	Not	167 Leslie	5.00	8/19/2020	$429,000	1980	1,665	$257.66	3/2	Det2Gar	Ranch	
	Not	2393 Old Chapel	2.47	8/10/2020	$330,000	1974	1,500	$220.00	3/1.5	Det Gar	Ranch	
	Not	102 Tilthammer	6.70	5/7/2019	$372,000	1970	1,548	$240.31	3/1.5	Det Gar	Ranch	UnBsmt

Adjoining Sales Adjusted

Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
							$385,000			1230
-$13,268		-$2,145	-$56,272		-$5,000	$50,000	$402,315	-4%		
-$9,956	$25,000	$8,250	-$19,008	$5,000		$50,000	$389,286	-1%		
$3,229		$16,740	-$29,991	$5,000			$366,978	5%		
									0%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
3	Adjoins	833 Nations Spr	5.13	1/9/2017	$295,000	1979	1,392	$211.93	3/2	Det Gar	Ranch	UnBsmt
	Not	6801 Middle	2.00	12/12/2017	$249,999	1981	1,584	$157.83	3/2	Open	Ranch	
	Not	4174 Rockland	5.06	1/2/2017	$300,000	1990	1,688	$177.73	3/2	2 Gar	2-story	
	Not	400 Sugar Hill	1.00	6/7/2018	$180,000	1975	1,008	$178.57	3/1	Open	Ranch	

Adjoining Sales Adjusted

Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
							$295,000			1230
-$7,100	$25,000	-$2,500	-$24,242		$5,000	$50,000	$296,157	0%		
$177		-$16,500	-$42,085		-$10,000	$50,000	$281,592	5%		
-$7,797		$3,600	$54,857	$10,000	$5,000	$50,000	$295,661	0%		
									1%	

11. Matched Pair – Simon Solar, Social Circle, GA

This 30 MW solar farm is located off Hawkins Academy Road and Social Circle Fairplay Road. I identified three adjoining sales to this tract after development of the solar farm. However, one of those is shown as Parcel 12 in the map above and includes a powerline easement encumbering over a third of the 5 acres and adjoins a large substation as well. It would be difficult to isolate those impacts from any potential solar farm impact and therefore I have excluded that sale. I also excluded the recent sale of Parcel 17, which is a farm with conservation restrictions on it that similarly would require a detailed examination of those conservation restrictions in order to see if there was any impact related to the solar farm. I therefore focused on the recent sale of Parcel 7 and the adjoining parcel to the south of that. They are technically not adjoining due to the access road for the flag-shaped lot to the east. Furthermore, there is an apparent access easement serving the two rear lots that encumber these two parcels which is a further limitation on these sales. This analysis assumes that the access easement does not negatively impact the subject property, though it may.

The landscaping buffer relative to this parcel is considered medium.

Adjoining Land Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	$/AC	Type	Other
7+	Adjoins	4514 Hawkins	36.86	3/31/2016	$180,000	$4,883	Pasture	Esmts
	Not	HD Atha	69.95	12/20/2016	$357,500	$5,111	Wooded	N/A
	Not	Pannell	66.94	11/8/2016	$322,851	$4,823	Mixed	*
	Not	1402 Roy	123.36	9/29/2016	$479,302	$3,885	Mixed	**

* Adjoining 1 acre purchased by same buyer in same deed. Allocation assigned on the County Tax Record.

** Dwelling built in 1996 with a 2016 tax assessed value of $75,800 deducted from sales price to reflect land value

Adjoining Sales Adjusted						Avg
Time	Size	Type	Other	Total/Ac	% Diff	% Diff
				$4,883		
$89	$256			$5,455	-12%	
-$90	$241			$4,974	-2%	
-$60	$389			$4,214	14%	
						0%

The range of impact identified by these matched pairs are -12% to +14%, with an average of 0% impact due to the solar farm. The best matched pair with the least adjustment supports a -2% impact due to the solar farm. I note again that this analysis considers no impact for the existing access easements that meander through this property and it may be having an impact. Still at -2% impact as the best indication for the solar farm, I consider that to be no impact given that market fluctuations support +/- 5%.

12. Matched Pair – Candace Solar, Princeton, NC

This 5 MW solar farm is located at 4839 US 70 Highway just east of Herring Road. This solar farm was completed on October 25, 2016.

I identified three adjoining sales to this tract after development of the solar farm with frontage on US 70. I did not attempt to analyze those sales as they have exposure to an adjacent highway and railroad track. Those homes are therefore problematic for a matched pair analysis unless I have similar homes fronting on a similar corridor.

I did consider a land sale and a home sale on adjoining parcels without those complications.

The lot at 499 Herring Road sold to Paradise Homes of Johnston County of NC, Inc. for $30,000 in May 2017 and a modular home was placed there and sold to Karen and Jason Toole on September 29, 2017. I considered the lot sale first as shown below and then the home sale that followed. The landscaping buffer relative to this parcel is considered medium.

Adjoining Land Sales After Solar Farm Approved							**Adjoining Sales Adjusted**				
Parcel	**Solar**	**Address**	**Acres**	**Date Sold**	**Sales Price**	**Other**	**Time**	**Site**	**Other**	**Total**	**% Diff**
16	Adjoins	499 Herring	2.03	5/1/2017	$30,000					$30,000	
	Not	37 Becky	0.87	7/23/2019	$24,500	Sub/Pwr	-$1,679	$4,900		$27,721	8%
	Not	5858 Bizzell	0.88	8/17/2016	$18,000		$390	$3,600		$21,990	27%
	Not	488 Herring	2.13	12/20/2016	$35,000		$389			$35,389	-18%
										Average	5%

Following the land purchase, the modular home was placed on the site and sold. I have compared this modular home to the following sales to determine if the solar farm had any impact on the purchase price.

Adjoining Residential Sales After Solar Farm Approved

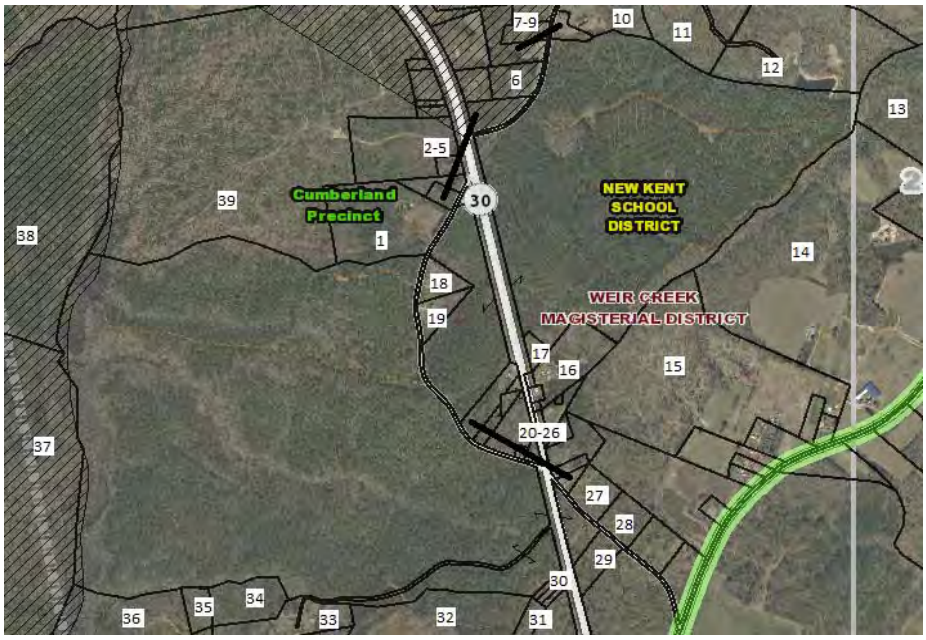
Parcel	**Solar**	**Address**	**Acres**	**Date Sold**	**Sales Price**	**Built**	**GBA**	**$/GBA**	**BR/BA**	**Park**	**Style**	**Other**
16	Adjoins	499 Herring	2.03	9/27/2017	$215,000	2017	2,356	$91.26	4/3	Drive	Modular	
	Not	678 WC	6.32	3/8/2019	$226,000	1995	1,848	$122.29	3/2.5	Det Gar	Mobile	Ag bldgs
	Not	1810 Bay V	8.70	3/26/2018	$170,000	2003	2,356	$72.16	3/2	Drive	Mobile	Ag bldgs
	Not	1795 Bay V	1.78	12/1/2017	$194,000	2017	1,982	$97.88	4/3	Drive	Modular	

Adjoining Residential Sales Af			**Adjoining Sales Adjusted**									**Avg**	
Parcel	**Solar**	**Address**	**Time**	**Site**	**YB**	**GLA**	**BR/BA**	**Park**	**Other**	**Total**	**% Diff**	**% Diff**	**Distance**
16	Adjoins	499 Herring								$215,000			488
	Not	678 WC	-$10,037	-$25,000	$24,860	$37,275	-$5,000	-$7,500	-$20,000	$220,599	-3%		
	Not	1810 Bay V	-$2,579	-$20,000	$11,900	$0				$159,321	26%		
	Not	1795 Bay V	-$1,063		$0	$21,964				$214,902	0%		
												8%	

The best comparable is 1795 Bay Valley as it required the least adjustment and was therefore most similar, which shows a 0% impact. This signifies no impact related to the solar farm.

The range of impact identified by these matched pairs ranges are therefore -3% to +26% with an average of +8% for the home and an average of +4% for the lot, though the best indicator for the lot shows a $5,000 difference in the lot value due to the proximity to the solar farm or a -12% impact.

13. Matched Pair – Walker-Correctional Solar, Barham Road, Barhamsville, VA



This project was built in 2017 and located on 484.65 acres for a 20 MW with the closest home at 110 feet from the closest solar panel with an average distance of 500 feet.

I considered the recent sale identified on the map above as Parcel 19, which is directly across the street and based on the map shown on the following page is 250 feet from the closest panel. A

limited buffering remains along the road with natural growth being encouraged, but currently the panels are visible from the road. Alex Uminski, SRA with MGMiller Valuations in Richmond VA confirmed this sale with the buying and selling broker. The selling broker indicated that the solar farm was not a negative influence on this sale and in fact the buyer noticed the solar farm and then discovered the listing. The privacy being afforded by the solar farm was considered a benefit by the buyer. I used a matched pair analysis with a similar sale nearby as shown below and found no negative impact on the sales price. Property actually closed for more than the asking price. The landscaping buffer is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	5241 Barham	2.65	10/18/2018	$264,000	2007	1,660	$159.04	3/2	Drive	Ranch	Modular
Not	17950 New Kent	5.00	9/5/2018	$290,000	1987	1,756	$165.15	3/2.5	3 Gar	Ranch	
Not	9252 Ordinary	4.00	6/13/2019	$277,000	2001	1,610	$172.05	3/2	1.5-Gar	Ranch	
Not	2416 W Miller	1.04	9/24/2018	$299,000	1999	1,864	$160.41	3/2.5	Gar	Ranch	

Adjoining Sales Adjusted

Solar	Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
Adjoins	5241 Barham								$264,000		250
Not	17950 New Kent		-$8,000	$29,000	-$4,756	-$5,000	-$20,000	-$15,000	$266,244	-1%	
Not	9252 Ordinary	-$8,310	-$8,000	$8,310	$2,581		-$10,000	-$15,000	$246,581	7%	
Not	2416 W Miller		$8,000	$11,960	-$9,817	-$5,000	-$10,000	-$15,000	$279,143	-6%	
								Average Diff		0%	

I also spoke with Patrick W. McCrerey of Virginia Estates who was marketing a property that sold at 5300 Barham Road adjoining the Walker-Correctional Solar Farm. He indicated that this property was unique with a home built in 1882 and heavily renovated and updated on 16.02 acres. The solar farm was through the woods and couldn't be seen by this property and it had no impact on marketing this property. This home sold on April 26, 2017 for $358,000. I did not set up any matched pairs for this property since it is a unique property that any such comparison would be difficult to rely on. The broker's comments do support the assertion that the adjoining solar farm had no impact on value. The home in this case was 510 feet from the closest panel.

14. Matched Pair – Innovative Solar 46, Roslin Farm Rd, Hope Mills, NC

This project was built in 2016 and located on 532 acres for a 78.5 MW solar farm with the closest home at 125 feet from the closest solar panel with an average distance of 423 feet.

I considered the recent sale of a home on Roslin Farm Road just north of Running Fox Road as shown below. This sale supports an indication of no impact on property value. The landscaping buffer is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	6849 Roslin Farm	1.00	2/18/2019	$155,000	1967	1,610	$96.27	3/3	Drive	Ranch	Brick	435
Not	6592 Sim Canady	2.43	9/5/2017	$185,000	1974	2,195	$84.28	3/2	Gar	Ranch	Brick	
Not	1614 Joe Hall	1.63	9/3/2019	$145,000	1974	1,674	$86.62	3/2	Det Gar	Ranch	Brick	
Not	109 Bledsoe	0.68	1/17/2019	$150,000	1973	1,663	$90.20	3/2	Gar	Ranch	Brick	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	6849 Roslin Farm								$155,000		5%
Not	6592 Sim Canady	$8,278		-$6,475	-$39,444	$10,000	-$5,000		$152,359	2%	
Not	1614 Joe Hall	-$2,407		-$5,075	-$3,881	$10,000	-$2,500		$141,137	9%	
Not	109 Bledsoe	$404	$10,000	-$4,500	-$3,346		-$5,000		$147,558	5%	

15. Matched Pair – Innovative Solar 42, County Line Rd, Fayetteville, NC

This project was built in 2017 and located on 413.99 acres for a 71 MW with the closest home at 135 feet from the closest solar panel with an average distance of 375 feet.

I considered the recent sales identified on the map above as Parcels 2 and 3, which is directly across the street these homes are 330 and 340 feet away. Parcel 2 includes an older home built in 1976, while Parcel 3 is a new home built in 2019. So the presence of the solar farm had no impact on new construction in the area.

The matched pairs for each of these are shown below. The landscaping buffer relative to these parcels is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	2923 County Ln	8.98	2/28/2019	$385,000	1976	2,905	$132.53	3/3	2-Car	Ranch	Brick/Pond	340
Not	1928 Shaw Mill	17.00	7/3/2019	$290,000	1977	3,001	$96.63	4/4	2-Car	Ranch	Brick/Pond/Rental	
Not	2109 John McM.	7.78	4/25/2018	$320,000	1978	2,474	$129.35	3/2	Det Gar	Ranch	Vinyl/Pool,Stable	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	2923 County Ln								$385,000		3%
Not	1928 Shaw Mill	-$3,055	$100,000	-$1,450	-$7,422	-$10,000			$368,074	4%	
Not	2109 John McM.	$8,333		-$3,200	$39,023	$10,000		$5,000	$379,156	2%	

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	2935 County Ln	1.19	6/18/2019	$266,000	2019	2,401	$110.79	4/3	Gar	2-Story		330
Not	3005 Hemingway	1.17	5/16/2019	$269,000	2018	2,601	$103.42	4/3	Gar	2-Story		
Not	7031 Glynn Mill	0.60	5/8/2018	$255,000	2017	2,423	$105.24	4/3	Gar	2-Story		
Not	5213 Bree Brdg	0.92	5/7/2019	$260,000	2018	2,400	$108.33	4/3	3-Gar	2-Story		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	2935 County Ln								$266,000		3%
Not	3005 Hemingway	$748		$1,345	-$16,547				$254,546	4%	
Not	7031 Glynn Mill	$8,724		$2,550	-$1,852				$264,422	1%	
Not	5213 Bree Brdg	$920		$1,300	$76			-$10,000	$252,296	5%	

Both of these matched pairs adjust to an average of +3% on impact for the adjoining solar farm, meaning there is a slight positive impact due to proximity to the solar farm. This is within the standard +/- of typical real estate transactions, which strongly suggests no impact on property value. I noted specifically that for 2923 County Line Road, the best comparable is 2109 John McMillan as it does not have the additional rental unit on it. I made no adjustment to the other sale for the value of that rental unit, which would have pushed the impact on that comparable downward – meaning there would have been a more significant positive impact.

16. Matched Pair – Sunfish Farm, Keenebec Rd, Willow Spring, NC

This project was built in 2015 and located on 49.6 acres (with an inset 11.25-acre parcel) for a 6.4 MW project with the closest home at 135 feet with an average distance of 105 feet.

I considered the 2017 sale identified on the map above, which is 205 feet away from the closest panel. The matched pairs for each of these are shown below followed by a more recent map showing the panels at this site. The average difference in the three comparables and the subject property is +3% after adjusting for differences in the sales date, year built, gross living area, and other minor differences. This data is supported by the comments from the broker Brian Schroepfer with Keller Williams that the solar farm had no impact on the purchase price. The landscaping screen is considered light.

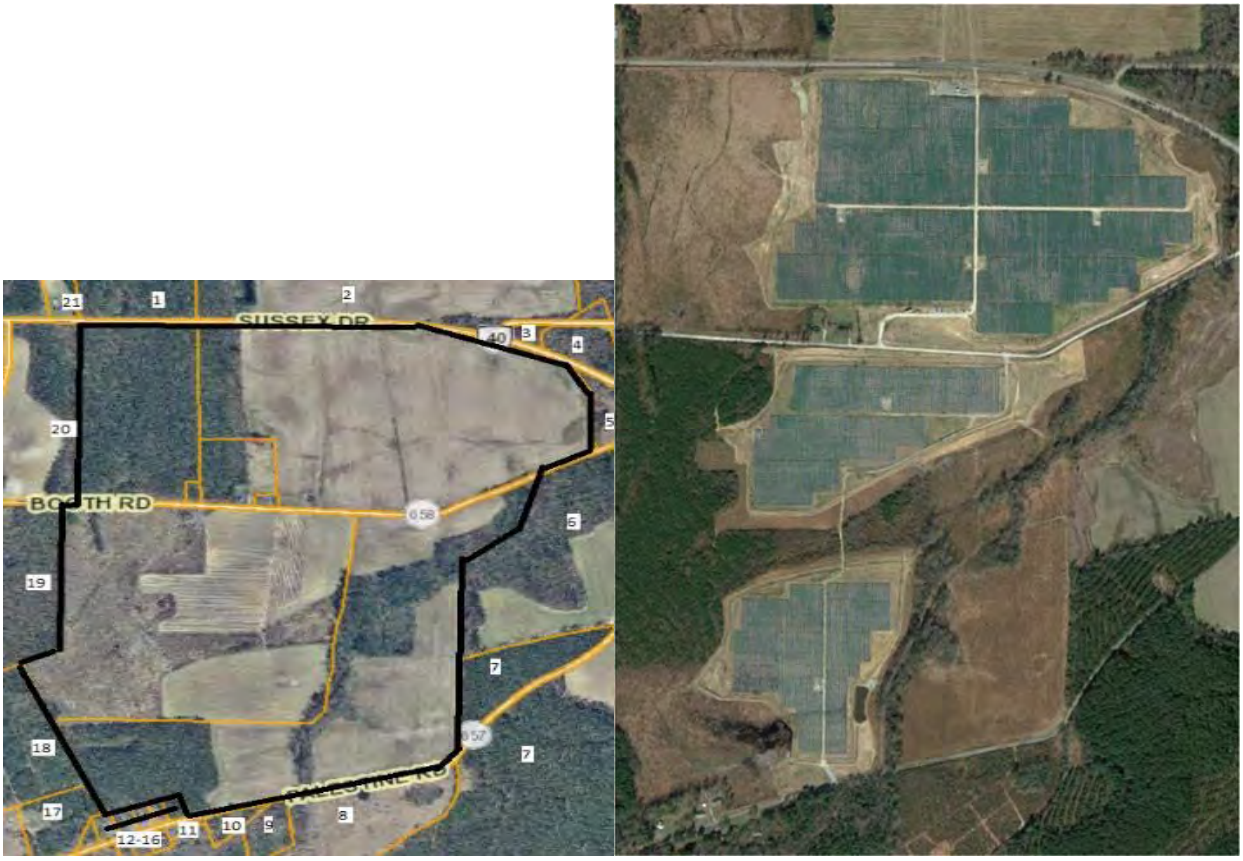
Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style
	Adjoins	7513 Glen Willow	0.79	9/1/2017	$185,000	1989	1,492	$123.99	3/2	Gar	BR/Rnch
	Not	2968 Tram	0.69	7/17/2017	$155,000	1984	1,323	$117.16	3/2	Drive	BR/Rnch
	Not	205 Pine Burr	0.97	12/29/2017	$191,000	1991	1,593	$119.90	3/2.5	Drive	BR/Rnch
	Not	1217 Old Honeycutt	1.00	12/15/2017	$176,000	1978	1,558	$112.97	3/2.5	2Carprt	VY/Rnch

Adjustments

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	7513 Glen Willow								$185,000		
Not	2968 Tram	$601		$3,875	$15,840		$10,000		$185,316	0%	
Not	205 Pine Burr	-$1,915		-$1,910	-$9,688	-$5,000			$172,487	7%	
Not	1217 Old Honeycutt	-$1,557		$9,680	-$5,965	-$5,000		$5,280	$178,438	4%	
											3%

17. Matched Pair – Sappony Solar, Sussex County, VA



This project is a 30 MW facility located on a 322.68-acre tract that was built in the fourth quarter of 2017.

I have considered the 2018 sale of Parcel 17 as shown below. This was a 1,900 s.f. manufactured home on a 6.00-acre lot that sold in 2018. I have compared that to three other nearby manufactured homes as shown below. The range of impacts is within typical market variation with an average of -1%, which supports a conclusion of no impact on property value. The landscaping buffer is considered medium.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
	Adjoins	12511 Palestine	6.00	7/31/2018	$128,400	2013	1,900	$67.58	4/2.5	Open	Manuf	
	Not	15698 Concord	3.92	7/31/2018	$150,000	2010	2,310	$64.94	4/2	Open	Manuf	Fence
	Not	23209 Sussex	1.03	7/7/2020	$95,000	2005	1,675	$56.72	3/2	Det Crpt	Manuf	
	Not	6494 Rocky Br	4.07	11/8/2018	$100,000	2004	1,405	$71.17	3/2	Open	Manuf	

Adjoining Sales Adjusted									Avg	
Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	% Diff	Distance
							$128,400			1425
$0		$2,250	-$21,299	$5,000			$135,951	-6%		
-$5,660	$13,000	$3,800	$10,209	$5,000	$1,500		$122,849	4%		
-$843		$4,500	$28,185				$131,842	-3%		
									-1%	

18. Matched Pair – Camden Dam, Camden, NC

This 5 MW project was built in 2019 and located on a portion of 49.83 acres.

Parcel 1 noted above along with the home on the adjoining parcel to the north of that parcel sold in late 2018 after this solar farm was approved but prior to construction being completed in 2019. I have considered this sale as shown below. The landscaping screen is considered light.

The comparable at 548 Trotman is the most similar and required the least adjustment shows no impact on property value. The other two comparables were adjusted consistently with one showing significant enhancement and another as showing a mild negative. The best indication is the one requiring the least adjustment. The other two sales required significant site adjustments which make them less reliable. The best comparable and the average of these comparables support a finding of no impact on property value.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	122 N Mill Dam	12.19	11/29/2018	$350,000	2005	2,334	$149.96	3/3.5	3-Gar	Ranch	
Not	548 Trotman	12.10	5/31/2018	$309,000	2007	1,960	$157.65	4/2	Det2G	Ranch	Wrkshp
Not	198 Sand Hills	2.00	12/22/2017	$235,000	2007	2,324	$101.12	4/3	Open	Ranch	
Not	140 Sleepy Hlw	2.05	8/12/2019	$330,000	2010	2,643	$124.86	4/3	1-Gar	1.5 Story	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
122 N Mill Dam								$350,000			342
548 Trotman	$6,163		-$3,090	$35,377	$5,000			$352,450	-1%		
198 Sand Hills	$8,808	$45,000	-$2,350	$607		$30,000		$317,064	9%		
140 Sleepy Hlw	-$9,258	$45,000	-$8,250	-$23,149	$5,000	$30,000		$369,343	-6%		
										1%	

19. Matched Pair – Grandy Solar, Grandy, NC

This 20 MW project was built in 2019 and located on a portion of 121 acres.

Parcels 40 and 50 have sold since construction began on this solar farm. I have considered both in matched pair analysis below. I note that the marketing for Parcel 40 (120 Par Four) identified the lack of homes behind the house as a feature in the listing. The marketing for Parcel 50 (269 Grandy) identified the property as "very private." Landscaping for both of these parcels is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	120 Par Four	0.92	8/17/2019	$315,000	2006	2,188	$143.97	4/3	2-Gar	1.5 Story	Pool
Not	102 Teague	0.69	1/5/2020	$300,000	2005	2,177	$137.80	3/2	Det 3G	Ranch	
Not	112 Meadow Lk	0.92	2/28/2019	$265,000	1992	2,301	$115.17	3/2	Gar	1.5 Story	
Not	116 Barefoot	0.78	9/29/2020	$290,000	2004	2,192	$132.30	4/3	2-Gar	2 Story	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
120 Par Four								$315,000			405
102 Teague	-$4,636		$1,500	$910	$10,000		$20,000	$327,774	-4%		
112 Meadow Lk	$4,937		$18,550	-$7,808	$10,000	$10,000	$20,000	$320,679	-2%		
116 Barefoot	-$12,998		$2,900	-$318			$20,000	$299,584	5%		
										0%	

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	269 Grandy	0.78	5/7/2019	$275,000	2019	1,535	$179.15	3/2.5	2-Gar	Ranch	
Not	307 Grandy	1.04	10/8/2018	$240,000	2002	1,634	$146.88	3/2	Gar	1.5 Story	
Not	103 Branch	0.95	4/22/2020	$230,000	2000	1,532	$150.13	4/2	2-Gar	1.5 Story	
Not	103 Spring Lf	1.07	8/14/2018	$270,000	2002	1,635	$165.14	3/2	2-Gar	Ranch	Pool

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
269 Grandy								$275,000			477
307 Grandy	$5,550		$20,400	-$8,725	$5,000	$10,000		$272,225	1%		
103 Branch	-$8,847		$21,850	$270				$243,273	12%		
103 Spring Lf	$7,871		$22,950	-$9,908	$5,000		-$20,000	$275,912	0%		
										4%	

Both of these matched pairs support a finding of no impact on value. This is reinforced by the listings for both properties identifying the privacy due to no housing in the rear of the property as part of the marketing for these homes.

20. Matched Pair – Champion Solar, Lexington County, SC

This project is a 10 MW facility located on a 366.04-acre tract that was built in 2017.

I have considered the 2020 sale of an adjoining home located off 517 Old Charleston Road. Landscaping is considered light.

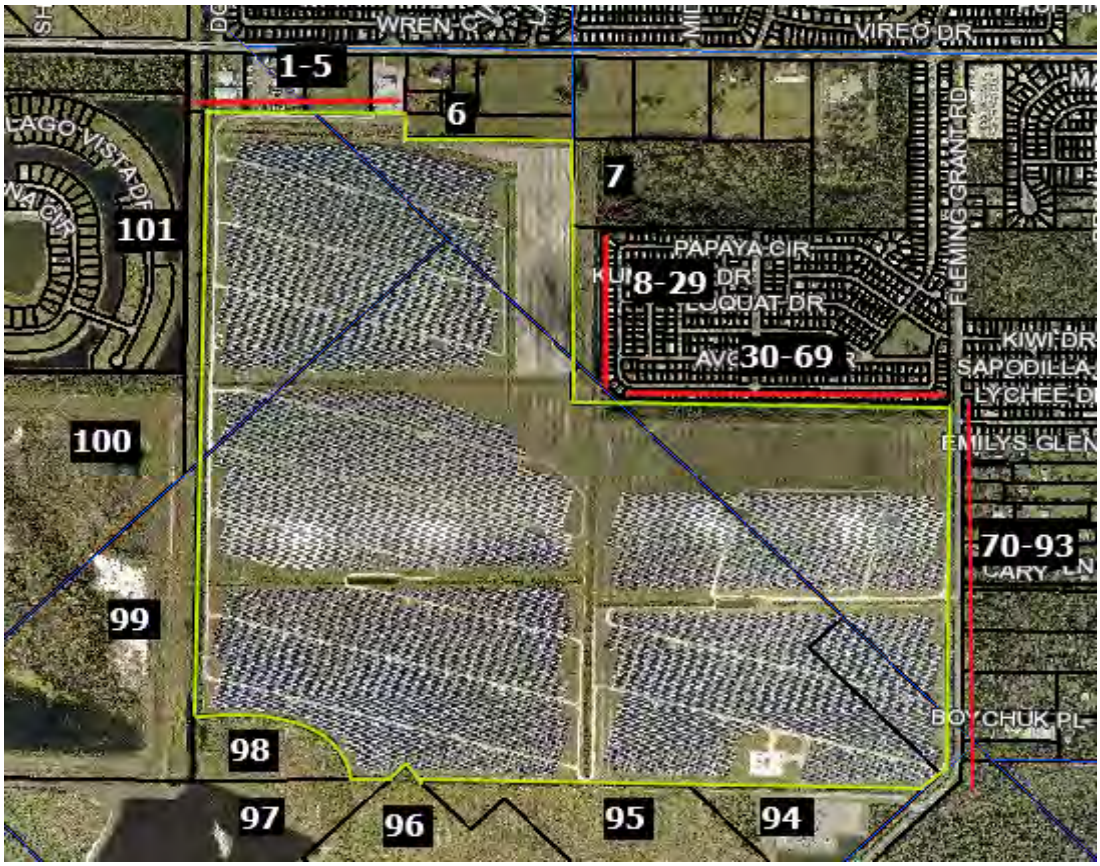
Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	517 Old Charleston	11.05	8/25/2020	$110,000	1962	925	$118.92	3/1	Crport	Br Rnch	
Not	133 Buena Vista	2.65	6/21/2020	$115,000	1979	1,104	$104.17	2/2	Crport	Br Rnch	
Not	214 Crystal Spr	2.13	6/10/2019	$102,500	1970	1,025	$100.00	3/2	Crport	Rnch	
Not	1429 Laurel	2.10	2/21/2019	$126,000	1960	1,250	$100.80	2/1.5	Open	Br Rnch	3 Gar/Brn

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
517 Old Charleston								$110,000			505
133 Buena Vista	$410	$17,000	-$9,775	-$14,917	-$10,000			$97,718	11%		
214 Crystal Spr	$2,482	$18,000	-$4,100	-$8,000	-$10,000		$10,000	$110,882	-1%		
1429 Laurel	$3,804	$18,000	$1,260	-$26,208	-$5,000	$5,000	-$15,000	$107,856	2%		
										4%	

21. Matched Pair – Barefoot Bay Solar Farm, Barefoot Bay, FL



This project is located on 504 acres for a 704.5 MW facility. Most of the adjoining uses are medium density residential with some lower density agricultural uses to the southwest. This project was built in 2018. There is a new subdivision under development to the west.

I have considered a number of recent home sales from the Barefoot Bay Golf Course in the Barefoot Bay Recreation District. There are a number of sales of these mobile/manufactured homes along the eastern boundary and the lower northern boundary. I have compared those home sales to other similar homes in the same community but without the exposure to the solar farm. Staying within the same community keeps location and amenity impacts consistent. I did avoid any comparison with home sales with golf course or lakefront views as that would introduce another variable.

The six manufactured/double wide homes shown below were each compared to three similar homes in the same community and are consistently showing no impact on the adjoining property values. Based on the photos from the listings, there is limited but some visibility of the solar farm to the east, but the canal and landscaping between are providing a good visual buffer and actually are commanding a premium over the non-canal homes.

