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Renewable Energy Siting Guidelines

Part 1: Interim Siting Factors for Terrestrial Wind Energy Systems

RHODE ISLAND
DIVISION OF
PLANNING

STATEWIDE PLANNING
HOUSING AND COMMUNITY DEVELOPMENT
LOCAL GOVERNMENT ASSISTANCE
STRATEGIC PLANNING

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The **Rhode Island Statewide Planning Program**, Division of Planning, Department of Administration is established by Rhode Island General Law Chapter 42-11 as the central planning agency for state government. The State Planning Council is comprised of state, local, and public representatives. Federal and other advisors, guide the work of the Program. The objectives of the Program are:

(1) to prepare strategic and systems plans for the state

(2) to coordinate activities of the public and private sectors within this framework of policies and programs

(3) to assist local governments in management, and

(4) to advise the Governor and others concerned on physical, social, and economic topics.

Further, the Division of Planning is authorized by RI General Law 42-11-10 entitled, Statewide Planning Program, to study and evaluate the needs of the State for current and future energy supply and shall have the following powers:

(1) To adopt, amend and maintain as an element of the State Guide Plan or as an amendment to an existing element of the State Guide Plan, guidelines for the location of eligible renewable energy resources and renewable energy facilities in Rhode Island with due consideration for the location of such resources and facilities in commercial and industrial areas, agricultural areas, areas occupied by public and private institutions, and property of the State and its agencies and corporations, provided such areas are of sufficient size, and in other areas of the State as appropriate.

(2) State Guide Plan. The State Guide Plan is comprised of functional elements or plans dealing with land use, physical development and environmental concerns, economic development, housing production, energy supply (including the development of renewable energy resources in Rhode Island), energy access, use, and conservation, human services, and other factors.

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ABSTRACT

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ABSTRACT:

As part of RI General Law 42-11-10-f.7, *RI Comprehensive Energy Conservation, Efficiency and Affordability Act of 2006*, the Statewide Planning Program was charged with producing renewable energy facility siting guidelines. This is the first part of siting guidelines and it relates to terrestrial wind energy system siting Other forms or renewable energy will be addressed at a later date. This Paper is intended to be a guide for stakeholders interested in wind power development. The guidelines include the identification and evaluation of the typical "siting impacts" which should be reviewed when siting a wind energy system including safety from structural hazards, shadow flicker, icing, noise, residential property values, the natural environment, visual, and signal interference. These interim guidelines and the subsequent technical information to be developed through the RI Renewable Energy Siting Partnership (RESP) from the University of Rhode Island Coastal Resources Center are intended to assist municipalities in addressing wind turbine development if they choose to do so.

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GLOSSARY OF TERMS

- **Accretion –** Build up of size/mass, through external addition
- **Allowable Flicker–** Maximum time that shadow flicker is allowed, (usually expressed in number of hours allowed annually)
- **Ambient sound level –** The total noise measurement of a given environment at a given point
- **Amplitude Modulation** – A transmitted signal with varying strength
- **Annoyance**- A caused irritation
- **Appraiser** – A Rhode Island certified private individual or firm(s) who estimates property values through various research techniques.
- **Assessor –** A municipal or state official responsible for determining the value of a property for tax purposes.
- **Blade Throw –** Detachment of turbine blade or blade fragment while in motion, resulting in the piece being launched outward
- **Barotrauma -** is physical damage to body tissues (typically birds or bats) caused by a difference in pressure between an air space inside or beside the body
- **Cut-in speed –** Lower threshold wind speed below which a wind turbine does not operate
- **Decibels (dB)** – The most common measurement of sound. A decibel is a measure of the intensity of a sound wave
- **Electromagnetic Interference** - A disturbance within a circuit caused by an outside source
- **Habitat Alteration** - These impacts could increase the risk of mortality of wildlife or render the habitat less suitable for occupation by wildlife
- **Habitat Destruction / Fragmentation** - When native vegetation is cleared for human activities. Habitats which were once continuous become divided into separate pieces resulting in the reduction in the amount of available habitat
- **Hub –** The center of the rotor assembly, to which the blades are attached
- **Ice Carry –** Falling ice that is dislodged from a stationary turbine that is carried by the wind
- **Ice Shed/Ice Fall** - Falling of ice from a turbine
- **Ice Throw –** Projecting of ice from a moving turbine blade
- **Icing –** Accumulation of ice-buildup on a wind turbine
- **Kilowatt (kW) –** Common unit of power used in energy generation (1000 kW = 1 Megawatt (MW))
- **Kilowatt hour (kWh)** – Common unit of energy used to gage wind turbine production or end user electrical consumption (1000 kWh = 1 MWh)
- **Large Wind Energy Systems (LWES) –** Wind energy Systems that are 200 feet in height or greater or have 100kW or more of generating power
- **Microwave Communications** - Radio wave communications at fixed frequencies between two or more points
- **Nacelle –** The housing containing the drive mechanism and generator, to which the rotor is attached
- **Pure Tones –** A steady sound without overtones
- **Renewable Energy Standard** – A standard set by RI General Law Chapter 39-26 that requires 16% of the State's energy come from renewable sources
- **Retransmission** - Effectively accepting a radio or video signal and rebroadcasting the signal
- **Rotor Diameter –**The diameter that the blades cover

- **Rotor Sweep** - Swept area –The area swept by the blades as they rotate through a cycle. It is also called the 'capture area'. pi x Radius^2 = Area Swept by the Blades.
- **Small Wind Energy Systems (SWES) –** Wind energy systems that are less than 200 feet in height or have less than 100kW of generating power.
- **Special Use** - A regulated use which is permitted pursuant to the special-use permit issued by a municipal Zoning Board of Review pursuant to RI General Law 45-24-42.
- **Special Use Permit** - Authorization granted by a municipal Zoning Board of Review to allow a special use on the property pursuant to RI General Law 45-24-42
- **Terrestrial Wind Energy –** Electricity generated from wind devices whose location is solely on land
- **Turbine Height –** Measure of a turbine blade tip at its highest point, from the base of the tower
- **View-shed –** Extent of the area visible by the naked eye, from a fixed vantage point
- **Wind Energy System –** Equipment, machinery and all related structures utilized in the conversion of wind to electricity

I. INTRODUCTION

Rhode Island's Renewable Energy Policies and Goals

States and municipalities across the nation are increasingly seeking to capitalize on the economic, health, and environmental benefits of renewable energy through local incentives and programs. To date, thirty-two states have adopted renewable portfolio standards, requiring a certain percentage of energy used to be generated from renewable sources. Rhode Island, through various policies, has demonstrated its commitment to the development of renewable energy resources in the state and the region. Doing so will improve the state's long-term economic competitiveness, environmental quality, energy security, and public health and safety.

Portsmouth High Turbine, (ProJo 2011)

Currently just over 2% of Rhode Island's electricity is generated with renewable sources, including wind power, hydroelectric power, municipal solid waste, and landfill gas. The Renewable Energy Standard (RES), established by the Rhode Island General Law Chapter 39-26, requires that 16% of electricity sold in the state be generated from renewable sources by 2020. The RES mandates a specific percent target to be met each year by energy suppliers, from sources located within New England or, subject to some limitations, from adjacent grids in New York and Canada. Technologies eligible for the RES include solar, wind, biomass, hydro, landfill gas, and fuel cells. Only 2% of the RES can be met with resources developed prior to 1997.

While electricity used to comply with the RES does not need to be sourced from resources within Rhode Island, the state's Distributed Generation Standard Contracts program specifically targets the development of renewable facilities within the state. This program, created pursuant to the enactment of HB 6104 in June 2011, does not specify how much of its targeted 40 MW must come from specific technologies. At this time it appears that land-based wind is the most cost-effective technology allowed under this program. As an example, in the program's first round, the lowest price ceiling for electricity from solar photovoltaics was more than double that for electricity from wind. To achieve the program's goals while minimizing ratepayer impacts suggests that at least some of 40 MW should come from wind energy systems.

