Rhode Island Airport Corporation

October 1, 2015

Addendum No. 001
Request for Proposals, Contract No. 26124
Solar Photovoltaic Generating Systems

Prospective Proposers and all concerned are hereby notified of the following changes in the Request for Proposals document for the **Solar Photovoltaic Generating Systems RFP No. 26124.** These changes shall be incorporated in and shall become an integral part of the contract documents.

Dan Porter
VP, Planning & Environmental

Jeffrey P. Goulart
AVP, Financial Administration

1. Please provide the National Grid invoices for the respective meters shown under Exhibit 2. **RIAC has provided each of the potential proposers and email with the copies of the National Grid invoices. Any potential proposer should contact procurement@pvdairport.com if they did not receive the email.**

2. Please clarify the rate RIAC staff mentioned with respect to "hedging"? **RIAC has entered into a contract for the supply "portion" of electricity for the meters provided (see question 1). This rate is $0.0769 and is for 100% of the capacity from October 2015 to September 2017 and for 75% of the capacity from October 2017 to September 2018**

3. RIAC has secured times for onsite walk-throughs for each of the General Aviation Airports. This is only open for those who attended the mandatory conference. If you are unable to attend, you may designate an attendee. Please see attached worksheet. This worksheet needs to be emailed to procurement@pvdairport.com no later than October 7, 2015, 1PM Easter Standard Time. Please be sure to list your name, company name and a "YES" by the dates/time you are planning to participate (see example). Please note, the walk-throughs will start at the times shown and no other times will be made available under this RFP. Please be sure to arrive 10 minutes early. We have allowed adequate time for travel between the General Aviation Airports. Each attendee is responsible for their transportation.

4. **RIAC has updated Exhibit A. Please see attached.**

Attendee Site Visit

		Thursday, October 8, 2015			
		North Central	Quonset	Newport	Westerly
Full Name	Company	9am-10am	11:30am - 12:30pm	1:30pm - 2:30pm	4:00pm - 5:00pm
John Smith	Solar Co, Inc.	Yes	Yes	Yes	Yes

		Friday, October 9, 2015			
		North Central	Quonset	Newport	Westerly
Full Name	Company	9am-10am	11:30am - 12:30pm	1:30pm - 2:30pm	4:00pm - 5:00pm

RIAC Solar Project Siting

Revisions to memorandum (contained within RFP) dated September 7, 2015 (now dated October 1, 2015)

- Page 2, Table 1: BID – 1, added language that site potentially conflicts with ALP.
- Page 2, Table 1: BID – 4, new likely feasible site.
- Page 3, Table 1: SFZ – 3, added language that site potentially conflicts with ALP.
- Page 3, Table 1: correction to SFZ Acres/MW columns.
- Page 5, BID – 1: added language that site potentially conflicts with ALP.
- Page 5, BID – 4: new likely feasible site.
- Page 8, SFZ – 3: added language that site potentially conflicts with ALP.
- Attachment A, Figure A-1: BID – 4: new likely feasible site.
- Attachment A: added Tables A-1 through A-6.
- Attachment B: added Tables B-1 through B-4.
- Attachment C: Solar Glare Modeling Results (available online at Procurement site w/ Addendum).

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MEMORANDUM

To:	Daniel Porter, RIAC
From:	Stephen Barrett, HMMH
Copy:	Nicholas Stefaniak, LBG
Date:	October 1, 2015
Subject:	RIAC Solar Project Siting
Reference:	HMMH Project Number 307600

The Rhode Island Airport Corporation (RIAC) is interested in the feasibility of installing solar photovoltaic (PV) projects at the six airports that it operates: Block Island (BID), Quonset (OQU), TF Green (PVD), North Central (SFZ), Newport (UUU), and Westerly (WST). To provide information for its decision-making process, HMMH is working with the Louis Berger Group (LBG) on a Solar Feasibility Study for RIAC. The solar feasibility study is a planning tool that will be used by RIAC to determine how to proceed with solar deployment on airport property in order to accrue final benefits to the airport.

Work associated with completing the feasibility study is organized into six tasks focused on various aspects of evaluating the technical and financial feasibility of airport solar projects and various development scenarios. Task 1 was a site visit to inspect the six airports for potential siting opportunities. This memo addresses our initial findings for Task 2, an Airport Land Use and Technical Analysis, whose purpose is to identify suitable sites.

Evaluation of Sites

As supported by the analysis described in this memo, HMMH has evaluated a suite of airport sites to assess their feasibility for solar power development. The sites are ranked by the following categories: likely feasible, potentially feasible, likely infeasible, and infeasible.

- Likely feasible sites are those that are consistent with the Airport Layout Plan (ALP) and Federal Aviation Administration (FAA) safety zones, have no environmental resources to complicate the approval process, appear to be close to existing electrical infrastructure based on available information, and can comply with FAA ocular hazard standards.
- Potentially feasible sites are similar to the first category except that there is some uncertainty about either the available environmental information or the existing electrical infrastructure.
- Likely infeasible sites are those that are not excluded for some other reason (e.g., glare, wetlands) but are in remote areas that appear to require more cost to develop and interconnect, and have greater uncertainty.
- The infeasible sites are those that did not meet the FAA ocular hazard standard even when alternative designs were tested or, in one case, the entire site is a wetland and not developable.

The environmental and electrical interconnection information utilized in this study is screening level based on available information and a desktop analysis. It should be confirmed by any entity looking to develop a particular site that has been identified.

The glare modeling performed for each site is accurate for the design parameters that have been inserted into the Solar Glare Hazard Analysis Tool (SGHAT) which was used for evaluating glare as required by the FAA. Any proponent will need to replicate the modeling results and submit them to the FAA to obtain formal approval of the project before pursuing construction.

For planning purposes, we have also provided a nameplate electricity generation capacity for each site based on the project area as estimated using Google Earth measuring tool. For ground-mounted sites, we used the standard factor of five acres of land required to build a 1 MW solar project. For a roof mounted project, we

decided to use a factor associated with the West Davisville rooftop solar project in the Quonset Business Park which includes 3.3 acres of rooftop to generate 1 MW of solar.

See Table 1 for a summary of sites, attributes, and ranking. We recommend that only the sites listed as infeasible be excluded from future consideration at this time.