Landscaping for these adjoining homes is considered light, though photographs from the listings show that those homes on Papaya that adjoin the solar farm from east/west have no visibility of the solar farm and is effectively medium density due to the height differential. The homes that adjoin the solar farm from north/south along Papaya have some filtered view of the solar farm through the trees.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
14	Adjoins	465 Papaya Cr	0.12	7/21/2019	$155,000	1993	1,104	$140.40	2/2	Drive	Manuf	Canal
	Not	1108 Navajo	0.14	2/27/2019	$129,000	1984	1,220	$105.74	2/2	Crprt	Manuf	Canal
	Not	1007 Barefoot	0.11	9/3/2020	$168,000	2005	1,052	$159.70	2/2	Crprt	Manuf	Canal
	Not	1132 Waterway	0.11	7/10/2020	$129,000	1982	1,012	$127.47	2/2	Crprt	Manuf	Canal

Adjoining Sales Adjusted

Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
465 Papaya Cr							$155,000			765
1108 Navajo	$1,565	$5,805	-$9,812				$126,558	18%		
1007 Barefoot	-$5,804	-$10,080	$6,643				$158,759	-2%		
1132 Waterway	-$3,859	$7,095	$9,382				$141,618	9%		
									8%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
19	Adjoins	455 Papaya	0.12	9/1/2020	$183,500	2005	1,620	$113.27	3/2	Crprt	Manuf	Canal
	Not	938 Waterway	0.11	2/12/2020	$160,000	1986	1,705	$93.84	2/2	Crprt	Manuf	Canal
	Not	719 Barefoot	0.12	4/14/2020	$150,000	1996	1,635	$91.74	3/2	Crprt	Manuf	Canal
	Not	904 Fir	0.17	9/27/2020	$192,500	2010	1,626	$118.39	3/2	Crprt	Manuf	Canal

Adjoining Sales Adjusted

Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
455 Papaya							$183,500			750
938 Waterway	$2,724	$15,200	-$6,381				$171,542	7%		
719 Barefoot	$1,770	$6,750	-$1,101				$157,419	14%		
904 Fir	-$422	-$4,813	-$568				$186,697	-2%		
									6%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
37	Adjoins	419 Papaya	0.09	7/16/2019	$127,500	1986	1,303	$97.85	2/2	Crprt	Manuf	Green
	Not	865 Tamarind	0.12	2/4/2019	$133,900	1995	1,368	$97.88	2/2	Crprt	Manuf	Green
	Not	501 Papaya	0.10	6/15/2018	$109,000	1986	1,234	$88.33	2/2	Crprt	Manuf	
	Not	418 Papaya	0.09	8/28/2019	$110,000	1987	1,248	$88.14	2/2	Crprt	Manuf	

Adjoining Sales Adjusted

Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
419 Papaya							$127,500			690
865 Tamarind	$1,828	-$6,026	-$5,090				$124,613	2%		
501 Papaya	$3,637	$0	$4,876			$5,000	$122,513	4%		
418 Papaya	-$399	-$550	$3,878			$5,000	$117,930	8%		
									5%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
39	Adjoins	413 Papaya	0.09	7/16/2020	$130,000	2001	918	$141.61	2/2	Crprt	Manuf	Grn/Upd
	Not	341 Loquat	0.09	2/3/2020	$118,000	1985	989	$119.31	2/2	Crprt	Manuf	Full Upd
	Not	1119 Pocatella	0.19	1/5/2021	$120,000	1993	999	$120.12	2/2	Crprt	Manuf	Green
	Not	1367 Barefoot	0.10	1/12/2021	$130,500	1987	902	$144.68	2/2	Crprt	Manuf	Green/Upd

Adjoining Sales Adjusted

Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
413 Papaya							$130,000			690
341 Loquat	$1,631	$9,440	-$6,777				$122,294	6%		
1119 Pocatella	-$1,749	$4,800	-$7,784			$5,000	$120,267	7%		
1367 Barefoot	-$1,979	$9,135	$1,852				$139,507	-7%		
									2%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
48	Adjoins	343 Papaya	0.09	12/17/2019	$145,000	1986	1,508	$96.15	3/2	Crprt	Manuf	Gn/Fc/Upd
	Not	865 Tamarind	0.12	2/4/2019	$133,900	1995	1,368	$97.88	2/2	Crprt	Manuf	Green
	Not	515 Papaya	0.09	3/22/2018	$145,000	2005	1,376	$105.38	3/2	Crprt	Manuf	Green
	Not	849 Tamarind	0.15	6/26/2019	$155,000	1997	1,716	$90.33	3/2	Crprt	Manuf	Grn/Fnce

Adjoining Sales Adjusted

Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
343 Papaya							$145,000			690
865 Tamarind	$3,566	-$6,026	$10,963				$142,403	2%		
515 Papaya	$7,759	-$13,775	$11,128				$150,112	-4%		
849 Tamarind	$2,273	-$8,525	-$15,030			$5,000	$138,717	4%		
									1%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
52	Nearby	335 Papaya	0.09	4/17/2018	$110,000	1987	1,180	$93.22	2/2	Crprt	Manuf	Green
	Not	865 Tamarind	0.12	2/4/2019	$133,900	1995	1,368	$97.88	2/2	Crprt	Manuf	Green
	Not	501 Papaya	0.10	6/15/2018	$109,000	1986	1,234	$88.33	2/2	Crprt	Manuf	
	Not	604 Puffin	0.09	10/23/2018	$110,000	1988	1,320	$83.33	2/2	Crprt	Manuf	

Adjoining Sales Adjusted

Address	Time	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
335 Papaya							$110,000			710
865 Tamarind	-$3,306	-$5,356	-$14,721			$0	$110,517	0%		
501 Papaya	-$542	$545	-$3,816			$5,000	$110,187	0%		
604 Puffin	-$1,752	-$550	-$9,333			$5,000	$103,365	6%		
									2%	

I also identified a new subdivision being developed just to the west of this solar farm called The Lakes at Sebastian Preserve. These are all canal-lot homes that are being built with homes starting at $271,000 based on the website and closed sales showing up to $342,000. According to Monique, the onsite broker with Holiday Builders, the solar farm is difficult to see from the lots that back up to that area and she does not anticipate any difficulty in selling those future homes or lots or any impact on the sales price. The closest home that will be built in this development will be approximately 340 feet from the nearest panel.

Based on the closed home prices in Barefoot Bay as well as the broker comments and activity at The Lakes at Sebastian Preserve, the data around this solar farm strongly indicates no negative impact on property value.

22. Matched Pair – Miami-Dade Solar Farm, Miami, FL

This project is located on 346.80 acres for a 74.5 MW facility. All of the adjoining uses are agricultural and residential. This project was built in 2019.

I considered the recent sale of Parcel 26 to the south that sold for over $1.6 million dollars. This home is located on 4.2 acres with additional value in the palm trees according to the listing. The comparables include similar homes nearby that are all actually on larger lots and several include avocado or palm tree income as well. All of the comparables are in similar proximity to the subject and all have similar proximity to the Miami-Dade Executive airport that is located 2.5 miles to the east.

These sales are showing no impact on the value of the property from the adjoining solar farm. The landscaping is considered light.

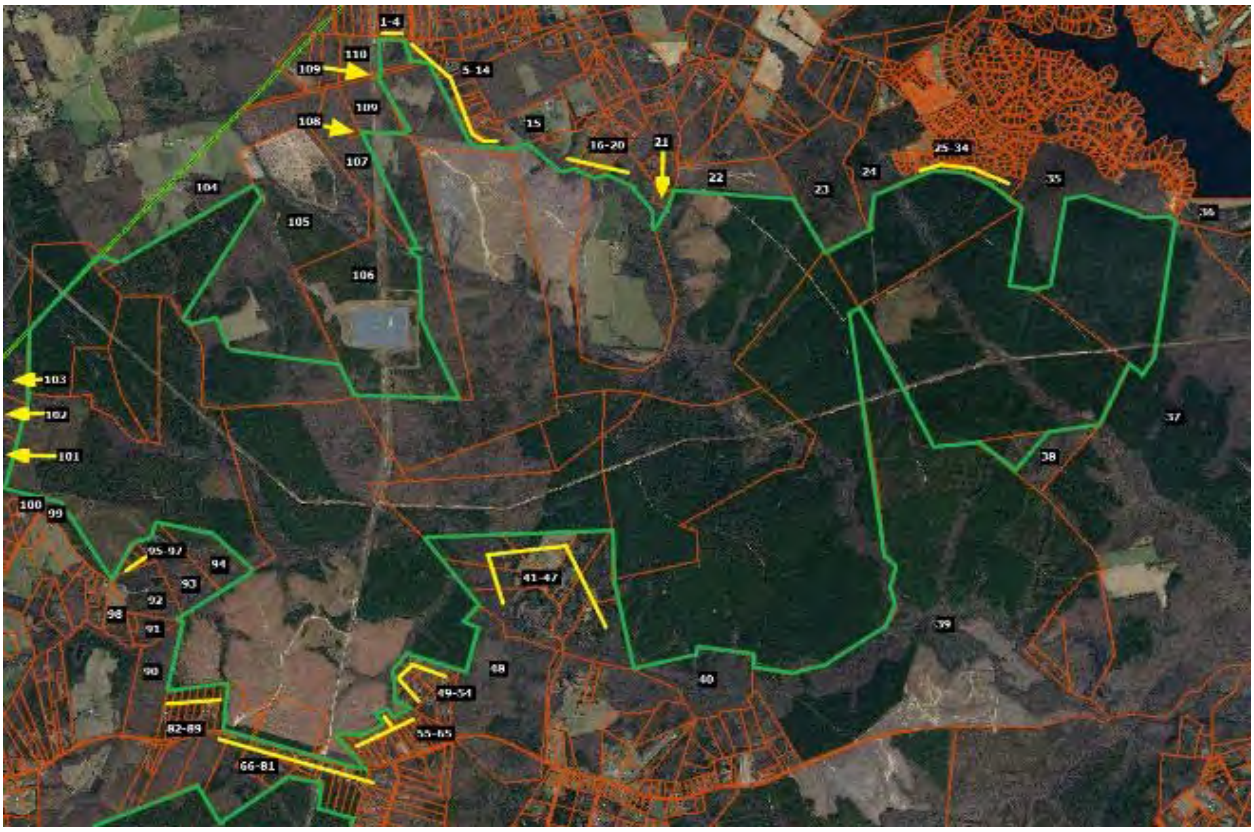
Adjoining Residential Sales After Solar Farm Approved

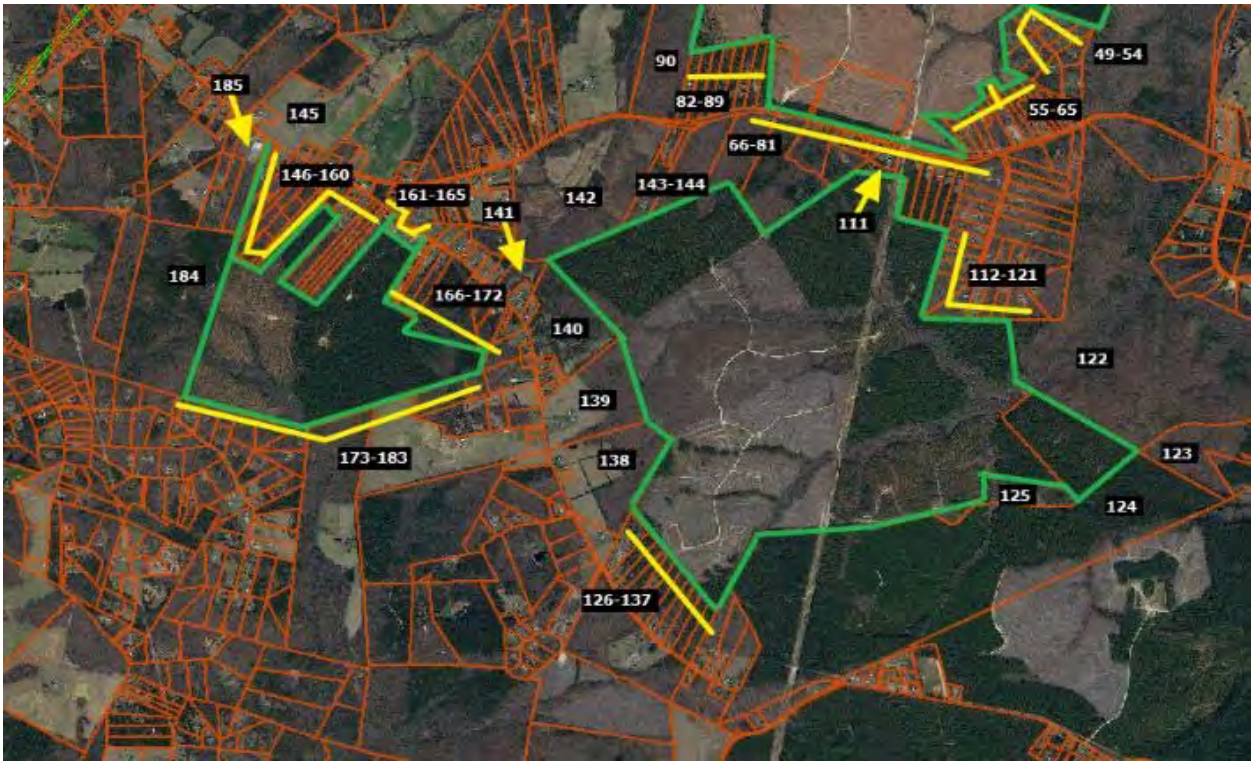
Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
26	Adjoins	13600 SW 182nd	4.20	11/5/2020	$1,684,000	2008	6,427	$262.02	5/5.5	3 Gar	CBS Rnch	Pl/Guest
	Not	18090 SW 158th	5.73	10/8/2020	$1,050,000	1997	3,792	$276.90	5/4	3 Gar	CBS Rnch	
	Not	14311 SW 187th	4.70	10/22/2020	$1,100,000	2005	3,821	$287.88	6/5	3 Gar	CBS Rnch	Pool
	Not	17950 SW 158th	6.21	10/22/2020	$1,730,000	2000	6,917	$250.11	6/5.5	2 Gar	CBS Rnch	Pool

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
13600 SW 182nd								$1,684,000			1390
18090 SW 158th	$2,478		$57,750	$583,703	$30,000			$1,723,930	-2%		
14311 SW 187th	$1,298		$16,500	$600,178	$10,000			$1,727,976	-3%		
17950 SW 158th	$2,041		$69,200	-$98,043		$10,000		$1,713,199	-2%		
										-2%	

23. Matched Pair – Spotsylvania Solar, Paytes, VA





This solar farm is being built in four phases with the area known as Site C having completed construction in November 2020 after the entire project was approved in April 2019. Site C, also known as Pleinmont 1 Solar, includes 99.6 MW located in the southeast corner of the project and shown on the maps above with adjoining parcels 111 through 144. The entire Spotsylvania project totals 617 MW on 3500 acres out of a parent tract assemblage of 6,412 acres.

I have identified three adjoining home sales that occurred during construction and development of the site in 2020.

The first is located on the north side of Site A on Orange Plank Road. The second is located on Nottoway Lane just north of Caparthin Road on the south side of Site A and east of Site C. The third is located on Post Oak Road for a home that backs up to Site C that sold in September 2020 near the completion of construction for Site C.

Spotsylvania Solar Farm

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	12901 Orng Plnk	5.20	8/27/2020	$319,900	1984	1,714	$186.64	3/2	Drive	1.5	Un Bsmt
Not	8353 Gold Dale	3.00	1/27/2021	$415,000	2004	2,064	$201.07	3/2	3 Gar	Ranch	
Not	6488 Southfork	7.26	9/9/2020	$375,000	2017	1,680	$223.21	3/2	2 Gar	1.5	Barn/Patio
Not	12717 Flintlock	0.47	12/2/2020	$290,000	1990	1,592	$182.16	3/2.5	Det Gar	Ranch	

Adjoining Sales Adjusted

Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
12901 Orng Plnk								$319,900		1270
8353 Gold Dale	-$5,219	$20,000	-$41,500	-$56,298		-$20,000		$311,983	2%	
6488 Southfork	-$401	-$20,000	-$61,875	$6,071		-$15,000		$283,796	11%	
12717 Flintlock	-$2,312	$40,000	-$8,700	$17,779	-$5,000	-$5,000		$326,767	-2%	
							Average Diff		4%	

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	9641 Nottoway	11.00	5/12/2020	$449,900	2004	3,186	$141.21	4/2.5	Garage	2-Story	Un Bsmt
Not	26123 Lafayette	1.00	8/3/2020	$390,000	2006	3,142	$124.12	3/3.5	Gar/DtG	2-Story	
Not	11626 Forest	5.00	8/10/2020	$489,900	2017	3,350	$146.24	4/3.5	2 Gar	2-Story	
Not	10304 Pny Brnch	6.00	7/27/2020	$485,000	1998	3,076	$157.67	4/4	2Gar/Dt2	Ranch	Fn Bsmt

Adjoining Sales Adjusted

Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
9641 Nottoway								$449,900		1950
26123 Lafayette	-$2,661	$45,000	-$3,900	$4,369	-$10,000	-$5,000		$417,809	7%	
11626 Forest	-$3,624		-$31,844	-$19,187		-$5,000		$430,246	4%	
10304 Pny Brnch	-$3,030		$14,550	$13,875	-$15,000	-$15,000	-$10,000	$470,396	-5%	
							Average Diff		2%	

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	13353 Post Oak	5.20	9/21/2020	$300,000	1992	2,400	$125.00	4/3	Drive	2-Story	Fn Bsmt
Not	9609 Logan Hgt	5.86	7/4/2019	$330,000	2004	2,352	$140.31	3/2	2Gar	2-Story	
Not	12810 Catharpian	6.18	1/30/2020	$280,000	2008	2,240	$125.00	4/2.5	Drive	2-Story	Bsmt/Nd Pnt
Not	10725 Rbrt Lee	5.01	10/26/2020	$295,000	1995	2,166	$136.20	4/3	Gar	2-Story	Fn Bsmt

Adjoining Sales Adjusted

Address	Time	Ac/Loc	YB	GLA	BR/BA	Park	Other	Total	% Diff	Dist
13353 Post Oak								$300,000		1171
9609 Logan Hgt	$12,070		-$19,800	$5,388		-$15,000	$15,000	$327,658	-9%	
12810 Catharpian	$5,408		-$22,400	$16,000	$5,000		$15,000	$299,008	0%	
10725 Rbrt Lee	-$849		-$4,425	$25,496		-$10,000		$305,222	-2%	
								Average Diff	-4%	

All three of these homes are well set back from the solar panels at distances over 1,000 feet and are well screened from the project. All three show no indication of any impact on property value.

There are a couple of recent lot sales located along Southview Court that have sold since the solar farm was approved. The most recent lot sales include 11700 Southview Court that sold on December 29, 2021 for $140,000 for a 0.76-acre lot. This property was on the market for less than 2 months before closing within 6% of the asking price. This lot sold earlier in September 2019 for $55,000 based on a liquidation sale from NTS to an investor.

A similar 0.68-acre lot at 11507 Stonewood Court within the same subdivision located away from the solar farm sold on March 9, 2021 for $109,000. This lot sold for 18% over the asking price within 1 month of listing suggesting that this was priced too low. Adjusting this lot value upward by 12% for very strong growth in the market over 2021, the adjusted indicated value is $122,080 for this lot. This is still showing a 15% premium for the lot backing up to the solar farm.

The lot at 11009 Southview Court sold on August 5, 2019 for $65,000, which is significantly lower than the more recent sales. This lot was sold by NTS the original developer of this subdivision, who was in the process of liquidating lots in this subdivision with multiple lot sales in this time period throughout the subdivision being sold at discounted prices. The home was later improved by the buyer with a home built in 2020 with 2,430 square feet ranch, 3.5 bathrooms, with a full basement, and a current assessed value of $492,300.

I spoke with Chris Kalia, MAI, Mark Doherty, local real estate investor, and Alex Doherty, broker, who are all three familiar with this subdivision and activity in this neighborhood. All three indicated that there was a deep sell off of lots in the neighborhood by NTS at discounted prices under $100,000 each. Those lots since that time are being sold for up to $140,000. The prices paid for the lots below $100,000 were liquidation values and not indicative of market value. Homes are being built in the neighborhood on those lots with home prices ranging from $600,000 to $800,000 with no sign of impact on pricing due to the solar farm according to all three sources.

Conclusion – SouthEast Over 5 MW

Southeast USA Over 5 MW
Matched Pair Summary

						Topo	Adj. Uses By Acreage				1 mile Radius (2010-2020 Data)			
	Name	City	State	Acres	MW	Shift	Res	Ag	Ag/Res	Com/Ind	Pop.	Med. Income	Avg. Housing Unit	Veg. Buffer
1	AM Best	Goldsboro	NC	38	5.00	2	38%	0%	23%	39%	1,523	$37,358	$148,375	Light
2	Mulberry	Selmer	TN	160	5.00	60	13%	73%	10%	3%	467	$40,936	$171,746	Lt to Med
3	Leonard	Hughesville	MD	47	5.00	20	18%	75%	0%	6%	525	$106,550	$350,000	Light
4	Gastonia SC	Gastonia	NC	35	5.00	48	33%	0%	23%	44%	4,689	$35,057	$126,562	Light
5	Summit	Moyock	NC	2,034	80.00	4	4%	0%	94%	2%	382	$79,114	$281,731	Light
6	Tracy	Bailey	NC	50	5.00	10	29%	0%	71%	0%	312	$43,940	$99,219	Heavy
7	Manatee	Parrish	FL	1,180	75.00	20	2%	97%	1%	0%	48	$75,000	$291,667	Heavy
8	McBride	Midland	NC	627	75.00	140	12%	10%	78%	0%	398	$63,678	$256,306	Lt to Med
9	Mariposa	Stanley	NC	36	5.00	96	48%	0%	52%	0%	1,716	$36,439	$137,884	Light
10	Clarke Cnty	White Post	VA	234	20.00	70	14%	39%	46%	1%	578	$81,022	$374,453	Light
11	Simon	Social Circle	GA	237	30.00	71	1%	63%	36%	0%	203	$76,155	$269,922	Medium
12	Candace	Princeton	NC	54	5.00	22	76%	24%	0%	0%	448	$51,002	$107,171	Medium
13	Walker	Barhamsville	VA	485	20.00	N/A	12%	68%	20%	0%	203	$80,773	$320,076	Light
14	Innov 46	Hope Mills	NC	532	78.50	0	17%	83%	0%	0%	2,247	$58,688	$183,435	Light
15	Innov 42	Fayetteville	NC	414	71.00	0	41%	59%	0%	0%	568	$60,037	$276,347	Light
16	Sunfish	Willow Spring	NC	50	6.40	30	35%	35%	30%	0%	1,515	$63,652	$253,138	Light
17	Sappony	Stony Crk	VA	322	20.00	N/A	2%	98%	0%	0%	74	$51,410	$155,208	Light
18	Camden Dam	Camden	NC	50	5.00	0	17%	72%	11%	0%	403	$84,426	$230,288	Light
19	Grandy	Grandy	NC	121	20.00	10	55%	24%	0%	21%	949	$50,355	$231,408	Light
20	Champion	Pelion	SC	100	10.00	N/A	4%	70%	8%	18%	1,336	$46,867	$171,939	Light
21	Barefoot Bay	Barefoot Bay	FL	504	74.50	0	11%	87%	0%	3%	2,446	$36,737	$143,320	Lt to Med
22	Miami-Dade	Miami	FL	347	74.50	0	26%	74%	0%	0%	127	$90,909	$403,571	Light
23	Spotyslvania	Paytes	VA	3,500	617.00	160	37%	52%	11%	0%	74	$120,861	$483,333	Md to Hvy
	Average			485	57.04	38	24%	48%	22%	6%	923	$63,955	$237,700	
	Median			234	20.00	20	17%	59%	11%	0%	467	$60,037	$231,408	
	High			3,500	617.00	160	76%	98%	94%	44%	4,689	$120,861	$483,333	
	Low			35	5.00	0	1%	0%	0%	0%	48	$35,057	$99,219	

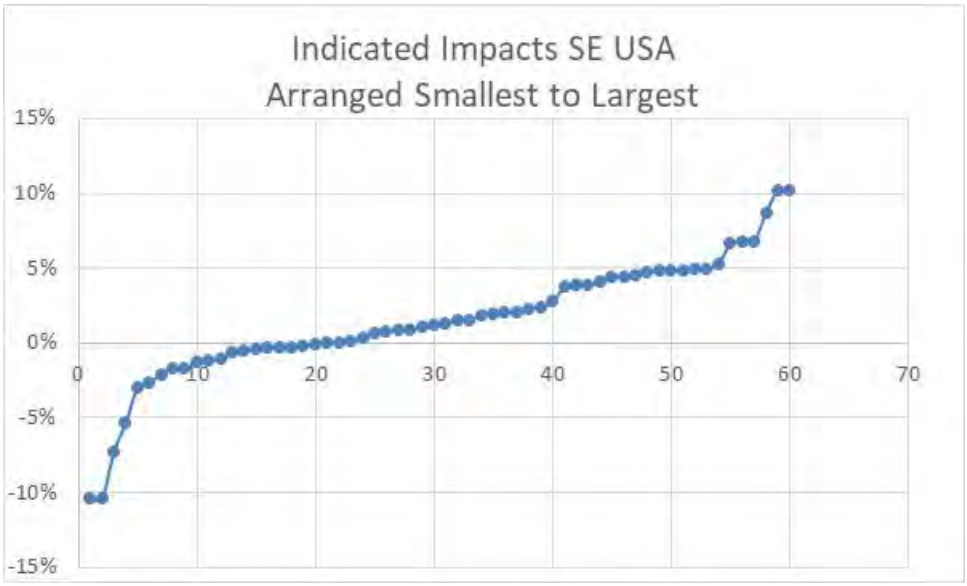
The solar farm matched pairs shown above have similar characteristics to each other in terms of population, but with several outliers showing solar farms in farm more urban areas. The median income for the population within 1 mile of a solar farm is $60,037 with a median housing unit value of $231,408. Most of the comparables are under $300,000 in the home price, with $483,333 being the high end of the set, though I have matched pairs in multiple states over $1,000,000 adjoining solar farms. The adjoining uses show that residential and agricultural uses are the predominant adjoining uses. These figures are in line with the larger set of solar farms that I have looked at with the predominant adjoining uses being residential and agricultural and similar to the solar farm breakdown shown for Virginia and adjoining states as well as the proposed subject property.

Based on the similarity of adjoining uses and demographic data between these sites and the subject property, I consider it reasonable to compare these sites to the subject property.

I have pulled 56 matched pairs from the above referenced solar farms to provide the following summary of home sale matched pairs and land sales next to solar farms. The summary shows that the range of differences is from -10% to +10% with an average of +1% and median of +1%. This means that the average and median impact is for a slight positive impact due to adjacency to a solar farm. However, this +1 to rate is within the typical variability I would expect from real estate. I therefore conclude that this data shows no negative or positive impact due to adjacency to a solar farm.

While the range is seemingly wide, the graph below clearly shows that the vast majority of the data falls between -5% and +5% and most of those are clearly in the 0 to +5% range. This data strongly supports an indication of no impact on adjoining residential uses to a solar farm.

I therefore conclude that these matched pairs support a finding of no impact on value at the subject property for the proposed project, which as proposed will include a landscaped buffer to screen adjoining residential properties.


Indicated Impacts SE USA
Arranged Smallest to Largest
15%
10%
5%
0%
-5%
-10%
-15%
0
10
20
30
40
50
60
70

Residential Dwelling Matched Pairs Adjoining Solar Farms

Pair	Solar Farm	City	State	MW	Approx Distance	Tax ID/Address	Date	Sale Price	Adj. Sale Price	% Diff	Veg. Buffer
1	AM Best	Goldsboro	NC	5	280	3600195570	Sep-13	$250,000			Light
						3600198928	Mar-14	$250,000	$250,000	0%	
2	AM Best	Goldsboro	NC	5	280	3600195361	Sep-13	$260,000			Light
						3600194813	Apr-14	$258,000	$258,000	1%	
3	AM Best	Goldsboro	NC	5	280	3600199891	Jul-14	$250,000			Light
						3600198928	Mar-14	$250,000	$250,000	0%	
4	AM Best	Goldsboro	NC	5	280	3600198632	Aug-14	$253,000			Light
						3600193710	Oct-13	$248,000	$248,000	2%	
5	AM Best	Goldsboro	NC	5	280	3600196656	Dec-13	$255,000			Light
						3601105180	Dec-13	$253,000	$253,000	1%	
6	AM Best	Goldsboro	NC	5	280	3600182511	Feb-13	$247,000			Light
						3600183905	Dec-12	$240,000	$245,000	1%	
7	AM Best	Goldsboro	NC	5	280	3600182784	Apr-13	$245,000			Light
						3600193710	Oct-13	$248,000	$248,000	-1%	
8	AM Best	Goldsboro	NC	5	280	3600195361	Nov-15	$267,500			Light
						3600195361	Sep-13	$260,000	$267,800	0%	
9	Mulberry	Selmer	TN	5	400	0900A011	Jul-14	$130,000			Light
						099CA043	Feb-15	$148,900	$136,988	-5%	
10	Mulberry	Selmer	TN	5	400	099CA002	Jul-15	$130,000			Light
						0990NA040	Mar-15	$120,000	$121,200	7%	
11	Mulberry	Selmer	TN	5	480	491 Dusty	Oct-16	$176,000			Light
						35 April	Aug-16	$185,000	$178,283	-1%	
12	Mulberry	Selmer	TN	5	650	297 Country	Sep-16	$150,000			Medium
						53 Glen	Mar-17	$126,000	$144,460	4%	
13	Mulberry	Selmer	TN	5	685	57 Cooper	Feb-19	$163,000			Medium
						191 Amelia	Aug-18	$132,000	$155,947	4%	
14	Leonard Rd	Hughesville	MD	5.5	230	14595 Box Elder	Feb-16	$291,000			Light
						15313 Bassford Rd	Jul-16	$329,800	$292,760	-1%	
15	Neal Hawkins	Gastonia	NC	5	225	609 Neal Hawkins	Mar-17	$270,000			Light
						1418 N Modena	Apr-18	$225,000	$242,520	10%	
16	Summit	Moyock	NC	80	1,060	129 Pinto	Apr-16	$170,000			Light
						102 Timber	Apr-16	$175,500	$175,101	-3%	
17	Summit	Moyock	NC	80	980	105 Pinto	Dec-16	$206,000			Light
						127 Ranchland	Jun-15	$219,900	$198,120	4%	
18	Tracy	Bailey	NC	5	780	9162 Winters	Jan-17	$255,000			Heavy
						7352 Red Fox	Jun-16	$176,000	$252,399	1%	
19	Manatee	Parrish	FL	75	1180	13670 Highland	Aug-18	$255,000			Heavy
						13851 Highland	Sep-18	$240,000	$255,825	0%	
20	McBride Place	Midland	NC	75	275	4380 Joyner	Nov-17	$325,000			Medium
						3870 Elkwood	Aug-16	$250,000	$317,523	2%	
21	McBride Place	Midland	NC	75	505	5811 Kristi	Mar-20	$530,000			Medium
						3915 Tania	Dec-19	$495,000	$504,657	5%	
22	Mariposa	Stanley	NC	5	1155	215 Mariposa	Dec-17	$249,000			Light
						110 Airport	May-16	$166,000	$239,026	4%	
23	Mariposa	Stanley	NC	5	570	242 Mariposa	Sep-15	$180,000			Light
						110 Airport	Apr-16	$166,000	$175,043	3%	
24	Clarke Cnty	White Post	VA	20	1230	833 Nations Spr	Jan-17	$295,000			Light
						6801 Middle	Dec-17	$249,999	$296,157	0%	
25	Candace	Princeton	NC	5	488	499 Herring	Sep-17	$215,000			Medium
						1795 Bay Valley	Dec-17	$194,000	$214,902	0%	
26	Walker	Barhamsville	VA	20	250	5241 Barham	Oct-18	$264,000			Light
						9252 Ordinary	Jun-19	$277,000	$246,581	7%	
27	AM Best	Goldsboro	NC	5	385	103 Granville Pl	Jul-18	$265,000			Light
						2219 Granville	Jan-18	$260,000	$265,682	0%	
28	AM Best	Goldsboro	NC	5	315	104 Erin	Jun-17	$280,000			Light
						2219 Granville	Jan-18	$265,000	$274,390	2%	
29	AM Best	Goldsboro	NC	5	400	2312 Granville	May-18	$284,900			Light
						2219 Granville	Jan-18	$265,000	$273,948	4%	