RI General Law 42-11-10-f.7, *RI Comprehensive Energy Conservation, Efficiency and Affordability Act*,[1] requires the Statewide Planning Program to develop renewable energy siting guidelines as part of an element of the State Guide Plan. This technical paper will be incorporated into a comprehensive update of State Guide Plan 781, *Rhode Island Energy Plan*. Other aspects related to energy policy for the State will be addressed in that element. The law directs the Program to consider standards and guidelines for the location of eligible renewable energy resources and facilities with consideration for the location of such resources and facilities in commercial, industrial, and agricultural areas, areas occupied by public and private institutions, and property of the State, and in other areas of the state as appropriate. This paper will present recommendations for factors to be considered when siting terrestrial wind energy systems.

Rhode Island Wind Power Resources

Although the Act requires all types of renewable energy be addressed, Part 1 of this paper will deal solely with the siting of terrestrial wind power systems. Other forms of renewable energy will be addressed in subsequent sections as necessary.

Wind speeds in the state are such that there are some areas more suitable for terrestrial wind power development than others, where installations will have a much greater return on the ratepayers' investment. There are various wind industry thresholds for minimum wind speeds for economical wind power generation, depending on the type of project (private, public, net-metered, behind the meter, production facility, etc) for turbines over 100kW. This threshold is subject to change as project economics, incentives and electricity (revenue) rates change. A wind speed threshold of 6 meters per second (m/s) is often considered the minimum speed for consideration as an economically viable project, but this number is subject to many conditions and is really only a preliminary screening value. As seen in Figure 1, RI Wind Resource Map, wind speeds vary around the state.

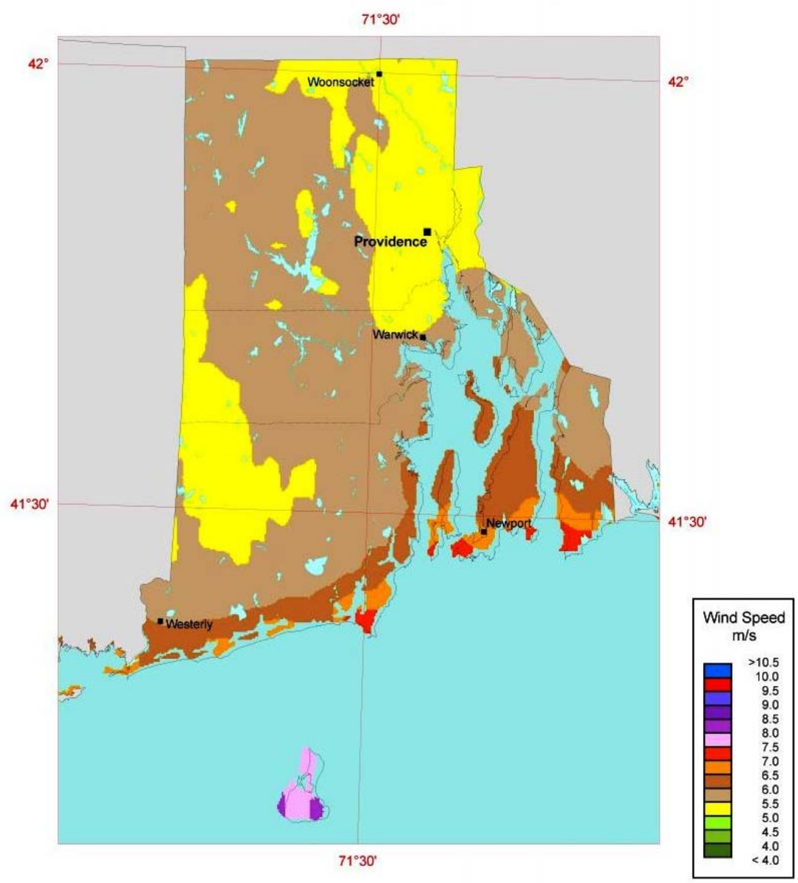

Figure 1 RI Wind Resource Map[1]
(Average Wind Speed at 80 meters)

Wind Power Development in Rhode Island

Large Wind Energy Systems

Wind power development in Rhode Island is a relatively new use for planners to contemplate. Currently, there are eight operating wind turbines in RI that are considered "large scale," or large wind energy systems (LWES). The first LWES built in the state was developed at Portsmouth Abbey in Portsmouth. The turbine project was approved by a "special use permit" in 2006. Wind turbine development through special use permits will be discussed in the next section. See Table 1, LWES in RI, below for existing turbines.

Table 1, LWES in RI

Municipality	Location	Turbine Size	Turbine Generating Power	Date Installed
Portsmouth	Portsmouth Abbey	240 ft	660 kW	2006
Portsmouth	Portsmouth High	336 ft	1500 kW	2009
Portsmouth	Hodges Badge	190 ft	250 kW	2011
Warwick	New England Tech	156 ft	100 kW	2009
Middletown	Aquidneck Industrial Park	150 ft	100 kW	2009
Warwick	Shalom Housing	156 ft	100 kW	2011
Narragansett	Fisherman's Memorial Campground	117 ft	100 kW	2011
Tiverton	Sandywoods Farm	233 ft	275 kW	2012

Small Wind Energy Systems

There are many other wind power generating systems that are much smaller than the ones cited above, known as small wind energy systems (SWES). These turbines are less than 200 feet in height and less than 100kW in generating power. These turbines may be suitable for industrial, commercial and recreational areas such-as Salty Brine State Beach in Narragansett (at right). SWES may also be suitable in residential settings, but those instances will be addressed separately in the next section, due to the more sensitive nature of residential areas.

Salty Brine Beach – 10kW (RIDEM)

In 2009, the American Wind Energy Association devised a set of small wind turbine standards[1] through *The Small Wind Certification Council (SWCC)*, which municipalities may choose to consult along with the recommendations in this document. The SWCC was formed with the support of the US Department of Energy. These standards are meant to apply to turbines with a

[1] http://www.awea.org/learnabout/smallwind/upload/AWEA_Small_Turbine_Standard_Adopted_Dec09.pdf

rotor swept area of 200 square meters or less, which is roughly a rotor diameter of 8 meters (or ~26 feet).

Residential Wind Systems (Free Standing and Roof Mounted)

Given their relative impacts and footprints, SWES are more commonly found in residential settings than are LWES. Even these smaller wind applications have to be addressed carefully, as to not affect “quality of life” issues in neighborhoods. For example, communities may wish to enact a stricter noise standard for turbines in residential areas because turbines may produce more sound at night, which could lead to an increased chance of sleep disturbance. Non-residential areas will not be as sound-sensitive in the overnight hours. On the other hand, fairness may dictate municipalities rely upon a existing municipal noise ordinance that covers all noise, not singling out wind turbines per se.

In addition to free-standing SWES in residential areas, there are also smaller scale roof/building mounted wind systems designed for residential uses. These smaller scale roof/building mounted varieties are some of the newest technologies emerging in the wind power arena. The issue of noise propagation from these roof/building mounted turbines may prove to be the biggest challenge. The municipal development regulations for these turbines should include mitigation mechanisms triggered by operational turbines that exceed noise and other development standards.

Municipal Zoning/Permitting Considerations

To date, seven Rhode Island municipalities have adopted wind ordinances, but several of the ordinances were either revoked and/or revised due to community opposition to several LWES proposals. Some municipalities have enacted turbine moratoriums or have banned the development of LWES altogether. With the development of these siting guidelines and with additional information from the RI Renewable Energy Siting Partnership (RESP), municipalities will be in a better position to address wind turbine development more effectively, if they choose to do so.

Fisherman’s Memorial Campground

Except for the two turbines erected on state property and the Portsmouth High School turbine on town property, the other six existing LWES were approved through the “special use permit” zoning process granted to municipalities through RI General law Section 45-24-42 of the *RI Zoning Enabling Act*[4]. Special use permits allow for a regulated use pursuant to meeting certain performance criteria and procedures for the use and are issued by municipal zoning boards of review. The permit is granted if the applicant demonstrates that the use would not be injurious to the public health, safety and welfare. A special use permit is not to be confused with a dimensional variance, which concerns only the physical setback requirements of a particular parcel.

There is no "one-size-fits-all" approach to siting wind energy systems. Each case should be evaluated considering its location, terrain, zoned use, proximity to abutting uses (especially residences), among other factors. This paper identifies interim guidelines for municipalities to consider when addressing siting issues of terrestrial wind energy systems in order to protect the public's health, safety and general welfare.

