PRELIMINARY ASSESSMENT OF RENEWABLE ENERGY OPPORTUNITIES NAVAL WEAPONS INDUSTRIAL RESERVE PLANT

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STUDY PURPOSE

The U.S. Environmental Protection Agency (EPA) places a high priority on the development of renewable energy (RE) projects and green remediation as part of addressing formerly contaminated properties. Through efforts such as the Superfund Redevelopment and RE-Powering America's Land initiatives, EPA works to identify Superfund, Brownfield and mining sites with RE development potential. EPA provides technical resources for site managers, developers, facility energy managers and other stakeholders interested in using RE at these sites.

The purpose of this pre-feasibility study, prepared by EPA New England in cooperation with the Department of the Navy (Navy), is to evaluate the possibility of a large-scale photovoltaic (PV) solar project at the former Naval Weapons Industrial Reserve Plant Bedford (NWIRP Bedford). Because of the proximity of NWIRP Bedford to Hanscom Air Field, there is potential concern about glare that a large-scale PV solar project might produce. As a result, this study also summarizes findings from a review of research on studies examining the potential impacts from glint and glare resulting from the operation of large PV solar systems. In addition to this study, EPA has prepared a companion assessment that summarizes the extent to which RE, specifically solar and possibly wind, can be used on site to offset electricity demand from ongoing ground water treatment activities underway to address contaminated ground water in the northern portion of NWIRP Bedford.

INTRODUCTION

EPA initiated this study to explore opportunities for increasing the use of RE technologies at NWIRP Bedford, as part of EPA's interest in encouraging RE development on current and formerly contaminated land and mining sites. Through EPA New England, the Navy received technical assistance to conduct a pre-feasibility assessment of the opportunities for using PV solar energy technologies at NWIRP Bedford.

There are some inherent challenges in evaluating different PV solar energy technologies: they have different operating parameters and costs; projects occur at locations with different RE resources; they displace different energy types with different competing costs of energy; they qualify for different incentives; and they meet different objectives. This study is a first-level screening assessment to enable the Navy, or the United States Air Force (Air Force) which operates a nearby air field, to establish priorities in pursuing PV solar energy project opportunities. A more detailed technical engineering and economic feasibility study will be needed prior to final solar PV project decision-making at NWIRP Bedford.

SITE BACKGROUND

NWIRP Bedford is a 46-acre inactive United States naval facility located in Middlesex County in Bedford, Massachusetts (Figure 1). The installation is located immediately north of Hanscom Field. The Massachusetts Port Authority (Massport) currently operates Hanscom Field. However, the Air Force operates various military-related infrastructure near Hanscom Field. The military also occasionally uses Hanscom Field to support operations. Hanscom Air Force Base is located directly south of Hanscom Field.