Residential Dwelling Matched Pairs Adjoining Solar Farms

Pair	Solar Farm	City	State	MW	Approx Distance	Tax ID/Address	Date	Sale Price	Adj. Sale Price	% Diff	Veg. Buffer
30	AM Best	Goldsboro	NC	5	400	2310 Granville	May-19	$280,000			Light
						634 Friendly	Jul-19	$267,000	$265,291	5%	
31	Summit	Moyock	NC	80	570	318 Green View	Sep-19	$357,000			Light
						336 Green View	Jan-19	$365,000	$340,286	5%	
32	Summit	Moyock	NC	80	440	164 Ranchland	Apr-19	$169,000			Light
						105 Longhorn	Oct-17	$184,500	$186,616	-10%	
33	Summit	Moyock	NC	80	635	358 Oxford	Sep-19	$478,000			Light
						176 Providence	Sep-19	$425,000	$456,623	4%	
34	Summit	Moyock	NC	80	970	343 Oxford	Mar-17	$490,000			Light
						218 Oxford	Apr-17	$525,000	$484,064	1%	
35	Innov 46	Hope Mills	NC	78.5	435	6849 Roslin Farm	Feb-19	$155,000			Light
						109 Bledsoe	Jan-19	$150,000	$147,558	5%	
36	Innov 42	Fayetteville	NC	71	340	2923 County Line	Feb-19	$385,000			Light
						2109 John McMillan	Apr-18	$320,000	$379,156	2%	
37	Innov 42	Fayetteville	NC	71	330	2935 County Line	Jun-19	$266,000			Light
						7031 Glynn Mill	May-18	$255,000	$264,422	1%	
38	Sunfish	Willow Sprng	NC	6.4	205	7513 Glen Willow	Sep-17	$185,000			Light
						205 Pine Burr	Dec-17	$191,000	$172,487	7%	
39	Neal Hawkins	Gastonia	NC	5	145	611 Neal Hawkins	Jun-17	$288,000			Light
						1211 Still Forrest	Jul-18	$280,000	$274,319	5%	
40	Clarke Cnty	White Post	VA	20	1230	833 Nations Spr	Aug-19	$385,000			Light
						2393 Old Chapel	Aug-20	$330,000	$389,286	-1%	
41	Sappony	Stony Creek	VA	20	1425	12511 Palestine	Jul-18	$128,400			Medium
						6494 Rocky Branch	Nov-18	$100,000	$131,842	-3%	
42	Camden Dam	Camden	NC	5	342	122 N Mill Dam	Nov-18	$350,000			Light
						548 Trotman	May-18	$309,000	$352,450	-1%	
43	Grandy	Grandy	NC	20	405	120 Par Four	Aug-19	$315,000			Light
						116 Barefoot	Sep-20	$290,000	$299,584	5%	
44	Grandy	Grandy	NC	20	477	269 Grandy	May-19	$275,000			Light
						103 Spring Leaf	Aug-18	$270,000	$275,912	0%	
45	Champion	Pelion	SC	10	505	517 Old Charleston	Aug-20	$110,000			Light
						1429 Laurel	Feb-19	$126,000	$107,856	2%	
46	Barefoot Bay	Barefoot Bay	FL	74.5	765	465 Papaya	Jul-19	$155,000			Medium
						1132 Waterway	Jul-20	$129,000	$141,618	9%	
47	Barefoot Bay	Barefoot Bay	FL	74.5	750	455 Papaya	Sep-20	$183,500			Medium
						904 Fir	Sep-20	$192,500	$186,697	-2%	
48	Barefoot Bay	Barefoot Bay	FL	74.5	690	419 Papaya	Jul-19	$127,500			Medium
						865 Tamarind	Feb-19	$133,900	$124,613	2%	
49	Barefoot Bay	Barefoot Bay	FL	74.5	690	413 Papaya	Jul-20	$130,000			Medium
						1367 Barefoot	Jan-21	$130,500	$139,507	-7%	
50	Barefoot Bay	Barefoot Bay	FL	74.5	690	343 Papaya	Dec-19	$145,000			Light
						865 Tamarind	Feb-19	$133,900	$142,403	2%	
51	Barefoot Bay	Barefoot Bay	FL	74.5	710	335 Papaya	Apr-18	$110,000			Light
						865 Tamarind	Feb-19	$133,900	$110,517	0%	
52	Miami-Dade	Miami	FL	74.5	1390	13600 SW 182nd	Nov-20	$1,684,000			Light
						17950 SW 158th	Oct-20	$1,730,000	$1,713,199	-2%	
53	Spotsylvania	Paytes	VA	617	1270	12901 Orange Plnk	Aug-20	$319,900			Medium
						12717 Flintlock	Dec-20	$290,000	$326,767	-2%	
54	Spotsylvania	Paytes	VA	617	1950	9641 Nottoway	May-20	$449,900			Medium
						11626 Forest	Aug-20	$489,900	$430,246	4%	
55	Spotsylvania	Paytes	VA	617	1171	13353 Post Oak	Sep-20	$300,000			Heavy
						12810 Catharpin	Jan-20	$280,000	$299,008	0%	
56	McBride Place	Midland	NC	75	470	5833 Kristi	Sep-20	$625,000			Light
						4055 Dakeita	Dec-20	$600,000	$594,303	5%	

MW	Avg. Distance
64.91	612
20.00	479
617.00	1,950
5.00	145

	Indicated Impact
Average	1%
Median	1%
High	10%
Low	-10%

I have further broken down these results based on the MWs, Landscaping, and distance from panel to show the following range of findings for these different categories.

Most of the findings are for homes between 201 and 500 feet. Most of the findings are for Light landscaping screens.

Light landscaping screens are showing no impact on value at any distances, including for solar farms over 75.1 MW.

MW Range 4.4 to 10									
Landscaping	**Light**	**Light**	**Light**	**Medium**	**Medium**	**Medium**	**Heavy**	**Heavy**	**Heavy**
Distance	**100-200**	**201-500**	**500+**	**100-200**	**201-500**	**500+**	**100-200**	**201-500**	**500+**
#	1	19	2	0	1	2	0	0	1
Average	5%	2%	3%	N/A	0%	4%	N/A	N/A	1%
Median	5%	1%	3%	N/A	0%	4%	N/A	N/A	1%
High	5%	10%	4%	N/A	0%	4%	N/A	N/A	1%
Low	5%	-5%	3%	N/A	0%	4%	N/A	N/A	1%

10.1 to 30									
Landscaping	**Light**	**Light**	**Light**	**Medium**	**Medium**	**Medium**	**Heavy**	**Heavy**	**Heavy**
Distance	**100-200**	**201-500**	**500+**	**100-200**	**201-500**	**500+**	**100-200**	**201-500**	**500+**
#	0	3	2	0	0	1	0	0	0
Average	N/A	4%	-1%	N/A	N/A	-3%	N/A	N/A	N/A
Median	N/A	5%	-1%	N/A	N/A	-3%	N/A	N/A	N/A
High	N/A	7%	0%	N/A	N/A	-3%	N/A	N/A	N/A
Low	N/A	0%	-1%	N/A	N/A	-3%	N/A	N/A	N/A

30.1 to 75									
Landscaping	**Light**	**Light**	**Light**	**Medium**	**Medium**	**Medium**	**Heavy**	**Heavy**	**Heavy**
Distance	**100-200**	**201-500**	**500+**	**100-200**	**201-500**	**500+**	**100-200**	**201-500**	**500+**
#	0	2	3	0	0	4	0	0	0
Average	N/A	1%	0%	N/A	N/A	0%	N/A	N/A	N/A
Median	N/A	1%	0%	N/A	N/A	0%	N/A	N/A	N/A
High	N/A	2%	2%	N/A	N/A	9%	N/A	N/A	N/A
Low	N/A	1%	-2%	N/A	N/A	-7%	N/A	N/A	N/A

75.1+									
Landscaping	**Light**	**Light**	**Light**	**Medium**	**Medium**	**Medium**	**Heavy**	**Heavy**	**Heavy**
Distance	**100-200**	**201-500**	**500+**	**100-200**	**201-500**	**500+**	**100-200**	**201-500**	**500+**
#	0	2	5	0	0	2	0	0	1
Average	N/A	-3%	2%	N/A	N/A	1%	N/A	N/A	0%
Median	N/A	-3%	4%	N/A	N/A	1%	N/A	N/A	0%
High	N/A	5%	5%	N/A	N/A	4%	N/A	N/A	0%
Low	N/A	-10%	-3%	N/A	N/A	-2%	N/A	N/A	0%

C. Summary of National Data on Solar Farms

I have worked in 19 states related to solar farms and I have been tracking matched pairs in most of those states. On the following pages I provide a brief summary of those findings showing 37 solar farms over 5 MW studied with each one providing matched pair data supporting the findings of this report.

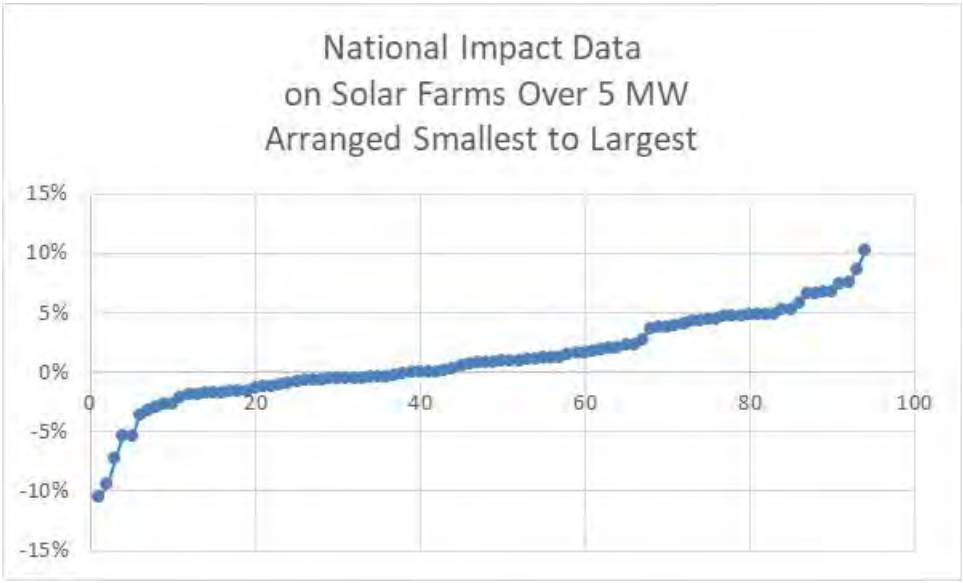
The solar farms summary is shown below with a summary of the matched pair data shown on the following page.

Matched Pair Summary							**Adj. Uses By Acreage**				**1 mile Radius (2010-2020 Data)**			
	Name	**City**	**State**	**Acres**	**MW**	**Topo Shift**	**Res**	**Ag**	**Ag/Res**	**Com/Ind**	**Popl.**	**Med. Income**	**Avg. Housing Unit**	**Veg. Buffer**
1	AM Best	Goldsboro	NC	38	5.00	2	38%	0%	23%	39%	1,523	$37,358	$148,375	Light
2	Mulberry	Selmer	TN	160	5.00	60	13%	73%	10%	3%	467	$40,936	$171,746	Lt to Med
3	Leonard	Hughesville	MD	47	5.00	20	18%	75%	0%	6%	525	$106,550	$350,000	Light
4	Gastonia SC	Gastonia	NC	35	5.00	48	33%	0%	23%	44%	4,689	$35,057	$126,562	Light
5	Summit	Moyock	NC	2,034	80.00	4	4%	0%	94%	2%	382	$79,114	$281,731	Light
7	Tracy	Bailey	NC	50	5.00	10	29%	0%	71%	0%	312	$43,940	$99,219	Heavy
8	Manatee	Parrish	FL	1,180	75.00	20	2%	97%	1%	0%	48	$75,000	$291,667	Heavy
9	McBride	Midland	NC	627	75.00	140	12%	10%	78%	0%	398	$63,678	$256,306	Lt to Med
10	Grand Ridge	Streator	IL	160	20.00	1	8%	87%	5%	0%	96	$70,158	$187,037	Light
11	Dominion	Indianapolis	IN	134	8.60	20	3%	97%	0%	0%	3,774	$61,115	$167,515	Light
12	Mariposa	Stanley	NC	36	5.00	96	48%	0%	52%	0%	1,716	$36,439	$137,884	Light
13	Clarke Cnty	White Post	VA	234	20.00	70	14%	39%	46%	1%	578	$81,022	$374,453	Light
14	Flemington	Flemington	NJ	120	9.36	N/A	13%	50%	28%	8%	3,477	$105,714	$444,696	Lt to Med
15	Frenchtown	Frenchtown	NJ	139	7.90	N/A	37%	35%	29%	0%	457	$111,562	$515,399	Light
16	McGraw	East Windsor	NJ	95	14.00	N/A	27%	44%	0%	29%	7,684	$78,417	$362,428	Light
17	Tinton Falls	Tinton Falls	NJ	100	16.00	N/A	98%	0%	0%	2%	4,667	$92,346	$343,492	Light
18	Simon	Social Circle	GA	237	30.00	71	1%	63%	36%	0%	203	$76,155	$269,922	Medium
19	Candace	Princeton	NC	54	5.00	22	76%	24%	0%	0%	448	$51,002	$107,171	Medium
20	Walker	Barhamsville	VA	485	20.00	N/A	12%	68%	20%	0%	203	$80,773	$320,076	Light
21	Innov 46	Hope Mills	NC	532	78.50	0	17%	83%	0%	0%	2,247	$58,688	$183,435	Light
22	Innov 42	Fayetteville	NC	414	71.00	0	41%	59%	0%	0%	568	$60,037	$276,347	Light
23	Demille	Lapeer	MI	160	28.40	10	10%	68%	0%	22%	2,010	$47,208	$187,214	Light
24	Turrill	Lapeer	MI	230	19.60	10	75%	59%	0%	25%	2,390	$46,839	$110,361	Light
25	Sunfish	Willow Spring	NC	50	6.40	30	35%	35%	30%	0%	1,515	$63,652	$253,138	Light
26	Picture Rocks	Tucson	AZ	182	20.00	N/A	6%	88%	6%	0%	102	$81,081	$280,172	None
27	Avra Valley	Tucson	AZ	246	25.00	N/A	3%	94%	3%	0%	85	$80,997	$292,308	None
28	Sappony	Stony Crk	VA	322	20.00	N/A	2%	98%	0%	0%	74	$51,410	$155,208	Medium
29	Camden Dam	Camden	NC	50	5.00	0	17%	72%	11%	0%	403	$84,426	$230,288	Light
30	Grandy	Grandy	NC	121	20.00	10	55%	24%	0%	21%	949	$50,355	$231,408	Light
31	Champion	Pelion	SC	100	10.00	N/A	4%	70%	8%	18%	1,336	$46,867	$171,939	Light
32	Eddy II	Eddy	TX	93	10.00	N/A	15%	25%	58%	2%	551	$59,627	$139,088	Light
33	Somerset	Somerset	TX	128	10.60	N/A	5%	95%	0%	0%	1,293	$41,574	$135,490	Light
34	DG Amp Piqua	Piqua	OH	86	12.60	2	26%	16%	58%	0%	6,735	$38,919	$96,555	Light
45	Barefoot Bay	Barefoot Bay	FL	504	74.50	0	11%	87%	0%	3%	2,446	$36,737	$143,320	Lt to Med
36	Miami-Dade	Miami	FL	347	74.50	0	26%	74%	0%	0%	127	$90,909	$403,571	Light
37	Spotyslvania	Paytes	VA	3,500	617.00	160	37%	52%	11%	0%	74	$120,861	$483,333	Med to Hvy
	Average			362	42.05	32	24%	52%	19%	6%	1,515	$66,292	$242,468	
	Median			150	17.80	10	16%	59%	7%	0%	560	$62,384	$230,848	
	High			3,500	617.00	160	98%	98%	94%	44%	7,684	$120,861	$515,399	
	Low			35	5.00	0	1%	0%	0%	0%	48	$35,057	$96,555	

From these 37 solar farms, I have derived 94 matched pairs. The matched pairs show no negative impact at distances as close as 105 feet between a solar panel and the nearest point on a home. The range of impacts is -10% to +10% with an average and median of +1%.

	MW	Avg. Distance		Indicated Impact
Average	44.80	569	**Average**	1%
Median	14.00	400	**Median**	1%
High	617.00	1,950	**High**	10%
Low	5.00	145	**Low**	-10%

While the range is broad, the two charts below show the data points in range from lowest to highest. There is only 3 data points out of 94 that show a negative impact. The rest support either a finding of no impact or 9 of the data points suggest a positive impact due to adjacency to a solar farm. As discussed earlier in this report, I consider this data to strongly support a finding of no impact on value as most of the findings are within typical market variation and even within that, most are mildly positive findings.



D. Larger Solar Farms

I have also considered larger solar farms to address impacts related to larger projects. Projects have been increasing in size and most of the projects between 100 and 1000 MW are newer with little time for adjoining sales. I have included a breakdown of solar farms with 20 MW to 80 MW facilities with one 617 MW facility.

Matched Pair Summary - @20 MW And Larger							Adj. Uses By Acreage				1 mile Radius (2010-2019 Data)			
	Name	City	State	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com/Ind	Popl.	Med. Income	Avg. Housing Unit	Veg. Buffer
1	Summit	Moyock	NC	2,034	80.00	4	4%	0%	94%	2%	382	$79,114	$281,731	Light
2	Manatee	Parrish	FL	1,180	75.00	20	2%	97%	1%	0%	48	$75,000	$291,667	Heavy
3	McBride	Midland	NC	627	75.00	140	12%	10%	78%	0%	398	$63,678	$256,306	Lt to Med
4	Grand Ridge	Streator	IL	160	20.00	1	8%	87%	5%	0%	96	$70,158	$187,037	Light
5	Clarke Cnty	White Post	VA	234	20.00	70	14%	39%	46%	1%	578	$81,022	$374,453	Light
6	Simon	Social Circle	GA	237	30.00	71	1%	63%	36%	0%	203	$76,155	$269,922	Medium
7	Walker	Barhamsville	VA	485	20.00	N/A	12%	68%	20%	0%	203	$80,773	$320,076	Light
8	Innov 46	Hope Mills	NC	532	78.50	0	17%	83%	0%	0%	2,247	$58,688	$183,435	Light
9	Innov 42	Fayetteville	NC	414	71.00	0	41%	59%	0%	0%	568	$60,037	$276,347	Light
10	Demille	Lapeer	MI	160	28.40	10	10%	68%	0%	22%	2,010	$47,208	$187,214	Light
11	Turrill	Lapeer	MI	230	19.60	10	75%	59%	0%	25%	2,390	$46,839	$110,361	Light
12	Picure Rocks	Tucson	AZ	182	20.00	N/A	6%	88%	6%	0%	102	$81,081	$280,172	Light
13	Avra Valley	Tucson	AZ	246	25.00	N/A	3%	94%	3%	0%	85	$80,997	$292,308	None
14	Sappony	Stony Crk	VA	322	20.00	N/A	2%	98%	0%	0%	74	$51,410	$155,208	None
15	Grandy	Grandy	NC	121	20.00	10	55%	24%	0%	21%	949	$50,355	$231,408	Medium
16	Barefoot Bay	Barefoot Bay	FL	504	74.50	0	11%	87%	0%	3%	2,446	$36,737	$143,320	Lt to Med
17	Miami-Dade	Miami	FL	347	74.50	0	26%	74%	0%	0%	127	$90,909	$403,571	Light
18	Spotyslvania	Paytes	VA	3,500	617.00	160	37%	52%	11%	0%	74	$120,861	$483,333	Med to Hvy
	Average			640	76.03		19%	64%	17%	4%	721	$69,501	$262,659	
	Median			335	29.20		12%	68%	2%	0%	293	$72,579	$273,135	
	High			3,500	617.00		75%	98%	94%	25%	2,446	$120,861	$483,333	
	Low			121	19.60		1%	0%	0%	0%	48	$36,737	$110,361	

The breakdown of adjoining uses, population density, median income and housing prices for these projects are very similar to those of the larger set. The matched pairs for each of these were considered earlier and support a finding of no negative impact on the adjoining home values.

I have included a breakdown of solar farms with 50 MW to 617 MW facilities adjoining.

Matched Pair Summary - @50 MW And Larger							Adj. Uses By Acreage				1 mile Radius (2010-2019 Data)			
	Name	City	State	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com/Ind	Popl.	Med. Income	Avg. Housing Unit	Veg. Buffer
1	Summit	Moyock	NC	2,034	80.00	4	4%	0%	94%	2%	382	$79,114	$281,731	Light
2	Manatee	Parrish	FL	1,180	75.00	20	2%	97%	1%	0%	48	$75,000	$291,667	Heavy
3	McBride	Midland	NC	627	75.00	140	12%	10%	78%	0%	398	$63,678	$256,306	Lt to Med
4	Innov 46	Hope Mills	NC	532	78.50	0	17%	83%	0%	0%	2,247	$58,688	$183,435	Light
5	Innov 42	Fayetteville	NC	414	71.00	0	41%	59%	0%	0%	568	$60,037	$276,347	Light
6	Barefoot Bay	Barefoot Bay	FL	504	74.50	0	11%	87%	0%	3%	2,446	$36,737	$143,320	Lt to Med
7	Miami-Dade	Miami	FL	347	74.50	0	26%	74%	0%	0%	127	$90,909	$403,571	Light
8	Spotyslvania	Paytes	VA	3,500	617.00	160	37%	52%	11%	0%	74	$120,861	$483,333	Med to Hvy
	Average			1,142	143.19		19%	58%	23%	1%	786	$73,128	$289,964	
	Median			580	75.00		15%	67%	0%	0%	390	$69,339	$279,039	
	High			3,500	617.00		41%	97%	94%	3%	2,446	$120,861	$483,333	
	Low			347	71.00		2%	0%	0%	0%	48	$36,737	$143,320	

The breakdown of adjoining uses, population density, median income and housing prices for these projects are very similar to those of the larger set. The matched pairs for each of these were considered earlier and support a finding of no negative impact on the adjoining home values.

The data for these larger solar farms is shown in the SE USA and the National data breakdowns with similar landscaping, setbacks and range of impacts that fall mostly in the +/-5% range as can be seen earlier in this report.

On the following page I show 81 projects ranging in size from 50 MW up to 1,000 MW with an average size of 111.80 MW and a median of 80 MW. The average closest distance for an adjoining home is 263 feet, while the median distance is 188 feet. The closest distance is 57 feet. The mix of adjoining uses is similar with most of the adjoining uses remaining residential or agricultural in nature. This is the list of solar farms that I have researched for possible matched pairs and not a complete list of larger solar farms in those states.

Parcel #	State	City	Name	Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre			
									Res	Agri	Ag/R	Com
78	NC	Moyock	Summit/Ranchland	80	2034		674	360	4%	94%	0%	2%
133	MS	Hattiesburg	Hattiesburg	50	1129	479.6	650	315	35%	65%	0%	0%
179	SC	Ridgeland	Jasper	140	1600	1000	461	108	2%	85%	13%	0%
211	NC	Enfield	Chestnut	75	1428.1		1,429	210	4%	96%	0%	0%
222	VA	Chase City	Grasshopper	80	946.25				6%	87%	5%	1%
226	VA	Louisa	Belcher	88	1238.1			150	19%	53%	28%	0%
305	FL	Dade City	Mountain View	55	347.12		510	175	32%	39%	21%	8%
319	FL	Jasper	Hamilton	74.9	1268.9	537	3,596	240	5%	67%	28%	0%
336	FL	Parrish	Manatee	74.5	1180.4		1,079	625	2%	50%	1%	47%
337	FL	Arcadia	Citrus	74.5	640				0%	0%	100%	0%
338	FL	Port Charlotte	Babcock	74.5	422.61				0%	0%	100%	0%
353	VA	Oak Hall	Amazon East(ern sh	80	1000		645	135	8%	75%	17%	0%
364	VA	Stevensburg	Greenwood	100	2266.6	1800	788	200	8%	62%	29%	0%
368	NC	Warsaw	Warsaw	87.5	585.97	499	526	130	11%	66%	21%	3%
390	NC	Ellerbe	Innovative Solar 34	50	385.24	226	N/A	N/A	1%	99%	0%	0%
399	NC	Midland	McBride	74.9	974.59	627	1,425	140	12%	78%	9%	0%
400	FL	Mulberry	Alafia	51	420.35		490	105	7%	90%	3%	0%
406	VA	Clover	Foxhound	91	1311.8		885	185	5%	61%	17%	18%
410	FL	Trenton	Trenton	74.5	480		2,193	775	0%	26%	55%	19%
411	NC	Battleboro	Fern	100	1235.4	960.71	1,494	220	5%	76%	19%	0%
412	MD	Goldsboro	Cherrywood	202	1722.9	1073.7	429	200	10%	76%	13%	0%
434	NC	Conetoe	Conetoe	80	1389.9	910.6	1,152	120	5%	78%	17%	0%
440	FL	Debary	Debary	74.5	844.63		654	190	3%	27%	0%	70%
441	FL	Hawthorne	Horizon	74.5	684				3%	81%	16%	0%
484	VA	Newsoms	Southampton	100	3243.9		-	-	3%	78%	17%	3%
486	VA	Stuarts Draft	Augusta	125	3197.4	1147	588	165	16%	61%	16%	7%
491	NC	Misenheimer	Misenheimer 2018	80	740.2	687.2	504	130	11%	40%	22%	27%
494	VA	Shacklefords	Walnut	110	1700	1173	641	165	14%	72%	13%	1%
496	VA	Clover	Piney Creek	80	776.18	422	523	195	15%	62%	24%	0%
511	NC	Scotland Neck	American Beech	160	3255.2	1807.8	1,262	205	2%	58%	38%	3%
514	NC	Reidsville	Williamsburg	80	802.6	507	734	200	25%	12%	63%	0%
517	VA	Luray	Cape	100	566.53	461	519	110	42%	12%	46%	0%
518	VA	Emporia	Fountain Creek	80	798.3	595	862	300	6%	23%	71%	0%
525	NC	Plymouth	Macadamia	484	5578.7	4813.5	1,513	275	1%	90%	9%	0%
526	NC	Mooresboro	Broad River	50	759.8	365	419	70	29%	55%	16%	0%
555	FL	Mulberry	Durrance	74.5	463.57	324.65	438	140	3%	97%	0%	0%
560	NC	Yadkinville	Sugar	60	477	357	382	65	19%	39%	20%	22%
561	NC	Enfield	Halifax 80mw 2019	80	1007.6	1007.6	672	190	8%	73%	19%	0%
577	VA	Windsor	Windsor	85	564.1	564.1	572	160	9%	67%	24%	0%
579	VA	Paytes	Spotsylvania	500	6412	3500			9%	52%	11%	27%
582	NC	Salisbury	China Grove	65	428.66	324.26	438	85	58%	4%	38%	0%
583	NC	Walnut Cove	Lick Creek	50	1424	185.11	410	65	20%	64%	11%	5%
584	NC	Enfield	Sweetleaf	94	1956.3	1250	968	160	5%	63%	32%	0%
586	VA	Aylett	Sweet Sue	77	1262	576	1,617	680	7%	68%	25%	0%
593	NC	Windsor	Sumac	120	3360.6	1257.9	876	160	4%	90%	6%	0%
599	TN	Somerville	Yum Yum	147	4000	1500	1,862	330	3%	32%	64%	1%
602	GA	Waynesboro	White Oak	76.5	516.7	516.7	2,995	1,790	1%	34%	65%	0%
603	GA	Butler	Butler GA	103	2395.1	2395.1	1,534	255	2%	73%	23%	2%
604	GA	Butler	White Pine	101.2	505.94	505.94	1,044	100	1%	51%	48%	1%
605	GA	Metter	Live Oak	51	417.84	417.84	910	235	4%	72%	23%	0%
606	GA	Hazelhurst	Hazelhurst II	52.5	947.15	490.42	2,114	105	9%	64%	27%	0%
607	GA	Bainbridge	Decatur Parkway	80	781.5	781.5	1,123	450	2%	27%	22%	49%
608	GA	Leslie-DeSoto	Americus	1000	9661.2	4437	5,210	510	1%	63%	36%	0%
616	FL	Fort White	Fort White	74.5	570.5	457.2	828	220	12%	71%	17%	0%
621	VA	Spring Grove	Loblolly	150	2181.9	1000	1,860	110	7%	62%	31%	0%
622	VA	Scottsville	Woodridge	138	2260.9	1000	1,094	170	9%	63%	28%	0%
625	NC	Middlesex	Phobos	80	754.52	734	356	57	14%	75%	10%	0%
628	MI	Deerfield	Carroll Road	200	1694.8	1694.8	343	190	12%	86%	0%	2%
633	VA	Emporia	Brunswick	150.2	2076.4	1387.3	1,091	240	4%	85%	11%	0%
634	NC	Elkin	Partin	50	429.4	257.64	945	155	30%	25%	15%	30%

Parcel #	State	City	Name	Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre Res	Agri	Ag/R	Com
638	GA	Dry Branch	Twiggs	200	2132.7	2132.7	-	-	10%	55%	35%	0%
639	NC	Hope Mills	Innovative Solar 46	78.5	531.87	531.87	423	125	17%	83%	0%	0%
640	NC	Hope Mills	Innovative Solar 42	71	413.99	413.99	375	135	41%	59%	0%	0%
645	NC	Stanley	Hornet	75	1499.5	858.4	663	110	30%	40%	23%	6%
650	NC	Grifton	Grifton 2	56	681.59	297.6	363	235	1%	99%	0%	0%
651	NC	Grifton	Buckleberry	52.1	367.67	361.67	913	180	5%	54%	41%	0%
657	KY	Greensburg	Horseshoe Bend	60	585.65	395	1,394	63	3%	36%	61%	0%
658	KY	Campbellsville	Flat Run	55	429.76	429.76	408	115	13%	52%	35%	0%
666	FL	Archer	Archer	74.9	636.94	636.94	638	200	43%	57%	0%	0%
667	FL	New Smyrna Bea	Pioneer Trail	74.5	1202.8	900	1,162	225	14%	61%	21%	4%
668	FL	Lake City	Sunshine Gateway	74.5	904.29	472	1,233	890	11%	80%	8%	0%
669	FL	Florahome	Coral Farms	74.5	666.54	580	1,614	765	19%	75%	7%	0%
672	VA	Appomattox	Spout Spring	60	881.12	673.37	836	335	16%	30%	46%	8%
676	TX	Stamford	Alamo 7	106.4	1663.1	1050	-	-	6%	83%	0%	11%
677	TX	Fort Stockton	RE Roserock	160	1738.2	1500	-	-	0%	100%	0%	0%
678	TX	Lamesa	Lamesa	102	914.5	655	921	170	4%	41%	11%	44%
679	TX	Lamesa	Ivory	50	706	570	716	460	0%	87%	2%	12%
680	TX	Uvalde	Alamo 5	95	830.35	800	925	740	1%	93%	6%	0%
684	NC	Waco	Brookcliff	50	671.03	671.03	560	150	7%	21%	15%	57%
689	AZ	Arlington	Mesquite	320.8	3774.5	2617	1,670	525	8%	92%	0%	0%
692	AZ	Tucson	Avalon	51	479.21	352	-	-	0%	100%	0%	0%
				81								
			Average	111.80	1422.4	968.4	1031	263	10%	62%	22%	6%
			Median	80.00	914.5	646.0	836	188	7%	64%	17%	0%
			High	1000.00	9661.2	4813.5	5210	1790	58%	100%	100%	70%
			Low	50.00	347.1	185.1	343	57	0%	0%	0%	0%

VIII. Distance Between Homes and Panels

I have measured distances at matched pairs as close as 105 feet between panel and home to show no impact on value. This measurement goes from the closest point on the home to the closest solar panel. This is a strong indication that at this distance there is no impact on adjoining homes.

However, in tracking other approved solar farms across Virginia, North Carolina and other states, I have found that it is common for there to be homes within 100 to 150 feet of solar panels. Given the visual barriers in the form of privacy fencing or landscaping, there is no sign of negative impact.