Each proposed wind energy system siting application comes with its own set of site-specific considerations. It is this unique set of circumstances that determine the impacts that need to be considered. For example, if a wind project is proposed far away from residences, the need for evaluating shadow flicker may not arise. For projects proposed in a close proximity to residences, a more thorough evaluation of the siting impacts should be required to ensure the public's welfare. The next section has been formatted as a checklist, to ensure that municipal officials don't overlook any potential impacts or other considerations pertinent to siting WES. A more thorough discussion of some of these impacts follows in Section III.

The major recommendation of these guidelines is that municipalities address wind energy development in their comprehensive plans in some fashion either as part of a complete update of the plan or as a single purpose amendment, prior to establishing ordinances. Municipalities should use the special use permit and the development plan review processes when reviewing WES applications. Further it is also recommended that municipalities consider the general development factors outlined herein for performance standards within their special use permit approval process. Any proposed changes (in design, make, model, height, size, etc.) after the submission of a permit application should be considered a material change and should require a new permit application.

II. CHECKLIST OF INTERIM GUIDELINES

The intent of this checklist is to provide guidance to Rhode Island municipalities when planning for wind energy systems (WES). Based on a review of approaches used in other jurisdictions as well as pertinent literature, the following should be considered minimum standards. These standards are designed to protect the public's health, safety, and general welfare. Municipalities may decide that more stringent standards are desirable. There is not necessarily a single ideal approach for a municipality, as existing municipal laws, land use, wind resources, environmental settings, community values, and the amount and types of available and suitable lands for WES will differ community by community. The suggestions contained within these guidelines are for informational purposes only and are not intended to constitute any legal advice. Municipalities need to work closely with their solicitor(s) and experts in wind energy projects when planning for WES.

The siting of wind energy systems (WES) in Rhode Island is a relatively recent land use activity. It has garnered much interest from all angles including state and municipal authorities, wind energy developers, non-profit entities as well as concerned citizens. Wind as a renewable energy will undoubtedly become a larger part of our energy mix in the future. The State has set a goal of procuring and maintaining sixteen percent of its energy from renewable sources by 2019, which the use of WES will help meet that mandated goal. At this time, there is no State mandate for municipalities to meet a certain threshold of renewable energy or even to use WES. This guidance document is intended to help guide municipalities that choose to address WES development.

This document was guided by an advisory committee consisting of members from other state agencies, municipalities, wind energy developers, non-profit groups and a member of the public. Included is an "outline" of standards that are typically found in municipal wind ordinances and how potential impacts from WES are generally addressed. The most common "impacts" usually considered include:

- safety (structural hazards, blade throw and icing)
- noise
- shadow flicker
- visual/aesthetic impacts
- the natural environment
- residential property values, and
- signal interference.

Table 2, Summary of Guidelines, provides direction as to where in the following pages an explanation of the above bulleted points can be found.

SEE ALSO:

- American Planning Association Planning Advisory Service's Report Number 566: *Planning for Wind Energy*, November, 2011. at: https://www.planning.org/apastore/Search/Default.aspx?p=4176
- University of Rhode Island Coastal Resources Center Rhode Island Renewable Energy Siting Partnership efforts on WES at: http://seagrant.gso.uri.edu/resp/

It is recommended that any measurements for setbacks and/or limiting locational standards be measured at the abutting property line, not just at occupied buildings, as undeveloped parts of an abutter's lot may be developed at some point in the future. The siting guidelines that follow should always apply to abutting residential zoned property, but those dealing with "annoyance factors" may be relaxed for abutting commercial or industrial zones. Public safety guidelines should not. Given the highly variable conditions in those zones, it may be preferable for siting limitations to be determined and approved during the development plan review process. Municipalities should set their own impact standards based on cumulative factors including but not limited to abutting land use development patterns, environmental constraints, available utility infrastructure, and existing municipal ordinances. For example, most municipalities have existing noise ordinances based on their community characteristics. These should be reviewed and amended to address potential noise impacts from WES. More detailed aspects of "noise studies" and other WES siting impacts will be discussed in Part 3, Interim Siting Recommendations.

When developing WES standards for an ordinance, there are several options that may be considered. Separate ordinances may be drafted for LWES, SWES, and building-mounted or residential wind energy systems. Alternatively, municipalities may devise a single ordinance that will address standards for all types of WES with detailed references to different types of WES within each section, as in this document.

Municipalities must also consider the process for reviewing and approving different types of WES in different zones. Some smaller types of turbines may be allowed in certain zones as a permitted or accessory use through the issuance of a building permit. In other instances, municipalities may decide a special use permit should be required. A municipality may require large projects to attend a pre-application conference with the planning board, prior to the development plan review procedures of the Subdivision and Land Development Regulations. This could also constitute the planning board's advisory opinion and recommendation before proceeding to a required special use permit application issued by the zoning board of review.

Wind Energy Issues for Comprehensive Plans:

- Is wind energy appropriate for the community?
- If yes, include available wind maps and other data.
- An assessment of the energy infrastructure capabilities of the community is needed.
- Goals, policies and strategies should be set for wind energy.
- Maps of locations where the municipality encourages wind energy systems to be located or not should be included.
- Identifying what scales of WES are suitable for different areas of a community should be included.

It is recommended that when enacting a specific procedure for WES, that communities use their existing Special Use Permit and Development Plan Review authorities.

Table 2, Summary of Guidelines for Locational Standards by Type of Impact

	Types of Impact						
Wind Energy System Type	**Safety/ Structural Hazards Pages 21-23**	**Safety/ Icing[2] Page 24**	**Shadow Flicker Page 29**	**Noise Pages 25-28**	**Signal Interference Page 34**	**Natural Environment Pages 31-32**	**Property Values Page 33**
Residential - Free Standing	1.5x of Height	1.5x to 1.75x Height	Modeling needed – 0 - 3 hrs annually*	See manufacturer's technical specifications	N/A	N/A	TBD
Building Mounted	N/A	N/A	TBD	See manufacturer's technical specifications	N/A	N/A	TBD
Small Industrial/Commercial (Under 200ft AND under 100kW)	2.0x of Height	1.5x to 1.75x Height	Modeling Needed – 0 - 3 hrs annually*	Noise Study - 0 to 5 dB above Ambient	TBD	Habitat/Terrain/ Soil Assesment	TBD
Large Industrial/Commercial (Over 200ft and/or 100kW or greater)	2.0x of Height	1.5x to 1.75x Height	Modeling Needed – 0 -3 hrs annually*	Noise Study - 0 to 5 dB above Ambient	TBD	Habitat/Terrain/ Soil Assesment	TBD

Height = Turbine Height
N/A = Not applicable
TBD = To be determined
* - Municipalities may choose to allow up to 30 hours of flicker annually, but should require that the turbine be shut down during that time period

[2] In icing and extreme wind conditions, "auto-shutdown" mechanisms should be in place as a prerequisite

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The following represents a checklist of items that should be considered in developing standards. The next Section, Part III, Interim Siting Recommendations, discusses the recommendations in more detail.

Impact	Consideration	LWES (over 200' and/or 100 kW or greater)	SWES (Under 200ft AND under 100kW)	Residential WES
☐ **Structural hazards – Blade Throw**	Minimum setback to property line based on height to turbine. Require auto-over speed controls.	2.0x total height setback	2.0x total height setback	2.0x total height setback Consult manufacturer's specifications
☐ **Structural hazards Ice Throw**	Require ability for turbine to auto-shutdown when it senses icing conditions	Require auto-shutdown feature in icing conditions.	Require auto-shutdown feature in icing conditions.	May consider requiring auto-shutdown feature in icing conditions. Not clear this technology is available in residential-scale turbines.
☐ **Shadow Flicker**	Limits on annual and daily flicker based on computer modeling. May consider mitigation, shut down requirements and/or curtailment. Mitigation such as appropriate plantings may be considered. Municipalities should consider a possible relaxation of measurement standards when involving protected, wet and/or undevelopable sections of abutters properties.	Modeling required – Three (3) hours annually maximum. No impacts on any residence or business in area. Municipalities may choose to set a maximum limit, such as allowing up to 30 hours with a provision to cease operation of the turbine during those times of flicker	Modeling required – Three (3) hours annually maximum. No impacts on any residence or business in area. Municipalities may choose to set a maximum limit, such as allowing up to 30 hours with a provision to cease operation of the turbine during those times of flicker	Modeling required – Three (3) hours annually maximum. No impacts on any residence or business in area. Municipalities may choose to set a maximum limit, such as allowing up to 30 hours with a provision to cease operation of the turbine during those times of flicker
☐ **Noise**	Standards may be defined either in terms of absolute limits or in terms of increase above ambient noise. Recommend an acoustic study be done. Noise limits set for turbines should not exceed noise limits already set in existing municipal ordinances.	Acoustic study required – maximum of 5 dB(A) above ambient, calculated for both daytime and night time. If absolute standard used, must vary based on existing land use and noise ordinances– i.e., higher standard in industrial areas, lower in residential or rural areas.	Acoustic study may be required. Given cost of study using existing noise ordinances– i.e., higher standard in industrial areas, lower in residential or rural areas may be useful...	See manufacturer's technical specifications pertaining to sound propagation. Smaller projects may consider use of setbacks from property lines to regulate noise.
☐ **Environmental Impact**	Environmental impact study by a professional environmental firm may be required based on individual site	Consider mitigation if issues found as per US Fish & Wildlife Land-Based Wind	Require map demonstrating proximity of site to wetlands, critical habitat for animal	Staff reviews of site application materials may suffice. To be determined site by site. Consider mitigation if issues found as per US Fish &