Table 1. Solar Project Site Attributes and Rank

Site #	Rank	Location	Acres	MW	Comment
BID-1	Likely Feasible	Behind Terminal	2.06	0.41	Interconnection needs to be assessed. Potentially conflicts with ALP.
BID-2	Likely Infeasible	Across Center Road	2.52	0.50	Wooded Area
BID-3	Infeasible	Runway 10 approach	1.37	0.27	Glare Problem
BID-4	Likely feasible	On Terminal Roof	0.03	0.02	Structural analysis needed
OQU-1	Potentially Feasible	North of Runway 16 end and near pond	2.06	0.41	Interconnection uncertain
OQU-2	Likely Feasible	Roof of Jet Center and hangar	1.14	0.34	Requires structural assessment, more costly than ground-mount
OQU-3	Likely Infeasible	Airfield near Bay	9.18	1.84	Distance to interconnect, contamination, floodplain
OQU-4	Infeasible	Airfield near Bay	22.95	4.59	Glare Problem
OQU-5	Potentially Feasible	East of Runway 16	11.70	2.34	Interconnection uncertain
PVD-1	Likely Infeasible	In RPZ to Runway 23	1.65	0.33	Only small project complies with FAA, located in the RPZ
PVD-2	Likely Feasible	Garages A & B	1.54	0.47	More costly than ground-mount
PVD-3	Likely Feasible	Roof of Interlink Garage	2.99	0.60	More costly than ground-mount
PVD-4	Likely Feasible	Surface Parking Lot	10.12	2.02	Most costly than ground-mount
PVD-5	Potentially Feasible	Sliver of land east of Warwick Industrial Dr.	2.75	0.55	Issues include interconnection and proximity to residences
PVD-6	Infeasible	South of Winslow Park	2.75	0.55	Glare problem
SFZ-1	Likely Infeasible	Adjacent to Runway 23	8.20	1.64	Isolated from roads and infrastructure, difficult to develop, wetlands
SFZ-2	Likely Infeasible	Across Harris Road	9.18	1.84	Isolated from roads and infrastructure, difficult to develop, wetlands

Table 1. Solar Project Site Attributes and Rank (continued)

Site #	Rank	Location	Acres	MW	Comment
SFZ-3	Likely Feasible	Adjacent to Runway 33	6.42	1.26	Interconnection needs to be assessed. Potentially conflicts with ALP.
SFZ-4	Likely Feasible	Behind Terminal Bldg	3.21	0.64	Interconnection needs to be assessed
SFZ-5	Likely Feasible	Across Rte. 123	6.31	1.28	Interconnection needs to be assessed
UUU-1	Likely Feasible	Behind Terminal Bldg	5.16	1.03	Interconnection needs to be assessed
UUU-2	Likely Feasible	South of Terminal Bldg	0.80	0.16	Interconnection needs to be assessed
UUU-3	Potentially Feasible	East of Runway 22	3.09	0.62	Interconnection uncertain
WST-1	Infeasible	North of Runway 25	5.16	1.03	Glare problem
WST-2	Infeasible	Adjacent and south of Runway 14	6.34	1.27	Entire site is wetlands
WST-3	Infeasible	Between Runways 25 & 32	12.62	2.52	Glare problem

Airport Solar Projects

There has been widespread adoption of solar PV by airports throughout the world. This activity has been driven by the expanding solar PV market and associated financial benefits to airports from lease payments and electricity price stabilization over the term of a long-term contract. In addition, airports are regularly seeking to make their operations more sustainable which has been an important but supplementary benefit. Furthermore, the flexible options in siting solar have provided airports with various options to consider a solar project that meets the scale and needs of an individual facility. There are approximately 70 solar PV facilities currently generating electricity at airports in the U.S. They are located in the airfield, on top of buildings, and as covered parking over surface parking areas and on top deck of parking garages. Some of the facilities are owned by the airport while others are owned by private companies that lease property from the airport.

In response to growing interest in deploying solar PV at airports, the Federal Aviation Administration (FAA) has issued solar policy and guidance. In November 2010, it published "Technical Guidance for Evaluating Selected Solar Technologies at Airports" which communicated to the industry basic information on solar technology, information on projects deployed at airports in the U.S., and guidance for general siting and FAA oversight responsibility. In September 2012, the FAA released "Interim Guidance on Land Uses in the Runway Protection Zone" which stated that certain unoccupied infrastructure including solar proposed in the RPZ would require an alternatives analysis for review by FAA Airports office before proceeding. In October 2013, the FAA published in the Federal Register "Interim Policy on Solar Projects at Airports" which specified information required to assess potential glare from solar projects on airport property and the standards the FAA would apply to determine if glare was acceptable. These policies have minimized potential regulatory risk associated with the review of solar projects which has resulted in a continued expansion in airport solar projects.

Description of Task

HMMH is working with LBG in the preparation of an airport land use and technical analysis. The purpose of this work is to determine the physical feasibility of solar projects at the six airports and to identify the most suitable sites. Physical feasibility is conducted primarily by evaluating various mapping data to exclude sites and

prioritize the remainder based on cost-effectiveness and minimizing development risk. Sites were identified through discussions with RIAC staff and reviewed during an initial site visit conducted under Task 1. The mapping layers used for the siting evaluation include:

- Federal Aviation Administration (FAA) airport design guidelines,
- electrical infrastructure,
- environmental resources, and
- FAA glare standards.

FAA Design Guidelines

The FAA airport design guidelines are presented for each airport on its Airport Layout Plan (ALP). The team utilized CAD files from the ALPs or otherwise digitized important information including safety zones (e.g., Runway Protection Zone, Object Free Areas), Part 77 surfaces, and navigational aids at each of the six airports. Some airport zones, including those identified as Object Free Areas (OFA), cannot accommodate non-aeronautical structures and are excluded from consideration for solar. Other areas, like the Runway Protection Zone (RPZ), allow the siting of unoccupied structures like solar but would require that an alternatives analysis be prepared and submitted to the FAA to demonstrate why the facility must be located in the RPZ. Part 77 limits the height of structures near the airport runway, which is often not an issue for solar projects given their limited vertical footprint. Similarly, navigational aids (or NAVAIDs) like radars are signal communication and processing systems which are impacted when objects obstruct the signal path, typically not an issue for low profile solar projects.

Electrical Infrastructure

LBG met with RIAC's utility staff to identify primary components of the on-site electrical infrastructure network which were then digitized as a data layer. This electrical information is at a relatively high-level and, in most cases, supports the concept of where the electricity from the electrical grid is delivered to the airport. Once sites are finalized, it will be important for project developers to confirm the feasibility of interconnecting a project of a particular size to the existing electrical infrastructure network. Information on the capacity of the off-site electrical network was not available and would also need to be confirmed as future parties as the degree of feasibility for some sites relies on this information.

Environmental Resources

HMMH then overlaid environmental mapping data, such as wetlands and floodplains, available from Rhode Island Geographic Information Systems (RI GIS) office. The environmental information helps to identify areas where environmental permits may be required and project development may be comparatively more complex and potentially costly. Sites with no identified environmental resources are more advantageous as they can be developed more cost-effectively with less risk due to limited permitting requirements. While projects can often be sited around environmental resources, in some cases, sites may be excluded due to extensive coverage of the resource.