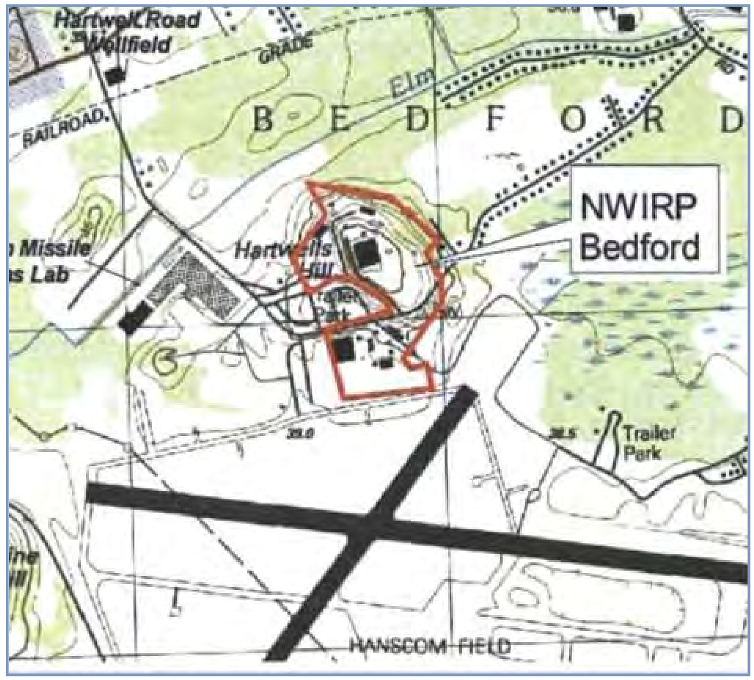


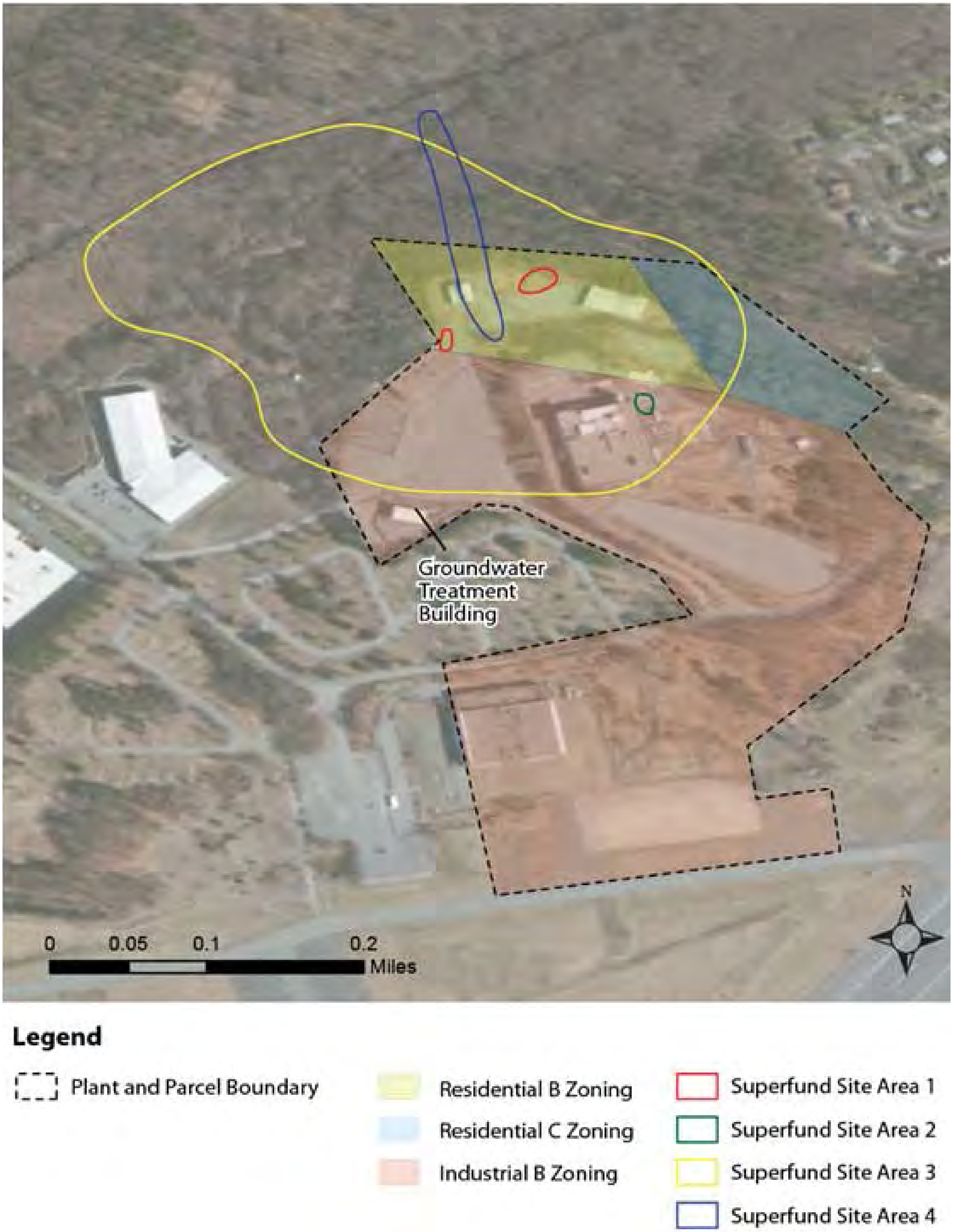
Figure 1: Historic map showing NWIRP Bedford facility boundary

NWIRP Bedford is located on a small hill. A portion of the installation (the Components Laboratory building) is located on the top of the hill and another portion is located at the bottom of the hill. Surroundings include undeveloped woodland and wetlands areas to the west and north, and a residential area and additional wooded wetlands to the east and northeast. Other uses abutting NWIRP Bedford include a large indoor sports complex to the west and Hanscom Field to the south.

NWIRP Bedford was historically operated by the Raytheon Company of Waltham, Massachusetts. The mission of NWIRP Bedford was to design, fabricate and test prototype weapons equipment such as missile guidance and control systems. Raytheon workers historically conducted activities at NWIRP Bedford in two main structures: the Components Laboratory building north of Hartwell Road, and the Flight Test Facility (also referred to as the South Flight Test Area) to the south and adjacent to Hanscom Field. The Navy currently controls the NWIRP Bedford property and Massport owns the western part of the South Flight Test Area. Raytheon conducted its operations at NWIRP Bedford from the mid-1950s through December 2000. The facility has remained vacant since that time except for the Navy's operation of a ground water pump-and-treat system in the northwest portion of NWIRP Bedford.