I have also tracked a number of locations where solar panels are between 50 and 100 feet of single-family homes. In these cases the landscaping is typically a double row of more mature evergreens at time of planting. There are many examples of solar farms with one or two homes closer than 100-feet, but most of the adjoining homes are further than that distance.

IX. Topography

As shown on the summary charts for the solar farms, I have been identifying the topographic shifts across the solar farms considered. Differences in topography can impact visibility of the panels, though typically this results in distant views of panels as opposed to up close views. The topography noted for solar farms showing no impact on adjoining home values range from as much as 160-foot shifts across the project. Given that appearance is the only factor of concern and that distance plus landscape buffering typically addresses up close views, this leaves a number of potentially distant views of panels. I specifically note that in Crittenden in KY there are distant views of panels from the adjoining homes that showed no impact on value.

General rolling terrain with some distant solar panel views are showing no impact on adjoining property value.

X. Potential Impacts During Construction

Any development of a site will have a certain amount of construction, whether it is for a commercial agricultural use such as large-scale poultry operations or a new residential subdivision. Construction will be temporary and consistent with other development uses of the land and in fact dust from the construction will likely be less than most other construction projects given the minimal grading. I would not anticipate any impacts on property value due to construction on the site.

I note that in the matched pairs that I have included there have been a number of home sales that happened after a solar farm was approved but before the solar farm was built showing no impact on property value. Therefore the anticipated construction had no impact as shown by that data.

XI. Scope of Research

I have researched over 750 solar farms and sites on which solar farms are existing and proposed in Virginia, Illinois, Tennessee, North Carolina, Kentucky as well as other states to determine what uses are typically found in proximity with a solar farm. The data I have collected and provide in this report strongly supports the assertion that solar farms are having no negative consequences on adjoining agricultural and residential values.

Beyond these references, I have quantified the adjoining uses for a number of solar farm comparables to derive a breakdown of the adjoining uses for each solar farm. The chart below shows the breakdown of adjoining or abutting uses by total acreage.

Percentage By Adjoining Acreage

	Res	Ag	Res/AG	Comm	Ind	Avg Home	Closest Home	All Res Uses	All Comm Uses
Average	19%	53%	20%	2%	6%	887	344	91%	8%
Median	11%	56%	11%	0%	0%	708	218	100%	0%
High	100%	100%	100%	93%	98%	5,210	4,670	100%	98%
Low	0%	0%	0%	0%	0%	90	25	0%	0%

Res = Residential, Ag = Agriculture, Com = Commercial

Total Solar Farms Considered: 705

I have also included a breakdown of each solar farm by number of adjoining parcels to the solar farm rather than based on adjoining acreage. Using both factors provide a more complete picture of the neighboring properties.

Percentage By Number of Parcels Adjoining

	Res	Ag	Res/AG	Comm	Ind	Avg Home	Closest Home	All Res Uses	All Comm Uses
Average	61%	24%	9%	2%	4%	887	344	93%	6%
Median	65%	19%	5%	0%	0%	708	218	100%	0%
High	100%	100%	100%	60%	78%	5,210	4,670	105%	78%
Low	0%	0%	0%	0%	0%	90	25	0%	0%

Res = Residential, Ag = Agriculture, Com = Commercial

Total Solar Farms Considered: 705

Both of the above charts show a marked residential and agricultural adjoining use for most solar farms. Every single solar farm considered included an adjoining residential or residential/agricultural use.

XII. Specific Factors Related To Impacts on Value

I have completed a number of Impact Studies related to a variety of uses and I have found that the most common areas for impact on adjoining values typically follow a hierarchy with descending levels of potential impact. I will discuss each of these categories and how they relate to a solar farm.

1. Hazardous material
2. Odor
3. Noise
4. Traffic
5. Stigma
6. Appearance

1. Hazardous material

A solar farm presents no potential hazardous waste byproduct as part of normal operation. Any fertilizer, weed control, vehicular traffic, or construction will be significantly less than typically applied in a residential development and even most agricultural uses.

The various solar farms that I have inspected and identified in the addenda have no known environmental impacts associated with the development and operation.

2. Odor

The various solar farms that I have inspected produced no odor.

3. Noise

Whether discussing passive fixed solar panels, or single-axis trackers, there is no negative impact associated with noise from a solar farm. The transformer reportedly has a hum similar to an HVAC that can only be heard in close proximity to this transformer and the buffers on the property are sufficient to make emitted sounds inaudible from the adjoining properties. No sound is emitted from the facility at night.

The various solar farms that I have inspected were inaudible from the roadways.

4. Traffic

The solar farm will have no onsite employee's or staff. The site requires only minimal maintenance. Relative to other potential uses of the site (such as a residential subdivision), the additional traffic generated by a solar farm use on this site is insignificant.

5. Stigma

There is no stigma associated with solar farms and solar farms and people generally respond favorably towards such a use. While an individual may express concerns about proximity to a solar farm, there is no specific stigma associated with a solar farm. Stigma generally refers to things such as adult establishments, prisons, rehabilitation facilities, and so forth.

Solar panels have no associated stigma and in smaller collections are found in yards and roofs in many residential communities. Solar farms are adjoining elementary, middle and high schools as well as churches and subdivisions. I note that one of the solar farms in this report not only adjoins a church, but is actually located on land owned by the church. Solar panels on a roof are often cited as an enhancement to the property in marketing brochures.

I see no basis for an impact from stigma due to a solar farm.

6. Appearance

I note that larger solar farms using fixed or tracking panels are a passive use of the land that is in keeping with a rural/residential area. As shown below, solar farms are comparable to larger greenhouses. This is not surprising given that a greenhouse is essentially another method for collecting passive solar energy. The greenhouse use is well received in residential/rural areas and has a similar visual impact as a solar farm.

The solar panels are all less than 15 feet high, which means that the visual impact of the solar panels will be similar in height to a typical greenhouse and lower than a single-story residential dwelling. Were the subject property developed with single family housing, that development would have a much greater visual impact on the surrounding area given that a two-story home with attic could be three to four times as high as these proposed panels.

Whenever you consider the impact of a proposed project on viewshed or what the adjoining owners may see from their property it is important to distinguish whether or not they have a protected viewshed or not. Enhancements for scenic vistas are often measured when considering properties that adjoin preserved open space and parks. However, adjoining land with a preferred view today conveys no guarantee that the property will continue in the current use. Any consideration of the impact of the appearance requires a consideration of the wide variety of other uses a property already has the right to be put to, which for solar farms often includes subdivision development, agricultural business buildings such as poultry, or large greenhouses and the like.

Dr. Randall Bell, MAI, PhD, and author of the book **Real Estate Damages**, Third Edition, on Page 146 "Views of bodies of water, city lights, natural settings, parks, golf courses, and other amenities are considered desirable features, particularly for residential properties." Dr. Bell continues on Page 147 that "View amenities may or may not be protected by law or regulation. It is sometimes argued that views have value only if they are protected by a view easement, a zoning ordinance, or covenants, conditions, and restrictions (CC&Rs), although such protections are relatively

uncommon as a practical matter. The market often assigns significant value to desirable views irrespective of whether or not such views are protected by law."

Dr. Bell concludes that a view enhances adjacent property, even if the adjacent property has no legal right to that view. He then discusses a "borrowed" view where a home may enjoy a good view of vacant land or property beyond with a reasonable expectation that the view might be partly or completely obstructed upon development of the adjoining land. He follows that with "This same concept applies to potentially undesirable views of a new development when the development conforms to applicable zoning and other regulations. Arguing value diminution in such cases is difficult, since the possible development of the offending property should have been known." In other words, if there is an allowable development on the site then arguing value diminution with such a development would be difficult. This further extends to developing the site with alternative uses that are less impactful on the view than currently allowed uses.

This gets back to the point that if a property has development rights and could currently be developed in such a way that removes the viewshed such as a residential subdivision, then a less intrusive use such as a solar farm that is easily screened by landscaping would not have a greater impact on the viewshed of any perceived value adjoining properties claim for viewshed. Essentially, if there are more impactful uses currently allowed, then how can you claim damages for a less impactful use.

7. Conclusion

On the basis of the factors described above, it is my professional opinion that the proposed solar farm will not negatively impact adjoining property values. The only category of impact of note is appearance, which is addressed through setbacks and landscaping buffers. The matched pair data supports that conclusion.

XIII. Conclusion

The adjoining properties are appropriately set back from the proposed solar panels and most of the site has sufficient existing landscaping for screening the proposed solar farm.

The matched pair analysis supports a finding of no impact on home values due to abutting or adjoining a solar farm as well as no impact to abutting or adjacent vacant residential or agricultural land where the solar farm is properly screened and buffered. The criteria that typically correlates with downward adjustments on property values such as noise, odor, and traffic all indicate that a solar farm is a compatible use for rural/residential transition areas and that it would function in a harmonious manner with this area.

The data points include a mix of negative and positive results, but the large majority of the findings fall within typical market variation of +/-5%. The aggregate of the findings support a mild positive impact, but within that typical market variation. As real estate is considered an imperfect market this +/-5% range is typical for any property type and supports a finding of no impact on property value.

Data from the university studies, broker commentary, and other appraisal studies support the same finding.

Comparable solar facilities in have been found by hundreds of towns and counties not to have a substantial negative effect to abutting or adjoining properties, and many of those findings of no impact have been upheld by appellate courts. Comparable solar facilities have been approved with adjoining agricultural uses, schools, churches, and residential developments.

Based on the data and analysis in this report, it is my professional opinion that the proposed White Oak Solar facility will have negligible impact on the value of adjoining or abutting properties and the proposed use is in harmony with the area in which it is located. As an aside, there are positive implications of a solar facility on nearby properties including protection from future residential development or other more intrusive uses, reduced dust, odor and chemicals from former farming operations, protection from light pollution at night, minimal noises, and minimal traffic.

XIV. Certification

I certify that, to the best of my knowledge and belief:

1. The statements of fact contained in this report are true and correct;

2. The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are my personal, unbiased professional analyses, opinions, and conclusions;

3. I have no present or prospective interest in the property that is the subject of this report and no personal interest with respect to the parties involved;

4. I have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment;

5. My engagement in this assignment was not contingent upon developing or reporting predetermined results;

6. My compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of the appraisal;

7. The reported analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute;

8. My analyses, opinions and conclusions were developed, and this report has been prepared, in conformity with the Uniform Standards of Professional Appraisal Practice.

9. The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives;

10. I have not made a personal inspection of the property that is the subject of this report, and;

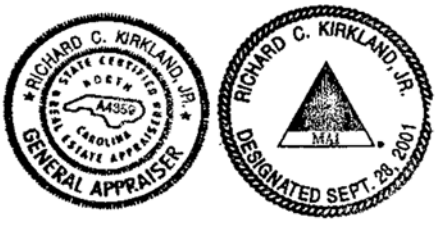
11. No one provided significant real property appraisal assistance to the person signing this certification.

12. As of the date of this report I have completed the continuing education program for Designated Members of the Appraisal Institute;

13. I provided an earlier analysis on this project with a slightly different layout on November 11, 2019. I have not completed any other appraisal related assignments regarding this project within the three years prior to engagement in this current assignment.

Disclosure of the contents of this appraisal report is governed by the bylaws and regulations of the Appraisal Institute and the National Association of Realtors.

Neither all nor any part of the contents of this appraisal report shall be disseminated to the public through advertising media, public relations media, news media, or any other public means of communications without the prior written consent and approval of the undersigned.



Richard C. Kirkland, Jr., MAI
State Certified General Appraiser

Kirkland Appraisals, LLC

Richard C. Kirkland, Jr., MAI
9408 Northfield Court
Raleigh, North Carolina 27603
Mobile (919) 414-8142
rkirkland2@gmail.com
www.kirklandappraisals.com

Professional Experience

Kirkland Appraisals, LLC, Raleigh, N.C. — 2003 – Present
Commercial appraiser

Hester & Company, Raleigh, N.C.
Commercial appraiser — 1996 – 2003

Professional Affiliations

MAI (Member, Appraisal Institute) designation #11796 — 2001
NC State Certified General Appraiser # A4359 — 1999
VA State Certified General Appraiser # 4001017291
SC State Certified General Appraiser # 6209
FL State Certified General Appraiser # RZ3950
GA State Certified General Appraiser # 321885
MI State Certified General Appraiser # 1201076620
PA State Certified General Appraiser # GA004598
OH State Certified General Appraiser # 2021008689
IN State Certified General Appraiser # CG42100052

Education

Bachelor of Arts in English, University of North Carolina, Chapel Hill — 1993

Continuing Education

Uniform Standards of Professional Appraisal Practice Update	2022
Sexual Harassment Prevention Training	2021
Appraisal of Land Subject to Ground Leases	2021
Florida Appraisal Laws and Regulations	2020
Michigan Appraisal Law	2020
Uniform Standards of Professional Appraisal Practice Update	2020
Uniform Appraisal Standards for Federal Land Acquisitions (Yellow Book)	2019
The Cost Approach	2019
Income Approach Case Studies for Commercial Appraisers	2018
Introduction to Expert Witness Testimony for Appraisers	2018
Appraising Small Apartment Properties	2018
Florida Appraisal Laws and Regulations	2018
Uniform Standards of Professional Appraisal Practice Update	2018
Appraisal of REO and Foreclosure Properties	2017
Appraisal of Self Storage Facilities	2017
Land and Site Valuation	2017
NCDOT Appraisal Principles and Procedures	2017
Uniform Standards of Professional Appraisal Practice Update	2016
Forecasting Revenue	2015
Wind Turbine Effect on Value	2015

Supervisor/Trainee Class	2015
Business Practices and Ethics	2014
Subdivision Valuation	2014
Uniform Standards of Professional Appraisal Practice Update	2014
Introduction to Vineyard and Winery Valuation	2013
Appraising Rural Residential Properties	2012
Uniform Standards of Professional Appraisal Practice Update	2012
Supervisors/Trainees	2011
Rates and Ratios: Making sense of GIMs, OARs, and DCFs	2011
Advanced Internet Search Strategies	2011
Analyzing Distressed Real Estate	2011
Uniform Standards of Professional Appraisal Practice Update	2011
Business Practices and Ethics	2011
Appraisal Curriculum Overview (2 Days – General)	2009
Appraisal Review - General	2009
Uniform Standards of Professional Appraisal Practice Update	2008
Subdivision Valuation: A Comprehensive Guide	2008
Office Building Valuation: A Contemporary Perspective	2008
Valuation of Detrimental Conditions in Real Estate	2007
The Appraisal of Small Subdivisions	2007
Uniform Standards of Professional Appraisal Practice Update	2006
Evaluating Commercial Construction	2005
Conservation Easements	2005
Uniform Standards of Professional Appraisal Practice Update	2004
Condemnation Appraising	2004
Land Valuation Adjustment Procedures	2004
Supporting Capitalization Rates	2004
Uniform Standards of Professional Appraisal Practice, C	2002
Wells and Septic Systems and Wastewater Irrigation Systems	2002
Appraisals 2002	2002
Analyzing Commercial Lease Clauses	2002
Conservation Easements	2000
Preparation for Litigation	2000
Appraisal of Nonconforming Uses	2000
Advanced Applications	2000
Highest and Best Use and Market Analysis	1999
Advanced Sales Comparison and Cost Approaches	1999
Advanced Income Capitalization	1998
Valuation of Detrimental Conditions in Real Estate	1999
Report Writing and Valuation Analysis	1999
Property Tax Values and Appeals	1997
Uniform Standards of Professional Appraisal Practice, A & B	1997
Basic Income Capitalization	1996

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

1001 Boulders Parkway
Suite 300
Richmond, VA 23225

P 804.200.6500
F 804.560.1016
www.timmons.com

To: Harry Kingery (CEP Solar)
From: W. Scott Dunn, AICP, PTP
RE: White Oak Solar, Fluvanna County, VA – Preliminary Roadway Assessment
Date: November 23, 2022
Copy: Lauren Wheeler (TG); Rick Thomas (TG)

Project Background

Commonwealth Energy Partners (CEP Solar) is pursuing the development of a solar facility in Fluvanna County, VA. White Oak Solar is located along Shores Road (Route 640), south of Cunningham Road (Route 697), and east of River Road (Route 6). The project encompasses a total of 434.7 acres, of which 345.4 acres will be developed (i.e., accommodate solar panels). The site will be served by three (3) entrances, two (2) on Shores Road (Route 640) and one (1) on Rockfish Run Road (Route 683). The northern site entrance on Shores Road will primarily serve as substation access while the two (2) southern site entrances will serve site-related traffic both during the construction and the operations/maintenance phases.

An aerial showing the project location and adjacent road network can be found on Figure 1. A concept plan for White Oak Solar can be found on Figure 2.

Adjacent Roadway Network

Four (4) primary roads were identified that will provide access to White Oak Solar:

- Route 6 (River Road);
- Route 697 (Cunningham Road);
- Route 640 (Shores Road); and
- Route 683 (Rockfish Run Road).

An inventory of these adjacent VDOT-maintained roadways is shown on Figure 3.

Study Intersections

There are three (3) noted intersections within the study area – Route 6/Route 697, Route 697/Route 640, and Route 6/Route 683 as shown in Figure 1.

Photos of the Route 6/Route 697 intersection of can be found in Figure 4. Photos of the Route 697/Route 640 intersection of can be found in Figure 5. Photos of the Route 6/Route 683 intersection of can be found in Figure 6.

All three (3) intersections are stop-controlled and and appear to have adequate sight distance except for the Route 6/Route 683 intersection. Route 683 is skewed relative to Route 6 and the sight distance to the south appears to be limited by the adjacent trees and the horizontal and vertical curvature along Route 6.

Crash Data

There has been a total of 23 crashes along the adjacent roadways that will be used to access the site over the past five (5) years. A map of these crashes can be found in Figure 7.

Of the 23 crashes reported, two (2) resulted in severe injury, three (3) resulted in visible injury; the remaining 18 (78%) resulted in property damage only. The most common type of crash was fixed object – off road (10) and the second most common was deer related crashes (5). The remaining crashes were as follows:

- Three (3) non-collision crashes;
- Two (2) fixed object – in road crashes;
- Two (2) head on crashes; and
- One (1) sideswipe – opposite direction crash.

Culvert and Bridge Data

Timmons Group completed a query of VDOT's Culvert and Bridge Database for information on structures in the vicinity of the project to determine if any adjacent roads may not be viable due to weight restrictions or current conditions based on recent inspections. Based on this query, there are no structures (culverts or bridges) in the vicinity of the site that will limit use of a road or access to the site.

Site Entrances

Access to the site will be provided via three (3) entrances as shown in Figure 2. Photos of the site individual site entrances can be found in Figures 8 through 10.

Based on photographs collected at each of the site entrances, sight distance at the proposed entrance locations is sufficient for both vehicles travelling along the state-maintained roadways as well as vehicles exiting the site driveways.

Proposed Access Route

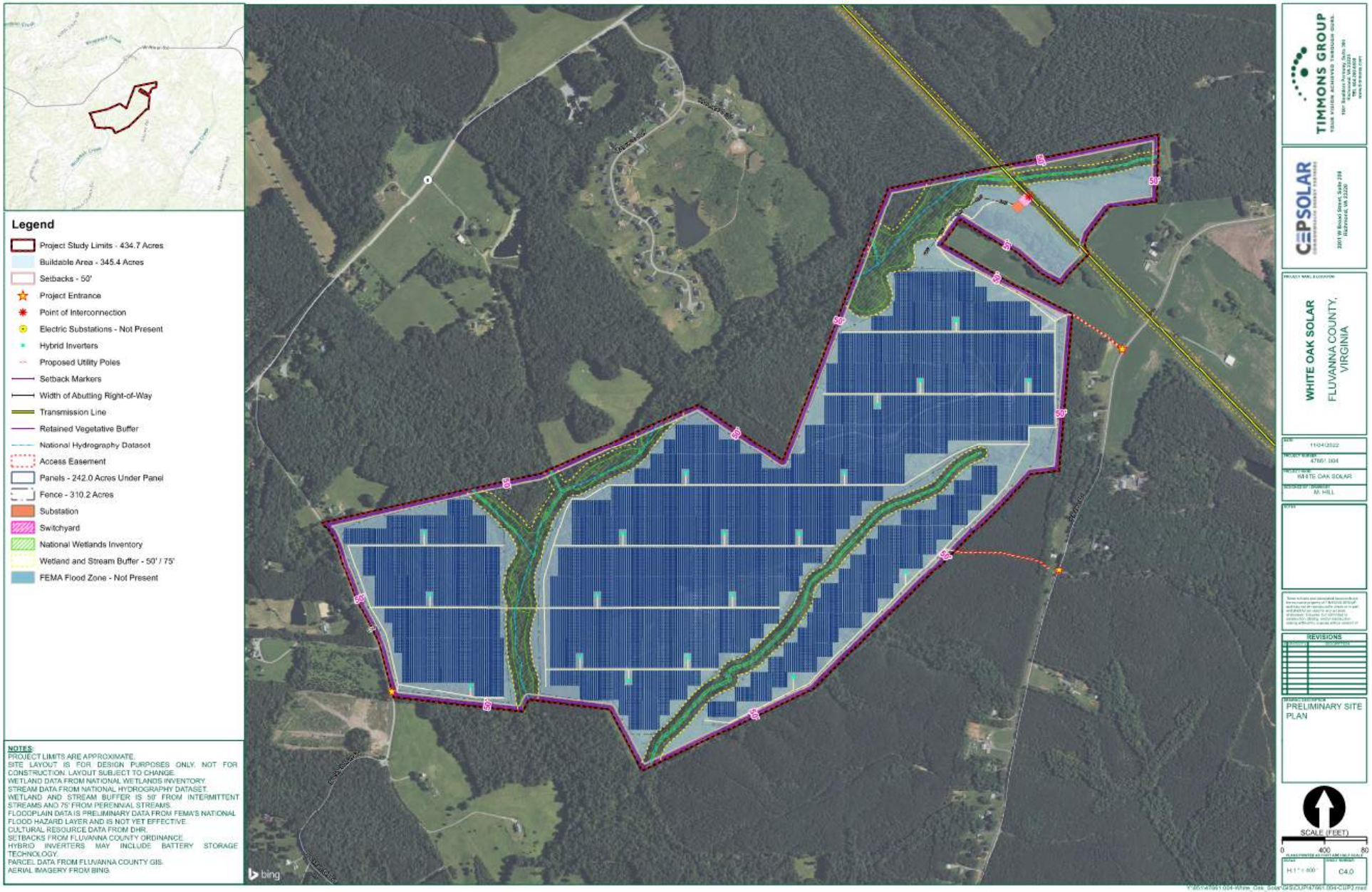
Based on the project location and proposed entrances, it is recommended that site-related traffic enter/exit via the proposed haul route shown on Figure 11.

River Road (Route 6) provides access to James Madison Highway (US Route 15) which can be used to access I-64 to the north and US Route 60 to the south. All facilities included in this review – Route 6, Route 697, Route 640, and Route 683 – have available carrying capacity to accommodate site-related traffic. However, it should be noted that the local nature of Routes 697, 640, and 683, indicate that these facilities are not designed to accommodate consistent heavy vehicle traffic and may witness physical degradation through the construction of White Oak Solar.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Surrounding Roadway Network and Site Location
White Oak Solar
Fluvanna County, Virginia

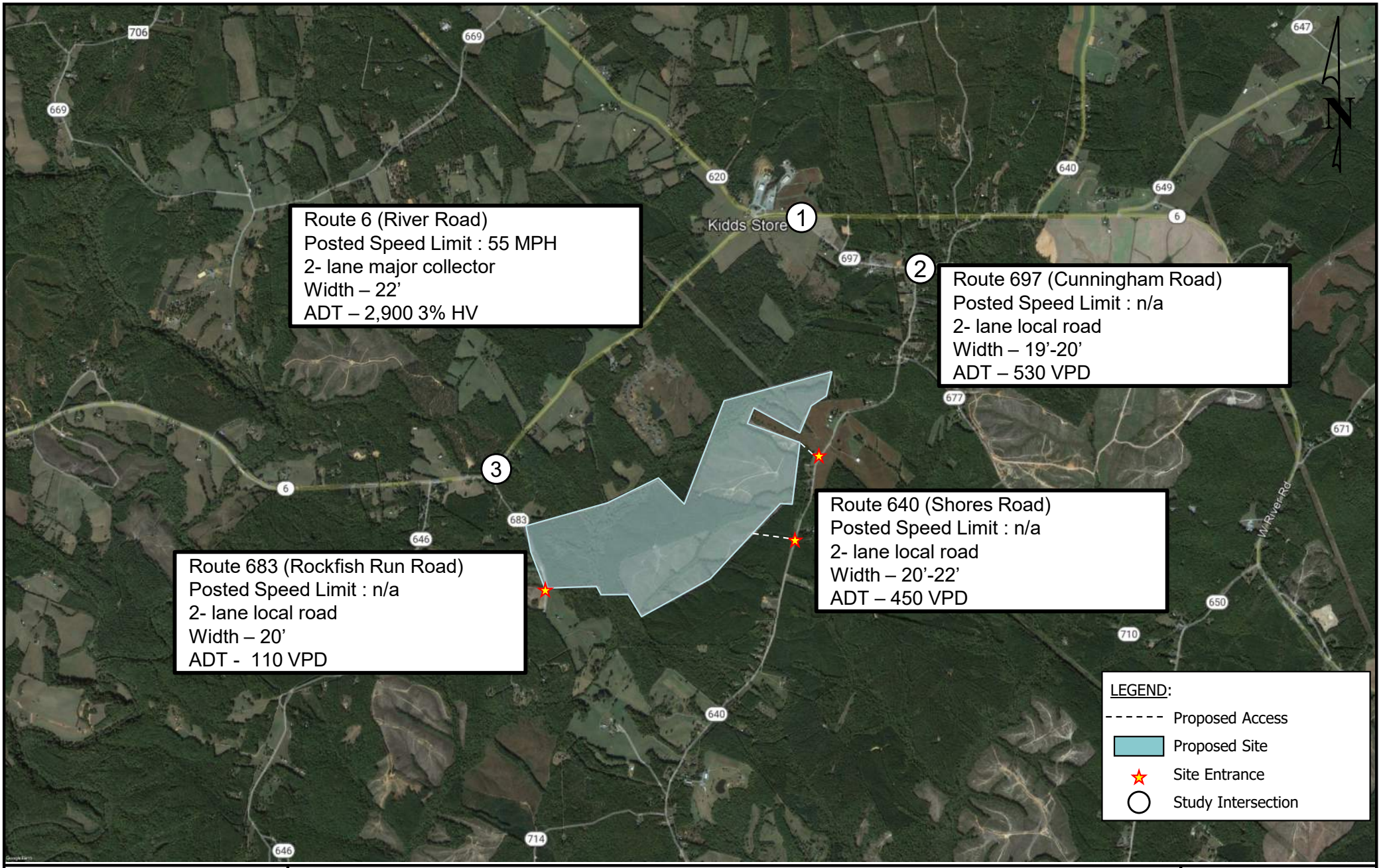
Figure
1



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Site Layout
White Oak Solar
Fluvanna County, Virginia

Figure
2



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Adjacent Roadway Inventory
White Oak Solar
Fluvanna County, Virginia

Figure 3

South along Route 697

North along Route 6

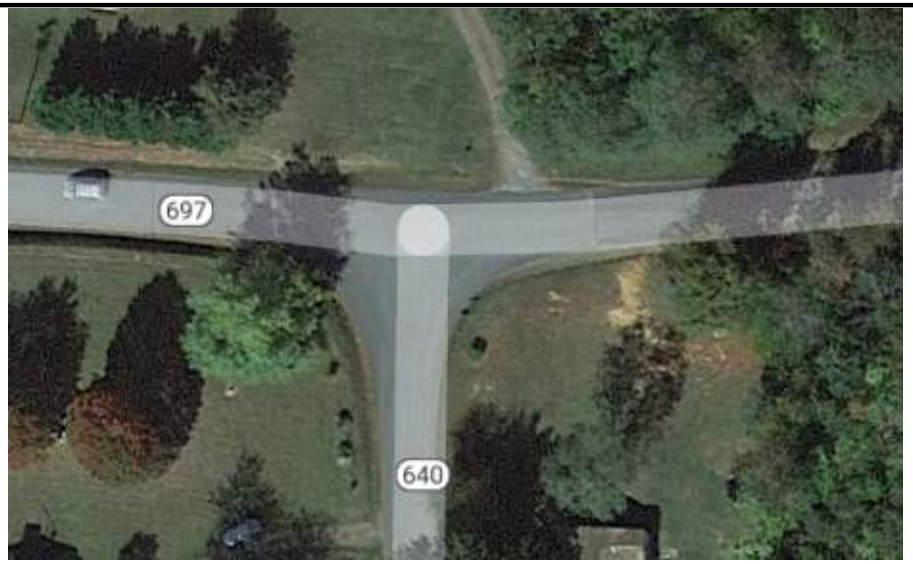
South along Route 6

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Intersection of Route 6 and Route 697
White Oak Solar
Fluvanna County, Virginia

Figure
4

South along Route 640



NOT TO SCALE

N

East along Route 697

West along Route 697

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Intersection of Route 697 and Route 640
White Oak Solar
Fluvanna County, Virginia

Figure
5

South along Route 683

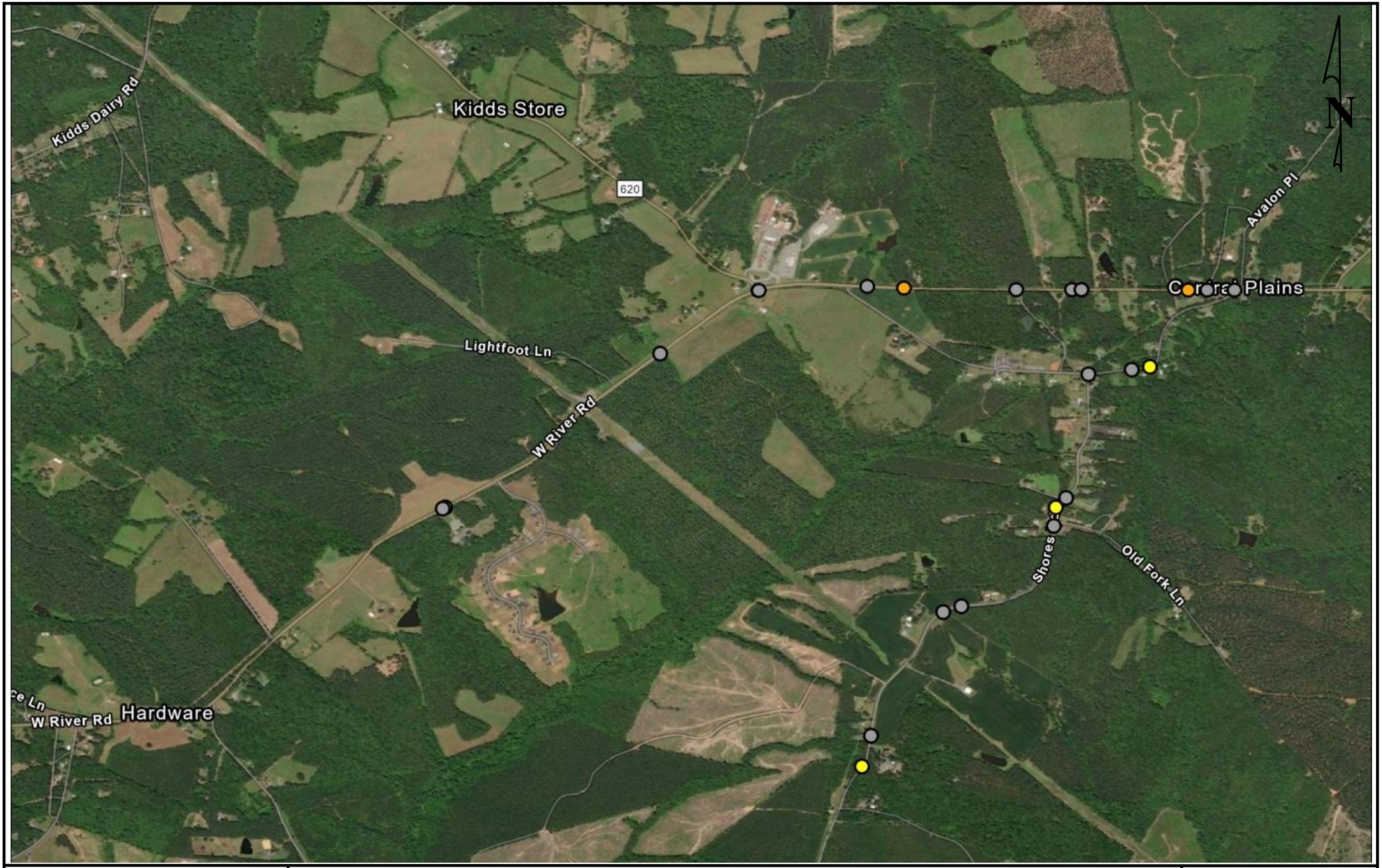
East along Route 6

West along Route 6

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Intersection of Route 6 and Route 683
White Oak Solar
Fluvanna County, Virginia