FAA Glare Standards

Once project sites are prioritized, they are evaluated for potential glare impacts using the FAA's Solar Glare Hazard Analysis Tool (SGHAT) to determine if the project site could comply with the FAA's ocular hazard standard. The FAA's Interim Solar Policy issued October 23, 2013 describes the procedure for evaluating glare to potentially impact sensitive airport receptors and the standards the FAA uses to determine if the glare will result in a significant impact. The FAA requires the use of SGHAT or a similar modeling tool to evaluate glare from the proposed project site and the potential impact on the Air Traffic Control Tower (ATCT) and on aircraft on final approach to all airport runways. The policy also includes the FAA's ocular hazard standard which states that the FAA will object to any project that produces glare on the ATCT, as well as projects that produce a potential for a temporary after-image (yellow glare recorded by the model) or potential for permanent eye damage (red glare recorded by the model) on aircraft. For this portion of the siting study, we have used typical "base" design parameters that a solar engineer would proscribe to maximize electricity generation and

minimize cost. For ground-mounted sites, this included panels with a tilt angle of 10° facing 180° (due south) raised an average of 10 feet above ground level. For roof-mounted structures, we assumed a flat roof with the same basic design features of the ground-mounted projects (i.e. 10° tilt angle); however, the panels were angled toward the south to an azimuth consistent with the building orientation and we assumed that the panels would not be elevated above the roof. For solar canopies, we assumed that the height of the panels would be an average of 18 feet above ground level to allow the sites to accommodate cars to be parked under the panel canopies and the panels would be oriented toward the south in a direction consistent with the garage and striping orientation.

Results

The results of the siting analysis by airport are provided in maps and tables which are included in Attachment A. There are six maps (A-1 to A-6), one for each airport, which show the location of identified potential solar project sites labeled with an identifier on an aerial photograph allowing for the sites to be reviewed relative to airport features (e.g., runways, buildings). Each map also includes the property boundary, airport safety zones, available electrical infrastructure information, and environmental resources so that potential solar sites can be reviewed relative to this information. There are also six tables (A-1 to A-6) which summarize the same type of information such that each site can be reviewed relative to each of the siting criteria (e.g. safety area, electrical, environmental).

A listing of sites by feasibility is included as Attachment B. There are four tables, B-1 through B-4, which categorize the sites respectively as likely feasible, potentially feasible, likely infeasible, and infeasible. The only sites identified at this time as infeasible are those that do not comply with the FAA's glare standard.

The table also identifies whether or not the solar project site using the base project design complies with the FAA's ocular hazard standard. The base design for ground-mounted projects is 10° tilt angle facing 180° (due south). For roof top and canopy projects, we used the 10° tilt but oriented the panels toward the south but in alignment with the parking and roof orientation. Where the modeling results for the base design did not comply with FAA ocular hazard standards, we looked at practical alternative designs. Table 2 lists the compliance of each project site with FAA glare standards and the design that achieved compliance where applicable. We have also provided the SGHAT glare modeling results for each airport site as Attachment C.

The following is a summary of the analysis for each airport.

BID: Solar opportunities at Block Island State Airport (BID) are limited by the availability of suitable land, expected electricity infrastructure capacity constraints, sensitive natural habitats, and potential opposition by neighbors from impact on aesthetics. Three potential sites were identified for analysis.

- **BID-1** is the most feasible site identified due to its close proximity to the Terminal Building and existing electrical infrastructure, and the existing cleared condition of the land which reduces environmental impacts and construction costs. The site could support a 400 kW ground-mounted facility. The base design produced negative glare inconsistent with FAA policy; however an alternative design oriented 160° slightly east of south would meet the glare standard without significant reduction in electricity production. There could be a potential conflict with the current ALP for aircraft overflow parking. Further coordination with FAA will be required.
- **BID-2** is relatively proximate to the electrical infrastructure associated with the terminal building; however, it is a wooded property which introduces several risks. First, development costs will increase for clearing and grading. Second, the wooded site may have wetlands and habitat issues that are not yet known which may render part of the site undevelopable, and may lead to increased development costs. Third, clearing the land for solar has a greater aesthetic impact and may lead to greater chance of local opposition. The base design for the site did not meet the FAA glare standard. No additional designs were evaluated at this time given the overall low suitability of the project site.
- **BID-3** is generally unfavorable given its remote location distant from the roadway and potential interconnection locations. The site also has wetlands identified along its southern boundary. The base design for the site did not meet the FAA glare standard. No additional designs were evaluated at this time given the overall low suitability of the project site.

- **BID-4** which is the roof of the Terminal Building is also a feasible site though limited in site by available roof area. Some if not all the power can be consumed by the terminal on-site and any excess that is generated is likely small enough to be accommodated by the electrical grid. The estimated design for panels to lay flat on the south facing part of the roof achieved compliance with the FAA's glare standard.

OQU: Quonset State Airport (OQU) is adjacent to the Quonset Business Park and connected to a relatively densely developed area with expected robust electrical infrastructure. The airfield also has a long history of military use and there may be some risk of encountering associated environmental issues. Much of the airfield located near the bay is in a floodplain, which introduces potential property damage and permitting risk, and this area is cut off from existing infrastructure by the runways. The following five potential sites were evaluated.

- **OQU-1** is a relatively small site in a cleared area with access to existing infrastructure to the north of the airport. The site complied with the FAA glare standard for the base design. A potential electrical interconnection directly to the National Grid system would need to be explored.
- **OQU-2** is comprised of two building rooftops: the Providence Jet Center, and its adjacent hangar. These sites are limited in size and would have greater unit costs to construct compared to a ground-mounted facility. However, the sites are close to existing infrastructure and would have no environmental permitting issues. We modeled the building installations with panels located based on orientation of the roof and they each met the FAA glare standard.
- **OQU-3** is a fairly large site on the east side of the airport adjacent to the bay. It is far from the existing electrical infrastructure which would be a significant development cost. The east side of the property also has risks associated with location in a floodplain which may introduce permitting complexity and could be exposed to storm damage. Pavement may likely need to be removed and the history of environmental contamination is uncertain further increasing potential development risks. The base design did not meet the FAA glare standard; however a modified design with an orientation to the southeast at 120° is feasible.
- **OQU-4** is a very large site also located on the east side of the airfield and therefore has the same risks associated with high development costs to interconnect a system, potential floodplain impacts, and unknown environmental contamination from past military activities. We were unable to identify a design that would comply with the FAA glare standard and therefore have deemed the site to be infeasible.
- **OQU-5** is located in a cleared and relatively flat airfield area on the north side of the airport suggesting that the site could be cost-effective to develop if the facilities can be directly interconnected to the existing electrical network on Jones Road. The base design did not comply with FAA glare standards; however an alternative design with a 140° orientation achieves compliance.

PVD: Six potential solar project sites have been identified at TF Green International Airport (PVD). PVD is densely developed with limited room for locating a larger ground-mounted solar facility. However, PVD has a large energy load connected by a robust electrical infrastructure network which provides for additional opportunity. Solar projects constructed in the developed airport on buildings or over parking areas are more expensive to construct than flat, airfield sites. While such projects requiring more complex design and engineering strategy, they typically have limited environmental permitting risk.

- **PVD-1** is located in the RPZ which would require an alternatives analysis and approval from FAA headquarters. Buckeye Brook also bisects the parcel placing further constraints on siting. The identified project did not comply with the FAA glare standard so a smaller project was located east of the intersection of Airport Road and Commerce Drive, and this project would meet the FAA glare standard.
- **PVD-2** is comprised of the rooftop of two adjacent parking garages. Garage top designs with canopy structures have been developed successfully at other airports (BOS, MHT, MSP) without loss of parking capacity. The garages are near the terminal campus, close to the airport's primary electricity load and

supported by existing electrical infrastructure. Each of the parking sites was analyzed separately (PVD-2a and PVD-2b) for the purposes of running the glare modeling but is considered a single project site for implementation purposes to increase its cost-effectiveness. The sites complied with the glare standard for both a due south azimuth and an alternative shifted to the southwest more in-line with the buildings' orientation.