EPA New England became involved at NWIRP Bedford because of multiple areas of contaminated ground water and soil. EPA listed NWIRP Bedford on the Superfund National Priorities List in 1994. EPA listed nearby Hanscom Field/Hanscom Air Force Base as a Superfund site the same year. The Navy is the lead agency for investigations and cleanup at NWIRP Bedford, with formal oversight by EPA via a federal facilities agreement. There has been significant cleanup progress at NWIRP Bedford since 1994. The Navy has been operating a ground water pump-and-treat system (Figure 2) to address a large trichloroethylene (TCE) plume located in the northern portion of NWIRP Bedford since 1997. The Navy continues to operate the system while preparing to implement the remaining parts of the cleanup remedy for the TCE plume. EPA anticipates

Figure 2: NWIRP Bedford parcel boundary, Superfund sub-sites and Town of Bedford zoning



that the pump-and-treat system will need to operate into the 2040s. Under a Memorandum of Understanding between the Navy and the Air Force, the Air Force is using its ground water pump-and-treat system located on Hanscom Field to address contaminated ground water underneath the Flight Test Facility. Table 1 summarizes the different sub-site areas within the NWIRP Bedford Superfund site and their cleanup statuses.

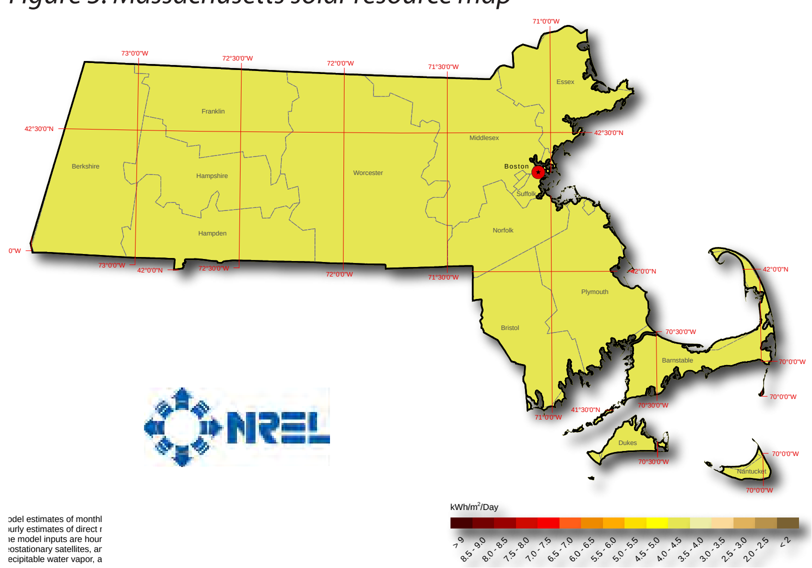
Table 1: NWIRP Bedford Superfund Site: Site Area Cleanup Approach and Statuses

Sub-site Area	Area Description	Cleanup Approach	Cleanup Status
Site 1	Old Incinerator Ash Disposal Area	No action needed	Not applicable
Site 2	Components Laboratory Fuel Tank	No action needed	Not applicable
Site 3	Chlorinated Solvent Ground water Plume	Ground water pump-and-treat Bioremediation and monitored natural attenuation (MNA)	In situ thermal treatment removal action conducted in 2003 Ground water pump-and-treat system underway since 1997 Bioremediation and MNA being planned
Site 4	Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) Plume	Subsurface soil excavation and MNA	In situ thermal treatment removal action conducted in 2003 Subsurface soil excavation and MNA implementation underway
Flight Test Facility	Flight Test Facility (Area immediately north of Hanscom Field)	Ground water pump-and-treat by Air Force	Underway

SITE SUITABILITY

The most important location-related requirements for PV solar energy projects at a site are the availability of a suitable solar energy resource, suitable local topography, compatible site infrastructure and location, and transmission access. In addition, at formerly impaired properties, compatibility with remedy components is also an important consideration.

Figure 3: Massachusetts solar resource map



Solar Energy Resource

Given NWIRP Bedford's location, topography and available solar energy resources, solar energy is likely the most promising renewable resource for the installation of a utility-scale project. Altitude, latitude, time of day, time of year and local weather conditions can all affect direct solar radiation levels at a location. Based upon data available from the National Renewable Energy Laboratory (NREL), Massachusetts has an average solar resource between 5.0 and 5.5 of kilowatt hours per square meter per day (kWh/m^2/day), which indicates a good but not great solar resource (Figure 3).

Site Infrastructure

Unused Paved Space and Open-space Areas

There is a considerable amount of minimal gradient, unused paved space and open-space that could be used to support a large-scale PV solar energy project at NWIRP Bedford. These areas are located to the west and southeast of the Components Laboratory building, as well to the east and south of the Flight Test Facility hangar. Some obstructions are present, notably from trees and the main buildings. However, the largest areas suitable for large-scale PV development generally have minimal to no obstructions.

Utilities

Electrical power is supplied to NWIRP Bedford by NSTAR, an operating company of Northeast Utilities, to power the ground water pump-and treat facility operating in the northwest portion of the installation (Figure 4). NSTAR also supplies natural gas to the ground water pump-and treat plant for heating purposes. During operations, NWIRP Bedford was served by three-phase power and there are three-phase lines along Hartwell Road. An interconnection study would be needed to determine the best way to interconnect any PV system to the local grid.