Figure
6



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Crash Map
White Oak Solar
Fluvanna County, Virginia

Figure
7

West along Site Entrance

South along Shores Road

North along Shores Road

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Site Entrance 1 on Shores Road
White Oak Solar
Fluvanna County, Virginia

Figure
8

West along Site Entrance

South along Shores Road

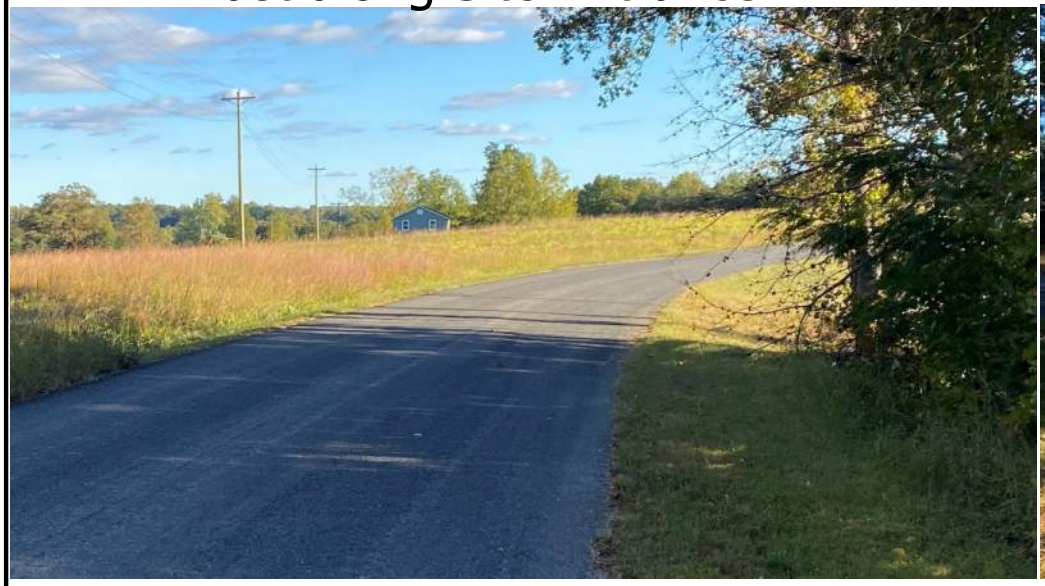
North along Shores Road

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Site Entrance 2 on Shores Road
White Oak Solar
Fluvanna County, Virginia

Figure
9

East along Site Entrance



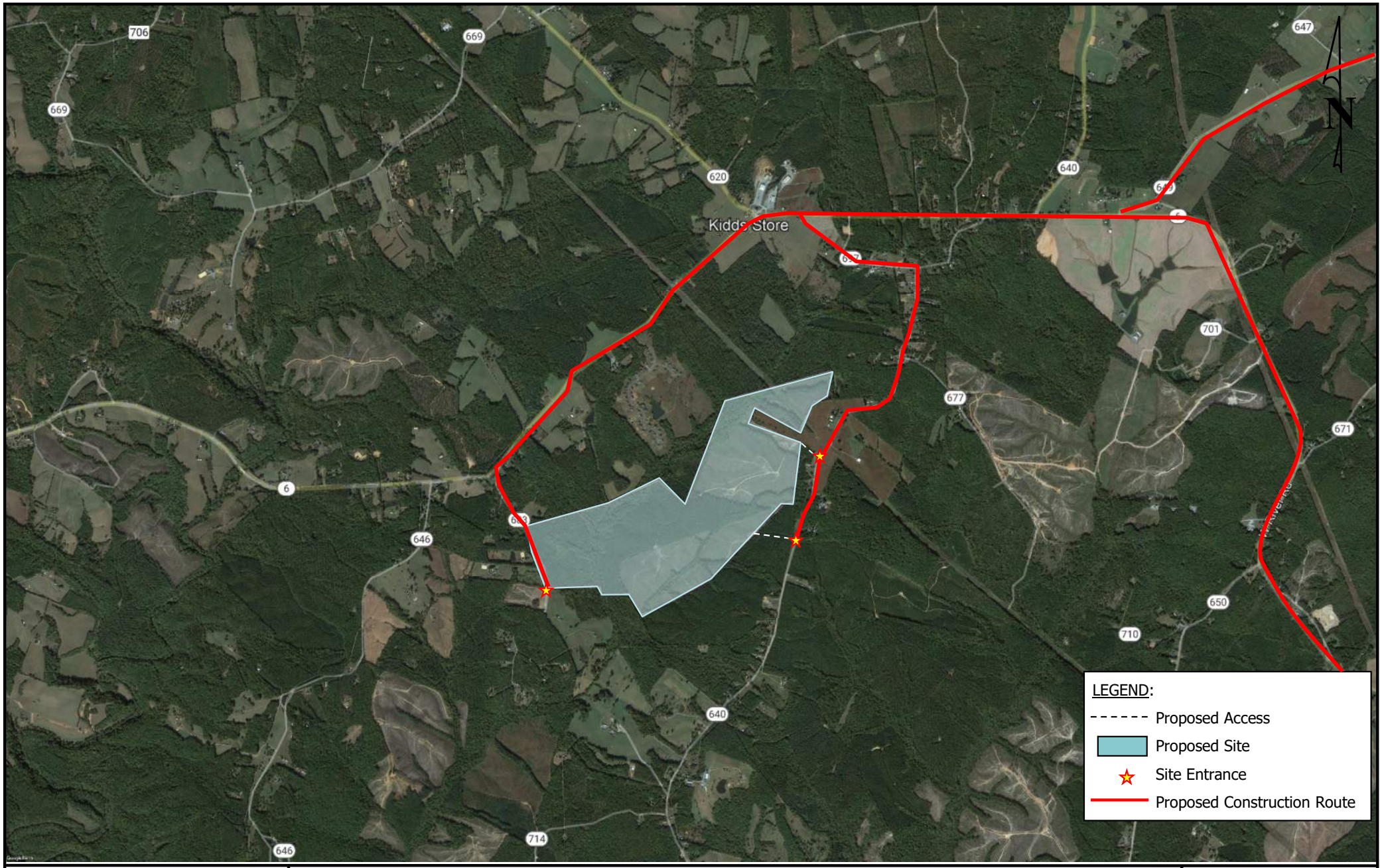
South along Rockfish Run Road

North along Rockfish Run Road

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Site Entrance 3 on Rockfish Run Road
White Oak Solar
Fluvanna County, Virginia

Figure
10



TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

Proposed Construction Traffic Route
White Oak Solar
Fluvanna County, Virginia

Figure
11

WHITE PAPER

Health and Safety Impacts of Solar Photovoltaics

By Tommy Cleveland
May 2017

NC CLEAN ENERGY TECHNOLOGY CENTER

NC STATE UNIVERSITY

Contents

Health and Safety Impacts of Solar Photovoltaics

The increasing presence of utility-scale solar photovoltaic (PV) systems (sometimes referred to as solar farms) is a rather new development in North Carolina's landscape. Due to the new and unknown nature of this technology, it is natural for communities near such developments to be concerned about health and safety impacts. Unfortunately, the quick emergence of utility-scale solar has cultivated fertile grounds for myths and half-truths about the health impacts of this technology, which can lead to unnecessary fear and conflict.

Photovoltaic (PV) technologies and solar inverters are not known to pose any significant health dangers to their neighbors. The most important dangers posed are increased highway traffic during the relative short construction period and dangers posed to trespassers of contact with high voltage equipment. This latter risk is mitigated by signage and the security measures that industry uses to deter trespassing. As will be discussed in more detail below, risks of site contamination are much less than for most other industrial uses because PV technologies employ few toxic chemicals and those used are used in very small quantities. Due to the reduction in the pollution from fossil-fuel-fired electric generators, the overall impact of solar development on human health is overwhelmingly positive. This pollution reduction results from a partial replacement of fossil-fuel fired generation by emission-free PV-generated electricity, which reduces harmful sulfur dioxide (SO2), nitrogen oxides (NOx), and fine particulate matter (PM2.5). Analysis from the National Renewable Energy Laboratory and the Lawrence Berkeley National Laboratory, both affiliates of the U.S. Department of Energy, estimates the health-related air quality benefits to the southeast region from solar PV generators to be worth 8.0 ¢ per kilowatt-hour of solar generation.[1] This is in addition to the value of the electricity and suggests that the air quality benefits of solar are worth more than the electricity itself.

Even though we have only recently seen large-scale installation of PV technologies, the technology and its potential impacts have been studied since the 1950s. A combination of this solar-specific research and general scientific research has led to the scientific community having a good understanding of the science behind potential health and safety impacts of solar energy. This paper utilizes the latest scientific literature and knowledge of solar practices in N.C. to address the health and safety risks associated with solar PV technology. These risks are extremely small, far less than those associated with common activities such as driving a car, and vastly outweighed by health benefits of the generation of clean electricity.

This paper addresses the potential health and safety impacts of solar PV development in North Carolina, organized into the following four categories:
(1) Hazardous Materials
(2) Electromagnetic Fields (EMF)
(3) Electric Shock and Arc Flash
(4) Fire Safety

1 • Hazardous Materials

One of the more common concerns towards solar is that the panels (referred to as "modules" in the solar industry) consist of toxic materials that endanger public health. However, as shown in this section, solar energy systems may contain small amounts of toxic materials, but these materials do not endanger public health. To understand potential toxic hazards coming from a solar project, one

must understand system installation, materials used, the panel end-of-life protocols, and system operation. This section will examine these aspects of a solar farm and the potential for toxicity impacts in the following subsections:

(1.2) Project Installation/Construction
(1.2) System Components
  1.2.1 Solar Panels: Construction and Durability
  1.2.2 Photovoltaic technologies
    (a) Crystalline Silicon
    (b) Cadmium Telluride (CdTe)
    (c) CIS/CIGS
  1.2.3 Panel End of Life Management
  1.2.4 Non-panel System Components
(1.3) Operations and Maintenance

1.1 Project Installation/ Construction

The system installation, or construction, process does not require toxic chemicals or processes. The site is mechanically cleared of large vegetation, fences are constructed, and the land is surveyed to layout exact installation locations. Trenches for underground wiring are dug and support posts are driven into the ground. The solar panels are bolted to steel and aluminum support structures and wired together. Inverter pads are installed, and an inverter and transformer are installed on each pad. Once everything is connected, the system is tested, and only then turned on.

Figure 1: Utility-scale solar facility (5 MWAC) located in Catawba County. *Source: Strata Solar*

1.2 · System Components

1.2.1 Solar Panels: Construction and Durability

Solar PV panels typically consist of glass, polymer, aluminum, copper, and semiconductor materials that can be recovered and recycled at the end of their useful life.[2] Today there are two PV technologies used in PV panels at utility-scale solar facilities, silicon, and thin film. As of 2016, all thin film used in North Carolina solar facilities are cadmium telluride (CdTe) panels from the US manufacturer First Solar, but there are other thin film PV panels available on the market, such as Solar Frontier's CIGS panels. Crystalline silicon technology consists of silicon wafers which are made into cells and assembled into panels, thin film technologies consist of thin layers of semiconductor material deposited onto glass, polymer or metal substrates. While there are differences in the components and manufacturing processes of these two types of solar technologies, many aspects of their PV panel construction are very similar. Specifics about each type of PV chemistry as it relates to toxicity are covered in subsections a, b, and c in section 1.2.2; on crystalline silicon, cadmium telluride, and CIS/CIGS respectively. The rest of this section applies equally to both silicon and thin film panels.

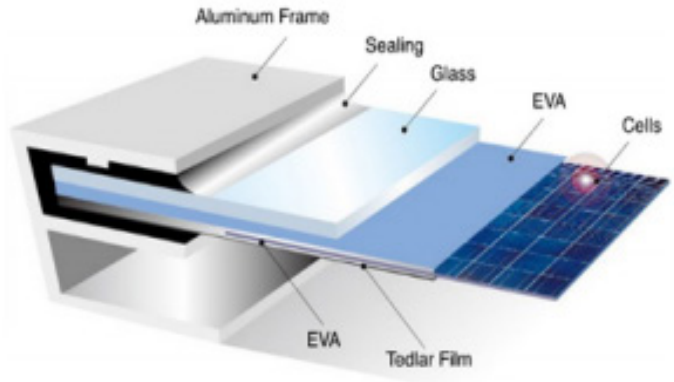


Figure 2: Components of crystalline silicon panels. The vast majority of silicon panels consist of a glass sheet on the topside with an aluminum frame providing structural support. Image Source: www.riteksolar.com.tw

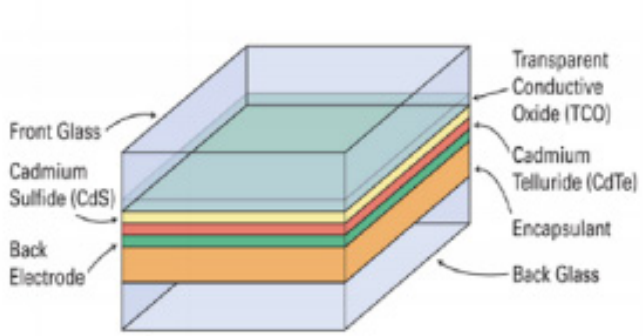


Figure 3: Layers of a common frameless thin-film panel (CdTe). Many thin film panels are frameless, including the most common thin-film panels, First Solar's CdTe. Frameless panels have protective glass on both the front and back of the panel. Layer thicknesses not to scale. Image Source: www.homepower.com

To provide decades of corrosion-free operation, PV cells in PV panels are encapsulated from air and moisture between two layers of plastic. The encapsulation layers are protected on the top with a layer of tempered glass and on the backside with a polymer sheet. Frameless modules include a protective layer of glass on the rear of the panel, which may also be tempered. The plastic ethylene-vinyl acetate (EVA) commonly provides the cell encapsulation. For decades, this same material has been used between layers of tempered glass to give car windshields and hurricane windows their great strength. In the same way that a car windshield cracks but stays intact, the EVA layers in PV panels keep broken panels intact (see Figure 4). Thus, a damaged module does not generally create small pieces of debris; instead, it largely remains together as one piece.

Figure 4: The mangled PV panels in this picture illustrate the nature of broken solar panels; the glass cracks but the panel is still in one piece. Image Source: http://img.alibaba.com/photo/115259576/broken_solar_panel.jpg

PV panels constructed with the same basic components as modern panels have been installed across the globe for well over thirty years.[3] The long-term durability and performance demonstrated over these decades, as well as the results of accelerated lifetime testing, helped lead to an industrystandard 25-year power production warranty for PV panels. These power warranties warrant a PV panel to produce at least 80% of their original nameplate production after 25 years of use. A recent SolarCity and DNV GL study reported that today's quality PV panels should be expected to reliably and efficiently produce power for thirty-five years.[4]

Local building codes require all structures, including ground mounted solar arrays, to be engineered to withstand anticipated wind speeds, as defined by the local wind speed requirements. Many racking products are available in versions engineered for wind speeds of up to 150 miles per hour, which is significantly higher than the wind speed requirement anywhere in North Carolina. The strength of PV mounting structures were demonstrated during Hurricane Sandy in 2012 and again during Hurricane Matthew in 2016. During Hurricane Sandy, the many large-scale solar facilities in New Jersey and New York at that time suffered only minor damage.[5] In the fall of 2016, the US and Caribbean experienced destructive winds and torrential rains from Hurricane Matthew, yet one leading solar tracker manufacturer reported that their numerous systems in the impacted area received zero damage from wind or flooding.[6]

In the event of a catastrophic event capable of damaging solar equipment, such as a tornado, the system will almost certainly have property insurance

that will cover the cost to cleanup and repair the project. It is in the best interest of the system owner to protect their investment against such risks. It is also in their interest to get the project repaired and producing full power as soon as possible. Therefore, the investment in adequate insurance is a wise business practice for the system owner. For the same reasons, adequate insurance coverage is also generally a requirement of the bank or firm providing financing for the project.

1.2.2 Photovoltaic (PV) Technologies

a. Crystalline Silicon

This subsection explores the toxicity of silicon-based PV panels and concludes that they do not pose a material risk of toxicity to public health and safety. Modern crystalline silicon PV panels, which account for over 90% of solar PV panels installed today, are, more or less, a commodity product. The overwhelming majority of panels installed in North Carolina are crystalline silicon panels that are informally classified as Tier I panels. Tier I panels are from well-respected manufacturers that have a good chance of being able to honor warranty claims. Tier I panels are understood to be of high quality, with predictable performance, durability, and content. Well over 80% (by weight) of the content of a PV panel is the tempered glass front and the aluminum frame, both of which are common building materials. Most of the remaining portion are common plastics, including polyethylene terephthalate in the backsheet, EVA encapsulation of the PV cells, polyphenyl ether in the junction box, and polyethylene insulation on the wire leads. The active, working components of the system are the silicon photovoltaic cells, the small electrical leads connecting them together, and to the wires coming out of the back of the panel. The electricity generating and conducting components makeup less than 5% of the weight of most panels. The PV cell itself is nearly 100% silicon, and silicon is the second most common element in the Earth's crust. The silicon for PV cells is obtained by high-temperature processing of quartz sand (SiO2) that removes its oxygen molecules. The refined silicon is converted to a PV cell by adding extremely small amounts of boron and phosphorus, both of which are common and of very low toxicity.

The other minor components of the PV cell are also generally benign; however, some contain lead, which is a human toxicant that is particularly harmful to young children. The minor components include an extremely thin antireflective coating (silicon nitride or titanium dioxide), a thin layer of aluminum on the rear, and thin strips of silver alloy that are screen-printed on the front and rear of cell.[7] In order for the front and rear electrodes to make effective electrical contact with the proper layer of the PV cell, other materials (called glass frit) are mixed with the silver alloy and then heated to etch the metals into the cell. This glass frit historically contains a small amount of lead (Pb) in the form of lead oxide. The 60 or 72 PV cells in a PV panel are connected by soldering thin solder-covered copper tabs from the back of one cell to the front of the next cell. Traditionally a tin-based solder containing some lead (Pb) is used, but some manufacturers have switched to lead-free solder. The glass frit and/or the solder may contain trace amounts of other metals, potentially including some with human toxicity such as cadmium. However, testing to simulate the potential for leaching from broken panels, which is discussed in more detail below, did not find a potential toxicity threat from these trace elements. Therefore, the tiny amount of lead in the grass frit and the solder is the only part of silicon PV panels with a potential to create a negative health impact. However, as described below, the very limited amount of lead involved and its strong physical and chemical attachment to other components of the PV panel means that even in worst-case scenarios the health hazard it poses is insignificant.

As with many electronic industries, the solder in silicon PV panels has historically been a leadbased solder, often 36% lead, due to the superior properties of such solder. However, recent advances in lead-free solders have spurred a trend among PV panel manufacturers to reduce or remove the lead in their panels. According to the 2015 Solar Scorecard from the Silicon Valley Toxics Coalition, a group that tracks environmental responsibility of photovoltaic panel manufacturers, fourteen companies (increased from twelve companies in 2014) manufacture PV panels certified to meet the European Restriction of Hazardous Substances (RoHS) standard. This means that the amount of cadmium and lead in the panels they manufacture fall below the RoHS thresholds, which are set by the European Union and serve as the world's de facto standard for hazardous substances in manufactured goods.[8] The Restriction of Hazardous Substances (RoHS) standard requires that the maximum concentration found in any homogenous material in a produce is less than 0.01% cadmium and less than 0.10% lead, therefore, any solder can be no more than 0.10% lead.[9]

While some manufacturers are producing PV panels that meet the RoHS standard, there is no requirement that they do so because the RoHS Directive explicitly states that the directive does not apply to photovoltaic panels.[10] The justification for this is provided in item 17 of the current RoHS Directive: "The development of renewable forms of energy is one of the Union's key objectives, and the contribution made by renewable energy sources to environmental and climate objectives is crucial. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources (4) recalls that there should be coherence between those objectives and other Union environmental legislation. Consequently, this Directive should not prevent the development of renewable energy technologies that have no negative impact on health and the environment and that are sustainable and economically viable."

The use of lead is common in our modern economy. However, only about 0.5% of the annual lead consumption in the U.S. is for electronic solder for all uses; PV solder makes up only a tiny portion of this 0.5%. Close to 90% of lead consumption in the US is in batteries, which do not encapsulate the pounds of lead contained in each typical automotive battery. This puts the lead in batteries at great risk of leaching into the environment. Estimates for the lead in a single PV panel with lead-based solder range from 1.6 to 24 grams of lead, with 13g (less than half of an ounce) per panel seen most often in the literature.[11] At 13 g/panel[12], each panel contains one-half of the lead in a typical 12-gauge shotgun shell. This amount equates to roughly 1/750th of the lead in a single car battery. In a panel, it is all durably encapsulated from air or water for the full life of the panel.[14]

As indicated by their 20 to 30-year power warranty, PV modules are designed for a long service life, generally over 25 years. For a panel to comply with its 25-year power warranty, its internal components, including lead, must be sealed from any moisture. Otherwise, they would corrode and the panel's output would fall below power warranty levels. Thus, the lead in operating PV modules is not at risk of release to the environment during their service lifetime. In extreme experiments, researchers have shown that lead can leach from crushed or pulverized panels.[15, 16] However, more real-world tests designed to represent typical trash compaction that are used to classify waste as hazardous or non-hazardous show no danger from leaching.[17,18] For more information about PV panel end-of-life, see the Panel Disposal section.

As illustrated throughout this section, silicon-based PV panels do not pose a material threat to public health and safety. The only aspect of the panels with potential toxicity concerns is the very small amount of lead in some panels. However, any lead in a panel is well sealed from environmental exposure for the operating lifetime of the solar panel and thus not at risk of release into the environment.

b. Cadmium Telluride (CdTe) PV Panels

This subsection examines the components of a cadmium telluride (CdTe) PV panel. Research demonstrates that they pose negligible toxicity risk to public health and safety while significantly reducing the public's exposure to cadmium by reducing coal emissions. As of mid-2016, a few hundred MWs of cadmium telluride (CdTe) panels, all manufactured by the U.S. company First Solar, have been installed in North Carolina.

Questions about the potential health and environmental impacts from the use of this PV technology are related to the concern that these panels contain cadmium, a toxic heavy metal. However, scientific studies have shown that cadmium telluride differs from cadmium due to its high chemical and thermal stability.[19] Research has shown that the tiny amount of cadmium in these panels does not pose a health or safety risk.[20] Further, there are very compelling reasons to welcome its adoption due to reductions in unhealthy pollution associated with burning coal. Every GWh of electricity generated by burning coal produces about 4 grams of cadmium air emissions.[21] Even though North Carolina produces a significant fraction of our electricity from coal, electricity from solar offsets much more natural gas than coal due to natural gas plants being able to adjust their rate of production more easily and quickly. If solar electricity offsets 90% natural gas and 10% coal, each 5-megawatt (5 MWAC, which is generally 7 MWDC) CdTe solar facility in North Carolina keeps about 157 grams, or about a third of a pound, of cadmium *out* of our environment.[22, 23]

Cadmium is toxic, but all the approximately 7 grams of cadmium in one CdTe panel is in the form of a chemical compound cadmium telluride,[24] which has 1/100th the toxicity of free cadmium.[25] Cadmium telluride is a very stable compound that is non-volatile and non-soluble in water. Even in the case of a fire, research shows that less than 0.1% of the cadmium is released when a CdTe panel is exposed to fire. The fire melts the glass and encapsulates over 99.9% of the cadmium in the molten glass.[27]

It is important to understand the source of the cadmium used to manufacture CdTe PV panels. The cadmium is a byproduct of zinc and lead refining. The element is collected from emissions and waste streams during the production of these metals and combined with tellurium to create the CdTe used in PV panels. If the cadmium were not collected for use in the PV panels or other products, it would otherwise either be stockpiled for future use, cemented and buried, or disposed of.[28] Nearly all the cadmium in old or broken panels can be recycled which can eventually serve as the primary source of cadmium for new PV panels.[29]

Similar to silicon-based PV panels, CdTe panels are constructed of a tempered glass front, one instead of two clear plastic encapsulation layers, and a rear heat strengthened glass backing (together >98% by weight). The final product is built to withstand exposure to the elements without significant damage for over 25 years. While not representative of damage that may occur in the field or even at a landfill, laboratory evidence has illustrated that when panels are ground into a fine powder, very acidic water is able to leach portions of the cadmium and tellurium,[30] similar to the process used to recycle CdTe panels. Like many silicon-based panels, CdTe panels are reported (as far back ask 1998[31] to pass the EPA's Toxic Characteristic Leaching Procedure (TCLP) test, which tests the potential for crushed panels in a landfill to leach hazardous substances into groundwater.[32] Passing this test means that they are classified as non-hazardous waste and can be deposited in landfills.[33,34] For more information about PV panel end-of-life, see the Panel Disposal section.

There is also concern of environmental impact resulting from potential catastrophic events involving CdTe PV panels. An analysis of worst-case scenarios for environmental impact from CdTe PV

panels, including earthquakes, fires, and floods, was conducted by the University of Tokyo in 2013. After reviewing the extensive international body of research on CdTe PV technology, their report concluded, "Even in the worst-case scenarios, it is unlikely that the Cd concentrations in air and sea water will exceed the environmental regulation values."[35] In a worst-case scenario of damaged panels abandoned on the ground, insignificant amounts of cadmium will leach from the panels. This is because this scenario is much less conducive (larger module pieces, less acidity) to leaching than the conditions of the EPA's TCLP test used to simulate landfill conditions, which CdTe panels pass.[36]

First Solar, a U.S. company, and the only significant supplier of CdTe panels, has a robust panel take-back and recycling program that has been operating commercially since 2005.[37] The company states that it is "committed to providing a commercially attractive recycling solution for photovoltaic (PV) power plant and module owners to help them meet their module (end of life) EOL obligation simply, costeffectively and responsibly." First Solar global recycling services to their customers to collect and recycle panels once they reach the end of productive life whether due to age or damage. These recycling service agreements are structured to be financially attractive to both First Solar and the solar panel owner. For First Solar, the contract provides the company with an affordable source of raw materials needed for new panels and presumably a diminished risk of undesired release of Cd. The contract also benefits the solar panel owner by allowing them to avoid tipping fees at a waste disposal site. The legal contract helps provide peace of mind by ensuring compliance by both parties when considering the continuing trend of rising disposal costs and increasing regulatory requirements.

c. CIS/CIGS and other PV technologies

Copper indium gallium selenide PV technology, often referred to as CIGS, is the second most common type of thin-film PV panel but a distant second behind CdTe. CIGS cells are composed of a thin layer of copper, indium, gallium, and selenium on a glass or plastic backing. None of these elements are very toxic, although selenium is a regulated metal under the Federal Resource Conservation and Recovery Act (RCRA).[38] The cells often also have an extremely thin layer of cadmium sulfide that contains a tiny amount of cadmium, which is toxic. The promise of high efficiency CIGS panels drove heavy investment in this technology in the past. However, researchers have struggled to transfer high efficiency success in the lab to low-cost full-scale panels in the field.[39] Recently, a CIGS manufacturer based in Japan, Solar Frontier, has achieved some market success with a rigid, glass-faced CIGS module that competes with silicon panels. Solar Frontier produces the majority of CIS panels on the market today.[40] Notably, these panels are RoHS compliant,[41] thus meeting the rigorous toxicity standard adopted by the European Union even thought this directive exempts PV panels. The authors are unaware of any completed or proposed utility-scale system in North Carolina using CIS/CIGS panels.

1.2.3 Panel End-of-Life Management

Concerns about the volume, disposal, toxicity, and recycling of PV panels are addressed in this subsection. To put the volume of PV waste into perspective, consider that by 2050, when PV systems installed in 2020 will reach the end of their lives, it is estimated that the global annual PV panel waste tonnage will be 10% of the 2014 global e-waste tonnage.[42] In the U.S., end-of-life disposal of solar products is governed by the Federal Resource Conservation and Recovery Act (RCRA), as well as state policies in some situations. RCRA separates waste into hazardous (not accepted at ordinary landfill) and solid waste (generally accepted

at ordinary landfill) based on a series of rules. According to RCRA, the way to determine if a PV panel is classified as hazardous waste is the Toxic Characteristic Leaching Procedure (TCLP) test. This EPA test is designed to simulate landfill disposal and determine the risk of hazardous substances leaching out of the landfill.[43,44,45] Multiple sources report that most modern PV panels (both crystalline silicon and cadmium telluride) pass the TCLP test.[46,47] Some studies found that some older (1990s) crystalline silicon panels, and perhaps some newer crystalline silicon panels (specifics are not given about vintage of panels tested), do not pass the lead (Pb) leachate limits in the TCLP test.[48,49]

The test begins with the crushing of a panel into centimeter-sized pieces. The pieces are then mixed in an acid bath. After tumbling for eighteen hours, the fluid is tested for forty hazardous substances that all must be below specific threshold levels to pass the test. Research comparing TCLP conditions to conditions of damaged panels in the field found that simulated landfill conditions provide overly conservative estimates of leaching for field-damaged panels.[50] Additionally, research in Japan has found no detectable Cd leaching from cracked CdTe panels when exposed to simulated acid rain.[51]

Although modern panels can generally be landfilled, they can also be recycled. Even though recent waste volume has not been adequate to support significant PV-specific recycling infrastructure, the existing recycling industry in North Carolina reports that it recycles much of the current small volume of broken PV panels. In an informal survey conducted by the NC Clean Energy Technology Center survey in early 2016, seven of the eight large active North Carolina utility-scale solar developers surveyed reported that they send damaged panels back to the manufacturer and/or to a local recycler. Only one developer reported sending damaged panels to the landfill.

The developers reported at that time that they are usually paid a small amount per panel by local recycling firms. In early 2017, a PV developer reported that a local recycler was charging a small fee per panel to recycle damaged PV panels. The local recycling firm known to authors to accept PV panels described their current PV panel recycling practice as of early 2016 as removing the aluminum frame for local recycling and removing the wire leads for local copper recycling. The remainder of the panel is sent to a facility for processing the non-metallic portions of crushed vehicles, referred to as “fluff” in the recycling industry.[52] This processing within existing general recycling plants allows for significant material recovery of major components, including glass which is 80% of the module weight, but at lower yields than PV-specific recycling plants. Notably almost half of the material value in a PV panel is in the few grams of silver contained in almost every PV panel produced today. In the long-term, dedicated PV panel recycling plants can increase treatment capacities and maximize revenues resulting in better output quality and the ability to recover a greater fraction of the useful materials.[53] PV-specific panel recycling technologies have been researched and implemented to some extent for the past decade, and have been shown to be able to recover over 95% of PV material (semiconductor) and over 90% of the glass in a PV panel.[54]

A look at global PV recycling trends hints at the future possibilities of the practice in our country. Europe installed MW-scale volumes of PV years before the U.S. In 2007, a public-private partnership between the European Union and the solar industry set up a voluntary collection and recycling system called PV CYCLE. This arrangement was later made mandatory under the EU’s WEEE directive, a program for waste electrical and electronic equipment.[55] Its member companies (PV panel producers) fully finance the association. This makes it possible for end-users to return the member companies’ defective panels for recycling at any of the over 300 collection points around

Europe without added costs. Additionally, PV CYCLE will pick up batches of 40 or more used panels at no cost to the user. This arrangement has been very successful, collecting and recycling over 13,000 tons by the end of 2015.[56]

In 2012, the WEEE Directive added the end-of-life collection and recycling of PV panels to its scope.[57] This directive is based on the principle of extended-producer-responsibility. It has a global impact because producers that want to sell into the EU market are legally responsible for end-of-life management. Starting in 2018, this directive targets that 85% of PV products "put in the market" in Europe are recovered and 80% is prepared for reuse and recycling.