	conditions. Such assessments should consider, at a minimum, birds, bats, ground dwelling species, presence of 'species of concern' or critical habitat for these species, wetlands, presence of plant communities of concern. Consider mitigation if issues found. Federally funded projects, NEPA review may be required by federal government. State environmental permits may be more controlling at this scale such as wetlands or CRMC permits.	Energy Guidelines.[3]	species of concern, plant communities of concern, and known critical areas of species congregation. Consider mitigation if issues found as per US Fish & Wildlife Land-Based Wind Energy Guidelines.	Wildlife Land-Based Wind Energy Guidelines.
☐ **Visual, Aesthetic**	Municipalities may require specific type and color of WES and limit writing and signage on nacelle, tower, and at the site.	In addition, may require photo simulations.	In addition, may require photo simulations.	Municipalities may require specific type and color of WES and limit writing and signage on nacelle, tower, and at the site.
☐ **Signal Interference**	WES may cause interference of microwave transmission signals. Radio signals may unknown concerns.	A communications tower search should be done to make certain that the WES is not interruptive to any communication stations. If specific concern is raised by owner/operator of nearby radio communications equipment, demonstrate no adverse effect.	A communications tower search should be done to make certain that the WES is not interruptive to any communication stations. If specific concern is raised by owner/operator of nearby communications equipment, demonstrate no adverse effect.	Not likely to cause interference.
☐ **Property Values**	In general, property values are protected by enforcement of other standards. There is insufficient evidence to suggest permanent effect of WES on surrounding property value, when sited in conformance to safety, noise and flicker standards.	Large, multi-turbine projects may be asked to guarantee no effect on real estate values of abutters.	Projects may be asked to guarantee no effect on real estate values of abutters.	N/A

[3] http://www.fws.gov/windenergy/

☐ **FAA Approvals**	FAA requires that all structures over 200' receive a Determination of No Hazard to Air Navigation. Municipality should require such determination before considering a proposed WES.	Require Determination of No Hazard to Air Navigation from FAA.	Require Determination of No Hazard to Air Navigation from FAA.	Require Determination of No Hazard to Air Navigation from FAA.
☐ **Minimum Ground Clearance**	May establish minimum ground clearance, based on existing land use and size of WES.	Same.	Same.	Free-standing – same. Building-mounted – N/A
☐ **Approved Design**	Ensure that make/model and design be certified by a RI Registered engineer and or architect and by a recognized national or industry certification bodies, such as the National Renewable Energy Laboratory.	Ensure that make/model and design be certified by a RI Registered engineer and or architect and by a recognized national or industry certification bodies, such as the National Renewable Energy Laboratory.	Ensure that make/model and design be certified by a RI Registered engineer and or architect and by a recognized national or industry certification bodies, such as the National Renewable Energy Laboratory.	Ensure that make/model and design be certified by a RI Registered engineer and or architect and by a recognized national or industry certification bodies, such as the National Renewable Energy Laboratory.
☐ **Decommissioning/ Abandonment**	Owners/operators should be required to remove a WES if it has been inoperable for a specified period of time or at the end of its useful life. Municipalities may require a decommissioning plan and guarantee	Owners/operators should be required to remove a WES if it has been inoperable for a specified period of time or at the end of its useful life. Municipalities may require a decommissioning plan and guarantee	Owners/operators should be required to remove a WES if it has been inoperable for a specified period of time or at the end of its useful life. Municipalities may require a decommissioning plan and guarantee	Owners/operators should be required to remove a WES if it has been inoperable for a specified period of time or at the end of its useful life. Municipalities may require a decommissioning plan and guarantee
☐ **Roads and Utilities**	Standards may require developer to document condition of roads, bridges and utilities prior to construction, and be required to make repairs if any damage occurs.	Standards may require developer to document condition of roads, bridges and utilities prior to construction, and be required to make repairs if any damage occurs.	Standards may require developer to document condition of roads, bridges and utilities prior to construction, and be required to make repairs if any damage occurs.	N/A
☐ **Erosion and Storm Water Control**	Require minimal disturbance of natural features.	State standards such as RIDEM Soil Erosion and Sediment Control Handbook and Storm Water Design Manual Control should be	State standards such as RIDEM Soil Erosion and Sediment Control Handbook and Storm Water Design Manual Control should be	State standards such as RIDEM Soil Erosion and Sediment Control Handbook and Storm Water Design Manual Control should be used.

		used..	used.	
☐ **Maintenance**	Municipality may require owner or operator to show maintenance schedule	Municipality may require owner or operator to show maintenance schedule	Municipality may require owner or operator to show maintenance schedule	Municipality may require owner or operator to show maintenance schedule
☐ **As-built Drawings**	Require submission of "as-built" drawings, certified by RI Registered Engineer, architect, and or Registered Land Surveyor.	Require submission of "as-built" drawings, certified by RI Registered Engineer, architect, and or Registered Land Surveyor.	Require submission of "as-built" drawings, certified by RI Registered Engineer, architect, and or Registered Land Surveyor.	Require submission of "as-built" drawings, certified by RI Registered Engineer, architect, and or Registered Land Surveyor.
☐ **Notification Requirements.**	Standards should require developer to notify all land-owners within a given radius of intended development. The minimum radius recommended is the defined by the RI Zoning Enabling Act.. Municipalities may choose to increase the notification radius in areas as they deem appropriate.	The minimum radius recommended is the defined by the RI Zoning Enabling Act.	The minimum radius recommended is the defined by the RI Zoning Enabling Act.	The minimum radius recommended is the defined by the RI Zoning Enabling Act..
☐ **Review Fees and Escrow Policy**	If not already within other provisions of the ordinance, standards should establish a schedule of review fees and set an escrow policy to cover any engineering, legal, or other associated bills for review of the WES applications by the municipality.	Same.	Same.	Same.

III: INTERIM SITING RECOMMENDATIONS

This section will present more detailed recommendations for mitigation of anticipated siting impacts. The most commonly addressed impacts are addressed within the following topical subsections:

- safety(structural hazards, blade throw and icing)
- noise
- shadow flicker
- visual/aesthetic impacts
- the natural environment
- residential property values, and
- signal interference.

Each topical subsection is laid out by the particular issues that siting impact standards should address, the key terms related to that impact are defined, general guidelines are presented, and then more specific siting recommendations follow.

Safety - Structural Hazards

There are several factors to be taken into account in managing public safety considerations, the first being construction. The use of experienced developers of wind energy systems, installing proven and certified turbine designs, and implementation of a thorough review process by experienced individuals all decrease the likelihood of structural failure. At the same time, even a perfectly manufactured and installed turbine still presents some element of risk within the maximum blade throw distance. This risk should be evaluated comparative to other sources in daily life. A "One in One Million" mortality risk is less than that associated with pedestrian/motor vehicle collision, bicycle accidents, earthquakes, leukemia, or receiving a single x-ray. However, it is not zero percent. It should also be noted that several state's guidelines promulgate setbacks of 1.0x turbine height from buildings on the same property. This document gives no setback recommendation for this instance.