- **PVD-3** is located on the roof of the Interlink Garage. It would be similar to PVD-2 and could be more cost-effective if constructed as a single project on all three rooftops. The base design with a 180° azimuth cast glare on the ATCT and did not comply with the FAA glare standard. However, alternatives with azimuth of 160° and 220° both met the standard and appear to be feasible.
- **PVD-4** is a large surface parking canopy project, which like the building mounted designs (PVD-2 and 3), are more costly to build, but may enjoy some economies of scale given its large size. The interconnection strategy will need to be reviewed. It is further from the Terminal complex but expected to be in close proximity to existing electrical infrastructure. However, it is unclear if it is near sufficient capacity owned by the airport or the electric utility. The base design did not comply with the FAA glare standard but an alternative (azimuth of 220°) which would be closely aligned with the parking lots orientation was compliant.
- **PVD-5** is a ground mounted site at the southeast fringe of the airport near the intersection of Main Avenue and Warwick Industrial Drive. It is a long and narrow parcel of land which constrains potential siting flexibility and electricity production. A base design with a 180° azimuth may be difficult to develop as it would result in many short array strings. It is also adjacent to residential areas along Sundance Street to the east which may engender some opposition to its development. We modeled the base design and it cast hazardous glare on aircraft landing at Runway 5. A more viable design aligned with the length of the parcel would have the panels facing southeast and a feasible design with an azimuth of 120° and a tilt angle of 25° produced modeling result compliant with the FAA glare standard.
- **PVD-6** is a ground-mounted site located north of the ATCT between Runway 34 and the recently constructed Winslow Park. It is located in a relatively remote area of the airport accessed through nearby residential properties which suggests that the electrical infrastructure may require upgrading to support its development. The site is relatively close to the runway and the ATCT just to the south. The site was excluded from future consideration when no feasible design could be identified that would be compliant with the FAA's glare standard.

SFZ: North Central Airport (SFZ) is located in a relatively developed area between Providence and Smithfield. While the airport serves General Aviation and does not have a significant electrical load, the areas adjacent to the airport are commercial and industrial which suggests that the electricity infrastructure may have capacity to carry power from a solar project. The airport also has some land available to support solar including parcels relatively close to the terminal which may be feasible given the modest plans for near-term aeronautical development. Other undeveloped parcels of land are less favorable due to high land clearing and grading cost, and uncertainty about environmental permitting and electrical interconnection.

- **SFZ-1** is located alongside and west of Runway 23. The area requires regular maintenance by the airport and locating a solar project in this area would have the dual benefit of providing a financial benefit of a lease and future avoided costs associated with vegetation management. Environmental mapping shows extensive wetlands in the middle of the site making in practically unsuitable for solar. Furthermore, the airport's electrical infrastructure is on the opposite side of Runway 23 which would require the facility to interconnect with the businesses off-site. The project site in base design did not comply with the FAA glare standards. Given its overall unfavorable condition for development, we did not assess the potential compliance of alternatives.
- **SFZ-2** is a similar site located between Runway End 15 and Harris Road. Environmental mapping shows extensive wetlands and the interconnection would be to Harris Road and Route 116 where the existing capacity is not currently known. Another drawback to SFZ-2 is that the land is heavily wooded and would need to be cleared and graded which increases development costs. The site meets the FAA glare standard using the base design.

- **SFZ-3** is a somewhat larger parcel of land which is part of the cleared airfield east of Runway 33. It also is relatively close to the existing airport interconnection point and infrastructure serving the industrial area. There is reported to be a burial area that was not identified through RI GIS that would need to be considered during siting. The base design did not meet glare standards but an alternative design with a tilt angle of 10° and an azimuth of 120° did comply. There could be a potential conflict with the current ALP for future aircraft hangar storage. Further coordination with FAA will be required.
- **SFZ-4** and **SFZ-5** are both located close to the terminal building and existing electricity infrastructure both on and off airport. The sites are forested but appear to be relatively flat and accessible from existing developed areas. The neighboring land uses are industrial suggesting both a robust electricity infrastructure and a lack of potential neighborly opposition to a solar project. Neither site met glare standards for the base design; however alternative designs were identified as compliant: SFZ-4 with a tilt angle of 10° and an azimuth of 120°; and SFZ-5 with a tilt angle of 10° and an azimuth of 160°.

UUU: Solar siting at Newport State Airport is limited by available space. The potential to interconnect is uncertain although it is expected that there should be some electrical infrastructure capacity in the area given the relative density of development. The sites that have been identified are in the managed airfield and do not pose environmental and development uncertainty. A few sites close to the terminal building look to be opportunities.

- **UUU-1** is located west of and behind the terminal building. Wetlands have been delineated to the west establishing a clear limit of work. The area is presently cleared and managed by the airport. The electrical infrastructure serving the airport is adjacent to the site. The base design did not meet the FAA glare standard; however, an alternative design with a 10° tilt angle and an azimuth of 240° is compliant.
- **UUU-2** is also located near the terminal building. It is a developed area used for temporary storage with no known environmental issues. It could also be served by the same electrical interconnection as UUU-1. The base design with a 10° tilt angle and an azimuth of 180° complies with FAA glare standards.
- **UUU-3** is located east of Runway 22 in a narrow cleared area between the object free area and the property line and forested lands to the east. To be feasibly and cost-effectively interconnected, the site would need approval to directly interconnect with the utility's infrastructure on Oliphant Lane. A wetland is identified along the southern edge of the proposed area and on-site work would likely be required to confirm wetland resources and avoid impact. The base design with a 10° tilt angle and an azimuth of 180° complies with FAA glare standards.

WST: Solar siting at Westerly State Airport is limited by the availability of cleared airfield. Three sites have been identified and each is presently forested which increases development costs and potential environmental permitting risk. The electrical infrastructure in the area is not known; however, its northern boundary is with Route 1 which suggests a potential corridor for power distribution as well.

- **WST-1** is located north of Runway End 25. A portion of the area is wooded and there are residences nearby to the west. Developing a wooded site increases construction costs. The interconnection would need to be directly to the off-site electrical network along Route 1 which would be expected the provide capacity if the direct interconnection were allowed by National Grid. Due to the close proximity of the project between the approach to Runway 25 to the east and Runway 14 to the west, we could not identify a design that would comply with the FAA's glare standard.
- **WST-2** is a large wooded area between Airport Road and Runway End 14. Environmental mapping shows that the entire site is wetland and therefore it has been considered infeasible.
- **WST-3** is located east of Runway End 25. It would also require forest clearing, is close to a residential area, and would depend on a direct interconnection to Route 1 similar to WST-1. Due to the close proximity of the project between the approach to Runway 25 to the east and Runway 14 to the west, we could not identify a design that would comply with the FAA's glare standard.