The success of the PV panel collection and recycling practices in Europe provides promise for the future of recycling in the U.S. In mid-2016, the US Solar Energy Industry Association (SEIA) announced that they are starting a national solar panel recycling program with the guidance and support of many leading PV panel producers.[58] The program will aggregate the services offered by recycling vendors and PV manufacturers, which will make it easier for consumers to select a cost-effective and environmentally responsible end-of-life management solution for their PV products. According to SEIA, they are planning the program in an effort to make the entire industry landfill-free. In addition to the national recycling network program, the program will provide a portal for system owners and consumers with information on how to responsibly recycle their PV systems.

While a cautious approach toward the potential for negative environmental and/or health impacts from retired PV panels is fully warranted, this section has shown that the positive health impacts of reduced emissions from fossil fuel combustion from PV systems more than outweighs any potential risk. Testing shows that silicon and CdTe panels are both safe to dispose of in landfills, and are also safe in worst case conditions of abandonment or damage in a disaster. Additionally, analysis by local engineers has found that the current salvage value of the equipment in a utility scale PV facility generally exceeds general contractor estimates for the cost to remove the entire PV system.[59,60,61]

1.2.4 Non-Panel System Components

(racking, wiring, inverter, transformer)

While previous toxicity subsections discussed PV panels, this subsection describes the non-panel components of utility-scale PV systems and investigates any potential public health and safety concerns. The most significant non-panel component of a ground-mounted PV system is the mounting structure of the rows of panels, commonly referred to as "racking". The vertical post portion of the racking is galvanized steel and the remaining above-ground racking components are either galvanized steel or aluminum, which are both extremely common and benign building materials. The inverters that make the solar generated electricity ready to send to the grid have weather-proof steel enclosures that protect the working components from the elements. The only fluids that they might contain are associated with their cooling systems, which are not unlike the cooling system in a computer. Many inverters today are RoHS compliant.

The electrical transformers (to boost the inverter output voltage to the voltage of the utility connection point) do contain a liquid cooling oil. However, the fluid used for that function is either a nontoxic mineral oil or a biodegradable non-toxic vegetable oil, such as BIOTEMP from ABB. These vegetable transformer oils have the additional advantage of being much less flammable than traditional mineral oils. Significant health hazards are associated with old transformers containing cooling oil with toxic PCBs. Transfers with PCB-containing oil were common before PCBs were outlawed in the U.S. in 1979. PCBs still exist in older transformers in the field across the country.

Other than a few utility research sites, there are no batteries on- or off-site associated with utility-scale solar energy facilities in North Carolina, avoiding any potential health or safety concerns related to battery technologies. However, as battery technologies continue to improve and prices continue to decline we are likely to start seeing some batteries at solar facilities. Lithium ion batteries currently dominate the world utility-scale battery market, which are not very toxic. No non-panel system components were found to pose any health or environmental dangers.

1.4 Operations and Maintenance – Panel Washing and Vegetation Control

Throughout the eastern U.S., the climate provides frequent and heavy enough rain to keep panels adequately clean. This dependable weather pattern eliminates the need to wash the panels on a regular basis. Some system owners may choose to wash panels as often as once a year to increase production, but most in N.C. do not regularly wash any PV panels. Dirt build up over time may justify panel washing a few times over the panels' lifetime; however, nothing more than soap and water are required for this activity.

The maintenance of ground-mounted PV facilities requires that vegetation be kept low, both for aesthetics and to avoid shading of the PV panels. Several approaches are used to maintain vegetation at NC solar facilities, including planting of limited-height species, mowing, weed-eating, herbicides, and grazing livestock (sheep). The following descriptions of vegetation maintenance practices are based on interviews with several solar developers as well as with three maintenance firms that together are contracted to maintain well over 100 of the solar facilities in N.C. The majority of solar facilities in North Carolina maintain vegetation primarily by mowing. Each row of panels has a single row of supports, allowing sickle mowers to mow under the panels. The sites usually require mowing about once a month during the growing season. Some sites employ sheep to graze the site, which greatly reduces the human effort required to maintain the vegetation and produces high quality lamb meat.[62]

In addition to mowing and weed eating, solar facilities often use some herbicides. Solar facilities generally do not spray herbicides over the entire acreage; rather they apply them only in strategic locations such as at the base of the perimeter fence, around exterior vegetative buffer, on interior dirt roads, and near the panel support posts. Also unlike many row crop operations, solar facilities generally use only general use herbicides, which are available over the counter, as opposed to restricted use herbicides commonly used in commercial agriculture that require a special restricted use license. The herbicides used at solar facilities are primarily 2-4-D and glyphosate (Round-up®), which are two of the most common herbicides used in lawns, parks, and agriculture across the country. One maintenance firm that was interviewed sprays the grass with a class of herbicide known as a growth regulator in order to slow the growth of grass so that mowing is only required twice a year. Growth regulators are commonly used on highway roadsides and golf courses for the same purpose. A commercial pesticide applicator license is required for anyone other than the landowner to apply herbicides, which helps ensure that all applicators are adequately educated about proper herbicide use and application. The license must be renewed annually and requires passing of a certification exam appropriate to the area in which the applicator wishes to work. Based on the limited data available, it appears that solar facilities in N.C. generally use significantly less herbicides per acre than most commercial agriculture or lawn maintenance services.

2. Electromagnetic Fields (EMF)

PV systems do not emit any material during their operation; however, they do generate electromagnetic fields (EMF), sometimes referred to as radiation. EMF produced by electricity is non-ionizing radiation, meaning the radiation has enough energy to move atoms in a molecule around (experienced as heat), but not enough energy to remove electrons from an atom or molecule (ionize) or to damage DNA. As shown below, modern humans are all exposed to EMF throughout our daily lives without negative health impact. Someone outside of the fenced perimeter of a solar facility is not exposed to significant EMF from the solar facility. Therefore, there is no negative health impact from the EMF produced in a solar farm. The following paragraphs provide some additional background and detail to support this conclusion.

Since the 1970s, some have expressed concern over potential health consequences of EMF from electricity, but no studies have ever shown this EMF to cause health problems.[63] These concerns are based on some epidemiological studies that found a slight increase in childhood leukemia associated with average exposure to residential power-frequency magnetic fields above 0.3 to 0.4 μT (microteslas) (equal to 3.0 to 4.0 mG (milligauss)). μT and mG are both units used to measure magnetic field strength. For comparison, the average exposure for people in the U.S. is one mG or 0.1 μT, with about 1% of the population with an average exposure in excess of 0.4 μT (or 4 mG).[64] These epidemiological studies, which found an association but not a causal relationship, led the World Health Organization's International Agency for Research on Cancer (IARC) to classify ELF magnetic fields as "possibly carcinogenic to humans". Coffee also has this classification. This classification means there is limited evidence but not enough evidence to designate as either a "probable carcinogen" or "human carcinogen". Overall, there is very little concern that ELF EMF damages public health. The only concern that does exist is for long-term exposure above 0.4 μT (4 mG) that may have some connection to increased cases of childhood leukemia. In 1997, the National Academies of Science were directed by Congress to examine this concern and concluded:

"Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects."[65]

There are two aspects to electromagnetic fields, an electric field and a magnetic field. The electric field is generated by voltage and the magnetic field is generated by electric current, i.e., moving electrons. A task group of scientific experts convened by the World Health Organization (WHO) in 2005 concluded that there were no substantive health issues related to electric fields (0 to 100,000 Hz) at levels generally encountered by members of the public.[66] The relatively low voltages in a solar facility and the fact that electric fields are easily shielded (i.e., blocked) by common materials, such as plastic, metal, or soil means that there is no concern of negative health impacts from the electric fields generated by a solar facility. Thus, the remainder of this section addresses magnetic fields. Magnetic fields are not shielded by most common materials and thus can easily pass through them. Both types of fields are strongest close to the source of electric generation and weaken quickly with distance from the source.

The direct current (DC) electricity produced by PV panels produce stationary (0 Hz) electric and magnetic fields. Because of minimal concern about potential risks of stationary fields, little scientific research has examined stationary fields' impact on human health.[67] In even the largest PV facilities, the DC voltages and currents are not very high. One can illustrate the weakness of the EMF generated by a PV panel by placing a compass on an operating solar panel and observing that the needle still points north.

While the electricity throughout the majority of a solar site is DC electricity, the inverters convert this DC electricity to alternating current (AC) electricity matching the 60 Hz frequency of the grid. Therefore, the inverters and the wires delivering this power to the grid are producing non-stationary EMF, known as extremely low frequency (ELF) EMF, normally oscillating with a frequency of 60 Hz. This frequency is at the low-energy end of the electromagnetic spectrum. Therefore, it has less energy than other commonly encountered types of non-ionizing radiation like radio waves, infrared radiation, and visible light.

The wide use of electricity results in background levels of ELF EMFs in nearly all locations where people spend time – homes, workplaces, schools, cars, the supermarket, etc. A person's average exposure depends upon the sources they encounter, how close they are to them, and the amount of time they spend there.[68] As stated above, the average exposure to magnetic fields in the U.S. is estimated to be around one mG or 0.1 μT, but can vary considerably depending on a person's exposure to EMF from electrical devices and wiring.[69] At times we are often exposed to much higher ELF magnetic fields, for example when standing three feet from a refrigerator the ELF magnetic field is 6 mG and when standing three feet from a microwave oven the field is about 50 mG.[70] The strength of these fields diminish quickly with distance from the source, but when surrounded by electricity in our homes and other buildings moving away from one source moves you closer to another. However, unless you are inside of the fence at a utility-scale solar facility or electrical substation it is impossible to get very close to the EMF sources. Because of this, EMF levels at the fence of electrical substations containing high voltages and currents are considered "generally negligible".[71,72]

The strength of ELF-EMF present at the perimeter of a solar facility or near a PV system in a commercial or residential building is significantly lower than the typical American's average EMF exposure.[73,74] Researchers in Massachusetts measured magnetic fields at PV projects and found the magnetic fields dropped to very low levels of 0.5 mG or less, and in many cases to less than background levels (0.2 mG), at distances of no more than nine feet from the residential inverters and 150 feet from the utility-scale inverters.[75] Even when measured within a few feet of the utility-scale inverter, the ELF magnetic fields were well below the International Commission on Non-Ionizing Radiation Protection's recommended magnetic field level exposure limit for the general public of 2,000 mG.[76] It is typical that utility scale designs locate large inverters central to the PV panels that feed them because this minimizes the length of wire required and shields neighbors from the sound of the inverter's cooling fans. Thus, it is rare for a large PV inverter to be within 150 feet of the project's security fence.

Anyone relying on a medical device such as pacemaker or other implanted device to maintain proper heart rhythm may have concern about the potential for a solar project to interfere with the operation of his or her device. However, there is no reason for concern because the EMF outside of the solar facility's fence is less than 1/1000 of the level at which manufacturers test for ELF EMF interference, which is 1,000 mG.[77] Manufacturers of potentially affected implanted devices often provide advice on electromagnetic interference that includes avoiding letting the implanted device get too close to certain sources of fields such as some

household appliances, some walkie-talkies, and similar transmitting devices. Some manufacturers' literature does not mention high-voltage power lines, some say that exposure in public areas should not give interference, and some advise not spending extended periods of time close to power lines.[78]

3. Electric Shock and Arc Flash Hazards

There is a real danger of electric shock to anyone entering any of the electrical cabinets such as combiner boxes, disconnect switches, inverters, or transformers; or otherwise coming in contact with voltages over 50 Volts.[79] Another electrical hazard is an arc flash, which is an explosion of energy that can occur in a short circuit situation. This explosive release of energy causes a flash of heat and a shockwave, both of which can cause serious injury or death. Properly trained and equipped technicians and electricians know how to safely install, test, and repair PV systems, but there is always some risk of injury when hazardous voltages and/or currents are present. Untrained individuals should not attempt to inspect, test, or repair any aspect of a PV system due to the potential for injury or death due to electric shock and arc flash, The National Electric Code (NEC) requires appropriate levels of warning signs on all electrical components based on the level of danger determined by the voltages and current potentials. The national electric code also requires the site to be secured from unauthorized visitors with either a six-foot chain link fence with three strands of barbed wire or an eight-foot fence, both with adequate hazard warning signs.

4. Fire Safety

The possibility of fires resulting from or intensified by PV systems may trigger concern among the general public as well as among firefighters. However, concern over solar fire hazards should be limited because only a small portion of materials in the panels are flammable, and those components cannot self-support a significant fire. Flammable components of PV panels include the thin layers of polymer encapsulates surrounding the PV cells, polymer backsheets (framed panels only), plastic junction boxes on rear of panel, and insulation on wiring. The rest of the panel is composed of non-flammable components, notably including one or two layers of protective glass that make up over three quarters of the panel's weight.

Heat from a small flame is not adequate to ignite a PV panel, but heat from a more intense fire or energy from an electrical fault can ignite a PV panel.[80] One real-world example of this occurred during July 2015 in an arid area of California. Three acres of grass under a thin film PV facility burned without igniting the panels mounted on fixed-tilt racks just above the grass.[81] While it is possible for electrical faults in PV systems on homes or commercial buildings to start a fire, this is extremely rare.[82] Improving understanding of the PV-specific risks, safer system designs, and updated fire-related codes and standards will continue to reduce the risk of fire caused by PV systems.

PV systems on buildings can affect firefighters in two primary ways, 1) impact their methods of fighting the fire, and 2) pose safety hazard to the firefighters. One of the most important techniques that firefighters use to suppress fire is ventilation of a building's roof. This technique allows superheated toxic gases to quickly exit the building. By doing so, the firefighters gain easier and safer access to the building, Ventilation of the roof also makes the challenge of putting out the fire easier. However, the placement of rooftop PV panels may interfere with ventilating the roof by limiting access to desired venting locations.

New solar-specific building code requirements are working to minimize these concerns. Also, the

latest National Electric Code has added requirements that make it easier for first responders to safely and effectively turn off a PV system. Concern for firefighting a building with PV can be reduced with proper fire fighter training, system design, and installation. Numerous organizations have studied fire fighter safety related to PV. Many organizations have published valuable guides and training programs. Some notable examples are listed below.

- The International Association of Fire Fighters (IAFF) and International Renewable Energy Council (IREC) partnered to create an online training course that is far beyond the PowerPoint click-andview model. The self-paced online course, "Solar PV Safety for Fire Fighters," features rich video content and simulated environments so fire fighters can practice the knowledge they've learned. www.iaff.org/pvsafetytraining
- Photovoltaic Systems and the Fire Code: Office of NC Fire Marshal
- Fire Service Training, Underwriter's Laboratory
- Firefighter Safety and Response for Solar Power Systems, National Fire Protection Research Foundation
- Bridging the Gap: Fire Safety & Green Buildings, National Association of State Fire Marshalls
- Guidelines for Fire Safety Elements of Solar Photovoltaic Systems, Orange County Fire Chiefs Association
- Solar Photovoltaic Installation Guidelines, California Department of Forestry & Fire Protection, Office of the State Fire Marshall
- PV Safety & Firefighting, Matthew Paiss, Homepower Magazine
- PV Safety and Code Development: Matthew Paiss, Cooperative Research Network

Summary

The purpose of this paper is to address and alleviate concerns of public health and safety for utility-scale solar PV projects. Concerns of public health and safety were divided and discussed in the four following sections: (1) Toxicity, (2) Electromagnetic Fields, (3) Electric Shock and Arc Flash, and (4) Fire. In each of these sections, the negative health and safety impacts of utility-scale PV development were shown to be negligible, while the public health and safety benefits of installing these facilities are significant and far outweigh any negative impacts.

---

1 Wiser, Ryan, Trieu Mai, Dev Millstein, Jordan Macknick, Alberta Carpenter, Stuart Cohen, Wesley Cole, Bethany Frew, and Garvin A. Heath. 2016. On the Path to SunShot: The Environmental and Public Health Benefits of Achieving High Penetrations of Solar Energy in the United States. Golden, CO: National Renewable Energy Laboratory. Accessed March 2017, www.nrel.gov/docs/fy16osti/65628.pdf

2 IRENA and IEA-PVPS (2016), "End-of-Life Management: Solar Photovoltaic Panels," International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems.

3 National Renewable Energy Laboratory, *Overview of Field Experience – Degradation Rates & Lifetimes*. September 14, 2015. Solar Power International Conference. Accessed March 2017, www.nrel.gov/docs/fy15osti/65040.pdf

4 Miesel et al. *SolarCity Photovoltaic Modules with 35 Year Useful Life*. June 2016. Accessed March 2017. http://www.solarcity.com/newsroom/reports/solarcity-photovoltaic-modules-35-year-useful-life

5 David Unger. *Are Renewables Stormproof? Hurricane Sandy Tests Solar, Wind*. November 2012. Accessed March 2017. http://www.csmonitor.com/Environment/Energy-Voices/2012/1119/Are-renewables-stormproof-Hurricane-Sandy-tests-solarwind & http://www.csmonitor.com/Environment/Energy-Voices/2012/1119/Are-renewables-stormproof-Hurricane-Sandytests-solar-wind

6 NEXTracker and 365 Pronto, *Tracking Your Solar Investment: Best Practices for Solar Tracker O&M*.

Accessed March 2017.
www.nextracker.com/content/uploads/2017/03/NEXTracker_OandM-WhitePaper_FINAL_March-2017.pdf
7 Christiana Honsberg, Stuart Bowden. *Overview of Screen Printed Solar Cells*. Accessed January 2017.
www.pveducation.org/pvcdrom/manufacturing/screen-printed
8 Silicon Valley Toxics Coalition. *2015 Solar Scorecard*. Accessed August 2016.
www.solarscorecard.com/2015/2015-SVTC-Solar-Scorecard.pdf
9 European Commission. *Recast of Reduction of Hazardous Substances (RoHS) Directive*. September 2016. Accessed August 2016.
http://ec.europa.eu/environment/waste/rohs_eee/index_en.htm
10 Official Journal of the European Union, *DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011* on the restriction of the use of certain hazardous substances in electrical and electronic equipment. June 2011. Accessed May 2017.
http://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:32011L0065&from=en
11 Giancarlo Giacchetta, Mariella Leporini, Barbara Marchetti. *Evaluation of the Environmental Benefits of New High Value Process for the Management of the End of Life of Thin Film Photovoltaic Modules*. July 2013. Accessed August 2016.
www.researchgate.net/publication/257408804_Evaluation_of_the_environmental_benefits_of_new_high_value_process_for_the_management_of_the_end_of_life_of_thin_film_photovoltaic_modules
12 European Commission. *Study on Photovoltaic Panels Supplementing The Impact Assessment for a Recast of the Weee Directive*. April 2011. Accessed August 2016.
http://ec.europa.eu/environment/waste/weee/pdf/Study%20on%20PVs%20Bio%20final.pdf
14 The amount of lead in a typical car battery is 21.4 pounds. Waste 360. Chaz Miller. *Lead Acid Batteries*. March 2006. Accessed August 2016.
http://waste360.com/mag/waste_leadacid_batteries_3
15 Okkenhaug G. *Leaching from CdTe PV module material results from batch, column and availability tests*. Norwegian Geotechnical Institute, NGI report No. 20092155-00-6-R; 2010
16 International Journal of Advanced Applied Physics Research. Renate Zapf-Gottwick1, et al. *Leaching Hazardous Substances out of Photovoltaic Modules*. January 2015. Accessed January 2016.
www.cosmosscholars.com/phms/index.php/ijaapr/article/download/485/298
17 ibid
18 Parikhit Sinha, et al. Evaluation of Potential Health and Environmental Impacts from End-Of-Life Disposal of Photovoltaics, Photovoltaics, 2014. Accessed May 2016
19 Bonnet, D. and P. Meyers. 1998. *Cadmium-telluride—Material for thin film solar cells*. J. Mater. Res., Vol. 13, No. 10, pp. 2740-2753
20 V. Fthenakis, K. Zweibel. *CdTe PV: Real and Perceived EHS Risks*. National Center ofr Photovoltaics and Solar Program Review Meeting, March 24-26, 2003. www.nrel.gov/docs/fy03osti/33561.pdf. Accessed May 2017
21 International Energy Agency Photovoltaic Power Systems Programme. *Life Cycle Inventories and Life Cycle Assessments of Photovoltaic Systems*. March 2015. Accessed August 2016.
http://iea-pvps.org/index.php?id=315
22 Data not available on fraction of various generation sources offset by solar generation in NC, but this is believed to be a reasonable rough estimate. The SunShot report entitled The Environmental and Public Health Benefits of Achieving High Penetrations of Solar Energy in the United States analysis contributes significant (% not provided) offsetting of coal-fired generation by solar PV energy in the southeast.
23 7 MWDC * 1.5 GWh/MWDC * 25 years * 0.93 degradation factor * (0.1 *4.65 grams/GWh + 0.9*0.2 grams/GWh)
24 Vasilis Fthenakis. *CdTe PV: Facts and Handy Comparisons*. January 2003. Accessed March 2017.
https://www.bnl.gov/pv/files/pdf/art_165.pdf
25 Kaczmar, S., *Evaluating the Read-Across Approach on CdTe Toxicity for CdTe Photovoltaics*, SETAC North America 32nd Annual Meeting, Boston, MA, November 2011. Available at:
ftp://ftp.co.imperial.ca.us/icpds/eir/campo-verdesolar/final/evaluating-toxicity.pdf, Accessed May 2017
27 V. M. Fthenakis et al, *Emissions and Encapsulation of Cadmium in CdTe PV Modules During Fires* Renewable Progress in Photovoltaics: Research and Application: Res. Appl. 2005; 13:1–11, Accessed March 2017, www.bnl.gov/pv/files/pdf/abs_179.pdf
28 Fthenakis V.M., *Life Cycle Impact Analysis of Cadmium in CdTe Photovoltaic Production*, Renewable

and Sustainable Energy Reviews, 8, 303-334, 2004. www.clca.columbia.edu/papers/Life_Cycle_Impact_Analysis_Cadmium_CdTe_Photovoltaic_production.pdf, Accessed May 2017
29 International Renewable Energy Agency. Stephanie Weckend, Andreas Wade, Garvin Heath. *End of Life Management: Solar Photovoltaic Panels*. June 2016. Accessed November 2016.
30 International Journal of Advanced Applied Physics Research. Renate Zapf-Gottwick1, et al. *Leaching Hazardous Substances out of Photovoltaic Modules*. January 2015. Accessed January 2016. www.cosmosscholars.com/phms/index.php/ijaapr/article/download/485/298
31 Cunningham D., Discussion about TCLP protocols, Photovoltaics and the Environment Workshop, July 23-24, 1998, Brookhaven National Laboratory, BNL-52557
32 Parikhit Sinha, et al. Evaluation of Potential Health and Environmental Impacts from End-Of-Life Disposal of Photovoltaics, Photovoltaics, 2014. Accessed May 2016
33 Practical Handbook of Photovoltaics: Fundamentals and Applications. T. Markvart and L. Castaner. *Chapter VII-2: Overview of Potential Hazards*. December 2003. Accessed August 2016. https://www.bnl.gov/pv/files/pdf/art_170.pdf
34 Norwegian Geotechnical Institute. *Environmental Risks Regarding the Use and End-of-Life Disposal of CdTe PV Modules*. April 2010. Accessed August 2016. https://www.dtsc.ca.gov/LawsRegsPolicies/upload/Norwegian-Geotechnical-InstituteStudy.pdf
35 First Solar. Dr. Yasunari Matsuno. December 2013. August 2016. *Environmental Risk Assessment of CdTe PV Systems to be considered under Catastrophic Events in Japan*. http://www.firstsolar.com/-/media/Documents/Sustainability/PeerReviews/Japan_Peer-Review_Matsuno_CdTe-PV-Tsunami.ashx
36 First Solar. Parikhit Sinha, Andreas Wade. *Assessment of Leaching Tests for Evaluating Potential Environmental Impacts of PV Module Field Breakage*. 2015 IEEE
37 See p. 22 of First Solar, Sustainability Report. Available at: www.firstsolar.com/-/media/FirstSolar/Sustainability-Documents/03801_FirstSolar_SustainabilityReport_08MAR16_Web.ashx, Accessed May 2017
38 40 CFR §261.24. *Toxicity Characteristic*. May 2017. Accessed May 2017. https://www.ecfr.gov/cgi-bin/textidx-?node=se40.26.261_124&rgn=div8
39 Office of Energy Efficiency & Renewable Energy. *Copper Indium Gallium Diselenide*. Accessed March 2017. https://www.energy.gov/eere/sunshot/copper-indium-gallium-diselenide
40 Mathias Maehlum. *Best Thin Film Solar Panels – Amorphous, Cadmium Telluride or CIGS?* April 2015. Accessed March 2017. http://energyinformative.org/best-thin-film-solar-panels-amorphous-cadmium-telluride-cigs/
41 RoHS tested certificate for Solar Frontier PV modules. TUVRheinland, signed 11.11.2013
42 International Renewable Energy Agency. Stephanie Weckend, Andreas Wade, Garvin Heath. *End of Life Management: Solar Photovoltaic Panels.* June 2016. Accessed November 2016. http://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf
43 40 C.F.R. §261.10. *Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste*. November 2016. Accessed November 2016 http://www.ecfr.gov/cgi-bin/textidx?SID=ce0006d-66da40146b490084ca2816143&mc=true&node=pt40.26.261&rgn=div5#sp40.28.261.b
44 40 C.F.R. §261.24 *Toxicity Characteristic*. November 2016. Accessed November 2016. http://www.ecfr.gov/cgi-bin/textidx?SID=ce0006d-66da40146b490084ca2816143&mc=true&node=pt40.26.261&rgn=div5#se40.28.261_124
45 International Renewable Energy Agency. Stephanie Weckend, Andreas Wade, Garvin Heath. *End of Life Management: Solar Photovoltaic Panels*. June 2016. Accessed November 2016. http://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf
46 TLCP test results from third-party laboratories for REC, Jinko, and Canadian Solar silicon-based panels. Provided by PV panel manufacturers directly or indirectly to authors
47 Sinovoltaics, Introduction to *Solar Panel Recycling*, March 2014. Accessed October 2016. http://sinovoltaics.com/solarbasics/introduction-to-solar-panel-recycling/
48 Brookhaven National Laboratory. Vasilis Fthenakis,

Regulations on Photovoltaic Module Disposal and Recycling. January 29, 2001.
49 Parikhit Sinha, et al. Evaluation of Potential Health and Environmental Impacts from End-Of-Life Disposal of Photovoltaics, Photovoltaics, 2014.
50 First Solar. Parikhit Sinha, Andreas Wade. *Assessment of Leaching Tests for Evaluating Potential Environmental Impacts of PV Module Field Breakage*. October 2015. Accessed August 2016. http://www.firstsolar.com/-/media/Documents/Sustainability/PVSC42-Manuscript-20150912--Assessment-of-Leaching-Tests-for-Evaluating-PotentialEnvironmental-Impa.ashx
51 First Solar. Dr. Yasunari Matsuno. December 2013. *Environmental Risk Assessment of CdTe PV Systems to be considered under Catastrophic Events in Japan*. http://www.firstsolar.com/-/media/Documents/Sustainability/PeerReviews/Japan_Peer-Review_Matsuno_CdTe-PV-Tsunami.ashx
52 Phone interview, February 3, 2016, TT&E Iron & Metal, Garner, NC www.ncscrapmetal.com
53 Wen-His Huang, et al. *Strategy and Technology To Recycle Water-silicon Solar Modules*. Solar Energy, Volume 144, March 2017, Pages 22-31
54 International Renewable Energy Agency. Stephanie Weckend, Andreas Wade, Garvin Heath. *End of Life Management: Solar Photovoltaic Panels*. June 2016. Accessed November 2016. http://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf
55 Official Journal of the European Union. *Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on Waste Electrical and Electronic Equipment*. July 2012. Accessed November 2016. http://eurlex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0019
56 PV CYCLE. *Annual Report 2015*. Accessed November 2016. https://pvcyclepublications.cld.bz/Annual-Report-PV-CYCLE-2015/6-7
57 Official Journal of the European Union. *Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on Waste Electrical and Electronic Equipment*. July 2012. Accessed November 2016. http://eurlex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0019
58 SEIA National PV Recycling Program: www.seia.org/seia-national-pv-recycling-program
59 RBI Solar, Decommissioning Plan submitted to Catawba County associated with permitting of a 5MW solar project in June 2016. Accessed April 2017. www.catawbacountync.gov/Planning/Projects/Rezonings/RZ2015-05_DecommissioningPlan.pdf
60 Birdseye Renewables, Decommissioning Plan submitted to Catawba County associated with permitting of a 5MW solar project in May 2015. Accessed April 2017. www.catawbacountync.gov/Planning/Projects/Rezonings/RZ2015-04_DecommissioningPlan.pdf
61 Cypress Creek Renewables, Decommissioning Plan submitted to Catawba County associated with permitting of a 5MW solar project in September 2016. Accessed April 2017. www.catawbacountync.gov/Planning/Projects/Rezonings/RZ2016-06decommission.pdf
62 Sun Raised Farms: http://sunraisedfarms.com/index.html
63 National Institute of Environmental Health Sciences and National Institutes of Health, EMF: Electric and Magnetic Fields Associated with Electric Power: Questions and Answers, June 2002
64 World Health Organization. *Electromagnetic Fields and Public Health: Exposure to Extremely Low Frequency Fields*. June 2007. Accessed August 2016. http://www.who.int/peh-emf/publications/facts/fs322/en/
65 Committee on the Possible Effects of Electromagnetic Fields on Biologic Systems, National Research Council, Possible Health Effects of Exposure to Residential Electric and Magnetic Fields, ISBN: 0-309-55671-6, 384 pages, 6 x 9, (1997) This PDF is available from the National Academies Press at: http://www.nap.edu/catalog/5155.html
66 World Health Organization. *Electromagnetic Fields and Public Health: Exposure to Extremely Low Frequency Fields*. June 2007. Accessed August 2016. http://www.who.int/peh-emf/publications/facts/fs322/en/
67 World Health Organization. *Electromagnetic Fields and Public Health: Static Electric and Magnetic Fields*. March 2006. Accessed August 2016. http://www.who.int/peh-emf/publications/facts/fs299/en/
68 Asher Sheppard, Health Issues Related to the Static and Power-Frequency Electric and Magnetic Fields (EMFs) of the Soitec Solar Energy Farms, April

30, 2014. Accessed March 2017: www.sandiegocounty.gov/content/dam/sdc/pds/ceqa/Soitec-Documents/Final-EIR-Files/Appendix_9.0-1_EMF.pdf
69 Massachusetts Clean Energy Center. *Study of Acoustic and EMF Levels from Solar Photovoltaic Projects*. December 2012. Accessed August 2016.
70 Duke Energy Corporation. *Frequently Asked Questions: Electric and Magnetic Fields*. Accessed August 2016. https://www.duke-energy.com/about-energy/frequently_asked_questions.asp
71 National Institute of Environmental Health Sciences, *Electric and Magnetic Fields Associate with the use of Electric Power: Questions and Answers*, 2002. Accessed November 2016 www.niehs.nih.gov/health/materials/electric_and_magnetic_fields
72 Duke Energy Corporation. *Frequently Asked Questions: Electric and Magnetic Fields*. Accessed August 2016. https://www.duke-energy.com/about-energy/frequently_asked_questions.asp
73 R.A. Tell et al, *Electromagnetic Fields Associated with Commercial Solar Photovoltaic Electric Power Generating Facilities*, Journal of Occupational and Environmental Hygiene, Volume 12, 2015,- Issue 11. Abstract Accessed March 2016: http://www.tandfonline.com/doi/full/10.1080/15459624.2015.1047021
74 Massachusetts Department of Energy Resources, Massachusetts Department of Environmental Protection, and Massachusetts Clean Energy Center. *Questions & Answers: Ground-Mounted Solar Photovoltaic Systems*. June 2015. Accessed August 2016. http://www.mass.gov/eea/docs/doer/renewables/solar/solar-pv-guide.pdf
75 Ibid.
76 Ibid.
77 *EMFs and medical devices*, Accessed March 2017. www.emfs.info/effects/medical-devices/
78 ibid.
79 Damon McCluer. *Electrical Construction & Maintenance: NFPA 70E's Approach to Considering DC Hazards*. September 2013. Accessed October 2016. http://ecmweb.com/safety/nfpa-70e-s-approach-considering-dc-hazards
80 Hong-Yun Yang, et. al. *Experimental Studies on the Flammability and Fire Hazards of Photovoltaic Modules, Materials*. July 2015. Accessed August 2016. http://www.mdpi.com/1996-1944/8/7/4210/pdf
81 Matt Fountain. The Tribune. *Fire breaks out at Topaz Solar Farm*. July 2015. Accessed August 2016. www.sanluisobispo.com/news/local/article39055539.html
82 Cooperative Research Network. Matthew Paiss. *Tech Surveillance: PV Safety & Code Developments*. October 2014. Accessed August 2016. http://www.nreca.coop/wp-content/uploads/2013/06/ts_pv_fire_safety_oct_2014.pdf

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

1001 Boulders Parkway
Suite 300
Richmond, VA 23225

P 804.200.6500
F 804.560.1016
www.timmons.com

MEMORANDUM

TO: Fluvanna County Planning and Zoning Department

FROM: Timmons Group on behalf of White Oak Solar

DATE: November 17, 2022

RE: White Oak Solar Environmental Resource Impact Analysis

Timmons Group, on behalf of White Oak Solar (Site), has conducted a limited environmental review of resources that may be present nearby the proposed project location. This environmental review includes National and State forests, National and State parks, wildlife management areas, conservation easements, recreational areas, and cultural and historic resources.