<u>General Guidelines – Safety:</u>

- Wind energy systems should comply with all national, state & local building code standards and with all additional municipal requirements.

- Ensure professional peer review of plans and specifications, safety of design, and compliance with the RI State Building Code. Use the provisions of RI Gen. Law 23-27.3-128 to retain third-party individuals to evaluate these issues

- Use industry standards including but not limited to the American National Standards Institute [This includes IEC 61400, which is the International Electrotechnical Commission's (IEC) standards for wind turbines. The IEC is a global non-profit organization involved with preparing and publishing standards related to electrical technology.] [4].

- Setback standards should be sufficient to reasonably minimize public risk in the event of a structural failure and blade throw.

- For projects abutting farmland/grazing land, a stray voltage assessment should be completed.

- Onsite construction and installation should be overseen by a RI licensed architect and or RI registered engineer.

The following are examples of a range of spatial standards for setback distances presented by wind energy system size from largest to smallest. Setback assessments are typically based upon assumed risks based on overall turbine height. A more detailed risk based assessment analyzing turbine types, hub height, blade length and rotation speed, and the probability of blade failure accident occurrence will be provided by the RESP final report.

Spatial Standards:

Large Wind Energy Systems (LWES):
(greater than 200 feet in height, or 100kW generated)

- LWES shall be set back a horizontal distance equivalent to at least 2.0x of the turbine height from **residential** property boundaries.

- LWES shall be set back a horizontal distance equivalent to at least 1.5x of the turbine height from **all other** property boundaries.

- LWES shall be set back a horizontal distance equivalent to 1.25x to 1.5x of the turbine height from **all** public roads and rights of ways.

    - These setbacks should be followed; however, municipalities may choose to include within the conditions of approval a reduced setback if the applicant requests a waiver and submits in writing: a notarized letter signed by the pertinent abutting landowner(s) (and 3rd property owner where necessary) stating that that if the reduced setback from the property boundary is granted, it would not adversely affect the abutting property owner and other written evidence such as operating protocols, safety programs, or recommendations from the manufacturer and a RI registered engineer.

[4] http://webstore.iec.ch/preview/info_iec61400-1%7Bed3.0%7Den.pdf

Small Wind Energy Systems (SWES):
(smaller than 200 feet in height, or less than 100kW generated.)

- SWES should be set back a horizontal distance equivalent to at least 2.0x of the turbine height from **residential** property boundaries.
- SWES should be set back a horizontal distance equivalent to at least 1.5x of the turbine height from **all other** property boundaries including public roads and rights of way.
    - These setbacks should be followed; however, municipalities may choose to include within the conditions for approval a reduced setback if the applicant requests a waiver and submits, in writing: a notarized letter signed by the pertinent abutting landowner(s) (and 3rd property owner where necessary) stating that the reduced setback from the property boundary if granted, it would not adversely affect the abutting property owner (or the 3rd property owner), and other written evidence, such as operating protocols, safety programs, or recommendations from the manufacturer and a RI registered engineer.

Residential Scale Wind Energy Systems

- RWES should be set back a horizontal distance equivalent to 1.5x of the turbine height (or the turbine height above the roof) from **residential** property boundaries.
- RWES should be set back a horizontal distance equivalent to 1.1x of the turbine height from **all other** property boundaries.
    - These setbacks should be followed; however, municipalities may choose to include within the conditions for approval a reduced setback if the applicant requests a waiver and submits, in writing: a notarized letter signed by the pertinent abutting landowner(s) (and 3rd property owner where necessary) stating that the reduced setback from the property boundary if granted, it would not adversely affect the abutting property owner (or the 3rd property owner), and evidence, such as operating protocols, safety programs, or recommendations from the manufacturer and a RI registered engineer with appropriate experience with wind energy systems, that demonstrates that the reduced setback requested by the applicant is appropriate.

Safety - Icing

Turner in Icing Conditions

Ice throw is a possible issue if the turbine operates during conditions in which ice could accrete on the turbine blades. Of the eight LWES currently installed in Rhode Island, none are designed to operate during icing conditions and all have procedures to shut down operation during icing events. The key to mitigating any potential public safety hazards from icing is to mandate as a condition of the application approval that turbine developers have automatic systems and operational procedures to ensure that a turbine is not rotating when ice throw could occur.

Most ice falls around the base of the turbine, both in instances of ice throw and ice shed. This is supported by the Guetsch and DEWI studies (See “Icing” section of Appendix). However, if a turbine operates in icing conditions, the risk contour, as expressed by the Wind Energy Production in Cold Climate (WECO) Program, increases to 1.5x hub height + rotor diameter. It should also be noted that in icy situations where auto-shutdown occurs, there may be potential for “ice carry” if there are extremely high winds present. Ice carry may occur when a turbine is in shutdown mode due to icing conditions and fragments of ice either fall off or are blown off and carried outward by the winds. Maine, Minnesota, Wisconsin and Michigan are states with a greater risk of icing than Rhode Island and they do not address ice throw differently from public safety impacts in their promulgated guidance.

General Guidelines - Icing

- The automatic systems and operational procedures that a developer will employ to ensure a turbine will not operate during ice accretion should be evaluated. If the procedures and systems appear to be sufficient to effectively preclude the operation of the turbine during a period when ice throw can occur, the setback standards provided in the “Structural Failure” section of this document may be sufficient to address this issue.
    - In the event that procedures are found to be deficient, or if the turbine is designed to operate in icing conditions, (which may be the case for the smaller, residential scale turbines) setback distances should be increased, at a minimum, to the (WECO) recommended 1.5 X (hub height + diameter), up to 1.75 times total height.
- During icing events, due to the danger of ice shed from the blades and nacelle, appropriate signs and fences should be placed for the protection of site personnel and the public.

Noise

Universally applied setbacks for noise are not recommended. Each turbine model has its own unique noise emissions. Setbacks have limited mitigation implications because they do not take individual site conditions and surrounding land uses into account. Every potential wind project comes with a unique set of geographical and physical circumstances.

The key to appropriate siting for noise control is to adhere to any state and/or municipal noise regulation/ordinance in force in the location of the proposed wind project. Noise impacts can generally be addressed in two different ways. In guidelines issued by Massachusetts, Michigan, and New Hampshire for SWES and LWES, a setback of 1.5x turbine height is deemed sufficient, so long as the noise standard is met (i.e. not more than 10dB above ambient in MA).

A noise study technique is more tailored to individual sites than a "minimum setback" approach, as it will gather data from the specific site and make siting recommendations based on the findings. **It is recommended that a noise study be conducted for each potential SWES and LWES project, rather than using a universal numeric setback.** In the case of roof mounted wind systems, the manufacturer's technical specifications should be used to determine noise propagation, as a wind study may make these projects cost prohibitive. The distance a turbine is sited from a residence or other type of land use should be determined by a noise study using the International Standards Organization (ISO) and World Health Organization (WHO) standards, See Figure 2 below. Many low-noise ambient environments will require increased distances. In industrial districts, reduced distances may be acceptable.

Figure 2, ISO Recommended Community Noise Limits [5]

District Type	Daytime Limit	Evening Limit (7 -11 PM)	Night limit (11 PM – 7 AM)
Rural	35 dB(A)	30 dB(A)	25 dB(A)
Suburban	40 dB(A)	35 dB(A)	30 dB(A)
Urban residential	45 dB(A)	40 dB(A)	35 dB(A)
Urban Mixed	50 dB(A)	45 dB(A)	40 dB(A)

Turbine noise standards, if none exist, should be developed in consultation with guidelines promulgated by the ISO and WHO and by community values (see Table 3, **Values for Community Noise in Specific Environments** at the end of this Section). In industrial or commercial areas where higher noise levels are the norm, noise standards may be less restrictive than in other places. In rural areas prized for recreation and peace and quiet, standards may require lower noise levels relative to ambient sound levels. There is no one "best fit" standard for all areas. In all areas, noise impact determinations should be measured from the abutting property line(s).

[5] RI Department of Environmental Management

In developing noise standards, focusing only on the dB (A) (broadband) loudness of the sound may not control for many of the factors which produce annoyance. The time durations and qualities of turbine noise, such as amplitude modulation, as well as pure tones, have been cited as prime causes of annoyance by numerous sources, and several state, international, and community wind ordinances control for these factors.