Table 2. FAA Glare Compliance

Site #	Location	Comply with FAA?	Azimuth / Tilt[1]
BID-1	Behind Terminal	Yes	160° / 10°
BID-2	Across Center Road	No	n/a
BID-3	Runway 10 approach	No	n/a
BID-4	Terminal Roof	Yes	175° / 10°
OQU-1	North of Runway 16 end and near pond	Yes	180° / 10°
OQU-2	Roof of Jet Center and hangar	Yes	240° / 10°
OQU-3	Airfield near Bay	Yes	120° / 10°
OQU-4	Airfield near Bay	No	n/a
OQU-5	East of Runway 16	Yes	140° / 10°
PVD-1	In RPZ to Runway 23	Yes	240° / 10°
PVD-2	Garages A & B	Yes	190° / 10°
PVD-3	Roof of Interlink Garage	Yes	220° / 10°
PVD-4	Surface Parking Lot	Yes	220° / 10°
PVD-5	Sliver of land east of Warwick Industrial Dr.	Yes	120° / 25°
PVD-6	South of Winslow Park	No	n/a
SFZ-1	Adjacent to Runway 23	No	n/a
SFZ-2	Across Harris Road	Yes	180° / 10°
SFZ-3	Adjacent to Runway 33	Yes	120° / 10°
SFZ-4	Behind Terminal Bldg	Yes	160° / 10°
SFZ-5	Across Rte. 123	Yes	120° / 10°
UUU-1	Behind Terminal Bldg	Yes	240° / 10°
UUU-2	South of Terminal Bldg	Yes	180° / 10°
UUU-3	East of Runway 22	Yes	180° / 10°
WST-1	North of Runway 25	No	n/a
WST-2	Adjacent and south of Runway 14	No	n/a
WST-3	Between Runways 25 & 32	No	n/a

1. Electricity generation is maximized when the panels are tilted towards due south or 180°. The amount of tilt can vary based on degree of latitude but generally between 10 and 25 degrees of tilt is preferred. As tilt increases above 25 degrees, wind loads exert a greater impact and the structure necessary to keep the panel stable must be augmented increasing costs. Panels tilted or facing due south is identified as having an azimuth or orientation angle of 180°. A change of 5 degrees from due south (i.e., 175° or 185°) will not measurably affect electricity production but greater offsets either toward the southeast (with lower azimuth angles) or southwest (with higher azimuth angles) will result in a reduction in electricity production. While no decrease in electricity production is good, a rule of thumb for acceptable electricity reduction is between 120° and 270°. In evaluating alternatives for sites to mitigate glare, we adjusted the azimuth angle in this range. Altering the tilt angle typically will not mitigate glare, however, there are exceptions as demonstrated in PVD-5.

Conclusions

RIAC is interested in determining if there are potential sites at its six airports where solar PV could be installed in a manner that is compatible with existing aviation uses and in a cost-effective way. This report has identified potential project sites that are feasible given available information on airport land uses, environmental resources, and existing electrical infrastructure. We then analyzed the sites for compliance with the FAA's Interim Solar Policy and Ocular Hazard Standard using a typical solar design appropriate for each site. A handful of the sites demonstrated compliance with a base solar design and we identified alternative designs for other sites that complied with the standard without significantly impacting solar electricity generation. Because private solar developers may be able to collect additional information on individual sites to improve its technical and financial feasibility, we recommend that only those sites that could not achieve compliance with FAA glare standards or are undevelopable because of environmental resources and are ranked as "Infeasible" be eliminated from consideration at this time.

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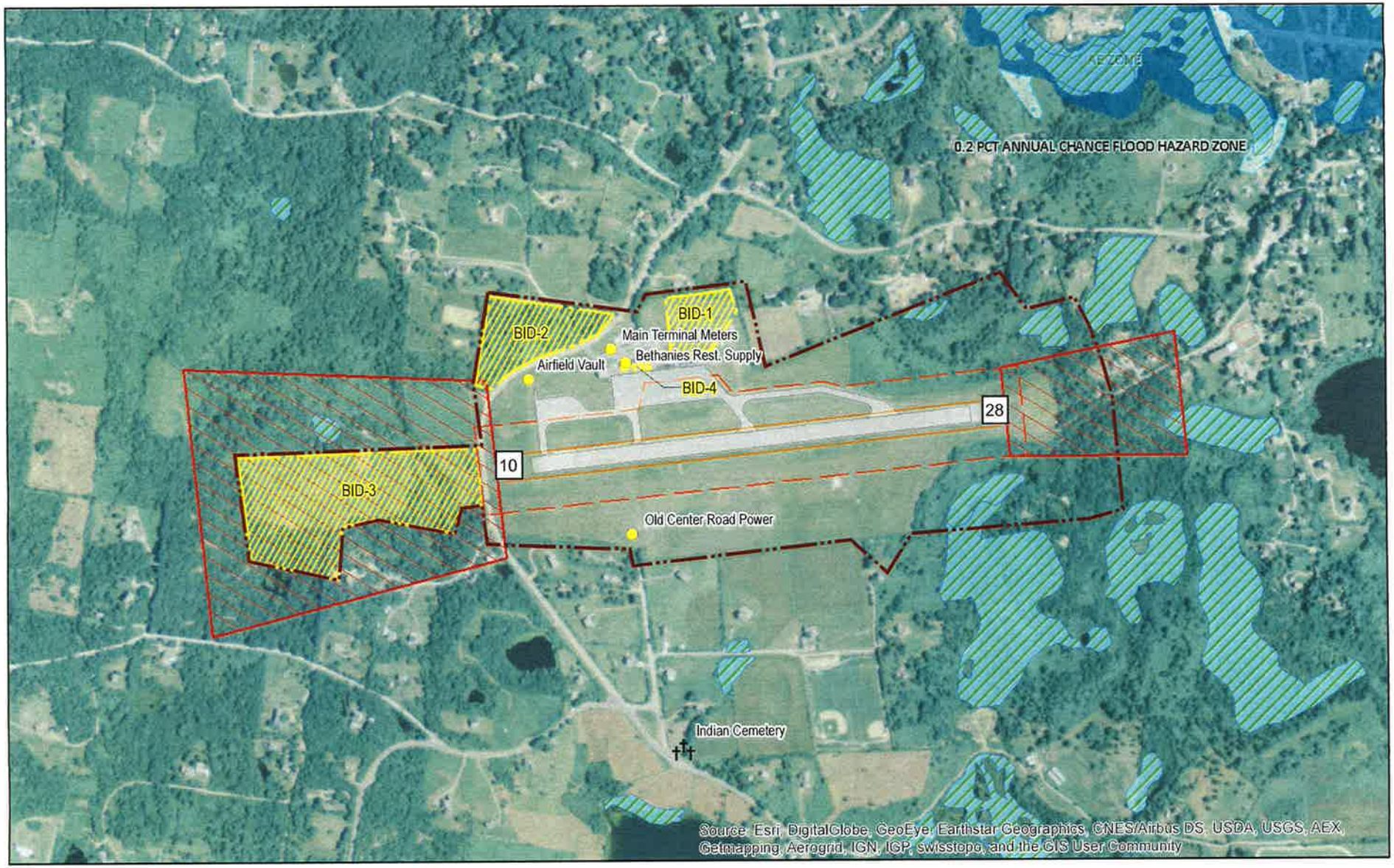
Attachment A