Federal, State, and Local Conservation and Recreation Lands

White Oak Solar does not intersect any federal, state, or local conservation or recreational lands. However, there are three Virginia Outdoors Foundation conservation easements located within two miles of the proposed project location. The nearest easement is adjacent to the site. The vegetative buffer provided by the project will mitigate any potential impacts to these easements.

Wetlands and Streams

Wetlands and streams are present on Site. As the project progresses, more precise locations of wetlands and streams will be delineated and verified by the United States Army Corps of Engineers (USACE). If wetland or stream impacts are unavoidable, the Applicant will obtain the appropriate permits for any impacts to USACE jurisdictional wetlands and streams.

Wetlands and streams form a natural wildlife corridor, and as they will generally not be impacted by the project, will remain as interior corridors for wildlife utilization. Wetlands and streams are outside the fenced area so free passage of wildlife will be allowed for the duration of the project. The Virginia Department of Wildlife Resources advises that interior passages through solar projects helps reduce potential impacts to wildlife, to which this project will adhere.

Threatened and Endangered Species

Timmons Group has conducted a threatened and endangered (T&E) species review of the White Oak Solar project. The following databases were reviewed for the potential presence of T&E species:

- Virginia Department of Conservation and Recreation (VDCR) – Natural Heritage Review Service
- Virginia Department of Wildlife Resources (VDWR) – Virginia Fish and Wildlife Information Service (VaFWIS)
- US Fish and Wildlife Service (USFWS) – Information for Planning and Consultation (IPaC)

Based on the queried databases, there is the potential for two T&E species to occur near the project.

Common Name	Scientific Name	Status	Agency Source
Northern Long-eared Bat	*Myotis septentrionalis*	Federal Threatened State Threatened	USFWS
James Spinymussel	*Parvaspina collina*	Federal Endangered State Endangered	VDWR
Monarch Butterfly	*Danaus plexippus*	Candidate Species	USFWS

There is potential habitat for the federally and state threatened northern long-eared bat (*Myotis septentrionalis*) to exist on the Site, as a portion of the land is forested. Based upon a review of available information, there are no known maternity roosts or hibernacula located within or in close proximity to the site. According to VDWR, the species has not been observed within the site or within the two-mile buffer around the site. As there are no known hibernacula or roost trees within 0.25 miles or 150 feet, respectively, the site may choose to implement voluntary conservation measures to reduce the likelihood of incidental takes by conducting tree removal activities outside of pup season (June 1 – July 31).

According to VDWR, the federally and state endangered James spinymussel (*Pleurobema collina*) has the potential to occur on the Site. The James spinymussel prefers free-flowing streams that vary in flow regimes and depths, and it can tolerate different substrates, except for silt. The Hardware River is noted as threatened and endangered waters where the James spinymussel has been observed, and the river is on the western edge of the two-mile buffer around the Site. The potential time of year restriction for instream work is May 15 – July 31. Further agency coordination may be required if state or federal permits are needed.

The monarch butterfly is a candidate species, but it is not currently listed as federally or state threatened or endangered. As the species is not listed as threatened or endangered, there are no time of year restrictions associated with this species.

According to VDCR, natural heritage resources have not been documented within the Site. The Site will not impact any documented state-listed plants or insects.

During permitting efforts at the state level, the Applicant will coordinate with agencies to ensure the protection and avoidance of T&E species.

Cultural and Historical Resources

The project is not expected to have any impacts to cultural and historical resources due to the amount of cultural work required at the state permitting level. In-depth cultural surveys conducted by qualified professionals will be submitted for approval and concurrence by the Virginia Department of Historic Resources (VDHR).

There are no known archaeological or architectural resources within the project. There are four architectural resources and two archaeological resources within two miles of the project. Two architectural resources are Not Eligible for placement on the National Register of Historic Places and Virginia Landmarks Register. All other resources have not yet been evaluated.

Landscaping

VDCR recommends the development of an invasive species management plan for the project and the planting of Virginia native pollinator species. The project has developed a landscaping maintenance plan which includes the planting of Virginia native pollinator species (see Sheet C5.1 of the General Development Plan). Greater than 75% of the site will be planted with a seed mix of native species.

Grid-Scale Battery Storage

Frequently Asked Questions

What is grid-scale battery storage?

Battery storage is a technology that enables power system operators and utilities to store energy for later use. A battery energy storage system (BESS) is an electrochemical device that charges (or collects energy) from the grid or a power plant and then discharges that energy at a later time to provide electricity or other grid services when needed. Several battery chemistries are available or under investigation for grid-scale applications, including lithium-ion, lead-acid, redox flow, and molten salt (including sodium-based chemistries).[1] Battery chemistries differ in key technical characteristics (see *What are key characteristics of battery storage systems?*), and each battery has unique advantages and disadvantages. The current market for grid-scale battery storage in the United States and globally is dominated by lithium-ion chemistries (Figure 1). Due to technological innovations and improved manufacturing capacity, lithium-ion chemistries have experienced a steep price decline of over 70% from 2010-2016, and prices are projected to decline further (Curry 2017).

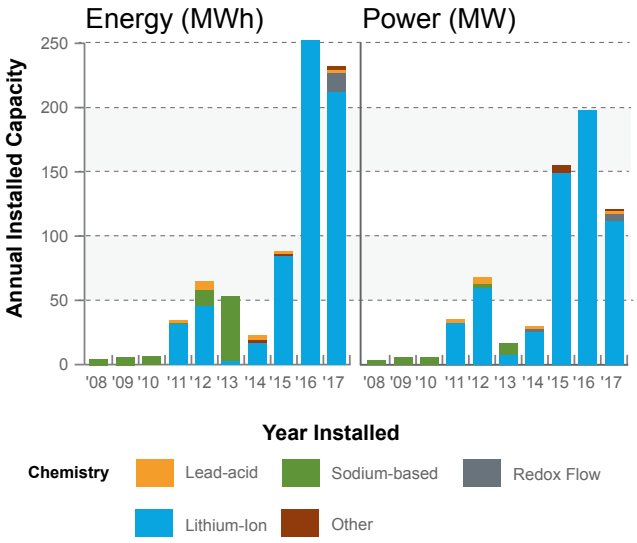


Figure 1: U.S. utility-scale battery storage capacity by chemistry (2008-2017). *Data source: U.S. Energy Information Administration, Form EIA-860, Annual Electric Generator Report*

Increasing needs for system flexibility, combined with rapid decreases in the costs of battery technology, have enabled BESS to play an increasing role in the power system in recent years. As prices for BESS continue to decline and the need for system flexibility increases with wind and solar deployment, more policymakers, regulators, and utilities are seeking to develop policies to jump-start BESS deployment.

Is grid-scale battery storage needed for renewable energy integration?

Battery storage is one of several technology options that can enhance power system flexibility and enable high levels of renewable energy integration. Studies and real-world experience have demonstrated that interconnected power systems can safely and reliably integrate high levels of renewable energy from variable renewable energy (VRE) sources without new energy storage resources.[2] There is no rule-of-thumb for how much battery storage is needed to integrate high levels of renewable energy. Instead, the appropriate amount of grid-scale battery storage depends on system-specific characteristics, including:

- The current and planned mix of generation technologies
- Flexibility in existing generation sources
- Interconnections with neighboring power systems
- The hourly, daily, and seasonal profile of electricity demand, and
- The hourly, daily, and seasonal profile of current and planned VRE.

In many systems, battery storage may not be the most economic resource to help integrate renewable energy, and other sources of system flexibility can be explored. Additional sources of system flexibility include, among others, building additional pumped-hydro storage or transmission, increasing conventional generation flexibility, and changing operating procedures (Cochran et al. 2014).

1. For information on battery chemistries and their relative advantages, see Akhil et al. (2013) and Kim et al. (2018).
2. For example, Lew et al. (2013) found that the United States portion of the Western Interconnection could achieve a 33% penetration of wind and solar without additional storage resources. Palchak et al. (2017) found that India could incorporate 160 GW of wind and solar (reaching an annual renewable penetration of 22% of system load) without additional storage resources.

What are the key characteristics of battery storage systems?

- **Rated power capacity** is the total possible instantaneous discharge capability (in kilowatts [kW] or megawatts [MW]) of the BESS, or the maximum rate of discharge that the BESS can achieve, starting from a fully charged state.
- **Energy capacity** is the maximum amount of stored energy (in kilowatt-hours [kWh] or megawatt-hours [MWh])
- **Storage duration** is the amount of time storage can discharge at its power capacity before depleting its energy capacity. For example, a battery with 1 MW of power capacity and 4 MWh of usable energy capacity will have a storage duration of four hours.
- **Cycle life/lifetime** is the amount of time or cycles a battery storage system can provide regular charging and discharging before failure or significant degradation.
- **Self-discharge** occurs when the stored charge (or energy) of the battery is reduced through internal chemical reactions, or without being discharged to perform work for the grid or a customer. Self-discharge, expressed as a percentage of charge lost over a certain period, reduces the amount of energy available for discharge and is an important parameter to consider in batteries intended for longer-duration applications.
- **State of charge,** expressed as a percentage, represents the battery's present level of charge and ranges from completely discharged to fully charged. The state of charge influences a battery's ability to provide energy or ancillary services to the grid at any given time.
- **Round-trip efficiency**, measured as a percentage, is a ratio of the energy charged to the battery to the energy discharged from the battery. It can represent the total DC-DC or AC-AC efficiency of the battery system, including losses from self-discharge and other electrical losses. Although battery manufacturers often refer to the DC-DC efficiency, AC-AC efficiency is typically more important to utilities, as they only see the battery's charging and discharging from the point of interconnection to the power system, which uses AC (Denholm 2019).

What services can batteries provide?

Arbitrage: Arbitrage involves charging the battery when energy prices are low and discharging during more expensive peak hours. For the BESS operator, this practice can provide a source of income by taking advantage of electricity prices that may vary throughout the day. One extension of the energy arbitrage service is **reducing renewable energy curtailment**. System operators and project developers have an interest in using as much low-cost, emissions-free renewable energy generation as possible; however, in systems with a growing share of VRE, limited flexibility of conventional generators and temporal mismatches between renewable energy supply and electricity demand (e.g., excess wind generation in the middle of the night) may require renewable generators to curtail their output. By charging the battery with low-cost energy during periods of excess renewable generation and discharging during periods of high demand, BESS can both reduce renewable energy curtailment and maximize the value of the energy developers can sell to the market. Another extension of arbitrage in power systems without electricity markets is **load-leveling**. With load-levelling, system operators charge batteries during periods of excess generation and discharge batteries during periods of excess demand to more efficiently coordinate the dispatch of generating resources.

Firm Capacity or Peaking Capacity: System operators must ensure they have an adequate supply of generation capacity to reliably meet demand during the highest-demand periods in a given year, or the peak demand. This peak demand is typically met with higher-cost generators, such as gas plants; however, depending on the shape of the load curve, BESS can also be used to ensure adequate peaking generation capacity. While VRE resources can also be used to meet this requirement, these resources do not typically fully count toward firm capacity, as their generation relies on the availability of fluctuating resources and may not always coincide with peak demand. But system operators can improve VRE's ability to contribute to firm capacity requirements through pairing with BESS. Pairing VRE resources with BESS can enable these resources to shift their generation to be coincident with peak demand, improving their capacity value (see text box below) and system reliability.

Firm Capacity, Capacity Credit, and Capacity Value are important concepts for understanding the potential contribution of utility-scale energy storage for meeting peak demand.

Firm Capacity (kW, MW): The amount of installed capacity that can be relied upon to meet demand during peak periods or other high-risk periods. The share of firm capacity to the total installed capacity of a generator is known as its **capacity credit (%)**.[3]

Capacity Value ($): The monetary value of the contribution of a generator (conventional, renewable, or storage) to balancing supply and demand when generation is scarce.

Operating Reserves and Ancillary Services: To maintain reliable power system operations, generation must exactly match electricity demand at all times. There are various categories of operating reserves and ancillary services that function on different timescales, from subseconds to several hours, all of which are needed to ensure grid reliability. BESS can rapidly charge or discharge in a fraction of a second, faster

3. See Mills and Wiser (2012) for a general treatment on the concept of capacity credit.

than conventional thermal plants, making them a suitable resource for short-term reliability services, such as Primary Frequency Response (PFR) and Regulation. Appropriately sized BESS can also provide longer-duration services, such as **load-following and ramping** services, to ensure supply meets demand.

Transmission and Distribution Upgrade Deferrals: The electricity grid's transmission and distribution infrastructure must be sized to meet peak demand, which may only occur over a few hours of the year. When anticipated growth in peak electricity demand exceeds the existing grid's capacity, costly investments are needed to upgrade equipment and develop new infrastructure. Deploying BESS can help defer or circumvent the need for new grid investments by meeting peak demand with energy stored from lower-demand periods, thereby reducing congestion and improving overall transmission and distribution asset utilization. Also, unlike traditional transmission or distribution investments, mobile BESS installations can be relocated to new areas when no longer needed in the original location, increasing their overall value to the grid.

Black Start: When starting up, large generators need an external source of electricity to perform key functions before they can begin generating electricity for the grid. During normal system conditions, this external electricity can be provided by the grid. After a system failure, however, the grid can no longer provide this power, and generators must be started through an on-site source of electricity, such as a diesel generator, a process known as black start. An on-site BESS can also provide this service, avoiding fuel costs and emissions from conventional black-start generators. As system-wide outages are rare, an on-site BESS can provide additional services when not performing black starts.

Table 1 below summarizes the potential applications for BESS in the electricity system, as well as whether the application is currently valued in U.S. electricity markets (Denholm 2018). Figure 2 shows the cumulative installed capacity (MW) for utility-scale storage systems in the United States in 2017 by the service the systems provide.

Most storage systems in the United States provide operating reserves and ancillary services. Despite this current focus, the total U.S. market for these services is limited, and utility-scale storage may begin providing more firm and peak capacity in the near future.

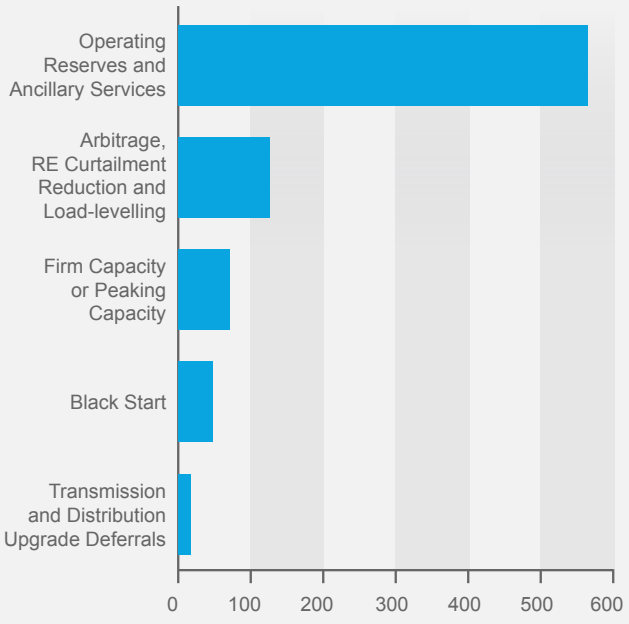


Figure 2: U.S. Utility-scale battery storage capacity by service. *Data source: U.S. Energy Information Administration, Form EIA-860, Annual Electric Generator Report*

Where should batteries be located?

Utility-scale BESS can be deployed in several locations, including: 1) in the transmission network; 2) in the distribution network near load centers; or 3) co-located with VRE generators. The siting of the BESS has important implications for the services the system can best provide, and the most appropriate location for the BESS will depend on its intended-use case.

In many cases, a BESS will be technically capable of providing a broad range of services in any of the locations described in the next section. Therefore, when siting storage, it is important to analyze the costs and benefits of multiple locations to determine the optimal siting to meet system needs. Considering all combinations of services the BESS can provide at each potential site will provide a better understanding of the expected revenue streams (see *What is value-stacking?*) and impact on the grid.

In the Transmission Network

BESS interconnected to the transmission system can provide a broad range of ancillary and transmission-related services. These systems can be deployed to replace or defer investments of peaking capacity, provide operating reserves to help respond to changes in generation and demand, or they can be used to defer transmission system upgrades in regions experiencing congestion from load or generation growth. Figure 3 below shows the configuration of a utility-scale storage system interconnected at the transmission substation level.

In the Distribution Network Near Load Centers

Storage systems located in the distribution network can provide all of the services as transmission-sited storage, in addition to several services related to congestion and power quality issues. In many areas, it may be difficult to site a conventional generator near load in order to provide peaking capacity, due to concerns about emissions or land use. Due to their lack of local emissions and their scalable nature, BESS systems can be co-located near load with fewer siting challenges than conventional generation. Placing storage near load can reduce transmission and distribution losses and relieve congestion, helping defer transmission and distribution upgrades. Distribution-level BESS systems can also provide local power quality services and support improved resilience during extreme weather events.

Table 1: Applications of Utility-Scale Energy Storage

Application	Description	Duration of Service Provision	Typically Valued in U.S. Electricity Markets?
Arbitrage	Purchasing low-cost off-peak energy and selling it during periods of high prices.	Hours	Yes
Firm Capacity	Provide reliable capacity to meet peak system demand.	4+ hours	Yes, via scarcity pricing and capacity markets, or through resource adequacy payments.
Operating Reserves			
• Primary Frequency Response	Very fast response to unpredictable variations in demand and generation.	Seconds	Yes, but only in a limited number of markets.
• Regulation	Fast response to random, unpredictable variations in demand and generation.	15 minutes to 1 hour	Yes
• Contingency Spinning	Fast response to a contingency such as a generator failure.	30 minutes to 2 hours	Yes
• Replacement/ Supplemental	Units brought online to replace spinning units.	Hours	Yes, but values are very low.
• Ramping/Load Following	Follow longer-term (hourly) changes in electricity demand.	30 minutes to hours	Yes, but only in a limited number of markets.
Transmission and Distribution Replacement and Deferral	Reduce loading on T&D system during peak times.	Hours	Only partially, via congestion prices.
Black-Start	Units brought online to start system after a system-wide failure (blackout).	Hours	No, typically compensated through cost-of-service mechanisms.

Co-Located with VRE Generators

Renewable resources that are located far from load centers may require transmission investments to deliver power to where it is needed. Given the variable nature of VRE resources, the transmission capacity used to deliver the power may be underutilized for large portions of the year. A BESS can reduce the transmission capacity needed to integrate these resources and increase the utilization of the remaining capacity by using storage to charge excess generation during periods of high resource availability and discharge during periods of low resource availability. The same BESS can be used to reduce the curtailment of VRE generation, either due to transmission congestion or a lack of adequate demand, as well as provide a broad range of ancillary services.

What is value-stacking? What are some examples of value-stacking opportunities and challenges?

BESS can maximize their value to the grid and project developers by providing multiple system services. As some services are rarely called for (i.e., black start) or used infrequently in a given hour (i.e., spinning reserves), designing a BESS to provide multiple services enables a higher overall battery utilization. This multi-use approach to BESS is known as **value-stacking**. For example, a BESS project can help defer the need for new transmission by meeting a portion of the peak demand with stored energy during a select few hours in the year. When not meeting peak demand, the BESS can earn revenue by providing operating reserve services for the transmission system operator.

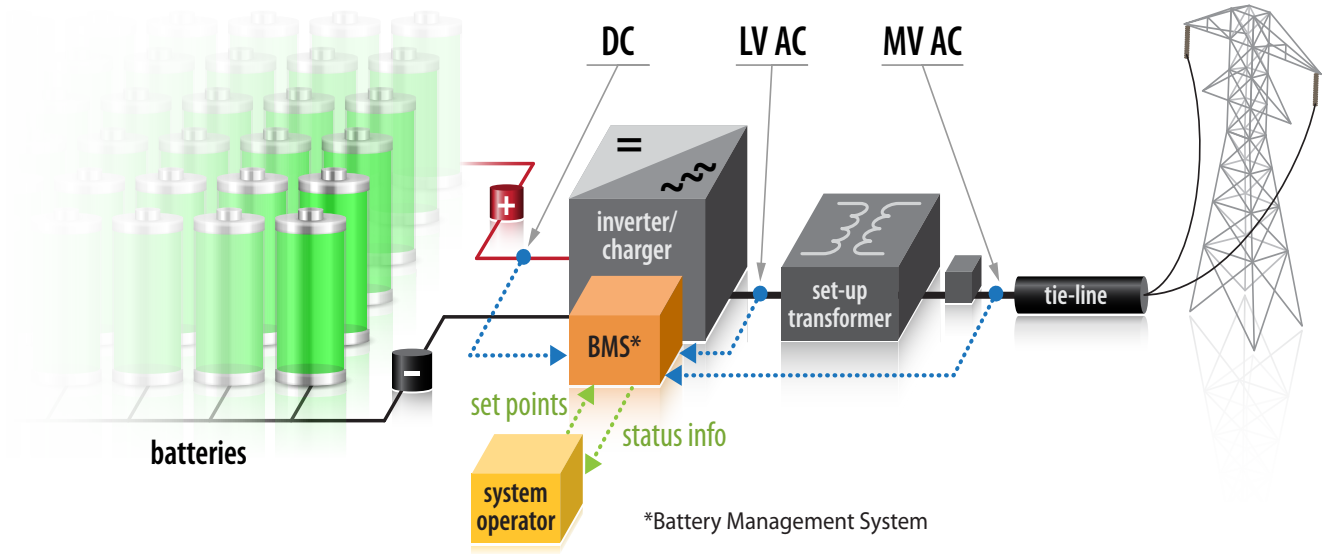


Figure 3: Key components of BESS interconnected at the transmission substation level. LV AC represents a low-voltage AC connection, while MV AC represents a medium-voltage AC connection.[4] *Source: Denholm (2019)*

Some system services may be mutually exclusive depending on the BESS design (e.g., a short duration storage device used to supply regulating reserves would have limited value for deferring transmission or distribution upgrades). Even if a BESS is technically capable of providing multiple services, the additional cycling of the battery (charging and discharging) may degrade the battery and shorten its lifetime and economic viability. Finally, a BESS can only provide a limited duration of any set of services before it runs out of charge, which means batteries must prioritize the services they provide.

Regulators have a variety of options to enable BESS to maximize its economic potential through value-stacking. For example, the California Public Utilities Commission (CPUC) developed categories of services BESS can provide based on their importance for reliability and location on the grid, as well as 12 rules for utilities when procuring services from BESS (CPUC 2018). The CPUC rules:

- Dictate that BESS projects can only provide services at the voltage level to which they are interconnected or higher, but not lower[5];
- Prioritize reliability services over non-reliability services and ensure storage cannot contract for additional services that would interfere with any obligation to provide reliability services;
- Require that a BESS project comply with all performance and availability requirements for services it provides and that noncompliance penalties be communicated in advance;
- Require that a BESS project inform the utility of any services it currently provides or intends to provide; and
- Take measures to prevent double compensation to BESS projects for services provided.

These CPUC rules are just one example of how regulators can help ensure BESS projects can select the most cost-effective combinations of services to provide without negatively impacting the reliability of the grid.

How are BESS operators compensated?

BESS operators can be compensated in several different ways, including in the wholesale energy market, through bilateral contracts, or directly by the utility through a cost-of-service mechanism. In a wholesale energy market, the BESS operator submits a bid for a specific service, such as operating reserves, to the market operator, who then arranges the valid bids in a least-cost fashion and selects as many bids as necessary to meet the system's demands. If the BESS operator's bid is selected and the BESS provides the service, the operator will receive compensation equal to the market price. This process ensures transparent prices and technology-agnostic consideration; however, many services are currently not available in the market, such as black start or transmission and distribution upgrade deferrals. Alternatively, BESS operators can enter into bilateral contracts for services directly with energy consumers, or entities which procure energy for end-consumers. This process does not ensure transparency and contracts can differ widely in both prices and terms. Finally, some BESS are owned directly by the utilities to whom they provide services, such as upgrade deferrals. In these cost-of-service cases, the utility pays the BESS operator at the predetermined price and recovers the payments through retail electricity rates. In some jurisdictions, however, BESS may be prevented from extracting revenues through both wholesale markets and cost-of-service agreements (Bhatnagar et al. 2013).

4. ANSI C84.1: Electric Power Systems and Equipment–Voltage Ratings (60 Hz) defines a low-voltage system as having a nominal voltage less than 1 kV and medium voltage as having a nominal voltage between 1 kV and 100 kV.
5. BESS interconnected at the distribution level can provide distribution or transmission level services, but BESS interconnected at the transmission level can only provide transmission-level services.

How does the value of batteries change with renewable energy deployment and increased VRE penetration?

The amount of renewable energy on the grid can influence the value and types of the services provided by a BESS. Increased levels of renewable energy may increase the need for frequency control services to manage increased variability and uncertainty in the power system. Increased levels of VRE penetration can also change the shape of the net load, or the load minus the VRE generation, influencing BESS projects that provide load following, arbitrage, peaking capacity, or similar services.

Models of the California system have shown a strong relationship between solar PV deployment and BESS' ability to replace conventional peaking capacity, also known as the BESS capacity credit (Denholm and Margolis 2018). As the shape of the load curve affects the ability of storage to provide peaking capacity, resources such as PV that cause load peaks to be shorter will enable shorter duration batteries, which are less expensive, to displace conventional peaking capacity.

Initially, low levels of PV penetration may flatten the load curve, reducing BESS' ability to cost-effectively offset the need for conventional peaking plants.[6] At higher levels of solar PV penetration, however, the net load curve becomes peakier, increasing the ability and value of BESS to reduce peak demand. Figure 4 illustrates how increasing levels of PV generation change the shape of the net load, causing it to become peakier. The shaded areas above and under the net load curves indicate BESS charging and discharging, while the text boxes show the amount of net load peak reduction (MW) and the total amount of energy met by BESS during the net load peak (MWh).

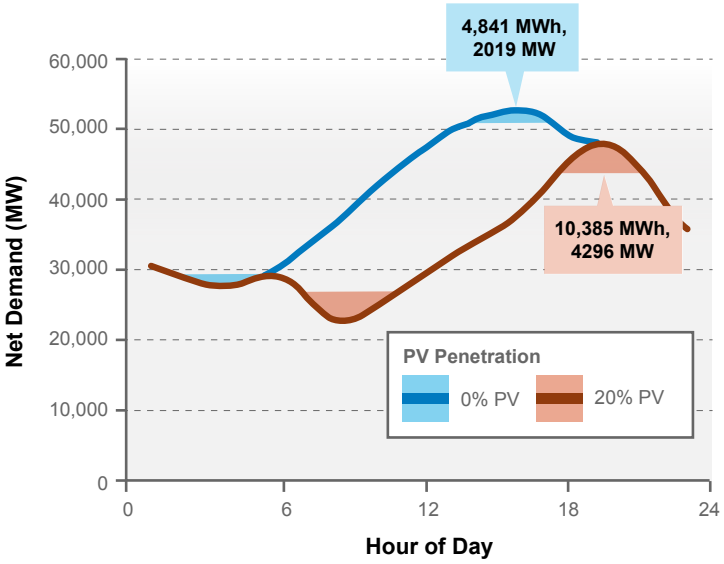


Figure 4: Change in California net load shape due to PV.
Adapted from Denholm and Margolis (2018)

What are the key barriers to BESS deployment?

Barriers to energy storage deployment can be broadly grouped into three different categories: regulatory barriers, market barriers, and data and analysis capabilities.

1. Regulatory Barriers

- **Lack of rules and regulations to clarify the role of BESS.** Although storage may be technically able to provide essential grid services, if no regulations or guidelines explicitly state that storage can provide these services, utilities and market operators may be unwilling to procure services from BESS. Furthermore, without a guarantee that services provided by a BESS project will be compensated, storage developers and financing institutions may be unwilling to make the necessary capital investments. Federal Energy Regulatory Commission (FERC) Order 841 addressed this issue in U.S. wholesale markets and directed market operators to develop rules governing storage's participation in energy, capacity, and ancillary service markets. Among other requirements, the rules must ensure open and equal access to the market for storage systems, taking into consideration their unique operating and technical characteristics (FERC 2018).

- **Restrictions or lack of clarity around if and how storage can be used across generation, transmission, and distribution roles.** The variety of different services storage can provide often cuts across multiple markets and compensation sources. For instance, frequency regulation may be compensated in a wholesale market, but transmission or distribution investment deferrals may be compensated as a cost of service by the utility or system operator. In some jurisdictions, providing services across different compensation sources is restricted by regulation. Limiting the services batteries can provide based on where the service is provided or how it is compensated can influence how often they are utilized and whether they remain an economic investment (Bhatnagar 2013).

2. Market Barriers

- **Lack of markets for system services.** A lack of markets for services that batteries are uniquely suited to provide can make it difficult for developers to include them as potential sources of income when making a business case, deterring investment. For example, in most U.S. Independent System Operator (ISO) markets, generators are currently expected to provide inertial and governor response during frequency excursions without market compensation. Although BESS can provide the same services, currently there is no way for BESS to seek market compensation for doing so. Furthermore, the price formation for a service may have evolved for conventional generators, meaning the presence

6. This is demonstrated by Denholm and Margolis (2018) for the California system.

of batteries in the market could distort prices, affecting storage systems and conventional generators alike (Bhatnagar 2013).

- **Lack of discernment in quality and quantity of services procured.** For some services, such as frequency regulation, the speed and accuracy of the response is correlated to its overall value to the system. Battery systems can provide certain services much faster and more accurately than conventional resources, which may not be reflected in compensation for the service. Markets can provide fair compensation to BESS by aligning compensation schemes with the quality of service provided, as is mandated by FERC Order 755, which requires compensation for frequency regulation that reflects "the inherently greater amount of frequency regulation service being provided by faster-ramping resources" (FERC 2011). Similarly, BESS can be uniquely suited to provide up- or down-regulation, given their larger operating range over which to provide regulating reserves (due to their lack of a minimum stable level and ability to provide up- and down-regulation in excess of their nameplate capacity, based on whether they are charging or discharging) (Denholm 2019). These unique features of BESS are not necessarily reflected in the procurement requirements and compensation of such services, diminishing BESS' economic viability.