> The special use permit process is recommended as it requires a public hearing to be held prior to any decision on the application. This hearing gives abutters and affected parties rights to testify and state their views on the proposed application before approval is granted.

Perception and public opinion have also been shown to greatly influence how turbine noise is perceived. In some communities where turbine benefits have been shared with the town or those closest to the turbine, annoyance has not become as significant an issue. Likewise, annoyance has been heightened in situations in which residents feel their concerns were not listened to during the application process. In addition, the way the application process is conducted will affect how noise (as well as shadow-flicker and aesthetic impacts), is perceived. Having a thorough public process for all review phases of a proposed project will help resolve perception issues.

General Guidelines – Noise:

- It is recommended that noise standards for wind energy systems be in conformance with the *Community Noise Guidelines* developed by the WHO and ISO and be consistent with other noise ordinances that may already exist in the municipality. Many community ordinances already prohibit sound above threshold intensity from trespassing over property lines at night, typically between 10 p.m. and 6 a.m., and during the day restrict it to a higher sound level. See Table 3 at the end of this section for the WHO guidelines. The table gives examples of various occurrences with their related noise levels and the potential health effects of each.
- Present municipal noise ordinance threshold standards may not be sufficient to control sound in the lowest noise environments, especially at night, or continuous noise or intermittent noise. Communities should adopt standards that set noise limits in relation to site specific ambient levels based on the surrounding land use(s), the expected duration of sound, time of day, and at different points during the year.
- Standards may allow for consideration of mitigation options.
- As part of the review process, noise should be modeled using a verified/industry accepted program, with input data from a respected source. Maps showing both expected sound level contours on non-participating properties, and the possible extent of criteria threshold sound should be developed.
- Noise standards should be designed to eliminate sleep disruption, as defined by the WHO. The WHO recommends that ambient noise levels be below 35 dB for optimum sleeping conditions.

Standards - Noise standards should:

- State the level at which noise must be limited and the limiting criteria in bB(A) above ambient:
  Example: daytime and nighttime. “X” dB (A) above ambient.
  - dB(G) should also be considered

- State the period of time for noise averaging:
  - **Examples**: 24 hours, 8 hours, or 1 hour

- State at which point noise shall be measured:
  - **Example:** at the property line

- State the standards that noise must be measured and modeled according to (ANSI, IEC, etc.)

- State the procedures to address noise complaints from neighbors along with procedures for curtailment or shutdown of the turbine if standards are exceeded.

- Consider and implement penalties for low-frequency noise, amplitude modulation or pure tones violations.

Table 3, Values for Community Noise in Specific Environments [6]

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmax, fast [dB]
Outdoor living area	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwelling, indoors Inside bedrooms	Speech intelligibility and moderate annoyance, daytime and evening Sleep disturbance, night-time	35 30	16 8	 45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoors	Sleep disturbance	30	sleeping-time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time Sleep disturbance, daytime and evenings	30 30	8 16	40 -
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults) Hearing impairment (children)	- -	- -	140 #2 120 #2
Outdoors in parkland and conservation areas	Disruption of tranquility	#3		

[6] World Health Organization (WHO)

Shadow Flicker

Shadow flicker of wind turbines occurs when the wind direction and height/angle of the sun cause the turbine blades to cast shadows upon stationary objects. Shadow flicker is affected both by the orientation of the WES's nacelle (i.e. nacelle perpendicular to the direction of the sun minimizes flicker and cloud cover). In Rhode Island, shadow flicker is more observable in the winter months when the sun is at its lower angles. Because of the available computer software, shadow flicker impact is a straight forward process to model and predict.

General Guidelines – Shadow Flicker:

- Communities should develop shadow flicker standards which evaluate and prevent shadow flicker and to control and prevent nuisances within surrounding structures and on properties, both on an annual and daily basis.
- As part of the review process, shadow flicker should be modeled using a verified/industry accepted program, with input data from a respected source. Maps showing both expected shadow flicker (real–case) at the property boundaries and on non-participating properties. Municipalities should consider a possible relaxation of measurement standards when involving protected, wet and/or undevelopable sections of abutters' properties.

- Wind energy facilities should be sited in a manner that minimizes or eliminates shadowing or flicker impact.

- Mitigation should be considered as one way to reduce the potential impacts of flicker.

- Communities should develop shadow flicker standards which clearly define the level of allowable shadow flicker in hours allowed. Three (3) hours is recommended as a base minimum but municipalities may choose to allow up to 30 hours of worst case flicker annually for those developers who will provide mitigation by shutting down the turbine during the times of flicker. During those times of greatest flicker impacts, the operation of the turbine(s) should cease. The number of allowable hours per year could be higher in industrial areas where shadow flicker will not be as significant of a nuisance as it is in residential areas.

- In addition to mitigation, municipalities may consider requiring curtailment to further reduce the impacts of flicker. The number of allowable hours per year could be higher in commercial and industrial areas where shadow flicker will not be as significant of a nuisance as it is in residential areas.

Visual /Aesthetic Impacts

There is no consensus recommendation for evaluating the visual impacts from wind turbines at this time. Aesthetic and visual impacts are inherently subjective and are difficult to measure. General recommendations are provided here to guide municipalities in making decisions on this topic.

General Guidelines – Visual:

- Municipalities should outline what their requirements are for photo simulations of proposed LWES. Standards may require a "viewshed impact study" for large WES projects. Consideration should be given to requiring photo simulations from specified viewpoints in different seasons, for WES projects that could have significant visual impact.

- Standards may limit the structure type to the "mono-pole" (single cylindrical pole) design, as opposed to the "lattice-type" (see picture on p.11), as a monopole design is generally considered to be more aesthetically acceptable and has also proven to be less hazardous to avian life. Signage (aside from that applied by the manufacturer as an identifier) on the nacelle (the section where the blades meet the tower) and tower itself may be restricted.

- Municipalities may require that a detailed assessment of visual resources be initiated before the planning stages of a project.

- The public should be involved and informed about the visual site design elements of the proposed wind energy projects.

Turbine Art, Hanover, Germany

The Natural Environment

This section will discuss the potential ecological impacts of wind energy systems with respect to floral and faunal resources. It is only an abbreviated summary of the issues that will be discussed in more depth in the final RESP report. Aside from the footprint of development itself, wind turbine operations can produce other threats to biological resources. The major environmental impacts of turbines include:

- habitat destruction/fragmentation,
- habitat alteration and
- direct avian (collision and barotraumas) impacts

The impacts of siting wind energy systems in Rhode Island are site-specific. Although there can be some general areas in the state where wind turbines should not be sited due to avian and wildlife resources, most sites will need to be evaluated on a case by case basis to assess site-specific wildlife assets. The size and precise locations of migratory flights of bats and birds vary considerably with season and weather conditions. There will always be some uncertainly in predicting the impacts of wind turbines on these resources; nevertheless some criteria can be used to minimize these negative impacts. A detailed analysis of WES siting factors is being conducted by the University of Rhode Island Coastal Resources Center for the RI Office of Energy. The Renewable Energy Siting Partnership Report will contain a map that identifies potential areas where terrestrial wind energy systems could be installed with minimal disruption. The report is expected to be completed in 2012 along with a digital wind energy siting tool.

The guidance that follows was recommended by both the Department of Environmental Management and the Coastal Resources Management Council staff. It was developed using their professional judgment and is based on the premise that that there will be some collisions of birds or bats with wind turbines. The guidance has been designed to minimize the loss of avian and bat resources and impacts to the habitats that support these resources.

<u>Environmental Factors</u>

The environmental impact of a proposed wind turbine project should be analyzed by a professional environmental firm. It must be specific to the site in terms of at risk species of concern and their habitats. The following issues should be addressed:

- Constraints imposed by environmental and archeological regulations.
- The presence of animal species of concern or critical habitat for these species.
- Presence of plant communities of concern.
- Presence of critical areas of species congregation, such as maternity roosts, hibernation sites, staging areas, winter ranges, nesting sites, and migration stopovers.
- The potential impact of habitat fragmentation.

- Current studies of avian risk specific to the proposed turbine type and its potential impact on known species that are either present, migrate through the project area, or may be attracted by site alteration.