Sites By Airport

Figures A-1 through A-6



Property Boundary
Airport Pavement
Runway Protection Zone
Object Free Area
Runway Safety Area
Potential Solar Site

Power Access
Historic Cemeteries

Wetlands (National Wetland Inventory - RIGIS)

Flood Hazard Zones (FEMA)
0.2 Percent Annual Chance Flood Zone
A Zone
AE Zone

Figure A-1, Potential Solar Sites
Block Island State Airport

Louis Berger
hmmh

Rhode Island Airport Corporation

0 750 1500 2250 Ft

N
S

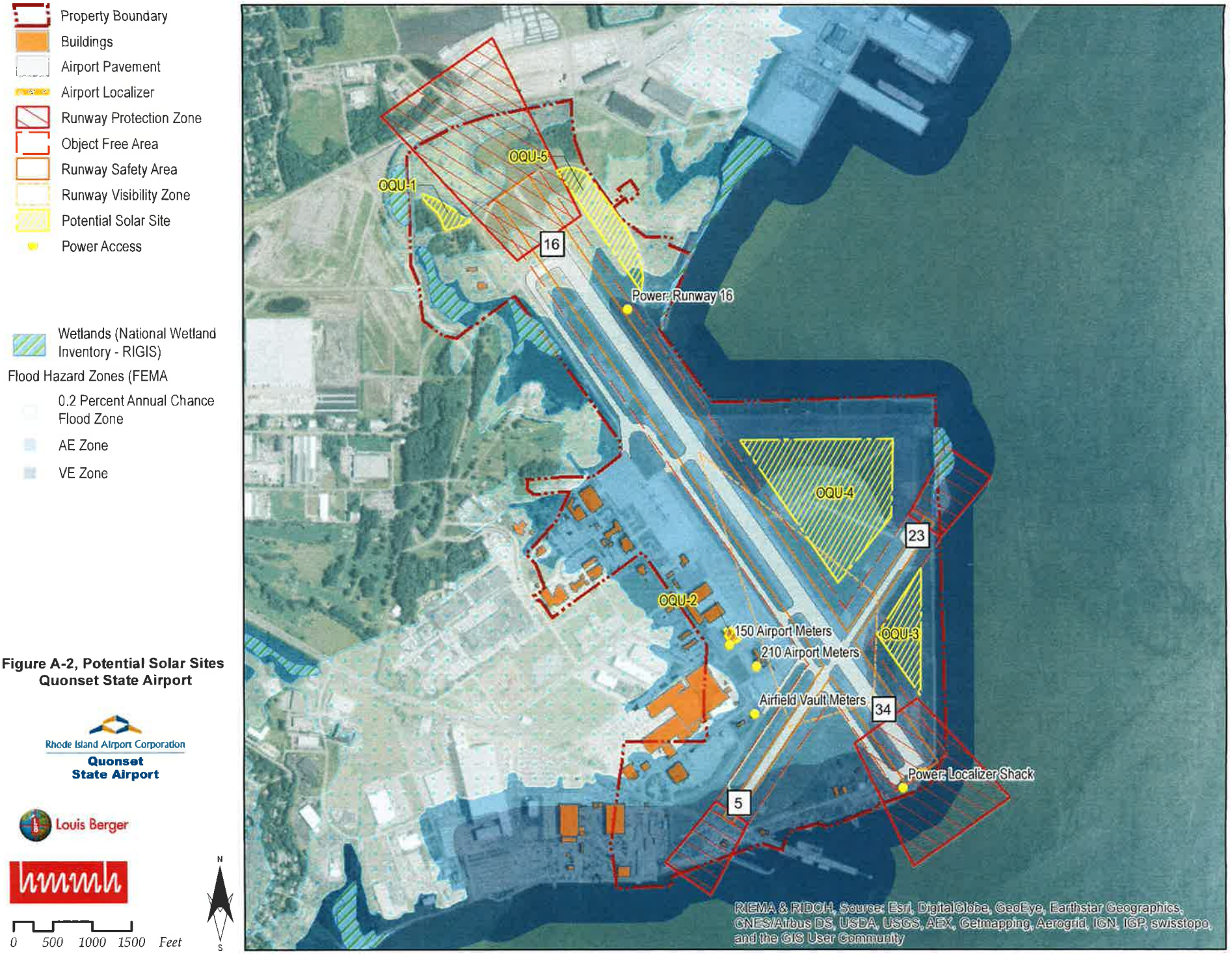


Figure A-2, Potential Solar Sites
Quonset State Airport

Rhode Island Airport Corporation
Quonset
State Airport

Louis Berger

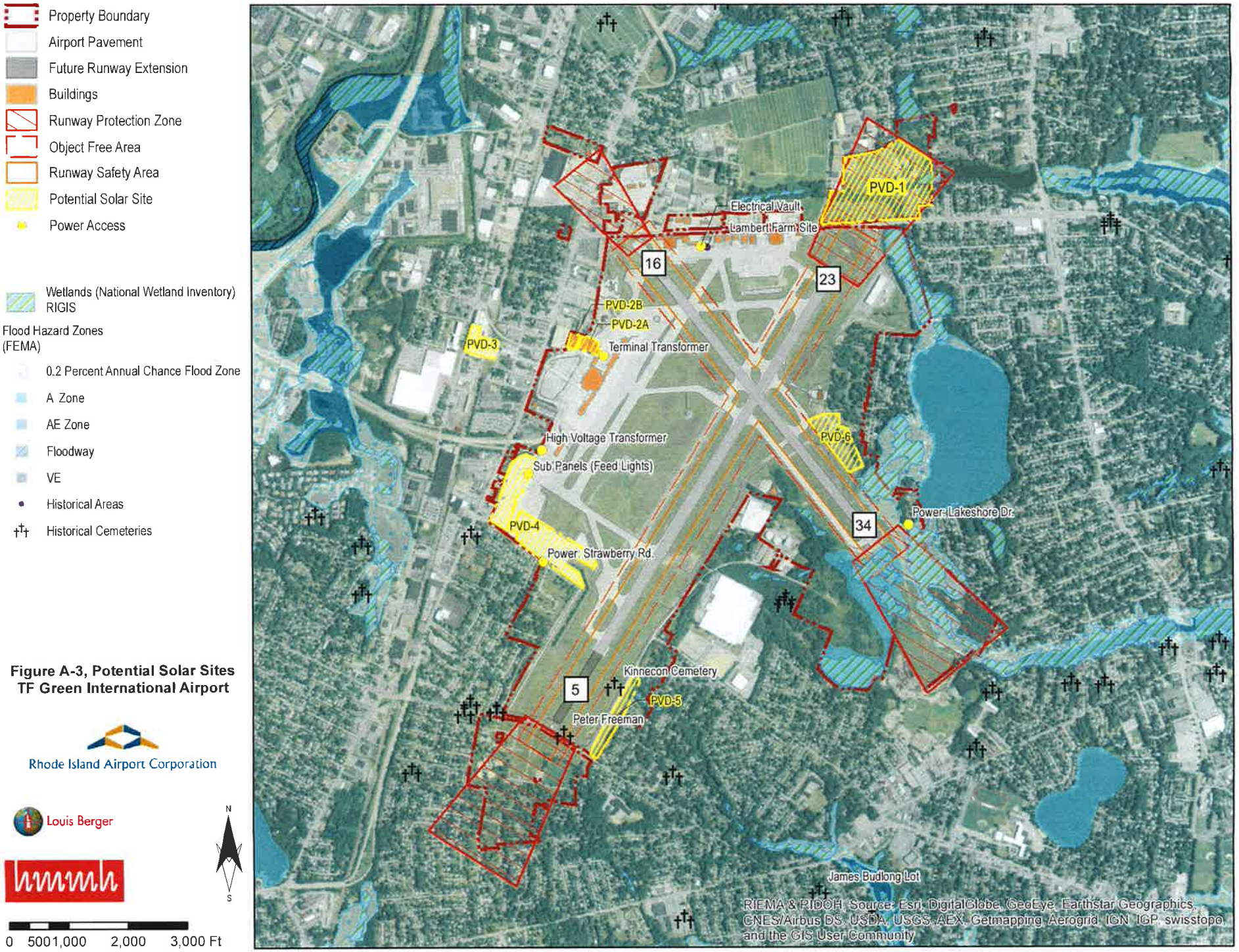


Figure A-3, Potential Solar Sites
TF Green International Airport

Rhode Island Airport Corporation

Louis Berger

hmmh

Property Boundary
Buildings
Airport Pavement
Runway Protection Zone
Object Free Area
Runway Safety Area
Runway Visibility Zone
Potential Solar Site
Power Access
Wetlands (National Wetland Inventory - RIGIS)
Flood Hazard Zones (FEMA)
0.2 Percent Annual Chance Flood Zone
A Zone
AE Zone
Historical Cemeteries

Figure A-4, Potential Solar Sites
North Central State Airport

Louis Berger
hmmh
Rhode Island Airport Corporation
North Central Airport

N
S

0 625 1,250 2,500 Ft