3. *Data and Analysis Capabilities*

Battery storage systems are an emerging technology that exhibit more risk for investors than conventional generator investments. These risks include the technical aspects of battery storage systems, which may be less understood by stakeholders and are changing faster than for other technologies, as well as potential policy changes that may impact incentives for battery deployment. Given the relatively recent and limited deployment of BESS, many stakeholders may also be unaware of the full capabilities of storage, including the ability of a BESS to provide multiple services at both the distribution and transmission level. At the same time, traditional analysis tools used by utilities may be inadequate to fully capture the value of BESS. For example, production cost models typically operate at an hourly resolution, which does not capture the value of BESS' fast-ramping capabilities. The gaps in data and analysis capabilities and lack of adequate tools can deter investments and prevent battery storage from being considered for services that can be provided by better understood conventional generators (Bhatnagar et al. 2013).

What are some real-world examples of batteries providing services and value-stacking?

There are several deployments of BESS for large-scale grid applications. One example is the Hornsdale Power Reserve, a 100 MW/129 MWh lithium-ion battery installation, the largest lithium-ion BESS in the world, which has been in operation in South Australia since December 2017. The Hornsdale Power Reserve provides two distinct services: 1) energy arbitrage; and 2) contingency spinning reserve. The BESS can bid 30 MW and 119 MWh of its capacity directly into the market for energy arbitrage, while the rest is withheld for maintaining grid frequency during unexpected outages until other, slower generators can be brought online (AEMO 2018). In 2017, after a large coal plant tripped offline unexpectedly, the Hornsdale Power reserve was able to inject several megawatts of power into the grid within milliseconds, arresting the fall in grid frequency until a gas generator could respond. By arresting the fall in frequency, the BESS was able to prevent a likely cascading blackout.

Another example of value-stacking with grid-scale BESS is the Green Mountain Power project in Vermont. This 4 MW lithium-ion project began operation in September 2015 and is paired with a 2 MW solar installation. The installation provides two primary functions: 1) backup power and micro-grid capabilities; and 2) demand charge reductions. The solar-plus-storage system enables the utility to create a micro-grid, which provides power to a critical facility even when the rest of the grid is down. The utility operating the BESS also uses it to reduce two demand charges: an annual charge for the regional capacity market and a monthly charge for the use of transmission lines. Sandia National Laboratories estimated that reducing the annual demand charge for a single year saved the utility over $200,000 (Schoenung 2017).

References

AEMO (Australian Energy Market Operator). *Hornsdale Wind Farm 2 FCAS Trial*. Knowledge Sharing Paper. Melbourne, Australia: AEMO. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Strategic-Partnerships/2018/HWF2-FCAS-trial-paper.pdf.

Akhil, Abbas, Georgianne Huff, Aileen Currier, Benjamin Kaun, Dan Rastler, Stella Bingquing Chen, Andrew Cotter, et al. *Electricity Storage Handbook*. SAND2013-5131. DOE, EPRI, NRECA. July 2013. https://www.sandia.gov/ess-ssl/lab_pubs/doeepri-electricity-storage-handbook/.

Bhatnagar, Dhruv, Aileen Currier, Jacquelynne Hernandez, Ookie Ma, and Kirby Brendan. *Market and Policy Barriers to Energy Storage Deployment.* SAND2013-7606. Albuquerque, NM: Sandia National Laboratories. September 2013. https://www.sandia.gov/ess-ssl/publications/SAND2013-7606.pdf.

Cochran, Jaquelin, Mackay Miller, Owen Zinaman, Michael Milligan, Doug Arent, Bryan Palmintier, Mark O'Malley, et al. "Flexibility in 21st Century Power Systems." NREL/TP-6A20-61721. 21st Century Power Partnership. Golden, CO: NREL. May 2014. https://www.nrel.gov/docs/fy14osti/61721.pdf.

CPUC (California Public Utilities Commission). *Decision on Multiple-Use Application Issues. Rulemaking 15-03-011.* January 17, 2018. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M206/K462/206462341.PDF.

Curry, Claire. "Lithium-Ion Battery Costs and Market." *Market Report. Bloomberg New Energy Finance*. July 5, 2017. https://data.bloomberglp.com/bnef/sites/14/2017/07/BNEF-Lithium-ion-battery-costs-and-market.pdf.

Denholm, Paul. "Greening the Grid: Utility-Scale Battery Storage." Webinar. Clean Energy Solutions Center. February 28, 2019. https://cleanenergysolutions.org/training/greening-grid-utility-scale-battery-storage.

Denholm, Paul. "Batteries and Storage: Truly a Game Changer?" presented at the JISEA 2018 Annual Meeting in Golden, CO. April 4, 2018. https://www.jisea.org/assets/pdfs/denholm-jisea-2018.pdf.

Denholm, Paul, and Robert Margolis. *The Potential for Energy Storage to Provide Peaking Capacity in California under Increased Penetration of Solar Photovoltaics*. NREL/TP-6A20-70905. Golden, CO: NREL. March 2018. https://www.nrel.gov/docs/fy18osti/70905.pdf.

FERC. *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*. Order No. 841. Issued February 15, 2018. https://www.ferc.gov/whats-new/comm-meet/2018/021518/E-1.pdf.

FERC. *Frequency Regulation Compensation in the Organized Wholesale Power Markets*. Order No. 755. Issued October 20, 2011. https://www.ferc.gov/whats-new/comm-meet/2011/102011/E-28.pdf.

Kim, Dae Kyeong, Susumu Yoneoka, Ali Zain Banatwala, and Yu-Tack Kim. *Handbook on Battery Energy Storage System*. Manila, Philippines: Asian Development Bank. December 2018. https://www.adb.org/publications/battery-energy-storage-system-handbook.

Lew, D., G. Brinkman, E. Ibanez, A. Florita, M. Heaney, B.-M. Hodge, M. Hummon, et al. *The Western Wind and Solar Integration Study Phase 2*. NREL/TP-5500-55588. Golden, CO: NREL. September 2013. https://www.nrel.gov/docs/fy13osti/55588.pdf.

Mills, Andrew, and Ryan Wiser. *Changes in the Economic Value of Variable Generation at High Penetration Levels: A Pilot Case Study of California*. LBNL-5445E. Berkeley, CA: Lawrence Berkeley National Laboratory. June 2012. https://emp.lbl.gov/sites/all/files/lbnl-5445e.pdf.

Palchak, David, Jaquelin Cochran, Ali Ehlen, Brendan McBennett, Michael Milligan, Ilya Chernyakhovskiy, Ranjit Deshmukh, et al. *Pathways to Integrate 175 Gigawatts of Renewable Energy into India's Electric Grid, Vol. I—National Study*. Golden, CO: NREL. June 2017. https://www.nrel.gov/docs/fy17osti/68530.pdf.

Schoenung, Susan, Raymond H. Byrne, Todd Olinsky-Paul, and Daniel R. Borneo. *Green Mountain Power (GMP): Significant Revenues from Energy Storage*. Albuquerque, NM: Sandia National Laboratories. May 2017. https://www.sandia.gov/ess-ssl/publications/SAND2017-6164.pdf.

Written by Thomas Bowen, Ilya Chernyakhovskiy, Paul Denholm, National Renewable Energy Laboratory

www.greeningthegrid.org | www.nrel.gov/usaid-partnership

Jennifer E. Leisch, Ph.D.
USAID-NREL Partnership Manager
U.S. Agency for International Development
Tel: +1-303-913-0103 | Email: jleisch@usaid.gov

Ilya Chernyakhovskiy
Energy Analyst
National Renewable Energy Laboratory
Tel: +1-303-275-4306
Email: ilya.chernyakhovskiy@nrel.gov

This work was authored, in part, by the National Renewable Energy Laboratory (NREL), operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the United States Agency for International Development (USAID) under Contract No. IAG-17-2050. The views expressed in this report do not necessarily represent the views of the DOE or the U.S. Government, or any agency thereof, including USAID.

NREL/TP-6A20-74426 | September 2019
NREL prints on paper that contains recycled content.

The Grid Integration Toolkit provides state-of-the-art resources to assist developing countries in integrating variable renewable energy into their power grids. Greening the Grid is supported by the U.S. Agency for International Development.

The USAID-NREL Partnership addresses critical challenges to scaling up advanced energy systems through global tools and technical assistance, including the Renewable Energy Data Explorer, Greening the Grid, the International Jobs and Economic Development Impacts tool, and the Resilient Energy Platform. More information can be found at: **www.nrel.gov/usaid-partnership**.

USAID FROM THE AMERICAN PEOPLE NREL Transforming ENERGY

REexplorer MAPPING OUR ENERGY FUTURE Greening the Grid I-JEDI Resilient Energy Platform

COMMONWEALTH ENERGY PARTNERS

White Oak Solar Farm

Decommissioning Plan

January 2023

CEPSOLAR
COMMONWEALTH ENERGY PARTNERS

Table of Contents

Executive Summary

White Oak Solar Farm (the "Project") is a solar power generation facility and Battery Energy Storage System (BESS) proposed by White Oak Tree Solar, LLC (the "Owner"), in Fluvanna County, Virginia. The Project will have a nameplate capacity of 38 Megawatts alternating current (MWac) and a BESS with a capacity of 15 MWac.

The Decommissioning and Restoration Plan (the "Plan") has been prepared to address the requirements of Fluvanna County. The Project will also comply with any applicable municipal, state, and federal regulations. The Plan assumes decommissioning and restoration will occur at the end of the Project's expected useful life of forty (40) years. An overview of all activities related to the removal of the Project's equipment and panels, appurtenant structures, and for restoration of the site to its previous condition (as much as reasonably practicable) can be found in the Plan.

1. Introduction and Project Description

White Oak Tree Solar, LLC proposes to develop this Project with a maximum nameplate capacity of 38 MWac as described in the special use permit application. The Battery Energy Storage System (BESS) will have a capacity of 15 MWac.

The following Plan is based on today's known technologies, means, and methods, which may change over the life of the Project.

2. Methodology

This Plan provides an overview of all activities during the decommissioning phase of the Project, as well as all activities related to the restoration of the Project site and the management of excess materials and waste.

3. Decommissioning Plan Overview

The facility has an engineered design life of forty (40) years but may be reasonably expected to economically produce beyond its designed life. This Plan, however, assumes that decommissioning activities will be completed at the end of forty (40) years.

During decommissioning, all of the Project's facilities will be dismantled and removed, including the perimeter fences, concrete foundations, steel piles, mounting racks, trackers, Photovoltaic ("PV") modules, BESS and associated components, above-ground and underground cables, transformers, inverters, fans, switch boxes, fixtures, combiner boxes and project substation. If requested by the landowners, fencing and/or access roads may be left in place. The electrical equipment and raw material that will be removed will carry significant salvage value and will be reused or recycled where

possible. All fill and gravel will be removed, and the site will be graded to restore terrain profiles to the extent practicable. If the landowners request that some or all of the fill and gravel remain, the Project Owner will work with the landowners to develop and execute an alternative plan that satisfies the landowners.

Decommissioning is triggered when the Project shall be considered discontinued after a twenty-four (24) month period of inactivity or substantially discontinuing energy production. Within one year, weather delays notwithstanding, of initiating the decommissioning, Project facilities will be removed and recycled or properly disposed of and the site will be restored in accordance with the process described below.

The Project Owner will notify with county to review its plans and schedule for decommissioning the Project and restoration of the premises. Within twelve (12) months of initiating the decommissioning, Project facilities will be removed from the leased land and restoration will be completed.

3.1 Decommissioning During Construction (Abandonment of the Project)

In the unlikely event that the construction of the project ceases prior to completion, the installed components and all materials on the Project site will be removed and recycled or properly disposed of and the site restored in accordance with applicable regulations and the process described in this plan.

3.2 Decommissioning After Ceasing Operation

In the event that the operation of the solar farm ceases prior to the end of its useful economic life, the installed components will be removed and recycled, and the site restored in accordance with applicable regulations and the procedures described in this plan.

4. Decommissioning of the Renewable Energy Generation Facility

4.1 Equipment Dismantling and Removal

Many of the Project's components are largely composed of recyclable materials, including glass semiconductor material, steel, and wiring. When the project is decommissioned, reusable and recyclable parts will be dismantled, removed from the site and transported to reuse or recycling facilities. All waste resulting from the decommissioning of the facility will be transported by a certified and licensed contractor and taken to a landfill facility.

4.1.1 Above-ground Structure Decommissioning

The decommissioning process will consist of the following sequence for the removal of the components:

Solar Panel Arrays, Inverters, Transformers, and Switchgear:

4.1.1.1 De-energize and disconnect the Project from the utility power grid;

4.1.1.2 Disconnect all above ground wirings, cables, fuses and electrical and protection components and reuse or recycle off-site by an approved facility;

4.1.1.3 Remove PV modules and metallic structures and ship to reuse or recycling facilities for aftermarket use or recycling and material reuse;

4.1.1.4 Remove all waste;

4.1.1.5 Remove the perimeter fence and recycle off-site by an approved metal recycler;

4.1.1.6 Remove inverters, transformers, meters, fans, lighting fixture, switchgear, and other electrical components and recycle off-site by an approved recycler;

4.1.1.7 Remove all MV feeders and utility poles;

4.1.1.8 Removal of Collector Substation;

4.1.1.9 Removal of Battery Energy Storage System (BESS) and associated components;

4.1.1.10 Remove concrete foundations of inverter and transformer pads;

Access Roads:

4.1.1.11 Project access roads will be used for decommissioning purposes, after which removal of roads will be discussed with the landowner to determine if any access roads may be left in place for their continued use.

4.1.1.12 If access roads are deemed unnecessary, removal of access roads and restoration of access road locations to their previous conditions are practicable with native soils and seeding. Should the landowner decide to keep the roads in place, they will not be removed. The plan assumes for cost estimation purposes that the roads will be removed.

4.1.2 Below-ground Structure Decommissioning

4.1.2.1 Disconnect and remove all underground cables, conduits, and collection lines and recycle off-site by an approved recycling facility.

4.1.2.2 Remove all PV panel racking below and above ground, including the steel pile foundations.

This Plan is based on current best industry practices and procedures. These practices may be subject to revision based on the development of new and improved decommissioning practices in the future. However, under no circumstance shall

these potential changes alleviate the Project Owner from any of its responsibilities to remove all facilities, equipment, and related infrastructure, both above- and below-ground, and restoring the site to its pre-construction condition.

4.2 Site Restoration

The Project Owner will develop a comprehensive restoration plan designed to restore the site so that it can be returned to its previous use. Restoration will include the following:

- Topsoil will be redistributed as necessary to effectively provide the same ground cover as was present prior to the site disturbance.
- Access roads and other areas that become compacted during Project operation will be decompacted to their previous conditions.

Where Project infrastructure has been removed, disturbed areas will be seeded with quick growing native species to prevent topsoil erosion. Erosion and control measures will be installed at ditches and will be left in place until ground cover is fully established.

4.2.1 Watercourses

The project was designed to avoid waterbodies and the renewable energy facility does not release emissions which could pollute the air and water bodies, therefore no impact to the aquatic environment is expected. As a result, no restoration of waterbodies, either during construction or decommissioning is planned. Wetlands will be avoided in the design and construction process.

4.2.2 Agricultural Lands

Once all Project facilities are removed, agricultural and silvicultural lands compacted during project operation (such as access roads) will be decompacted via tilling, plowing, or subsoiling and affected areas will be seeded with native grass species.

Similar to the construction phase, soil erosion and sedimentation control measures will be re-implemented during the decommissioning period and until the site is stabilized in order to mitigate erosion and silt or sediment runoff.

Access roads will be left based on agreement with the Landowner or graded to restore terrain profiles (to the extent practicable) and vegetated. If removed, filter fabric will be bundled and disposed of in accordance with all applicable regulations. As necessary, these areas will be backfilled and restored to meet existing grade. This material may come from an existing long-term berm or

stockpile.

The restoration of the site will allow the total runoff from the site to be similar to pre-construction conditions.

4.3 Managing Excess Materials and Waste

During the decommissioning phase, waste materials will be removed in accordance with applicable local, state, or federal regulations. This will include but not be limited to obtaining all required permits and doing all soil testing as deemed necessary either by permit or additionally by third party professionals to insure there is no contamination of the site after removal has occurred. It is the goal of the Project Owner to reuse and recycle materials to the extent practicable and to work with local subcontractors and waste firms to segregate material to be recycled. As an example, since the mounting racks are made up of manufactured metal, it is anticipated that nearly 100% of the above grade metal is salvageable based on current industry practices and trends.

Many components of the Project are reusable or recyclable and have salvage value. The Project Owner will manage decommissioning to minimize, to the extent practicable, the volume of project components and materials discarded as waste.

Table 4.1 below outlines the anticipated disposition methods of the different project components.

Table 4.1 - Anticipated Project Disposition

Component	Disposition Method
Concrete Foundations	Crush & Recycle
Solar Panels	Reuse or Recycle
Metal Racks & Mounts	Salvage/Recycle
Steel Piles & Rack Foundations	Salvage/Recycle
Wiring & Cabling	Recycle/Salvage
Inverters, Transformers, & Breakers	Salvage/Recycle/Reuse
Granular Material	Reuse/Dispose
Switchgear/Circuit Breakers	Reuse/sell
Fence Steel	Salvage/Recycle
Project Controls	Dispose/Reuse

Major pieces of equipment such as transformers and breakers are recyclable and reusable and will have significant market value. The solar panels are expected to retain over 75% of their generation capability after 40 years of operation, so their market value as a reusable item is very high.

Existing solar panel manufacturers have programs to buy and salvage panels. These programs extract the raw materials in the panels to make new panels at a significant discount from new material costs. Recycled materials include the semiconductor and glass.

Other components such as electrical cable have a high salvage-market value due to their copper and aluminum content. The same is true for the steel and aluminum racks and foundations that support the solar panels.

Because the majority of the facility will consist of reusable and recyclable items, only a small percentage of the project components and materials will be disposed of in landfills. Any items or materials that are landfilled will be nontoxic. The Project Owner will assume the responsibility for removing this material from the site and properly disposing of it.

5. Decommissioning Notification

Within six (6) months of notification of intent to decommission, the decommissioning process will begin.

6. Decommissioning Security

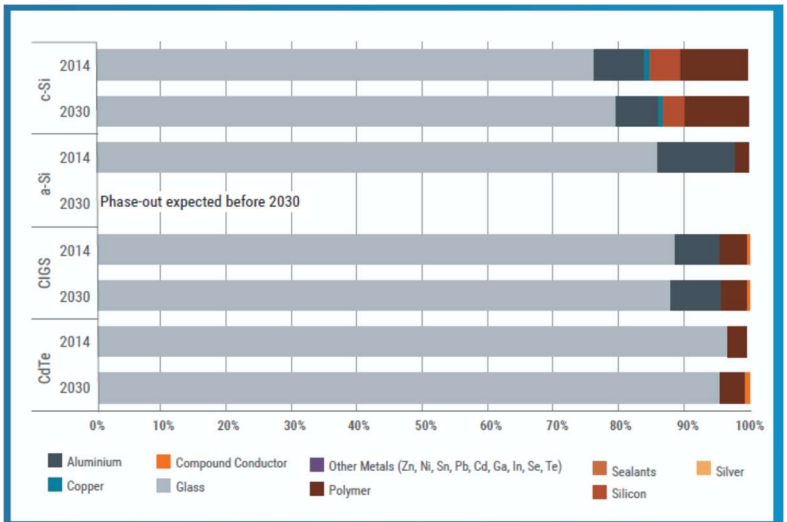
The net cost for decommissioning will be estimated and secured by an adequate surety in a form agreed to by the County. The net cost is determined by estimating the total cost of decommissioning and deducting the salvage value of project equipment and materials.

End-of-Life Management for Solar Photovoltaics: Recycling

SEIA PV Recycling Partner Network

SEIA's PV Recycling Working Group has been actively seeking and developing recycling partners across the U.S since 2016. Over 95% of PV modules deployed in the U.S have been installed since 2012, and such modules will stay in service for more than 25+ years. Nonetheless some waste is generated when panels are damaged during production, shipment or installation, determined to be defective, by weather events, and for warranty-related claims.

SEIA's National Recycling Program is preparing now for larger volumes of waste to come in future years. Already SEIA's recycling partners have processed >4M pounds of PV modules and related equipment since the program launched.

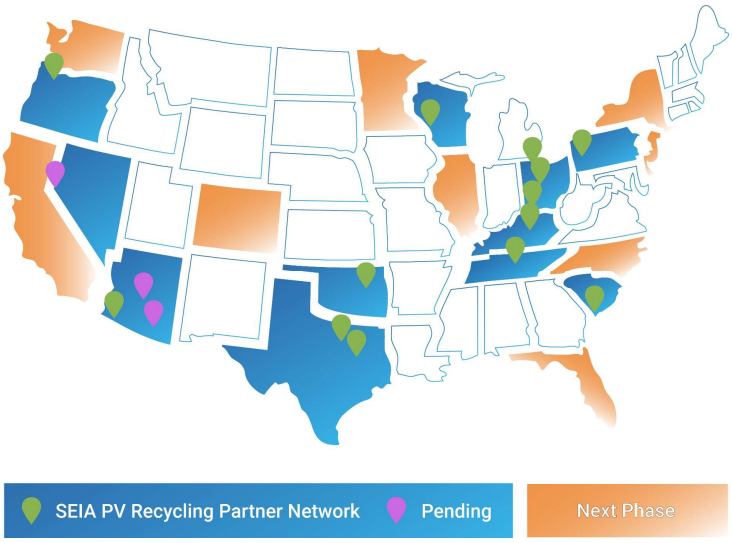


Source: IRENA and IEA-PVPS (2016), "End-of-Life Management: Solar Photovoltaic Panels," International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems.

While they offer specific benefits to SEIA members, the recyclers provide their services to interested installers, project and system owners, developers, distributors and other parties.

SEIA's current partners have prior expertise in recycling glass, polymerics, aluminum, scrap metal, and electronics; all of which provide a good foundation for recycling PV modules, inverters, racking systems and other components of a PV system. Our current network partners offer and provide services to SEIA members and industry throughout the U.S. SEIA is continually working to find new partners in more geographies to make recycling more accessible in areas where solar is installed.

The graphic below shows where SEIA's current partners are located and where we are in process of adding new partners. As we expand our network to more areas, we help partner companies to develop their processes and equipment for our technology. Overall, we aim to add 2-4 new partners yearly and for both new and existing partners to expand their collection and processing locations.



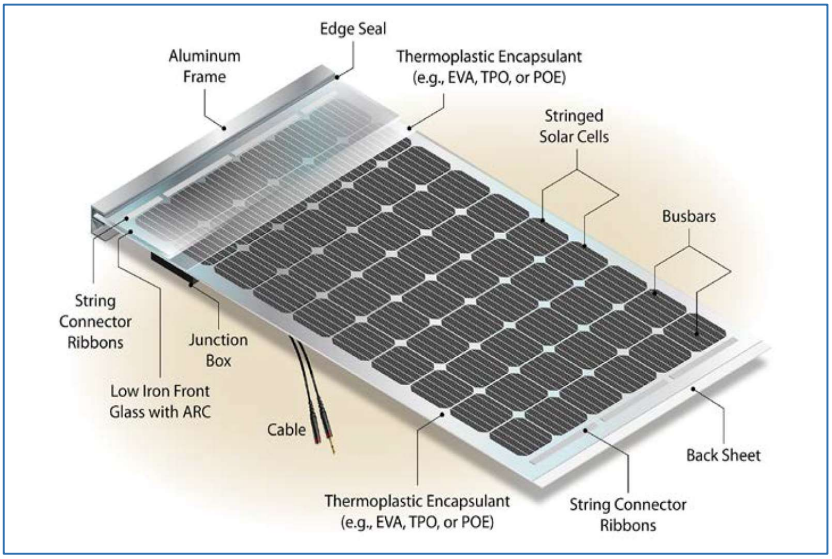
CEM Cascade Eco Minerals
CLEANLITES RECYCLING
DYNAMIC LIFECYCLE INNOVATIONS
Echo Environmental
First Solar
GREEN CENTURY RECYCLING

End-of-Life Management for Solar Photovoltaics: Recycling

Photovoltaic equipment and options for first end-of-life stages

Like many other durable products and construction materials, solar equipment can last for decades, particularly with proper maintenance. In some cases, PV modules can be reused or refurbished to have a 'second life' generating electricity. The other components of solar systems can also be handled responsibly. Inverters can be recycled as e-Waste and racking equipment can be re-utilized with newer technology or recycled like other metals.

SEIA advises manufacturers, system and project owners to consider reuse, refurbishment and / or recycling of first end-of-life PV modules, inverters, racking equipment and associated components when possible.



Source: NREL, Crystalline Silicon Photovoltaic Module Manufacturing Costs and Sustainable Pricing, 2019

Recycling

While most PV panels produced today will have a useful life for decades, there is inevitable waste created during production, when panels are damaged during shipment or installation, determined to be defective, become obsolete or reach their end-of-life. High-value recycling can help minimize lifecycle impacts and recover valuable and energy-intensive materials, thereby increasing sustainability within the PV industry.

PV panels typically consist of glass, aluminum, copper, silver and semiconductor materials that can be successfully recovered and reused. By weight, more than 80 percent of a typical PV panel is glass and aluminum – both common and easy-to-recycle materials. Recycling of solar equipment is increasingly possible as more recyclers accept modules.

Cooperation throughout the value chain

Research and development of PV-specific recycling equipment can optimize the recoverability and purity of reclaimed materials. The start-up and support of new organizations will help the industry extend the useful life of existing products while maintaining the quality and safety of the equipment. Working together with stakeholders from all these areas will help inform and develop policy appropriately so that end-of-life management solutions complement the deployment of solar.

SEIA and its members participate in research studies and projects, white papers, collaborative programs and present information, findings and research at stakeholder meetings, conferences and events to keep industry and others updated on our progress in developing end-of-life solutions.

R&D Organizations, Producers, Academia	Repair/Re-use/ Refurbishment Services	Recycling and Waste Management
• Public institutions • Private organizations • OEM Manufacturers • Component Manufacturers	• Manufacturers • Service providers • Contractors • Installers and EPCs • Operations & Maintenance companies • Waste management companies • Pre-treatment companies	• Public waste agencies • Regulators • Waste management companies • Pre-treatment companies • Manufacturers

CEP SOLAR
COMMONWEALTH ENERGY PARTNERS

2201 W. Broad St. Suite #200
Richmond, VA 23220
www.CEPSolar.com

Dear Neighbor,

I am contacting you to introduce myself and to share information about White Oak Solar Farm, a project that we are proposing to develop in Fluvanna County.

White Oak Solar Farm is a 38MW project located off Shores Road about 2 miles south of Kidds Store, VA (Parcel IDs: 49-A-1, 49-A-5, 49-A-8, 48-A-35, 48-14-4, 48-14-5, 48-14-6, and 48-14-6A). I have included the following documents to provide some more detail about the project, who we are as a company, and general information about solar farms.

Project Overview – Provides basic project details including size, buffering, and expected timeline.
Company Overview – Provides an overview of CEP Solar's purpose and mission.
Frequently Asked Questions – Provides answers to frequently asked questions about solar farms.

As the project manager, I am dedicated to ensuring that White Oak Solar Farm works in the best interest of the community. My colleagues and I will be hosting a community meeting to discuss the project with local landowners and other stakeholders. You are invited to attend, and your feedback and questions are appreciated.

White Oak Solar Farm Community Meeting
Wednesday, October 12th from 6:30-8:00PM
The Light Academy - Cafeteria
479 Cunningham Rd., Palmyra, VA 22963

If you have any questions or comments ahead of the meeting or if you are unable to attend, feel free to reach out to me by phone or email any time using the contact information below. I look forward to meeting with you.

Best,

Harry Kingery | Project Development Manager
(804) 789-4040 Ext. 707 | harry.kingery@cepsolar.com
2201 West Broad St. | Suite #200 | Richmond, VA 23230
www.cepsolar.com

Commonwealth Energy Partners, LLC
2201 W. Broad St. Suite #200
Richmond, VA 23220

White Oak Solar Farm Community Meeting Q&A

10/12/22

The following document summarizes questions and answers discussed during the White Oak Solar Farm Community Meeting.

1. What will you have to do to maintain the site?

- Seasonal landscaping (approximately 1-2 trucks every 1-2 weeks for landscaping)
- Routine electrical inspection
- Due to seasonal rainfall in Virginia, panels will not require cleaning maintenance
- Remote monitoring of the site will be utilized

2. Will you be able to see the panels?

- The project's visual impact on the viewshed will be negligible. A minimum setback of 50 ft. from all adjacent properties and right of ways will be utilized.
- A 25 ft. buffer will be kept in the setback area. The majority of the subject property is surrounded by a mature, retained buffer. Where the retained buffer does not meet requirements stipulated by the county, additional plantings will be added.

3. Will you be able to hear anything?

- Outside the fence, studies show that the sound generated by solar farms is generally not audible
- Inside the fence, the sound level of an inverter has been described as roughly equivalent to that of a dishwasher or refrigerator.

4. Should I be concerned about electromagnetic fields (EMFs)?

- EMFs are produced by common objects that we interact with on a daily basis and do not cause negative health impacts.
- While some equipment used in solar facilities does produce EMFs, it should not be considered a health concern. Note that the same equipment is used in residential applications, such a rooftop solar, where it is in closer proximity to people without producing detrimental health impacts.

5. What happens if there is a fire?

- Fires at a solar facility are a very rare occurrence, though they are possible. The project owner will coordinate with the local fire department to ensure that they are adequately prepared to handle a potential fire.
- There are also multiple site access points, all of which will be known and accessible by the local authorities.

Commonwealth Energy Partners, LLC
2201 W. Broad St. Suite #200
Richmond, VA 23220

6. Will the site be fenced?

- Yes, the perimeter of the panel area will be surrounded by a 6-foot-tall fence topped by one foot of 3 strands of barbed wire.
- The project will partner with local fire/rescue to ensure appropriate access.

7. What will the construction time be?

- The duration of construction depends on the megawatt capacity and the acreage of the solar farm.
- A typical project construction of this scale would require between 8-14 months.
- Construction may take place in a phased approach.

8. How long will it be till this project is in operation?

- CEP plans to have the project operational by 2026

9. How long will the project last?

- The project will have an operational lifetime of approximately 40 years

10. What happens at the end of the project's life?

- As a condition of project permitting, a decommissioning bond or other form of financial security will be established to ensure timely removal of the project.
- Upon removal of the equipment, the ground will be available for its original use (managed timber, agriculture, or otherwise).

11. How will the project benefit county residents?

- The project will provide increased tax revenue to the county, which can be used for the betterment of the county.
- The project will provide this revenue without having a material impact on county services, such as school, fire, and police, or county infrastructure, such a roads, water, and sewage.

12. Where will the electricity generated from this project go?

- The project interconnects to transmission lines that cross through the site.
- Power will flow from the project into the transmission system and then down into the distribution system to serve load in the area.

Welcome to the White Oak Community Meeting!

Please sign in below:

Name	Address	Phone	Email	Preferred Method of Contact
JM Whelan	1429 Salem Church Rd	[redacted]		
Douglas Miles				
Mozell H. Booker	258 Bass Lane			
Eric Dahl				
Tom Beecham	216 Winfield Ln.			
Deborah Jamison	4588 Shores Rd			
Chris Fairchild				
Carol Bragg	1505 SHORES RD			
Ashley Goodson	1184 Shores Road Palmyra VA 22963			
James Schoenster	843 Jefferson Dr.			
Robert C. Brown III TRC	1878 Shores Rd Palmyra Va 22963			
Heather Mucher	78 Rue Laiche Drive Palmyra VA 22963			
Mike Gorham	47 Pettit Foster Ln.			
Charlotte Brown	1878 Shores Rd Palmyra Va.			