Environmental Recommendations

The environmental analysis should include the following minimum recommendations:

- Suitability of the site for wind development in light of its environmental impact.
- Design and operational recommendations to avoid or minimize significant adverse environmental impacts.
- Recommended mitigation measures if significant adverse habitat impacts cannot be avoided.
- Determination if post construction studies are advised to evaluate mortality and develop operational measures for mitigation if necessary.

Mitigation

WES should be designed and sited to minimize environmental impact. Mitigation of negative impact may be possible by employing these strategies:

- Raising turbine cut-in speed during known times of migration if site studies predict significant bat mortality risk. Studies (e.g., Arnett, et al. 2010), have suggested that because many bat species fly during low-speed winds, raising turbine cut in speeds to between 5.0m/s-6.5m/s speeds would significantly reduce bat mortality.
- Stopping turbine operation during migration times.
- Altering turbine coloring or lighting to lessen the attraction of birds.
- Situating auxiliary structures (power lines, substations) in such a way as to avoid negative impacts to critical habitat for these species.

Residential Property Values

Wind energy systems should not be located in a way that exposes nearby residential properties to excess noise and shadow flicker that might have some negative effect on property values. If proper site selection eliminates or minimizes those factors, the visual effect of wind turbines is the primary concern. A survey of four tax assessors in communities of Rhode Island and Massachusetts where turbines have been built, has found that there had been no evidence to support changes to property assessments as a result of WES construction. It is important to note that the "absence of evidence" is not "evidence of absence," and turbines, especially poorly sited ones might impact property values. This is very pertinent where scenic vistas or historically recognized "premium viewsheds" are involved.

Properly sited turbines, without noise or shadow flicker impacts, should not adversely affect property values. If such impacts are projected, it is important to consider in the review process what mitigation should be required. Such a process could help with public acceptance of wind energy systems projects, and actually lessen the likelihood of a negative impact on real estate values. A plan for mitigating losses must include a credible, documented record of pre-installation property assessments. In a case where property value impacts may be suspected, a Rhode Island Certified General Real Estate Appraiser should be retained. There should also be an agreed compensation assessment and payment procedure in place before WES plans are put forward.

General Guidelines:

- Noise and shadow flicker standards should be restrictive enough to prevent property value impacts to surrounding properties.
- Requiring an evaluation by RI certified appraisers comparing actual pre- and post-construction values of similar projects of the potential effects on surrounding property values for Large Wind Energy Systems (LWES) developments should be required.
- A community outreach program for a proposed wind turbine project might diminish the potential negative effect on property values stimulated by public uncertainty following the announcement of a proposed project. Any related costs of an outreach program should be paid for by the applicant. Municipal officials, where applicable, should be part of the process to ensure factual and fair information is presented.
- Compensatory mitigation should be required for impacts which can't be mitigated to existing properties. It is important that pre-installation property assessments be documented.
- Where proposed projects would be in the viewsheds of recognized historic sites or scenic vistas, special considerations should exist.

Signal Interference

The impacts of a wind energy facility on telecommunications are determined by blade composition, location of the turbine outside/inside the line of sight between microwave links, distance from the transmitter or receiver, and antenna/receiver type, among other factors. The likelihood of interference with telecommunications also increases with turbine size and the number of turbines.

There is no consensus for minimizing telecommunication interference from wind turbines installations. Of the six other state's guideline documents reviewed, no setback distance is given; only three list signal interference as an impact for consideration (for facilities smaller than 25MW). Interference is an increasingly rare impact as technology evolves, turbine blade composition moves to synthetic material, and siting methodologies and mitigation measures improve.

In guidelines promulgated for SWES, Michigan, Massachusetts, and New Hampshire do not list this as an impact to be considered. Michigan does include signal interference in its guidelines for LWES. Due to their small profile, telecommunications interference is a very rare issue for SWES especially when the facility's height is comparable to surrounding structures.

General Guidelines – Signal Interference:

- No wind energy system shall be installed in any location where its proximity to existing fixed broadcast, retransmission, or reception antennae for radio, television, or wireless phone, EMS/Police/Fire, or other personal communication systems would produce electromagnetic interference with signal transmission or reception unless the applicant provides a replacement signal to the affected party that will restore reception to at least the level present before operation of the wind energy system.

- No wind energy system shall be installed in any location within the line of sight of an existing microwave communications link where operation of the wind energy system is likely to produce electromagnetic interference in the link's operation. Operators of these communication systems should be notified of any nearby wind turbine proposals prior to approval.

IV. FEDERAL AND STATE REGULATORY FRAMEWORK

Federal Level

Listed below in Table 4 are applicable federal statutes as related to permitting and approval of projects with association to federal lands, funding or necessary permits. This list is directly taken from the American Wind Energy Association, Wind Energy Siting Handbook[7]. A more thorough description of the regulatory environment surrounding wind energy development, as well as an overview concerning jurisdictions and processes for projects on federal lands, is listed in Chapter 4 of the 'Siting Handbook':

Table 4: Federal Permitting Requirements in Wind Turbine Siting

Regulatory Authority	Statute	Permit/Approval	Description	Triggers
Federal				
Lead Agency varies by project Council on Environmental Quality Regulations (CFR 1500-1508) and supplemental regulations from lead agency	National Environmental Policy Act (42 USC 4321)	Record of Decision or FONSI or Categorical Exclusion	Establishes national mandate for federal agencies to review environmental impacts of proposed actions Process can be combined with state and local environmental reviews	▪ Federal permit or approval required ▪ Siting on federal lands ▪ Accessing federally owned transmission line ▪ Receipt of federal grants
U.S. Fish and Wildlife Service (50 CFR 13 and 17)	Endangered Species Act (16 USC 1531-1544)	Endangered Species Act Consultation and Incidental Take Permit	Regulates activities affecting threatened and endangered species: Section 3 (16 USC 1532) defines terminology Section 7 (16 USC 1536) establishes federal interagency consultation Section 9 (16 USC 1538) establishes prohibited actions Section 10 (16 USC 1539) establishes permits and exceptions Section 11 (16 USC 1540) describes penalties and enforcement	▪ Consultation with FWS under Section 7 always recommended ▪ Activities that may result in take or harm to species and their habitat, such as site clearing and wind turbine operation
U.S. Fish and Wildlife Service (50 CFR 13and 21)	Migratory Bird Treaty Act (16 USC 703-712)	Consultation	Prohibits harm, possession, or take of migratory bird species, nests, and eggs. Strict liability statue.	▪ Potential impact to migratory bird species protected by the act
U.S. Fish and Wildlife Service (50 CFR 13 and 22)	Bald and Golden Eagle Protection Act (16 USC 668-668d)	Consultation Golden Eagle Nest Take permit	Prohibits harm, possession, or take of bald and golden eagles. Strict liability statue.	▪ Potential impact to bald or golden eagle ▪ Necessity for moving golden eagle nest

[7] http://www.awea.org/sitinghandbook/downloads/Chapter_4_Regulatory_Framework.pdf

Typical Federal Permitting Requirements for Wind Energy Projects (Cont'd)