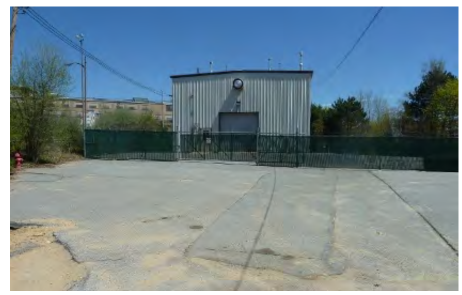


Figure 4: Ground water treatment building at NWIRP Bedford

Transportation

Hartwell Road, a paved road, is the main access road to NWIRP Bedford. Hartwell Road is located about three miles northwest of the Interstate 95-State Road 4 interchange.

RENEWABLE ENERGY CONTEXT FOR FEDERAL AGENCIES

In recent years, federal agencies have taken an interest in RE development for a variety of reasons, including a desire to reduce and stabilize electricity costs and reduce agency greenhouse gas emissions. Recognition of the value of RE has led to the creation of federal RE mandates that have provided federal agencies with concrete RE procurement targets, driving the development of new RE projects at federal facilities. Likewise, aggressive state-based renewable energy portfolio standards have created important market demand for RE and driven continued investment in RE projects.

The Department of Defense (DOD) could have interest in on-site RE projects at NWIRP Bedford in order to meet goals set by executive orders and requirements set by legislation. Three main policies encourage new RE deployment by federal agencies: the Energy Policy Act of 2005; Executive Order 13423 "Strengthening Federal Environmental, Energy, and Transportation Management; and the Energy Independence and Security Act of 2007.

In addition, in 2013, the Massachusetts Department of Energy Resources (DOER) launched a project to help Massachusetts' military bases identify and implement energy solutions that lower base operating costs and enhance energy security. Nearby Hanscom Air Force Base is included on the state's list for evaluation under the project. An RE project serving Hanscom Air Force Base could potentially utilize NWIRP Bedford and help DOD and the state meet their RE goals.

REMEDY COMPATIBILITY

Three locations at NWIRP Bedford are considered potentially viable locations for ground-mounted PV (Figure 5). These include the unused paved areas to the west and southeast of the Components Laboratory building and the unused paved/open space areas to the east and south of the Flight Test Facility hangar. NWIRP Bedford includes four designated sub-sites within the larger NWIRP Bedford Superfund site boundary: Sites 1 – 4 (Figure 2). Two sub-site areas (Site 3 and Site 4) are subject to institutional controls.

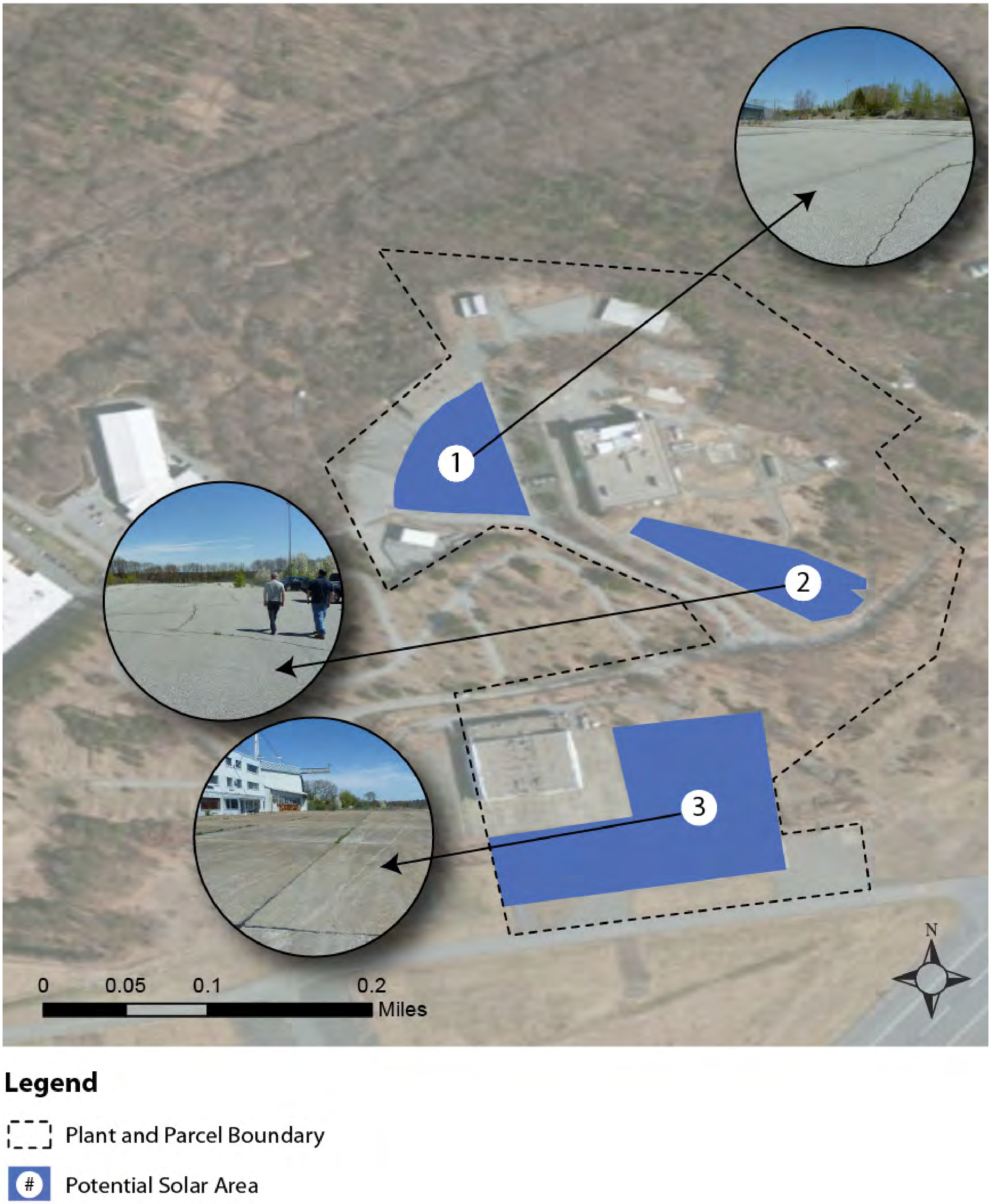
The unpaved areas west of the Components Laboratory building fall within Site 3. The institutional controls for Site 3 are required to prevent exposure to contaminants of concern (COCs) in ground water to protect human health until remedial actions have achieved remedial action objectives across the site. They call for:

- Preventing use of Site 3 ground water as a drinking water supply until COC concentrations in ground water achieve cleanup levels.
- Preventing occupancy of current and future Site 3 structures until COC concentrations allow for industrial use of the property.
- Preventing residential development of the Site 3 area until COC concentrations allow for unlimited use and unrestricted exposure.
- Maintaining the integrity of the current or future remedial and monitoring systems, such as extraction and treatment wells, monitoring wells and in-situ enhanced bioremediation.

Neither the institutional controls nor the other remedy components are likely to have any significant impact on placement of ground-mounted PV solar energy systems within Site 3.

The Flight Test Facility, while within the site boundary, does not fall within a designated Superfund sub-site. The Air Force is treating low-level ground water contamination beneath this area via its ground water pump-and-treat system at the base. It is unclear whether any institutional controls currently apply to this area of the site. It is assumed that on-going treatment of ground water would not have any impact on placement of ground-mounted PV solar energy systems within this area.

Figure 5: NWIRP Bedford potential solar areas and related information



Ground-mounted PV System

A ground-mounted PV system can be an in-ground system using poured concrete foundations or metal piers driven into the ground. Ballast-weighted mounting methods (Figure 6) rely on the weight of the PV modules, the mounting racks and extra ballasts if necessary to meet wind-loading design considerations. Wind-loading conditions – overturning, uplifting and sliding – require consideration when using a ballast-weighted system.

Figure 6: A ballast-weighted system using pre-cast concrete slabs in Barnstable, Massachusetts (source: NEXAMP)

Solar Technologies

A variety of technologies capture or convert sunlight into useful energy. Standard PV systems include PV modules (panels), inverter and balance-of-system components. The major types of commercially available solar technologies are PV, high concentrating PV (HCPV) and concentrating solar power (CSP).

CSP systems typically require large, contiguous land areas and significant amounts of water, but offer the advantage of being able to store energy. PV and HCPV systems, in contrast, can be located on smaller land areas. However, they do not have utility-scale storage capacity. Because of the solar resource requirements as well as the amount of land needed for a cost-effective CSP plant, this study found CSP technologies are not a viable option at NWIRP Bedford. HCPV technologies face a limitation as well; they cannot concentrate diffuse light to create electricity. Diffuse light occurs in cloudy and overcast conditions. With an average of 200 sunny days per year at the site, an HCPV system may not receive enough direct sunlight to make HCPV technologically or financially viable.

The only commercially available solar-related technology evaluated further as part of this study was solar PV. The type of PV material used in the module affects the ability of the modules to convert solar energy to electrical energy. The most common and widely used PV module is crystalline silicon. This type of PV module has a 25-30 year lifespan and an annual degradation rate of under 1 percent. These modules convert solar energy at a rate between 12 – 18 percent.