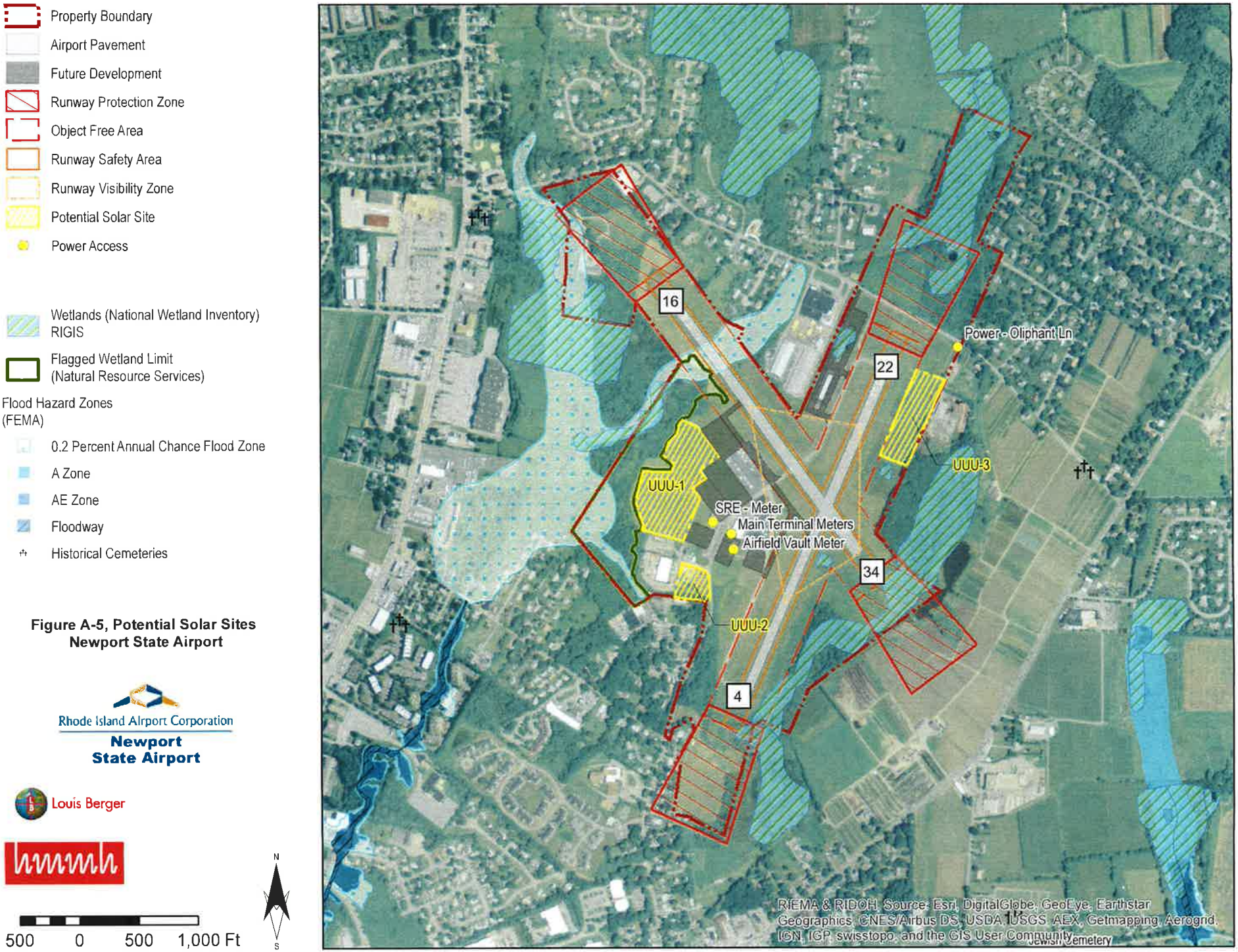


Figure A-5, Potential Solar Sites
Newport State Airport

Rhode Island Airport Corporation
Newport State Airport

Louis Berger

Property Boundary
Airport Runway
Airport Buildings
Airport Buildings Proposed
Runway Protection Zone
Object Free Area
Runway Safety Area

Potential Solar Site
Power Access

Wetlands (National Wetland Inventory - RIGIS)

Flood Hazard Zones (FEMA)
0.2 Percent Annual Chance Flood Zone
A Zone
AE Zone

Historic Cemeteries

Figure A-6, Potential Solar Sites
Westerly State Airport

Louis Berger

Rhode Island Airport Corporation
Westerly State Airport

0 500 1,000 2,000 3,000 Ft

N
S

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Tables A-1 through A-6

Table A-1
Block Island State Airport

Site ID	Location	System Type	ALP	Environmental	Electrical
BID-1	Managed airport property behind Terminal Building	Ground-mounted	Potential conflict, future parking	none	Close to Terminal interconnection
BID-2	Forested area across Center Road	Ground-mounted	none	Forested	Across public road from Terminal
BID-3	Approach to Runway 10	Ground-mounted	Located in the RPZ	Wetlands	Close to Terminal interconnection
BID-4	Terminal Roof	Building-mounted	none	none	Long distance from interconnection