Regulatory Authority	Statute	Permit/Approval	Description	Triggers
Federal (Cont'd)				
Advisory Council on Historic Preservation, Tribal Historic Preservation Office and State Historic Preservation Office (36 CFR 60 and 800)	National Historic Preservation Act (16 USC 470)	Section 106 Consultation	Requires federal agencies to review impacts to historic and Tribal resources and allows ACHP to provide comments. Consultation authority delegated to SHPO and THPO.	▪ Consultation with the SHPO is always recommended to determine need for Section 106 Consultation ▪ Federal permit or approval required ▪ Activity may impact property listed in or eligible for listing in the National Register of Historic Places (NRHP) ▪ Activity may impact Tribal resources
U.S. Army Corps of Engineers (33 CFR 320-331 and 40 CFR 230)	Clean Water Act (33 USC 1251 et seq) Section 404 (33 USC 1344)	Individual, general, and nationwide permits	Regulates discharge of dredged or fill materials into waters of the United States	▪ Activities that may impact federal waters, including wetlands
U.S. Army Corps of Engineers (33 CFR 320-331)	Rivers and Harbors Act of 1899 (33 USC 401 et seq) Section 10 (33 USC 403)	Section 10 Permit	Regulates obstructions to navigable waters of the United States	▪ Building or replacing bridges
Environmental Protection Agency and state agencies (40 CFR 122 and 123)	Clean Water Act (33 USC 1251 et seq) Section 402 (33 USC 1342)	National Pollution Discharge Elimination System (NPDES) Stormwater Permit	Regulates discharges into waters of the United States. Usually delegated to state authority.	▪ Potential for discharge from site assessment, construction, and operation
Federal Aviation Administration (14 CFR 77)	49 USC 44718	Notice of Proposed Construction (Form 7461-1) Hazard Determination	Notifies FAA of proposed structures that might affect navigable airspace. Form requires proposed markings and lighting. FAA must review possible impacts to air safety and navigation, as well as the potential for adverse effects on radar systems.	▪ Construction or alteration of structures standing higher than 200 feet above ground level ▪ Construction or alteration of structures near airports ▪ 14 CFR 77.13 provides details ▪ Siting within radar line-of-sight of an air defense facility
Environmental Protection Agency (40 CFR 112)	Oil Pollution Act (33 USC 2701 et seq)	Spill Prevention, Control, and Countermeasure (SPCC) Plan	Establishes procedures, methods, and equipment requirements to prevent and contain oil spills	▪ May apply to fuel stored on site for emergency power generator or other purpose. ▪ SPCC rules currently being amended
Environmental Protection Agency	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) (42 USC 9601-9675)	ASTM Environmental Site Assessment	CERCLA is the principal statue that governs liability with respect to contaminated properties	▪ Contaminated property

State Level

Energy related responsibilities are assigned to an array of state agencies. This is a reflection of the complexity and multi-dimensional issues concerning wind energy. State agencies with significant wind energy-related responsibilities are as follows:

- Public Utilities Commission
- Division of Public Utilities
- Department of Administration
  - Office of Energy Resources
    - Energy Efficiency and Resources Management Council
  - Building Code Standards Committee
  - Division of Planning - Statewide Planning Program
- Department of Environmental Management
- Energy Facilities Siting Board
- Coastal Resources Management Council
- Economic Development Corporation

Public Utilities Commission - (PUC) (RIGL 31-9) is a quasi-judicial body with the power to supervise, regulate, and make orders governing the conduct of companies offering to the public in intrastate commerce energy, communication, transportation services and water supplies, including approval of rates. Allied with the Commission is the Division of Public Utilities, which implements and oversees public utilities regulation in accordance with the requirements of law and the orders of the Commission.

Department of Administration - (RIGL 42-11) is both the staff agency of state government and the umbrella entity for a number of offices, programs, and commissions with significant responsibility for energy issues. These include the:

- Office of Energy Resources
  - Energy Efficiency and Resources Management Council
- Building Code Standards Committee
- Division of Planning - Statewide Planning Program

Office of Energy Resources - (OER) (RIGL 42-140) provides comprehensive, integrated development, administration and oversight of energy policies, plans and programs to meet state and federal requirements and to provide policy guidance to executive leadership. The Office is headed by a Commissioner. The Office administers programs including federal State Energy Office programs; development and management of energy efficiency and resource management programs, including wind energy; energy outreach and education, and low income energy assistance.

Energy Efficiency and Resources Management Council – (RIGL 42-140.1) is an advisory body with the power to evaluate and make recommendations with regard to the optimization of energy efficiency, energy conservation, energy resource development, the development of a plan for least-cost procurement, to provide stakeholder involvement in energy efficiency, energy conservation, and energy resource management. It is also charged with promoting public understanding of energy issues.

Building Code Standards Committee - (RIGL 23-27.3-100.1.3) adopts and administers a state building code for the purpose of regulating the design, construction, and use of buildings Under sections 23-27.3-100.1.5.4 of the Code, the State Building Code Standards Committee has the authority to adopt, maintain, amend, and repeal an optional energy conservation code, among other authorities, based on appropriate nationally and internationally recognized models, and authority to promulgate and administer the energy conservation code. According to RIGL the Energy Conservation Code should contain provisions pertaining to, but not limited to, the construction of buildings, the use of renewable energy resources in buildings, the efficient use of energy within buildings, and the orientation of buildings on their sites. The State Building Commissioner serves as the executive secretary to the State Building Code Standards Committee and has the authority to enforce the provisions of the State Building Code in a municipality where there is no local building official.

Division of Planning (DOP) (RIGL 42-11) is the central planning agency for state government. The DOP is comprised of four offices, one of which has functions related to wind energy policies, plans and programs. This is the Statewide Planning Program.

Statewide Planning Program (SPP) (RIGL 42-11-10) prepares, adopts, and amends plans for the physical, economic, and social development of the State. The State Guide Plan (SGP) is comprised of elements dealing with land use, physical development and environmental concerns, economic development, housing production, and energy supply, including the development of renewable energy resources, and energy access, use, and conservation. It serves as a means for centralizing, integrating, and monitoring long-range goals, policies, plans, and implementation activities. The State Planning Council (SPC) is staffed by the staff of the DOP and is the metropolitan planning organization (MPO) for transportation planning in Rhode Island. The SPC is also charged with the approval of all SGP elements. The SGP is the planning tool to coordinate and identify all energy issues, wind energy systems included, in Rhode Island.

Department of Environmental Management - (DEM) (RIGL 42-17.1) is the environmental regulatory agency of the State. It has the power to supervise and control the protection, development, planning, and utilization of the natural resources of the state, such resources, including but not limited to, water, plants, trees, soil, clay, sand, gravel, rocks and other minerals, air, mammals, birds, reptiles, amphibians, fish, shellfish, and other forms of aquatic, insect, and animal life. DEM's responsibilities with regard to energy include air quality protection. The Department has the lead role in Rhode Island's participation in Regional Greenhouse Gas Initiative, forestry, solid waste and waste to energy facilities, and minerals.

Energy Facilities Siting Board (EFSB) (RIGL 42-98) consists of members from the Public Utilities Commission, the Division of Planning, and the Department of Environmental Management. It consolidates the licensure and regulatory authority of the State into a single body, which renders the final licensing decision concerning the siting, construction, operation and/or alteration of major energy facilities (reviews projects greater than 40MW). For approval of a project, the Board must find that proposed energy facilities are justified by long term state and/or regional energy need forecasts, that the energy produced is at the least possible cost to the consumer consistent with the objective of ensuring that the construction, operation, and decommissioning of the facility shall produce the fewest possible adverse effects on the quality of the state's environment,, Before approving the construction, operation and/or alteration of major energy facilities, the Board shall determine whether cost effective efficiency and conservation opportunities provide an appropriate alternative to the proposed facility. The Board also has the power to override local land use decisions on major energy facilities, regarding any facility subject to its review. The energy facilities siting board is required to "give priority to energy generation projects based on the degree to which such projects meet, criteria including, but not limited to:

- Using renewable fuels, natural gas, or coal processed by "clean coal technology" as their primary fuel
- Maximizing efficiency
- Using low levels of high quality water
- Using existing energy-generation facilities and sites
- Producing low levels of potentially harmful air emissions
- Producing low levels of wastewater discharge
- Producing low levels of waste into the solid waste stream; and
- Having dual fuel capacity.

<u>Coastal Resources Management Council</u> - (CRMC*)* (RIGL 46-23) has planning, regulatory and permitting powers for the marine waters of the State and the adjacent land. The CRMC is empowered to adopt special area management plans to provide for the integration and coordination of the protection of natural resources, the promotion of reasonable coastal-dependent economic growth, and the improved protection of life and property. The CRMC has explicit jurisdiction over "power generating over forty (40) megawatts and desalination plants" in so far as they affect the marine waters of the state or the state's coastal zone. The CRMC has devised several Special Area Management Plans or SAMPs in order to coordinate approval and development of projects in areas of critical concern. The newest of these is the OCEAN SAMP, which was approved by the National Oceanic and Atmospheric Administration in July of 2011. The OCEAN SAMP is the guiding document for any off-shore wind development.

<u>Economic Development Corporation</u> – (EDC) (RIGL 42-64) is the official economic development organization for the State. A quasi-public agency, EDC serves as a government and community resource to help streamline the business expansion in, and relocation to, Rhode Island. The EDC administers a renewable energy development fund for the renewable energy standard and the DSM renewable energy program (RIGL 39-2-1.2).

APPENDIX: TECHNICAL REFERENCES FOR SITING IMPACTS

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