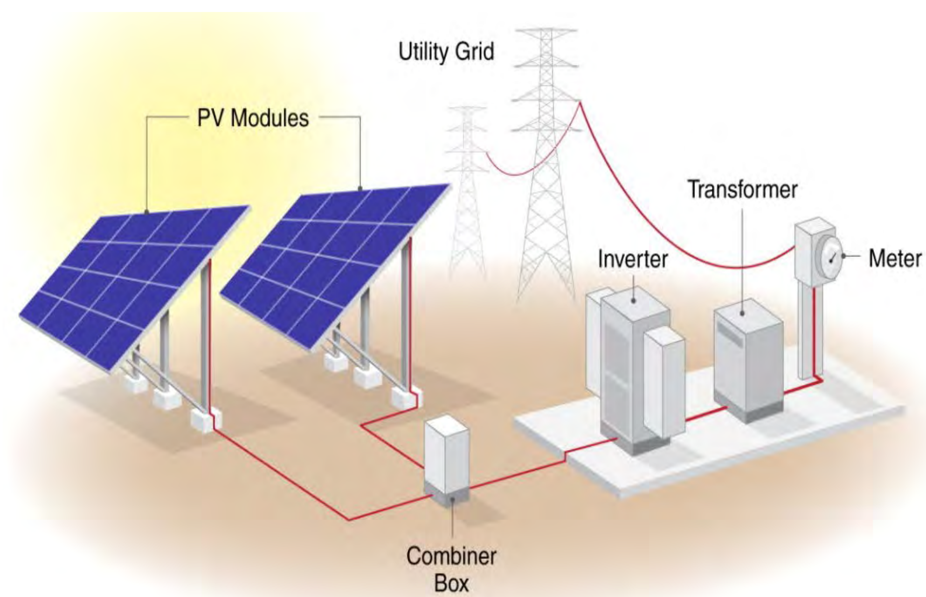


Figure 7: Solar PV ground-mounted array diagram (source: NREL)

There are two types of crystalline panels: mono and poly. Monocrystalline panels are made from a large silicon crystal. Monocrystalline panels are efficient in converting sunlight into electricity; however they are expensive to manufacture and are fragile. Polycrystalline panels are a commonly used type of solar panel. They are less efficient than monocrystalline solar panels but are also less expensive to produce. This type of panel consists of multiple smaller silicon crystals and looks like shattered glass.

Solar PV panels may be fixed, or mounted on single-axis or dual-axis trackers.[1] PV panels mounted on a single- or dual-axis tracking system capture more sunlight than fixed panel systems, however they are more costly to construct. This analysis focused on a fixed-panel system because the cost of a tracking system could be up 25 percent higher than a fixed system, and the available sunlight in the potential solar PV project locations will likely be insufficient to make up the cost.

Potential PV Solar Energy System Sizes

NWIRP Bedford has three paved/unpaved areas that could potentially support ground-mounted PV systems: the two paved areas west and southeast of the Components Laboratory building (Areas 1 and 2) and the paved/open space area south and east of the Flight Test Facility hangar (Area 3). Each of the three potential solar project areas is currently unused, relatively flat and relatively isolated from other commercial, industrial or residential activity.

Ground-mounted PV systems require about 3.5-5 acres per megawatt (MW) of capacity. Table 2 illustrates the range of scales at which a utility-scale PV project could be developed at NWIRP Bedford. It illustrates that it could be possible to place PV systems with up to 2.8 MW of generating capacity on the hypothetical Areas 1, 2 and 3 (Figure 5), depending upon the type of PV technology and efficiency of the panels.

Table 2: Potential PV Solar Energy Systems

Solar Area	Description	Acres	PV-Fixed Array Size (MW)
1	West of Components Laboratory building	2.7	0.5 – 0.8
2	Southeast of Components Laboratory building	1.3	0.3 – 0.4
3	South and East of Flight Test Facility Hangar	5.6	1.1 – 1.6
1+2+3	**Combined Areas**	**9.6**	**1.9 – 2.8**

Potential PV Array Output

The table below estimates the potential annual energy production from the hypothetical PV solar projects presented in Table 2. The potential array performance for the fixed arrays was calculated using PVWatts - a performance calculator for grid-connected PV solar energy systems created by NREL. PVWatts is a tool used to develop preliminary electricity output estimates for grid-connected PV systems within the United States based on historical solar data.

1 A fixed system means that the PV panels are installed at a set tilt and azimuth and will not move.

Table 3: Potential Annual PV System Output in Identified PV Project Areas

Solar Area	Description	PV-Fixed Array Size (MW)	PV-Fixed Array Estimated Annual Output (Megawatt Hour (MWh))
1	West of Components Laboratory building	0.5 – 0.8	622 – 995
2	Southeast of Components Laboratory building	0.3 – 0.4	373 – 497
3	South and East of Flight Test Facility Hangar	1.1 – 1.6	1,368 – 1,990
1+2+3	**Combined Areas**	**1.9 – 2.8**	**2,363 – 3,482**

Potential Issues with Glint and Glare

Issues with glint and glare from solar PV panels could potentially affect the siting of RE projects at NWIRP Bedford because of their potential proximity to Hanscom Field, especially Area 3. Solar installations are operating at several airports including megawatt-sized solar facilities covering multiple acres. This analysis found 15 studies published between 2009 and 2012 that examine the effect of glint and glare from solar technologies. Approximately half these studies examine the effect of glint and glare on nearby airfields. The studies consistently mention that panels are designed to absorb energy and light, so reflectivity should be relatively modest and any glare is likely to be comparable to other sources of potential glare (lakes, coated glass).