Table A-2
Quonset State Airport

Site ID	Location	System Type	ALP	Environmental	Electrical
OQU-1	North of Runway 16	Ground-mounted	Adjacent to RPZ	Adjacent to wetlands and floodplain	Requires direct interconnect to NGrid
OQU-2	On roof of Providence Jet Center and hangar	Building-mounted	none	none	Meters at Terminal
OQU-3	Between Runways 23 and 34	Ground-mounted	Adajcent to RPZs, OFAs	Floodplain	Far from interconnection options
OQU-4	Between Runways 16 and 23	Ground-mounted	Adjacent to RPZ	Floodplain	Far from interconnection options
OQU-5	Adjacent to Runway 16	Ground-mounted	Adajcent to RPZs, OFAs	Floodplain	Requires direct interconnect to NGrid

Table A-3
TF Green International Airport

Site ID	Location	System Type	ALP	Environmental	Electrical
PVD-1	Approach to Runway 23	Ground-mounted	In the RPZ	Wetlands	Requires direct interconnect to NGrid
PVD-2	Roof of two parking garages	Building-mounted	none	none	Meters at Terminal
PVD-3	Roof of Interlink garage	Building-mounted	none	none	On-site meters
PVD-4	Surface parking lot canopies	Ground-mounted	Existing parking	none	Close to electrical infrastructure
PVD-5	Managed Airfield Adjacent to Runway 5	Ground-mounted	Adajcent to RPZs, OFAs	Adajcent to residences	Requires direct interconnect to NGrid
PVD-6	Managed Airfield Adjacent to Runway 34	Ground-mounted	Adjacent to OFA	Adjacent to residences	Far from electrical interconnection

Table A-4					
North Central State Airport					
Site ID	**Location**	**System Type**	**ALP**	**Environmental**	**Electrical**
SFZ-1	Airfield between Runways 15 and 23	Ground-mounted	Adajcent to OFA	Wetlands	Long distance to interconnection
SFZ-2	Near Runway 15 end	Ground-mounted	Adjacent to RPZ	Wetlands, Forested	Potential direct interconnection to NGrid
SFZ-3	Airfield adjacent to Runway 33	Ground-mounted	May be future location of fuel farm and hangars	none	Potential direct interconnection to NGrid
SFZ-4	Behind Terminal Building	Ground-mounted	none	Forested	Close to electrical infrastructure
SFZ-5	Behind Terminal Building	Ground-mounted	none	Forested	Close to electrical infrastructure

Table A-5					
Newport State Airport					
Site ID	**Location**	**System Type**	**ALP**	**Environmental**	**Electrical**
UUU-1	Behind Terminal Building	Ground-mounted	none	Adjacent to wetlands	Close to Terminal infrastructure
UUU-2	Adjacent to Terminal Building	Ground-mounted	none	none	Close to Terminal infrastructure
UUU-3	Airfield adjacent to Ruwnay 22	Ground-mounted	Adjacent to OFA	Adjacent to wetlands	Potential direct interconnection to NGrid

Table A-6					
Westerly State Airport					
Site ID	**Location**	**System Type**	**ALP**	**Environmental**	**Electrical**
WST-1	Between Runway 14 and 23	Ground-mounted	none	Adjacent to residences	Potential direct interconnection to NGrid
WST-2	Adjacent to Runway 14	Ground-mounted	none	none	Close to Terminal infrastructure
WST-3	Between Runway 23 and 32	Ground-mounted	none	Adjacent to residences	Potential direct interconnection to NGrid

Attachment B

Sites by Feasibility

Tables B-1 through B-4

Table B-1 Likely Feasible Sites

Site #	Location	Acres	MW	Comment
BID-1	Behind Terminal	2.06	0.41	Interconnection needs to be assessed. Potential conflict with ALP
BID-4	Southern Terminal Roof	0.03	0.02	Structural analysis required
OQU-2	Roof of Jet Center and hangar	1.14	0.34	Requires structural assessment, more costly than ground-mount
PVD-2	Garages A & B	1.54	0.47	More costly than ground-mount
PVD-3	Roof of Interlink Garage	2.99	0.60	More costly than ground-mount
PVD-4	Surface Parking Lot	10.12	2.02	Most costly than ground-mount
SFZ-3	Adjacent to Runway 33	6.42	1.26	Interconnection needs to be assessed. Potential conflict with ALP
SFZ-4	Behind Terminal Bldg	3.21	0.60	Interconnection needs to be assessed
SFZ-5	Across Rte. 123	6.31	1.26	Interconnection needs to be assessed
UUU-1	Behind Terminal Bldg	5.16	1.03	Interconnection needs to be assessed
UUU-2	South of Terminal Bldg	0.80	0.16	Interconnection needs to be assessed
	SubTotal	**39.78**	**8.17**	

Table B-2 Potentially Feasible Sites

Site #	Location	Acres	MW	Comment
OQU-1	North of Runway 16 end and near pond	2.06	0.41	Interconnection uncertain
OQU-5	East of Runway 16	11.70	2.34	Interconnection uncertain
PVD-5	Sliver of land east of Warwick Industrial Dr.	2.75	0.55	Issues include interconnection and proximity to residences
UUU-3	East of Runway 22	3.09	0.62	Interconnection uncertain
	SubTotal	**19.6**	**3.92**	

Table B-3 Likely Infeasible Sites

Site #	Location	Acres	MW	Comment
BID-2	Across Center Road	2.52	0.50	Wooded Area
OQU-3	Airfield near Bay	9.18	1.84	Distance to interconnect, contamination, floodplain
PVD-1	In RPZ to Runway 23	1.65	0.33	Only small project complies with FAA, located in the RPZ
SFZ-1	Adjacent to Runway 23	8.20	1.64	Isolated from roads and infrastructure, difficult to develop, wetlands
SFZ-2	Across Harris Road	9.18	1.84	Isolated from roads and infrastructure, difficult to develop, wetlands
	SubTotal	**30.73**	**6.15**	

Table B-4 Infeasible Sites

Site #	Location	Acres	MW	Comment
BID-3	Runway 10 approach	1.37	0.27	Glare Problem
OQU-4	Airfield near Bay	22.95	4.59	Glare Problem
PVD-6	South of Winslow Park	2.75	0.55	Glare problem
WST-1	North of Runway 25	5.16	1.03	Glare problem
WST-2	Adjacent and south of Runway 14	6.34	1.27	Entire site is wetlands
WST-3	Between Runways 25 & 32	12.62	2.52	Glare problem
	SubTotal	**51.19**	**10.23**	

TOTAL 141.3 28.47

Attachment C

Solar Glare Modeling Results