One study found that PV systems provide less glare than other solar technologies and have been placed close to or on airfields, including a system on the southern approach corridor to Nellis Air Force Base in Nevada. Another study found no evidence of any reported problems of glare from existing solar energy projects around the world affecting pilots. Moreover, the research could not identify any cases of accidents caused by glare in United Kingdom or United States accident databases. Another study found that the potential for glare from flat plate PV systems is similar to that of still water and not expected to be a hazard to air navigation. Finally, a Federal Aviation Administration (FAA) study involving interviews with airport project managers found that, "either significant glare is not occurring during times of operation or if glare is occurring, it is not a negative effect and is a minor part of the landscape to which pilots and tower personnel are exposed."[2]

Currently the FAA has no specific standards for airport solar facilities and potential glare, however, as of June 26, 2012, the FAA is reviewing the reflectivity section of its technical guidance for evaluating solar technologies on airports based on new information and field experience.

2 FAA. Technical Guidance for Evaluating Selected Solar Technologies on Airports. 2010. http://www.faa.gov/airports/environmental/

Federal Incentives

Currently, federal solar incentives are embedded in the federal income tax code, so entities such as the Navy or state that have no income tax liability cannot directly access these incentives if they own and operate solar systems. These tax incentives (the 30 percent investment tax credit and accelerated depreciation) can reduce installed project costs by well over 40 percent for a private owner. Private owners can access the tax-based incentives and that is one reason for the frequency of private ownership of solar projects on public lands and buildings. The Navy or Air Force could indirectly participate in the federal tax incentives by signing a power purchase agreement or other contracting arrangement to purchase power from a privately owned RE project located at the site.

In the second half of 2013, DOE Federal Energy Management Program intends to issue a funding opportunity announcement potentially titled "Assisting Federal Facilities with Energy Conservation Technologies." This would provide direct funding to federal agencies for the development of capital projects and other initiatives to increase the energy efficiency and RE investments at agency facilities. The funding will include RE, including solar technologies.[3]

State Incentives

There are also incentives at the state-level to reduce the cost of a solar facility.

Massachusetts Renewable Energy Portfolio Standard and Renewable Energy Certificates

Massachusetts' renewable energy portfolio standard (RPS) requires each regulated electricity supplier/provider serving retail customers in the state to include 15 percent of qualifying renewables in the electricity it sells by December 31, 2020.[4] The state significantly expanded the RPS in 2008, establishing two separate renewable standards – a standard for Class I renewables (new systems) and a standard for Class II renewables (existing systems operating before December 31, 1997).

Retail electric suppliers are required to document compliance with RPS in annual filings submitted to DOER. Suppliers can meet their compliance obligations by purchasing Renewable Energy Certificates (RECs)[5] from qualified generators, making Annual Compliance Payments (ACPs) to the Massachusetts Clean Energy Center, or both.

In order to determine the prices for RECs, DOER sets an ACP rate. This rate serves as a ceiling price and exists as a penalty suppliers must pay if they do not meet their RPS compliance obligation in a given year. Essentially, for every megawatt hour (MWh) they are short of meeting their obligation, utilities must provide an alternative payment to DOER. This acts as an incentive for retail electric suppliers to purchase RECs from qualified projects for something less than the ACP in order to meet their compliance obligation and avoid ACP payments.

3 For more information, see Grants.gov: www.grants.gov.

4 This does not include municipal light districts.

5 RECs represent the positive environmental attributes associated with this clean energy production. One REC is created each time a qualified system generates 1 MWh of electricity. In order for suppliers to meet their compliance obligations as set by the RPS, they must purchase a number of RECs equal to the percentage for that particular compliance year. RECs are created on the New England Power Pool Generation Information System (NEPOOL GIS).

RPS Solar Carve-Out and SRECs

In 2011, DOER implemented final rules for the state's Solar Carve-Out program, which is the portion of the required RE under the Class I Standard that must come from qualified, in-state, interconnected solar facilities. The state intends for the Solar Carve-Out program to support about 400 MW of solar facilities in Massachusetts. Solar RECs (SRECs) represent the renewable attributes of solar generation, bundled in minimum denominations of 1 MWh of production. Massachusetts' Solar Carve-Out provides a means for SRECs to be created and verified, and allows electric suppliers to buy these certificates in order to meet their solar RPS requirements. All electric suppliers must use SRECs to demonstrate compliance with the RPS.

Market availability primarily determines the price of SRECs. The state is achieving its goal of 400 MW of solar facilities in Massachusetts much faster than anticipated. Once the state reaches its goal, and the opt-in term for all solar facilities has expired, SRECs can no longer be generated. Solar facilities will at that time generate RECs and will be able to sell those for compliance under the Class I standard.

In June 2013, DOER filed an Emergency Regulation to establish rules by which DOER intends to complete the current RPS Solar Carve-Out program. DOER is actively developing policy to maintain the growth of the solar PV market in Massachusetts after the 400 MW cap of the current RPS Solar Carve-Out is reached. According to DOER, the anticipated SREC-II program will create a new separate SREC market with separate new compliance obligations on retail electricity suppliers. The new Solar Carve-Out program will set a program cap of 1200 MW (or correspondingly less if the SREC-I cap exceeds 400 MW). Financial incentives for solar projects will adjust as the market grows.

Commonwealth Solar II Rebates

Commonwealth Solar II, offered by the Massachusetts Clean Energy Center, provides rebates for the installation of PV systems at residential, commercial, industrial, institutional and public facilities. Commonwealth Solar II rebates are available to electricity customers served by Massachusetts investor-owned electric utilities that include NSTAR. For all systems, rebates are calculated by multiplying the per watt incentive (base incentive plus adders) by the nameplate capacity of the system, up to 5 kilowatts (kW); projects are eligible for rebates only if their total capacity is under 15 kW. The applicable rebate levels for commercial PV systems include a base incentive of $0.40 per watt and an adder for Massachusetts-based company components of $0.05 per watt.

Net Metering

In Massachusetts, the state's investor-owned utilities must offer net metering. Net metering allows customers of certain electric distribution companies to generate their own electricity in order to offset their electricity usage. All customer classes are eligible for net metering. The Massachusetts Department of Public Utilities regulates net metering. Net metering regulations would be applicable if part of the system was used to power the on-site ground water treatment system near the Components Laboratory building, or if generation from the system was used to offset usage at another location, a process referred to as virtual net metering. Under state and NSTAR rules one can either net meter or participate in the REC system. If a host customer participates in net metering, the host customer will retain the right to the RECs, but the host customer cannot sell them.

Utility Incentives

NSTAR is the private utility serving NWIRP Bedford. The utility does not offer incentives or rebates for solar projects beyond what is offered by the State of Massachusetts through the state's net metering regulations.

PV SOLAR TECHNOLOGY COSTS

A typical ground-mounted solar energy project in Massachusetts could be expected to vary between $3.00 and $4.00 per installed watt depending on the size and complexity of the system, the type of technology, the type of tracking system and local labor rates.[6] Approximately 60 percent of their cost is materials; the balance is labor, engineering, environmental, permitting and other non PV-system related costs. Operation and maintenance costs are estimated at $20/kW/year.

Utility-scale PV solar systems are generally considered to be systems at least 2 MW in size, and would be expected to be at the lower end of the cost range. Table 5 highlights estimated costs for a PV fixed-axis system built upon the available area at NWIRP Bedford. Because none of the areas by themselves could support a system 2 MW in size or larger, cost estimates are assumed at the higher end of the installed cost scale.

Table 4: PV System Cost by Solar Area at $4/Watt

Solar Area	PV-Fixed Array Size (MW)	PV-Fixed Array Estimated Annual Output (MWh)	PV-Fixed Array Cost($) (in millions)
1	0.5 – 0.8	622 – 995	2.0 – 3.2
2	0.3 – 0.4	373 – 497	1.2 – 1.6
3	1.1 – 1.6	1,368 – 1,990	4.4 – 6.4
1+2+3	**1.9 – 2.8**	**2,363 – 3,482**	**7.6 – 11.2**

FINDINGS/NEXT STEPS

The following are findings and next steps that could potentially be undertaken if there is interest in further pursuing a large-scale RE project at NWIRP Bedford.

- NWIRP Bedford could potentially support utility-scale PV solar development.
- PV solar project size could range from 0.5 to 2.8 MW.
- Solar development would be unlikely to interfere with current or future site remedies.
- Potential issues with glint and glare will need to be reviewed with FAA and Hanscom Field. However, glint and glare studies generally suggest that glint and glare should not affect flight navigation.
- The ability to use incentives and obtain a long-term power purchase agreement would be critical for the economic viability of a utility-scale project at NWIRP Bedford.
- The Air Force, which operates the nearby Hanscom Air Force Base, is operating under laws and executive orders that mandate or encourage RE at federal facilities. PV solar development projects at NWIRP Bedford could potentially enable the Air Force to meet the federal requirements or goals for RE use.
- An RE project at NWIRP Bedford affiliated with Hanscom Air Force Base could also help the state achieve its goals of implementing energy solutions at Massachusetts-based military bases.

6 Solar system cost estimates were adapted from the November 2012 NREL report, "Photovoltaic (PV) Pricing Trends: Historical, Recent, and Near-Term Projections." http://emp.lbl.gov/sites/all/files/lbnl-6019e.pdf

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